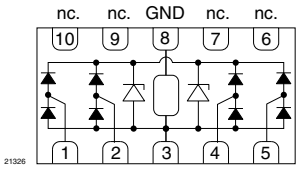
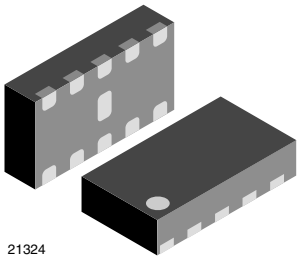
4-Line BUS-Port ESD-Protection - Flow Through Design





FEATURES

- Compact LLP2513-11L package
- Low package height < 0.6 mm
- 4-line ESD-protection
- Low leakage current I_R < 0.1 µA
- Low load capacitance C_D = 0.8 pF
- Ideal for high speed data line like
  - HDMI, DisplayPort, eSATA
  - USB, 1394/firewire
- ESD-protection acc. IEC 61000-4-2
  ± 15 kV contact discharge
  ± 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

Pb-free

e4

RoHS COMPLIANT

HALOGEN FREE GREEN (5-2008)

MARKING (example only)

Dot = pin 1 marking
YY = type code (see table below)
XX = date code

ORDERING INFORMATION

DEVICE NAME	ORDERING CODE	TAPED UNITS PER REEL (8 mm TAPE ON 7" REEL)	MINIMUM ORDER QUANTITY
VBUS054CD-FHI	VBUS054CD-FHI-GS08	3000	15 000

PACKAGE DATA

DEVICE NAME	PACKAGE NAME	TYPE CODE	WEIGHT	MOLDING COMPOUND FLAMMABILITY RATING	MOISTURE SENSITIVITY LEVEL	SOLDERING CONDITIONS
VBUS054CD-FHI	LLP2513-11L	9X	5.5 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	260 °C/10 s at terminals

ABSOLUTE MAXIMUM RATINGS VBUS054CD-FHI

PARAMETER	TEST CONDITIONS	SYMBOL	VALUE	UNIT
Peak pulse current	Acc. IEC 61000-4-5; t_P = 8/20 µs; single shot	I_{PPM}	3.5	A
Peak pulse power	Acc. IEC 61000-4-5; t_P = 8/20 µs; single shot	P_{PP}	45	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 VBUS054CD-FHI (pin 1, 2, 4 or 5 to pin 3)						
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}	6.9	7.9	8.7	V
Reverse clamping voltage	at I_{PP} = 1 A	V_C	-	9.1	11	V
	at I_{PP} = I_{PPM} = 3.5 A	V_C	-	11.6	13	V
Forward clamping voltage	at I_{PP} = 1 A	V_F	-	1.6	2.4	V
	at I_{PP} = 3.5 A	V_F	-	3.5	5	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	0.8	1	pF

Note

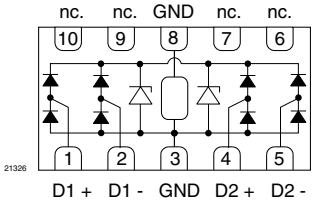
- T_{amb} = 25 °C, unless otherwise specified

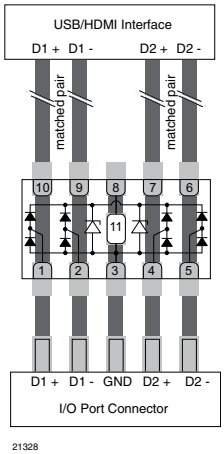
APPLICATION NOTE

The VBUS054CD-FHI is a four-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 VBUS054CD-FHI four high speed data lines can be protected against transient voltage signals like ESD (Electro Static Discharge). Connected to the data line (pin 1, 2 and pin 4, 5) and to ground (pin 3, 8 and 11) 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 behaviour of the VBUS054CD-FHI is bidirectional but asymmetrical (BiAs) and so it offers the best protection for applications running up to 5 V.

Pin configuration:

- Pin 3, 8 and 11 are internally shorted and have to be connected to ground
- Pin 1, 2 and 4, 5 are the inputs for the data lines D_{1+} and D_{1-} and D_{2+} and D_{2-}
- Pin 6, 7 and 9, 10 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 **VBUS054CD-FHI** is placed on top without any vias or loops.

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

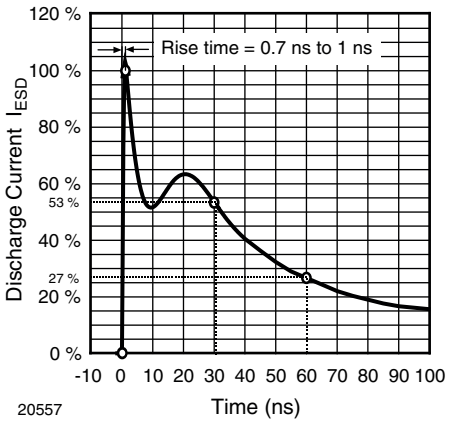


Fig. 1 - ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330 Ω/150 pF)

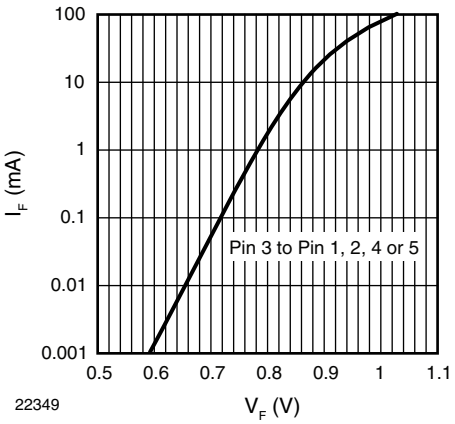


Fig. 4 - Typical Forward Current I_F vs. Forward Voltage V_F

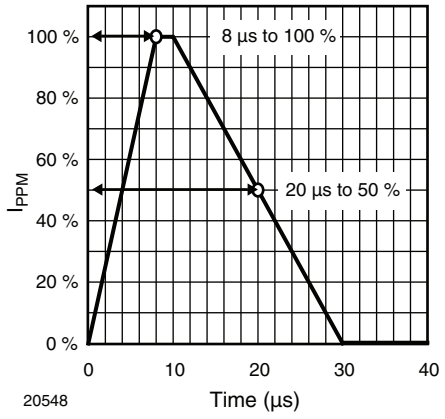


Fig. 2 - 8/20 µs Peak Pulse Current Wave Form acc. IEC 61000-4-5

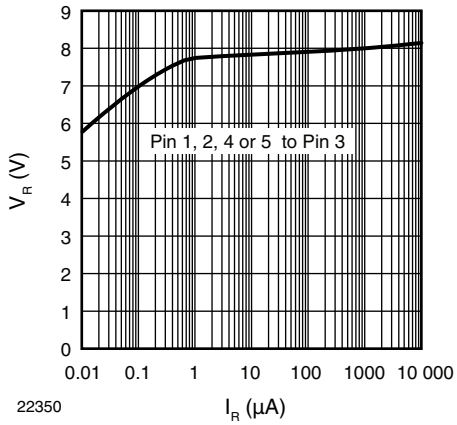


Fig. 5 - Typical Reverse Voltage V_R vs. Reverse Current I_R

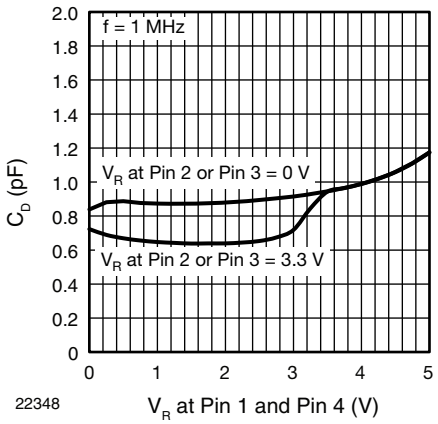


Fig. 3 - Typical Capacitance C_D vs. Reverse Voltage V_R

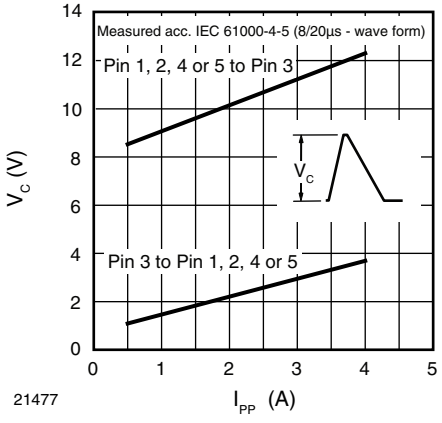


Fig. 6 - Typical Peak Clamping Voltage V_C vs. Peak Pulse Current I_{PP}

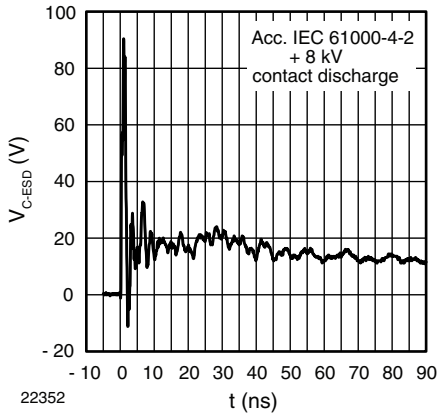


Fig. 7 - Typical Clamping Performance at + 8 kV
Contact Discharge (acc. IEC 61000-4-2)

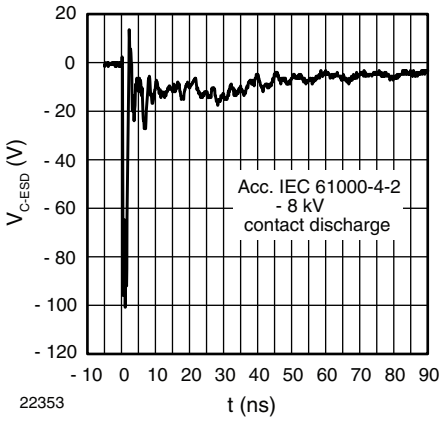


Fig. 8 - Typical Clamping Performance at - 8 kV
Contact Discharge (acc. IEC 61000-4-2)

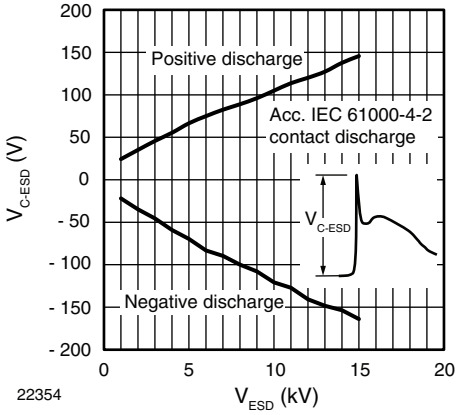
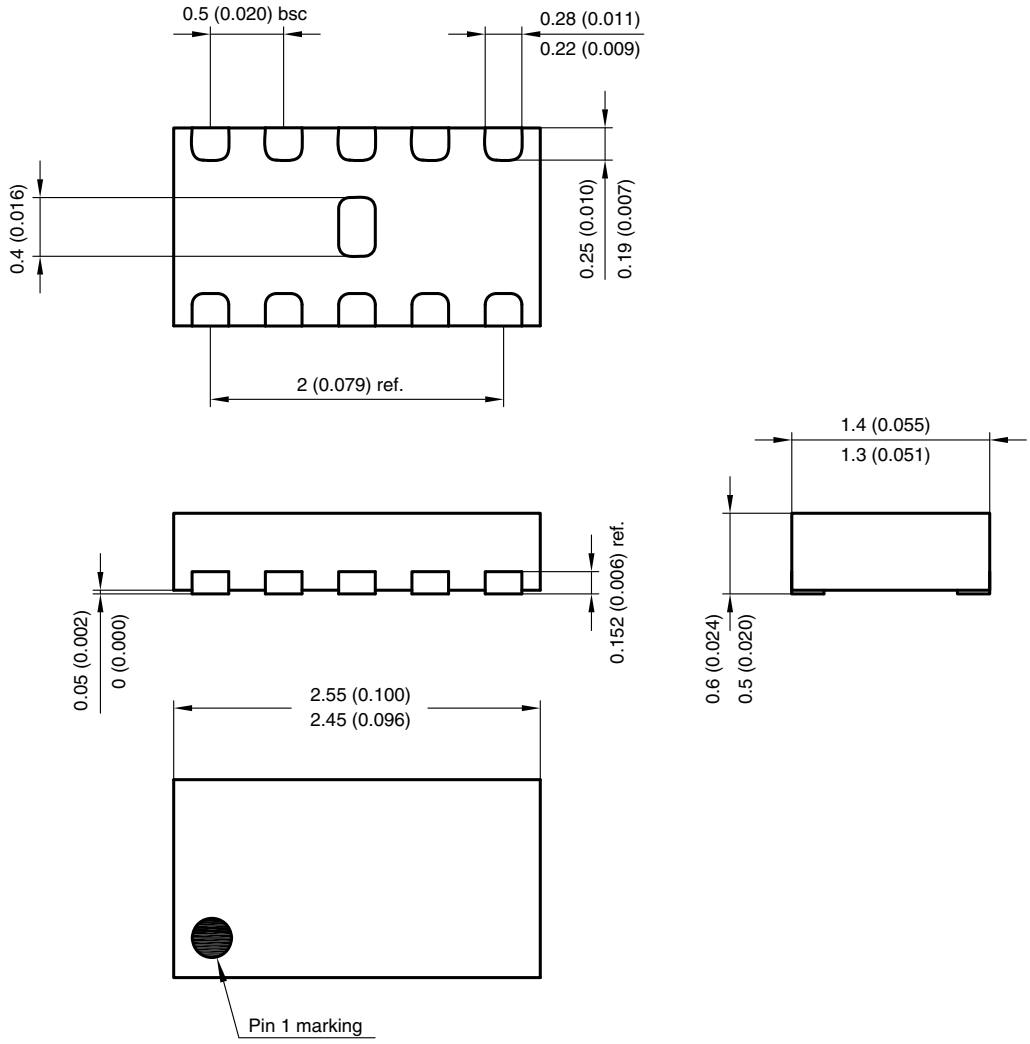
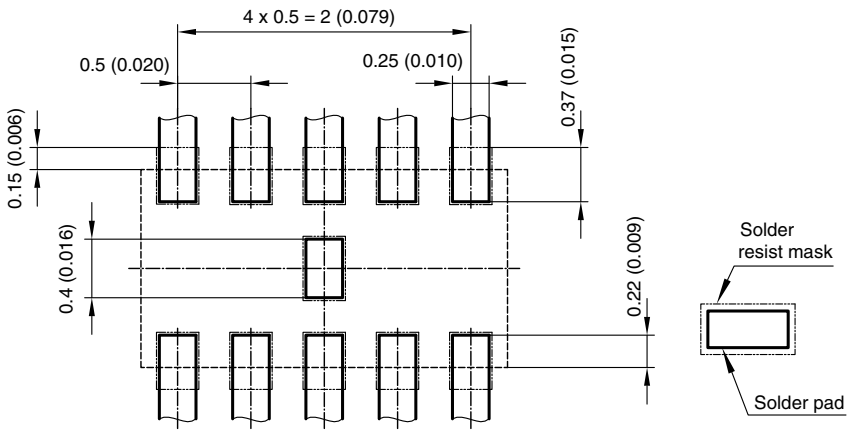


Fig. 9 - Typical Peak Clamping Voltage at ESD
Contact Discharge (acc. IEC 61000-4-2)

PACKAGE DIMENSIONS in millimeters (inches): **LLP2513-11L**



Foot print recommendation:



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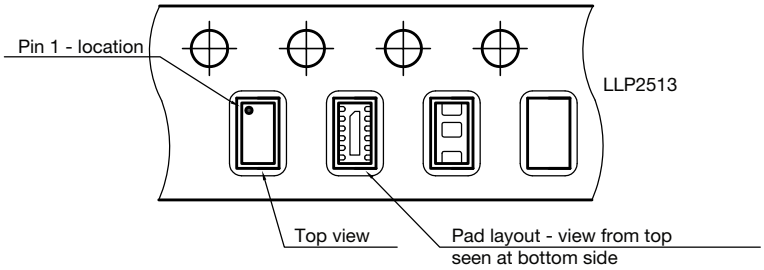

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