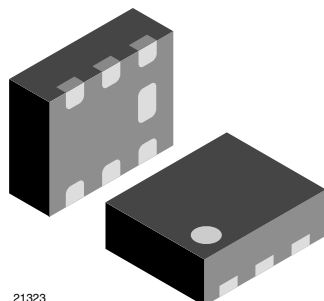
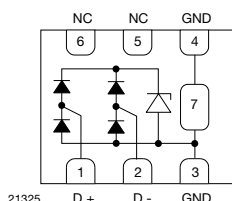


2-Line BUS-Port ESD Protection - Flow Through Design



MARKING (example only)



Dot = pin 1 marking

Y = type code (see table below)

XX = date code

FEATURES

- Compact LLP1713-7L package
- Low package height < 0.6 mm
- 2-line ESD protection
- Low leakage current $I_R < 0.1 \mu A$
- Low load capacitance $C_D = 0.8 pF$
- Ideal for high speed data line like
 - HDMI, DisplayPort, eSATA
 - USB, 1394/firewire
- ESD immunity acc. IEC 61000-4-2
 - $\pm 15 kV$ contact discharge
 - $\pm 15 kV$ air discharge
- Soldering can be checked by standard vision inspection; no X-ray necessary
- e4 - precious metal (e.g. Ag, Au, NiPd, NiPdAu) (no Sn)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

DESIGN SUPPORT TOOLS click logo to get started



| ORDERING INFORMATION | | | |
|----------------------|--------------------|--|------------------------|
| DEVICE NAME | ORDERING CODE | TAPED UNITS PER REEL (8 mm TAPE ON 7" REEL) | MINIMUM ORDER QUANTITY |
| VBUS052CD-FAH | VBUS052CD-FAH-GS08 | 3000 | 15 000 |

| PACKAGE DATA | | | | | | |
|---------------|--------------|-----------|--------|---|--------------------------------------|--------------------------|
| DEVICE NAME | PACKAGE NAME | TYPE CODE | WEIGHT | MOLDING COMPOUND FLAMMABILITY RATING | MOISTURE SENSITIVITY LEVEL | SOLDERING CONDITIONS |
| VBUS052CD-FAH | LLP1713-7L | G | 3.7 mg | UL 94 V-0 | MSL level 1 (according J-STD-020) | 260 °C/10 s at terminals |

| ABSOLUTE MAXIMUM RATINGS VBUS052CD-FAH | | | | |
|--|--|-----------|-------------|------|
| PARAMETER | TEST CONDITIONS | SYMBOL | VALUE | UNIT |
| Peak pulse current | Acc. IEC 61000-4-5; $t_P = 8/20 \mu s$; single shot | I_{PPM} | 3.5 | A |
| Peak pulse power | Acc. IEC 61000-4-5; $t_P = 8/20 \mu s$; single shot | P_{PP} | 63 | 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 | V_{ESD} | ± 15 | kV |
| Operating temperature | Junction temperature | T_J | -40 to +125 | °C |
| Storage temperature | | T_{STG} | -55 to +150 | °C |

ELECTRICAL CHARACTERISTICS VBUS052CD-FAH (pin 1 or 2 to pin 3, 4 or 7)

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

| PARAMETER | TEST CONDITIONS/REMARKS | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---------------------------|--|---------------|------|--------|------|---------------|
| Protection paths | Number of line which can be protected | $N_{channel}$ | - | - | 2 | 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} | 6.9 | 7.9 | 8.7 | V |
| Reverse clamping voltage | at $I_{PP} = 1\text{ A}$ | V_C | - | 10 | 12 | V |
| | at $I_{PP} = I_{PPM} = 3.5\text{ A}$ | V_C | - | 15 | 18 | V |
| Forward clamping voltage | at $I_F = 1\text{ A}$ | V_F | - | 1.9 | 2.4 | V |
| | at $I_{PP} = I_{PPM} = 3.5\text{ A}$ | V_F | - | 4 | 5 | V |
| Capacitance | at $V_R = 0\text{ V}$; $f = 1\text{ MHz}$ | C_D | - | 0.8 | 1 | pF |

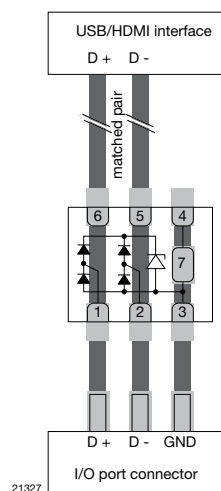
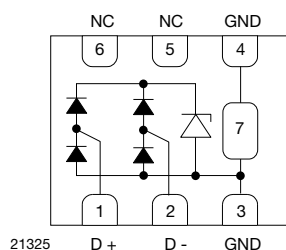
APPLICATION NOTE

The VBUS052CD-FAH is a two-line 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 VBUS052CD-FAH two high speed data lines can be protected against transient voltage signals like ESD (electro static discharge). Connected to the data line (pin 1 and pin 2) and to ground (pin 3) 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 VBUS052CD-FAH is bidirectional but asymmetrical (BiAs) and so it offers the best protection for applications running up to 5 V.

Pin configuration:

- Pin 3, 4 and 7 are internally shorted and have to be connected to ground
- Pin 1 and 2 are the inputs for the data lines D_+ and D_-
- Pin 5 and 6 are not connected internally


FLOW THROUGH DESIGN

Modern digital transmission lines can be clocked up to 480 Mbit/s (USB2.0) or 1.65 Gbit/s (HDMI).

At such high data rates the transmission lines like cables or the line traces on the PCBs have to be very homogeneous regarding their surge impedance. This requires well defined trace dimensions as trace width and distance which have to be calculated depending on the requested surge impedance (e.g. 50 Ω) and the PCB material and layer dimensions. Any device connected to the data lines - like ESD protection devices - have to be connected with minimal changes in these trace dimensions and distances.

With the package in the so called "Flow Through Design" this is possible. The lines are running straight along the PCB while the VBUS052CD-FAH is placed on top without any vias or loops.

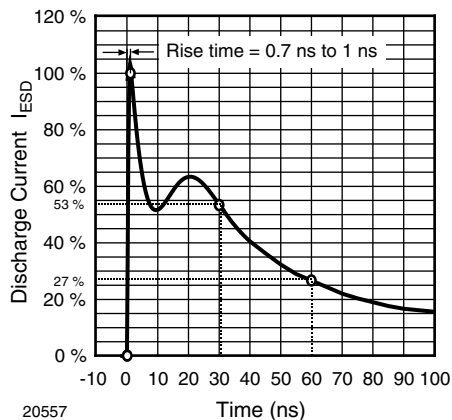
TYPICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)


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

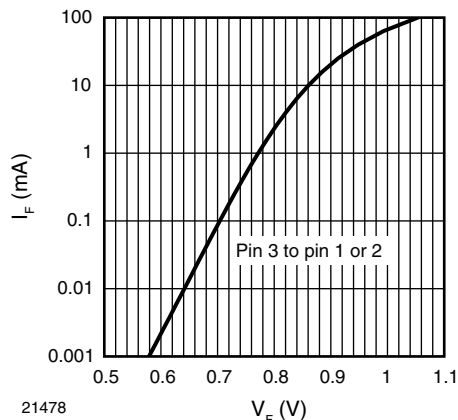


Fig. 4 - Typical Forward Current I_F vs. Forward Voltage V_F

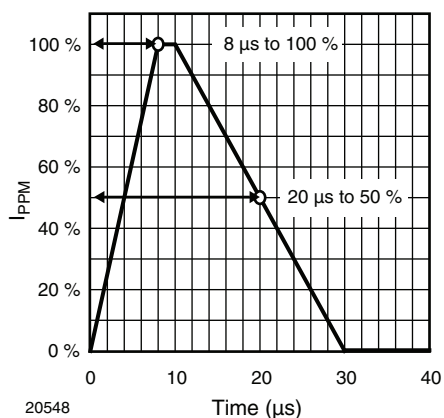


Fig. 2 - 8/20 μs Peak Pulse Current Wave Form
acc. IEC 61000-4-5

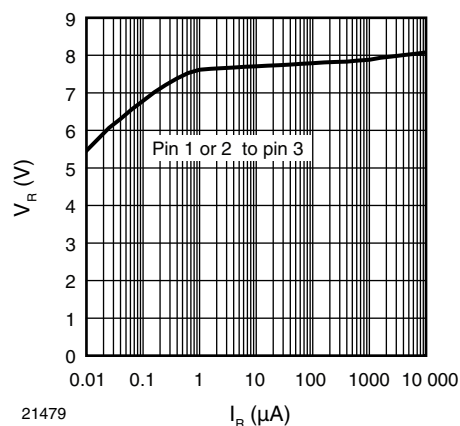


Fig. 5 - Typical Reverse Voltage V_R vs.
Reverse Current I_R

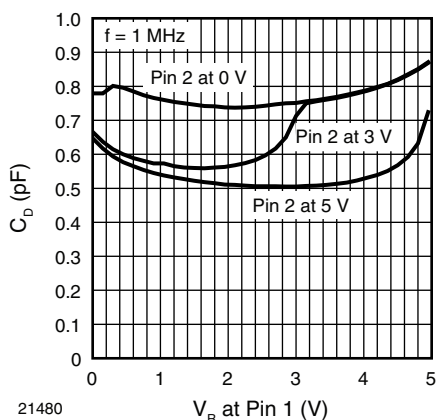


Fig. 3 - Typical Capacitance C_D vs. Reverse Voltage V_R

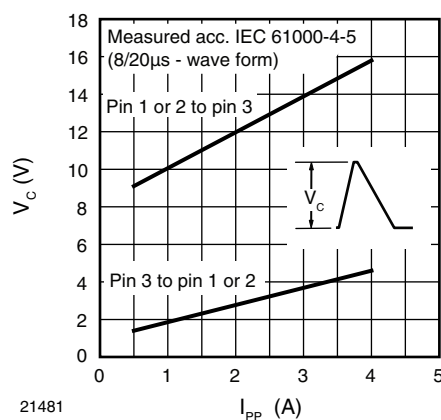


Fig. 6 - Typical Peak Clamping Voltage V_C vs.
Peak Pulse Current I_{PP}

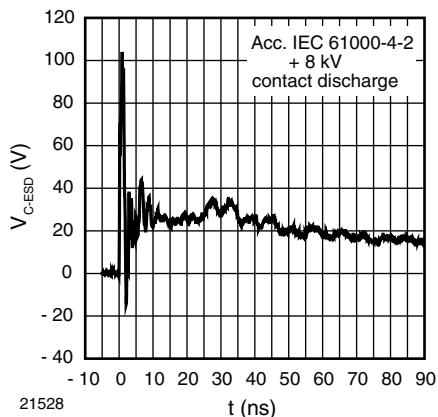


Fig. 7 - Typical Clamping Performance at + 8 kV Contact Discharge (acc. IEC 61000-4-2)

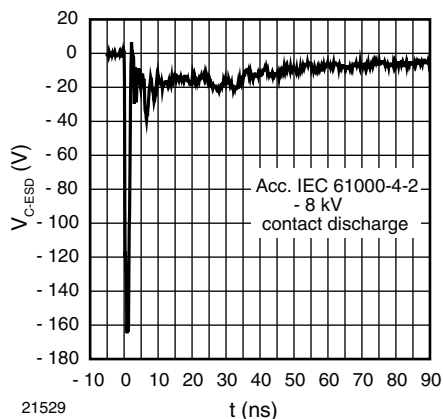


Fig. 8 - Typical Clamping Performance at - 8 kV Contact Discharge (acc. IEC 61000-4-2)

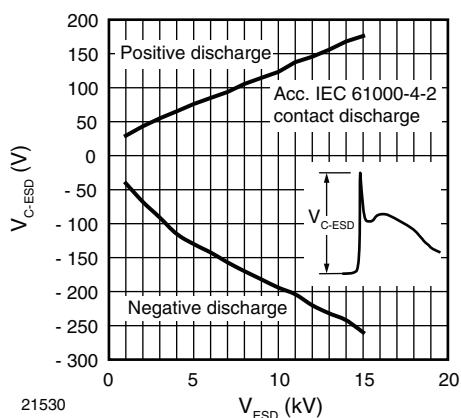
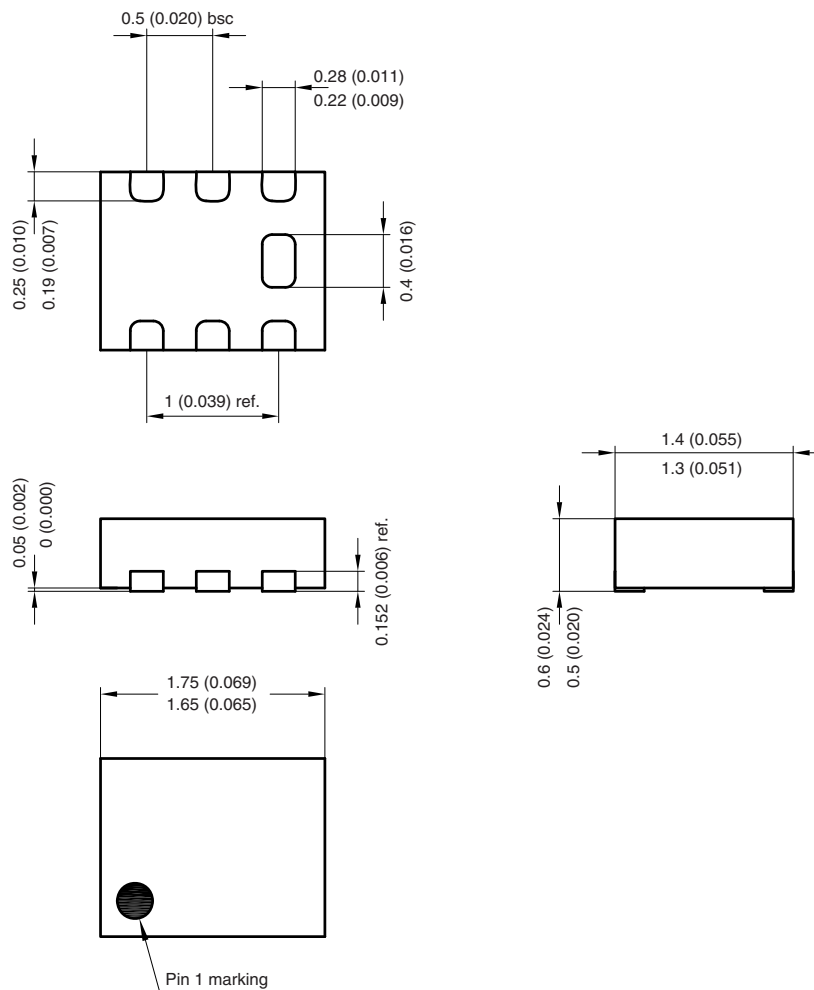


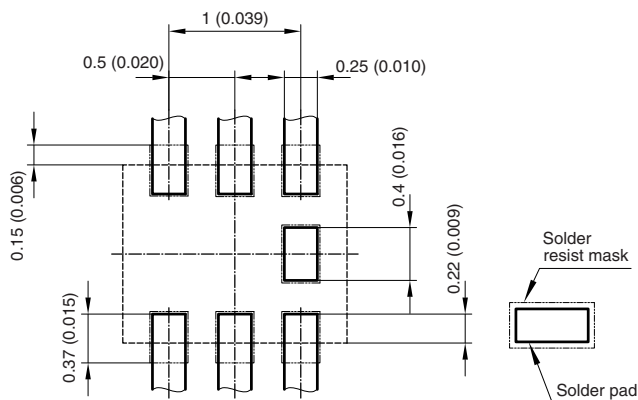
Fig. 9 - Typical Peak Clamping Voltage at ESD Contact Discharge (acc. IEC 61000-4-2)



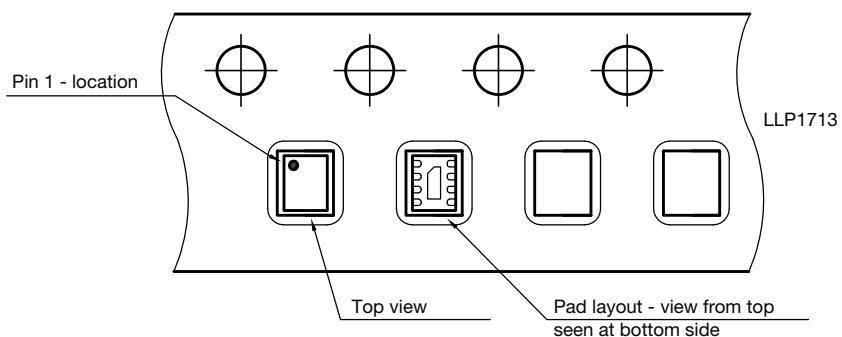
PACKAGE DIMENSIONS in millimeters (inches): **LLP1713-7L**



Foot print recommendation:



Document no.: S8-V-3906.04-008 (4)
Created - Date: 15. April 2008
Rev. 2 - Date: 09. Sep. 2008
21329





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