

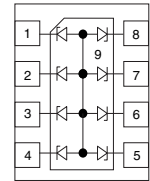
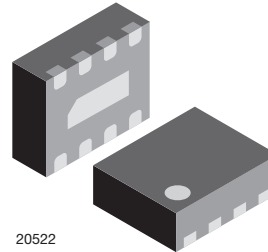
## 8-Line ESD-Protection Diode Array in LLP1713-9L

### Features

- Ultra compact LLP1713-9L package
- Low package profile < 0.6 mm
- **8-line** ESD-protection
- Low leakage current  $I_R < 0.5 \mu A$
- Low load capacitance  $C_D = 20 \text{ pF}$
- ESD-immunity acc. IEC 61000-4-2  
 $\pm 17 \text{ kV}$  contact discharge  
 $\pm 17 \text{ kV}$  air discharge
- Working voltage range  $V_{RWM} = 5 \text{ V}$
- e4 - precious metal (e.g. Ag, Au, NiPd, NiPdAu) (no Sn)
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC



**RoHS**  
COMPLIANT  
**GREEN**  
[5-2008]\*\*



### Marking (example only)



Dot = Pin 1 marking  
 Y = Type code (see table below)  
 XX = Date code

### Ordering Information

| Device name   | Ordering code      | Taped units per reel<br>(8 mm tape on 7" reel) | Minimum order quantity |
|---------------|--------------------|--|------------------------|
| VESD05A8B-HNH | VESD05A8B-HNH-GS08 | 3000   | 15 000                 |

### Package Data

| Device name   | Package name | Marking code | Weight | Molding compound flammability rating | Moisture sensitivity level        | Soldering conditions     |
|---------------|--------------|--------------|--------|--------------------------------------|-----------------------------------|--------------------------|
| VESD05A8B-HNH | LLP1713-9L   | E            | 3.7 mg | UL 94 V-0                            | MSL level 1 (according J-STD-020) | 260 °C/10 s at terminals |

\*\* Please see document "Vishay Material Category Policy" [www.vishay.com/doc?99902](http://www.vishay.com/doc?99902)

### Absolute Maximum Ratings

| Rating                | Test conditions  | Symbol            | Value         | Unit        |
|-----------------------|--|-------------------|---------------|-------------|
| Peak pulse current    | BiAs-mode: each input (pin 1 - pin 8) to ground (pin 9);<br>acc. IEC 61000-4-5; $t_p = 8/20 \mu s$ ; single shot                           | $I_{PPM}$         | 4             | A           |
|                       | BiSy-mode: each input (pin 1 - pin 8) to any other input pin.<br>Pin 9 not connected. Acc. IEC 61000-4-5; $t_p = 8/20 \mu s$ ; single shot | $I_{PPM}$         | 3             | A           |
| Peak pulse power      | BiAs-mode: each input (pin 1 - pin 8) to ground (pin 9);<br>acc. IEC 61000-4-5; $t_p = 8/20 \mu s$ ; single shot                           | $P_{PP}$          | 52            | W           |
|                       | BiSy-mode: each input (pin 1 - pin 8) to any other input pin.<br>Pin 9 not connected. Acc. IEC 61000-4-5; $t_p = 8/20 \mu s$ ; single shot | $P_{PP}$          | 45            | W           |
| ESD-immunity          | Acc. IEC61000-4-2; 10 pulses<br>BiAs-mode: each input (pin 1 - pin 8) to ground (pin 9)  | Contact discharge | $V_{ESD}$     | $\pm 17$ kV |
|                       |  | Air discharge     | $V_{ESD}$     | $\pm 17$ kV |
|                       | Acc. IEC 61000-4-2 ; 10 pulses<br>BiSy-mode: each input (pin 1 - pin 8) to any other input pin.<br>Pin 9 not connected                     | Contact discharge | $V_{ESD}$     | $\pm 10$ kV |
|                       |  | Air discharge     | $V_{ESD}$     | $\pm 10$ kV |
| Operating temperature | Junction temperature   | $T_J$             | - 40 to + 125 | $^{\circ}C$ |
| Storage temperature   |  | $T_{STG}$         | - 55 to + 150 | $^{\circ}C$ |

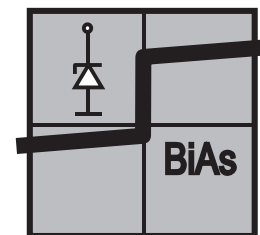
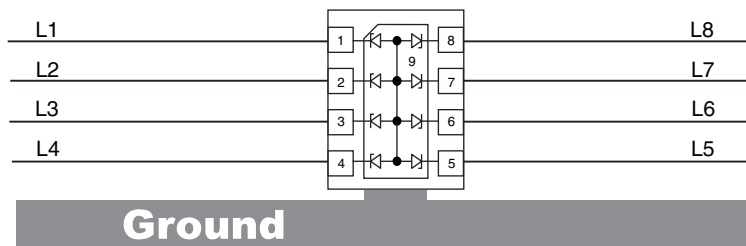
### BiAs-Mode (8-line Bidirectional Asymmetrical protection mode)

With the **VESD05A8B-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 **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 **VESD05A8B-HNH** clamping behaviour is **Bidirectional** and **Asymmetrical (BiAs)**.



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## Electrical Characteristics

Ratings at 25 °C, ambient temperature unless otherwise specified

### VESD05A8B-HNH

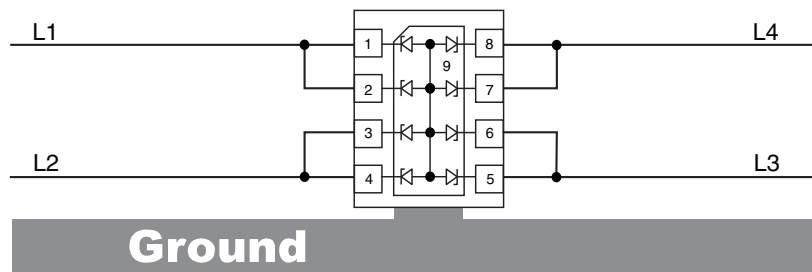
BiAs mode: each input (pin 1 - pin 8) to ground (pin 9)

| 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 $I_R = 0.5 \mu\text{A}$                     | $V_{RWM}$ | 5    |      |      | V             |
| Max. reverse current           | at $V_R = V_{RWM} = 5 \text{ V}$               | $I_R$     |      |      | 0.5  | $\mu\text{A}$ |
| Min. reverse breakdown voltage | at $I_R = 1 \text{ mA}$                        | $V_{BR}$  | 6    |      | 8    | V             |
| Max. clamping voltage          | at $I_{PP} = 4 \text{ A}$ acc. IEC 61000-4-5   | $V_C$     |      |      | 13   | V             |
| Max. forward clamping voltage  | at $I_F = 4 \text{ A}$ acc. IEC 61000-4-5      | $V_F$     |      |      | 4.5  | V             |
| Line capacitance               | at $V_R = 0 \text{ V}$ ; $f = 1 \text{ MHz}$   | $C_D$     |      | 20   | 23   | pF            |
|                                | at $V_R = 2.5 \text{ V}$ ; $f = 1 \text{ MHz}$ | $C_D$     |      | 12   | 14   | pF            |

If a higher surge current or **Peak Pulse current ( $I_{PP}$ )** is needed, some protection diodes in the **VESD05A8B-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 ( $2 \times I_{PPM}$ )
- 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** ( $2 \times I_R$ )



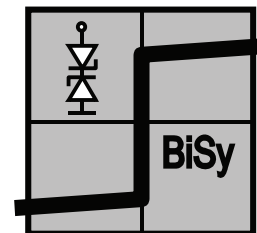
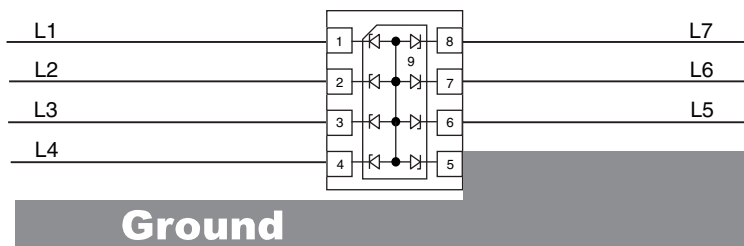
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## BiSy-mode (7-line Bidirectional Symmetrical protection mode)

If a bipolar symmetrical protection device is needed the **VESD05A8B-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 **VESD05A8B-HNH** 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 **VESD05A8B-HNH** voltage clamping behaviour is also **Bidirectional** and **Symmetrical (BiSy)**.



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## Electrical Characteristics

Ratings at 25 °C, ambient temperature unless otherwise specified

### VESD05A8B-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 $I_R = 0.5 \mu A$                  | $V_{RWM}$   | 5.5  |      |      | V       |
| Max. reverse current           | at $V_R = V_{RWM} = 5.5 V$            | $I_R$       |      |      | 0.5  | $\mu A$ |
| Min. reverse breakdown voltage | at $I_R = 1 mA$                       | $V_{BR}$    | 6.5  |      | 8.7  | V       |
| Max. clamping voltage          | at $I_{PP} = 3 A$ acc. IEC 61000-4-5  | $V_C$       |      |      | 15   | V       |
| Line capacitance               | at $V_R = 0 V$ ; $f = 1 MHz$          | $C_D$       |      | 10   | 13   | pF      |
|                                | at $V_R = 2.5 V$ ; $f = 1 MHz$        | $C_D$       |      | 8    | 10   | pF      |

## Typical Characteristics

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

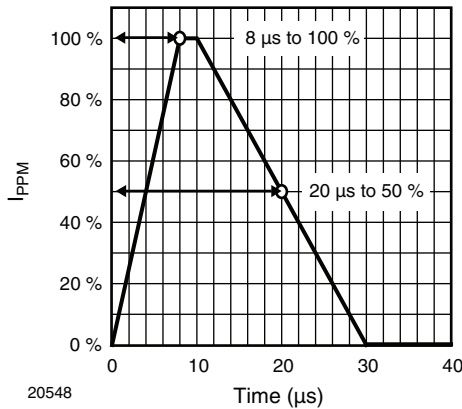


Figure 1. 8/20  $\mu\text{s}$  Peak Pulse Current Wave Form acc. IEC 61000-4-5

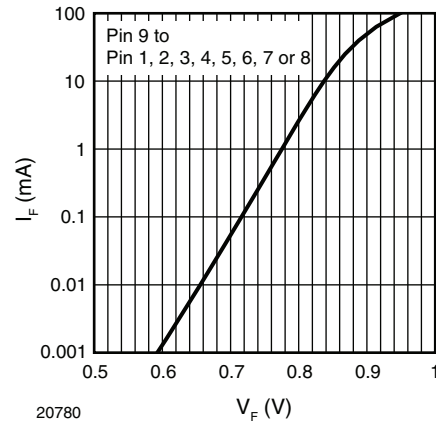


Figure 4. Typical Forward Current  $I_F$  vs. Forward Voltage  $V_F$

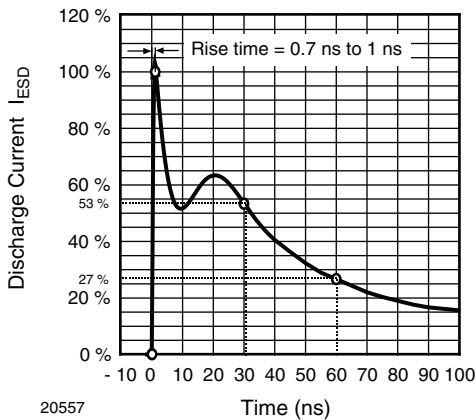


Figure 2. ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330  $\Omega$ /150 pF)

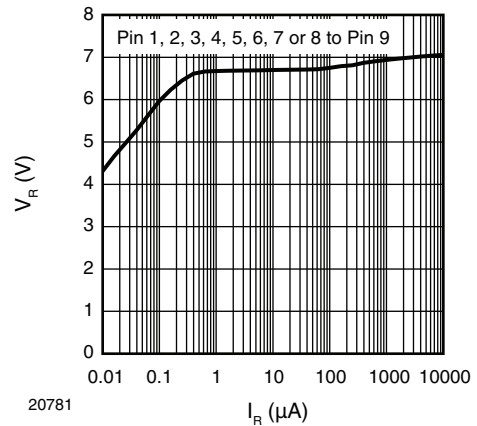


Figure 5. Typical Reverse Voltage  $V_R$  vs. Reverse Current  $I_R$

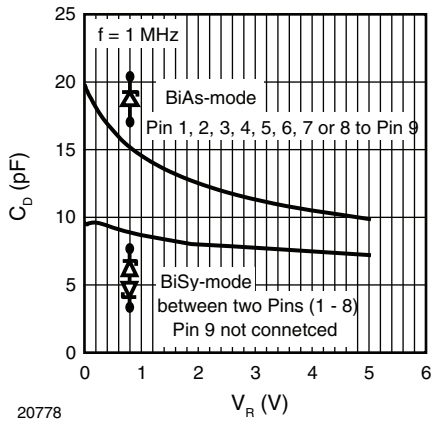


Figure 3. Typical Capacitance  $C_D$  vs. Reverse Voltage  $V_R$

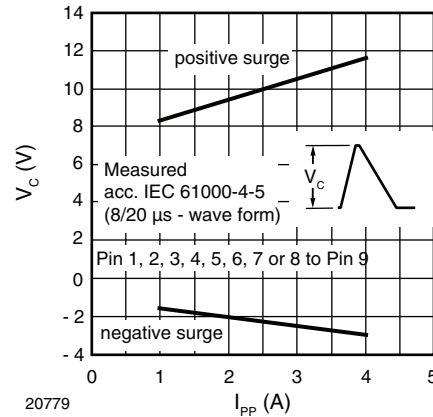
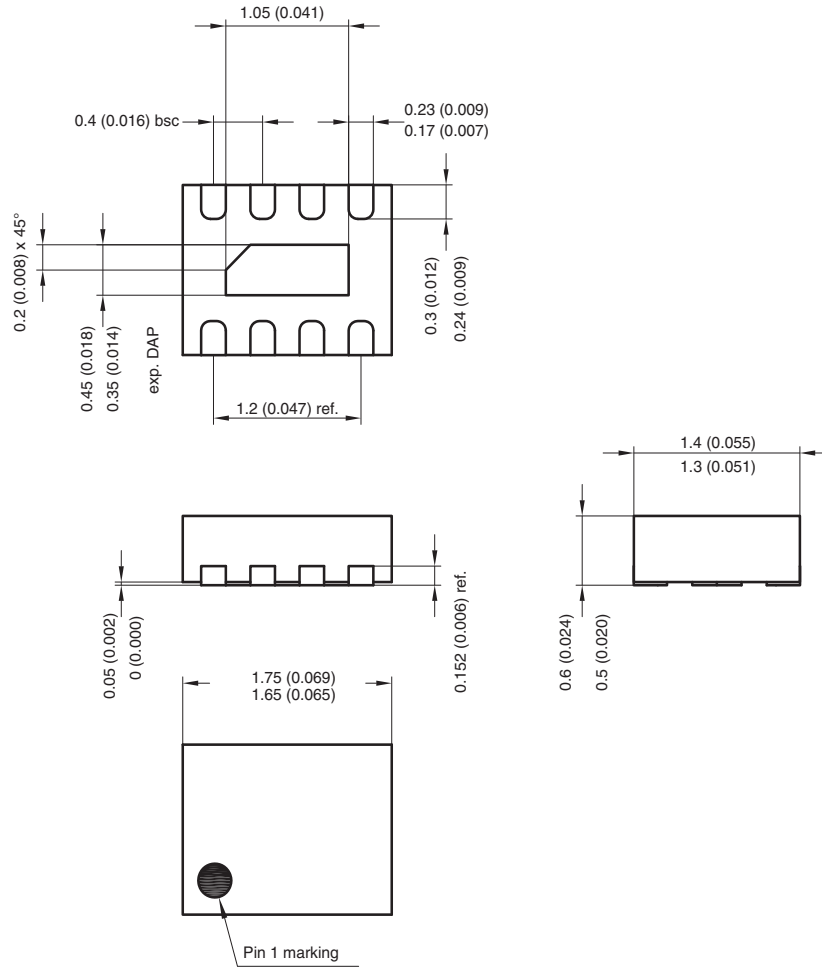
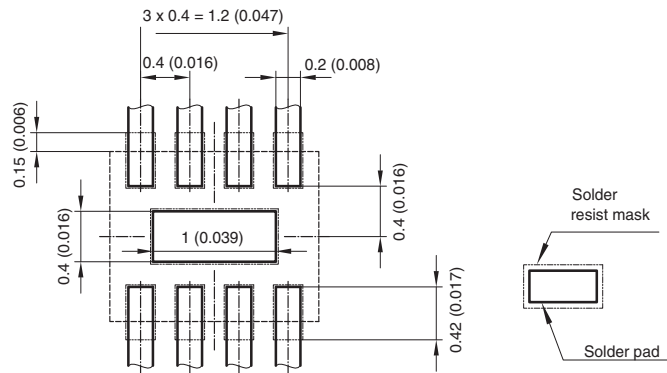


Figure 6. Typical Peak Clamping Voltage  $V_C$  vs. Peak Pulse Current  $I_{PP}$

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



Foot print recommendation:



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 20386



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