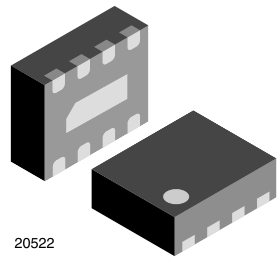
8-Line ESD-Protection Diode Array in LLP1713-9L

Features

- Ultra compact LLP1713-9L package
- Low package profile **< 0.6 mm**
- **8-line** ESD-protection
- Low leakage current **I_R < 1 µA**
- Low load capacitance **C_D = 30 pF**
- ESD-immunity acc. IEC 61000-4-2
  ± 25 kV contact discharge
  ± 30 kV air discharge
- Working voltage range **V_{RWM} = 5 V**
- Lead (Pb)-free component
- "Green" molding compound
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



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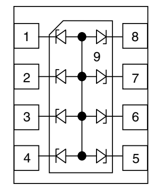

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Marking

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Dot = Pin 1 marking
B = Type code (see table below)
U4 = Date code (example only)

Ordering Information

Device name	Ordering code	Taped units per reel (8 mm tape on 7" reel)	Minimum order quantity
VESD05A8A-HNH	VESD05A8A-HNH-GS08	3000	15000

Package Data

Device name	Package name	Marking code	Weight	Molding compound flammability rating	Moisture sensitivity level	Soldering conditions
VESD05A8A-HNH	LLP1713-9L	B	3.7 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	260 °C/10 s at terminals

Absolute Maximum Ratings

Rating	Test condition		Symbol	Value	Unit
Peak pulse current	BiAs-mode: each input (pin 1 - pin 8) to ground (pin 9); acc. IEC 61000-4-5; t_p = 8/20 µs; single shot		I_{PPM}	5	A
	BiSy-mode: each input (pin 1 - pin 8) to any other input pin. Pin 9 not connected. Acc. IEC 61000-4-5; t_p = 8/20 µs; single shot		I_{PPM}	2.5	A
Peak pulse power	BiAs-mode: each input (pin 1 - pin 8) to ground (pin 9); acc. IEC 61000-4-5; t_p = 8/20 µs; single shot		P_{PP}	65	W
	BiSy-mode: each input (pin 1 - pin 8) to any other input pin. Pin 9 not connected. Acc. IEC 61000-4-5; t_p = 8/20 µs; single shot		P_{PP}	33	W
ESD-immunity	acc. IEC61000-4-2; 10 pulses BiAs-mode: each input (pin 1 - pin 8) to ground (pin 9)	contact discharge	V_{ESD}	± 25	kV
		air discharge	V_{ESD}	± 30	kV
	acc. IEC 61000-4-2 ; 10 pulses BiSy-mode: each input (pin 1 - pin 8) to any other input pin. Pin 9 not connected.	contact discharge	V_{ESD}	± 12	kV
		air discharge	V_{ESD}	± 12	kV
Operating temperature	junction temperature		T_J	- 40 to + 125	°C
Storage temperature			T_{STG}	- 55 to + 150	°C

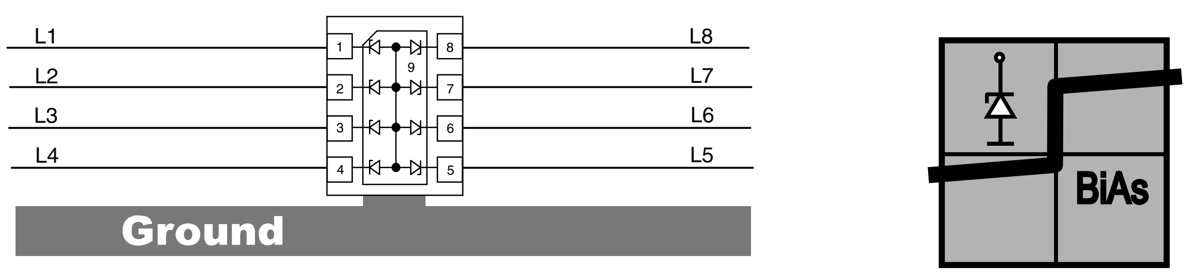
BiAs-Mode (8-line Bidirectional Asymmetrical protection mode)

With the **VESD05A8A-HNH** up to 8 signal- or data-lines (L1 - L8) can be protected against voltage transients. With pin 9 connected to ground and pin 1 up to pin 8 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 **M**aximum **R**everse **W**orking **V**oltage (**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 **C**lamping **V**oltage (**V_C**) is defined by the **BR**eakthrough **V**oltage (**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 **F**orward **V**oltage (**V_F**) clamps the negative transient close to the ground level.

Due to the different clamping levels in forward and reverse direction the **VESD05A8A-HNH** clamping behaviour is **Bi**directional and **As**ymmetrical (**BiAs**).



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Electrical Characteristics

Ratings at 25 °C, ambient temperature unless otherwise specified

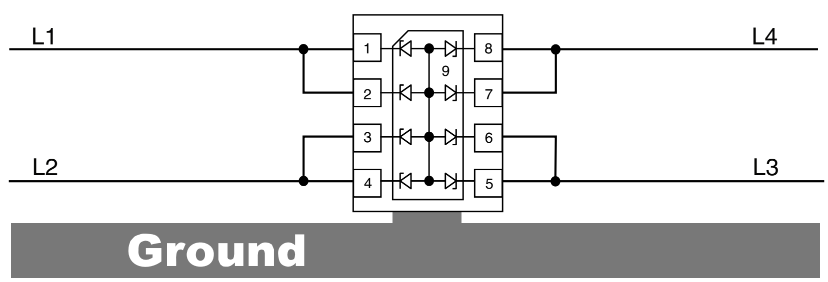
VESD05A8A-HNH

BiAs mode: each input (pin 1 - pin 8) to ground (pin 9)

Parameter	Test conditions/remarks	Symbol	Min.	Typ.	Max.	Unit
Protection paths	number of line which can be protected	N lines			8	lines
Reverse current	at I_R = 1 µA	V_{RWM}	5			V
Max. reverse current	at $V_R = V_{RWM}$ = 5 V	I_R		< 0.1	1	µA
Min. reverse breakdown voltage	at I_R = 1 mA	V_{BR}	6		8	V
Max. clamping voltage	at I_{PP} = 5 A acc. IEC 61000-4-5	V_C			13	V
Max. forward clamping voltage	at I_F = 5 A acc. IEC 61000-4-5	V_F			4.5	V
Line capacitance	at V_R = 0 V; f = 1 MHz	C_D		30	35	pF
	at V_R = 2.5 V; f = 1 MHz	C_D		18	23	pF

If a higher surge current or **P**eak **P**ulse **current** (**I_{PP}**) is needed, some protection diodes in the **VESD05A8A-HNH** 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 **C**apacitance (2 x **C_D**)
- double **R**everse leakage **current** (2 x **I_R**)



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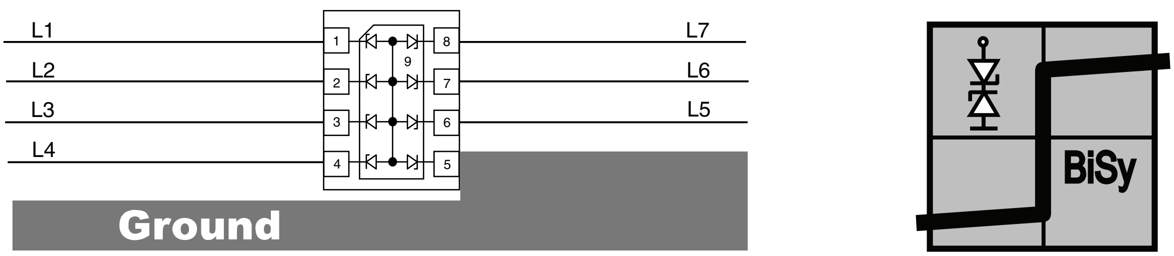
BiSy-mode (7-line Bidirectional Symmetrical protection mode)

If a bipolar symmetrical protection device is needed the **VESD05A8A-HNH** can also be used as a seven-line protection device. Therefore seven pins (example: pin 1, 2, 3, 4, 6, 7 and 8) has to be connected to the signal- or data-line (L1 - L7) and pin 5 to ground. Pin 9 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 **VESD05A8A-HNH** to the ground passes one diode in forward direction and the other one in reverse direction. The **C**lamping **V**oltage (**V_C**) is defined by the **BR**eakthrough **V**oltage (**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 **VESD05A8A-HNH** voltage clamping behaviour is also **Bi**directional and **Sy**mmetrical (**BiSy**).



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Electrical Characteristics

Ratings at 25 °C, ambient temperature unless otherwise specified

VESD05A8A-HNH

BiSy mode: each input (pin 1 - pin 8) to any other input pin connected to ground; pin 9 not connected

Parameter	Test conditions/remarks	Symbol	Min.	Typ.	Max.	Unit
Protection paths	number of line which can be protected	N_{lines}			7	lines
Reverse current	at I_R = 1 µA	V_{RWM}	5.5			V
Max. reverse current	at $V_R = V_{RWM}$ = 5.5 V	I_R		< 0.1	1	µA
Min. reverse breakdown voltage	at I_R = 1 mA	V_{BR}	6.5		8.7	V
Max. clamping voltage	at I_{PP} = 2.5 A acc. IEC 61000-4-5	V_C			13	V
Line capacitance	at V_R = 0 V; f = 1 MHz	C_D		15	18	pF
	at V_R = 2.5 V; f = 1 MHz	C_D		13	15	pF

Typical Characteristics

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

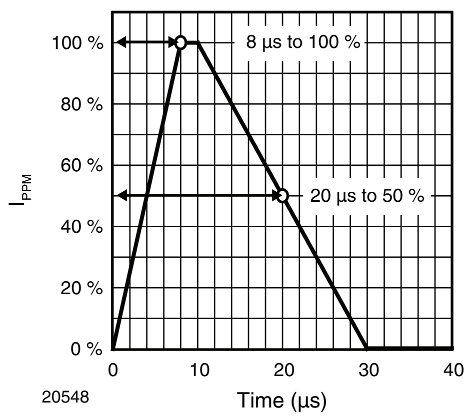


Figure 1. 8/20 µs Peak Pulse Current Wave Form acc. IEC 61000-4-5

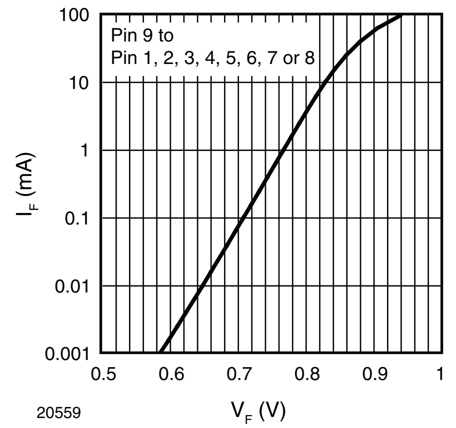


Figure 4. Typical Forward Current I_F vs. Forward Voltage V_F

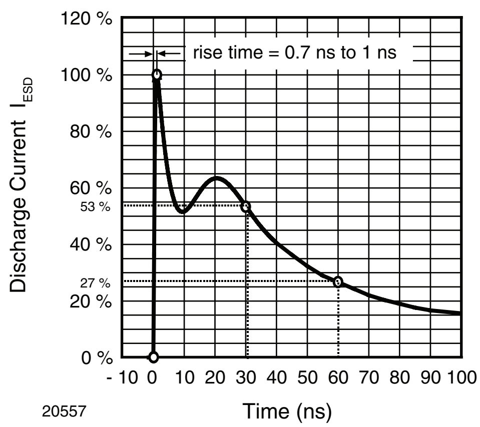


Figure 2. ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330 Ω/150 pF)

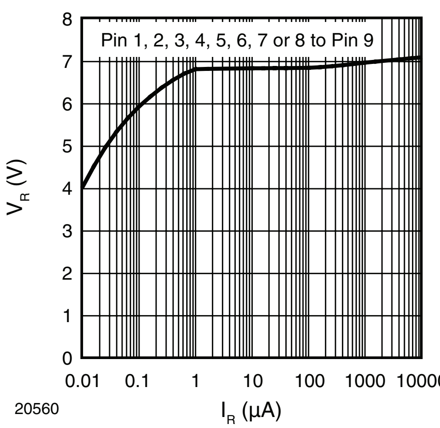


Figure 5. Typical Reverse Voltage V_R vs. Reverse Current I_R

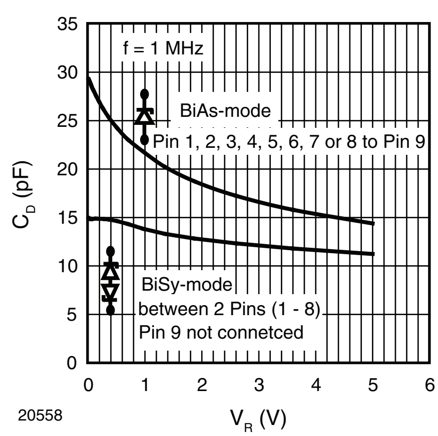


Figure 3. Typical Capacitance C_D vs. Reverse Voltage V_R

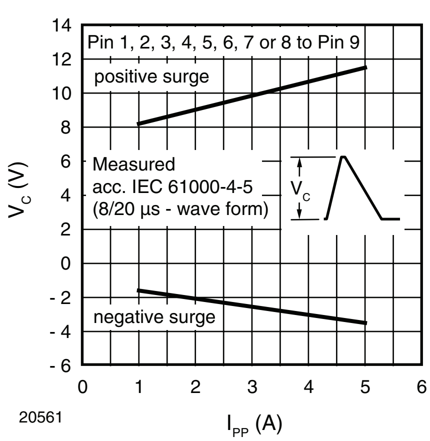


Figure 6. Typical Peak Clamping Voltage V_C vs. Peak Pulse Current I_{PP}

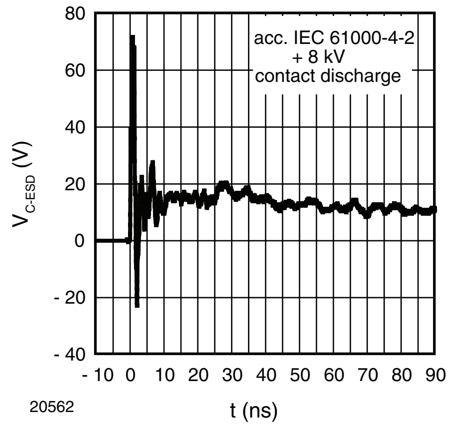


Figure 7. Typical Clamping Performance at + 8 kV Contact Discharge (Acc. IEC 61000-4-2)

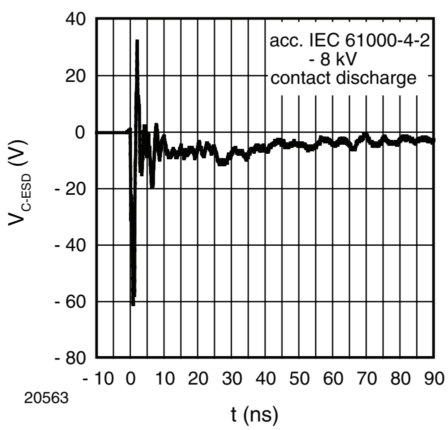


Figure 8. Typical Clamping Performance at - 8 kV Contact Discharge (acc. IEC 61000-4-2)

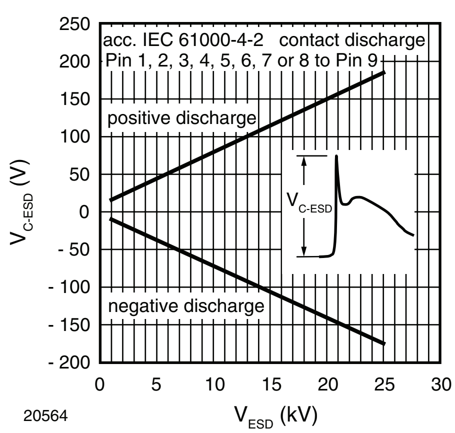
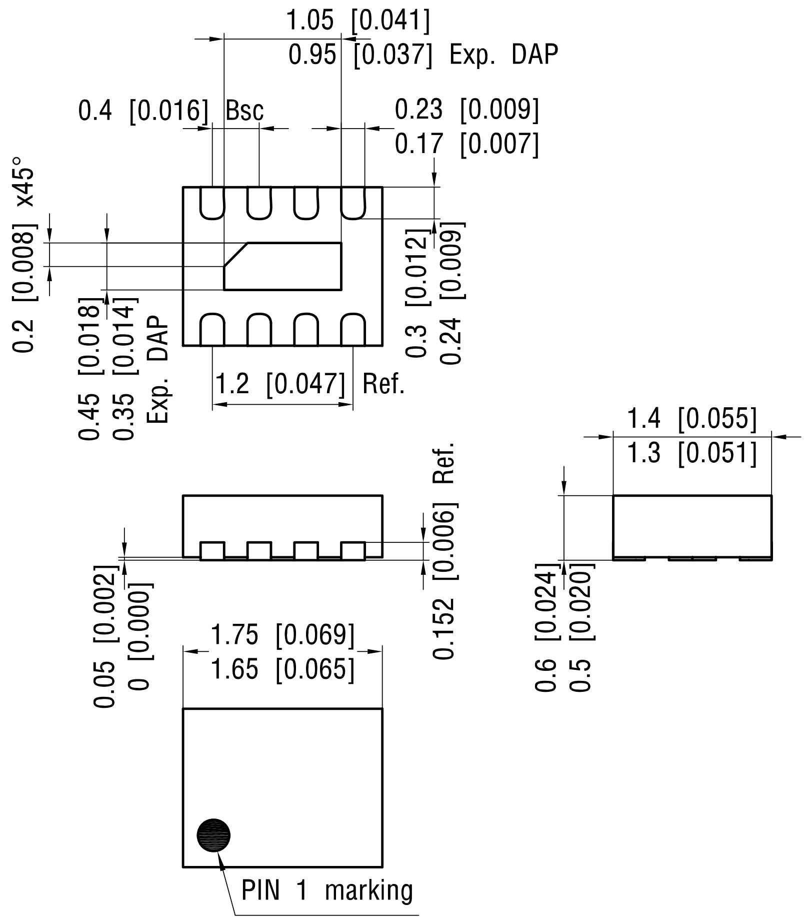
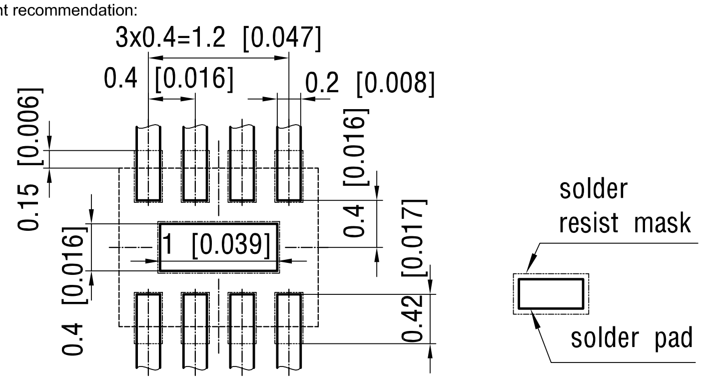


Figure 9. Typical Peak Clamping Voltage at ESD Contact Discharge (acc. IEC 61000-4-2)

Package Dimensions in millimeters (inches): **LLP1713-9L**



foot print recommendation:



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Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

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