

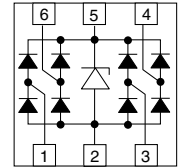
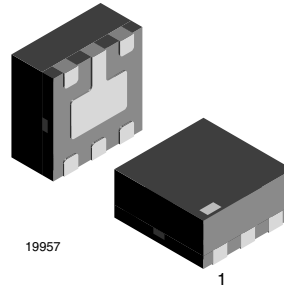
## 4-Line BUS-Port ESD-Protection

### Features

- Ultra compact LLP75-6A package
- 4-line USB ESD-protection
- Low leakage current
- Low load capacitance  $C_D = 1.2$  pF
- ESD-protection acc. IEC 61000-4-2  
 $\pm 30$  kV contact discharge  
 $\pm 30$  kV air discharge
- High surge current acc. IEC61000-4-5  $I_{PP} > 11$  A
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



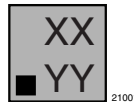
**RoHS**  
COMPLIANT  
**GREEN**  
[5-2008]\*



19957

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### Marking (example only)



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

### Ordering Information

Device name	Ordering code	Taped units per reel (8 mm tape on 7" reel)	Minimum order quantity
VBUS054CV-HS3	VBUS054CV-HS3-GS08	3000	15000

### Package Data

Device name	Package name	Marking code	Weight	Molding compound flammability rating	Moisture sensitivity level	Soldering conditions
VBUS054CV-HS3	LLP75-6A	U8	5.1 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	260 °C/10 s at terminals

### Absolute Maximum Ratings

Parameter	Test conditions	Symbol	Value	Unit
Peak pulse current	Pin 1, 3, 4 or 6 to pin 2 acc. IEC 61000-4-5; $t_p = 8/20$ $\mu$ s; single shot	$I_{PPM}$	11	A
	Pin 5 to pin 2 acc. IEC 61000-4-5; $t_p = 8/20$ $\mu$ s; single shot	$I_{PPM}$	13	A
Peak pulse power	Pin 1, 3, 4 or 6 to pin 2 acc. IEC 61000-4-5; $t_p = 8/20$ $\mu$ s; single shot	$P_{PP}$	242	W
	Pin 5 to pin 2 acc. IEC 61000-4-5; $t_p = 8/20$ $\mu$ s; single shot	$P_{PP}$	246	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	$V_{ESD}$	$\pm 30$	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses	$V_{ESD}$	$\pm 30$	kV
Operating temperature	Junction temperature	$T_J$	- 40 to + 125	°C
Storage temperature		$T_{STG}$	- 40 to + 150	°C

\* Please see document "Vishay Green and Halogen-Free Definitions (5-2008)" <http://www.vishay.com/doc?99902>

## Electrical Characteristics

Ratings at 25 °C, ambient temperature unless otherwise specified

### VBUS054CV-HS3

Date line: pin 1 , 3, 4 or 6 to pin 2

Parameter	Test conditions/remarks	Symbol	Min.	Typ.	Max.	Unit
Protection paths	Number of line which can be protected	$N_{lines}$			4	lines
Reverse working voltage	at $I_R = 0.1 \mu A$	$V_{RWM}$	5			V
Reverse current	at $V_{IN} = V_{RWM} = 5 V$	$I_R$		< 0.01	0.1	$\mu A$
Reverse breakdown voltage	at $I_R = 1 mA$	$V_{BR}$	7	7.9	8.6	V
Reverse clamping voltage	at $I_{PP} = 11 A$ ; acc. IEC 61000-4-5	$V_C$		18	22	V
Forward clamping voltage	at $I_F = 11 A$ ; acc. IEC 61000-4-5	$V_F$		6.5	8	V
Data line capacitance	$V_R$ (at I/O pin) = 0 V; $V_R$ (at pin 5) = 5 V; f = 1 MHz	$C_D$		1.2	2.5	pF
Line Symmetry	Difference of the line capacitances	$dC_D$			0.2	pF

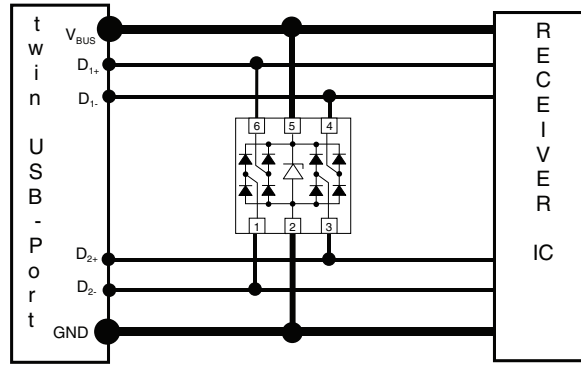
### VBUS054CV-HS3

$V_{BUS}$ -line: pin 5 to pin 2

Parameter	Test conditions/remarks	Symbol	Min.	Typ.	Max.	Unit
Reverse working voltage	at $I_R = 0.1 \mu A$	$V_{RWM}$	5	6.6		V
Reverse current	at $V_{IN} = V_{RWM} = 5 V$	$I_R$		< 0.01	0.1	$\mu A$
Reverse breakdown voltage	at $I_R = 1 mA$	$V_{BR}$	7	7.9	8.6	V
Reverse clamping voltage	at $I_{PP} = 13 A$ ; acc. IEC 61000-4-5	$V_C$		18	22	V
Forward clamping voltage	at $I_F = 13 A$ ; acc. IEC 61000-4-5	$V_F$			7	V
Line capacitance	$V_R$ (at pin 5) = 0 V; f = 1 MHz	$C_D$		190		pF

## Application Note

With the VBUS054CV-HS3 a double, high speed USB-port can be protected against transient voltage signals. Negative transients will be clamped close below the ground level while positive transients will be clamped close above the 5 V working range. An avalanche diode clamps the supply line ( $V_{BUS}$  at pin 5) to ground (pin 2). The high speed data lines, D1+, D2+, D1- and D2-, are connected to pin 1, 3, 4 and 6. As long as the signal voltage on the data lines is between the ground- and the  $V_{BUS}$ -level, the low capacitance PN-diodes offer a very high isolation to  $V_{BUS}$ , ground and to the other data lines. But as soon as any transient signal exceeds this working range, one of the PN-diodes gets in the forward mode and clamps the transient to ground or the avalanche break through voltage level.



## Typical Characteristics

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

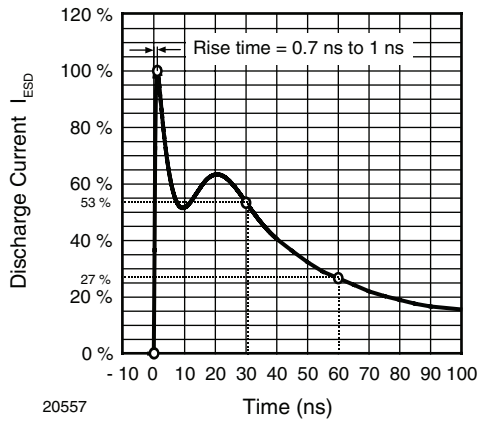


Figure 1. ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330  $\Omega$ /150 pF)

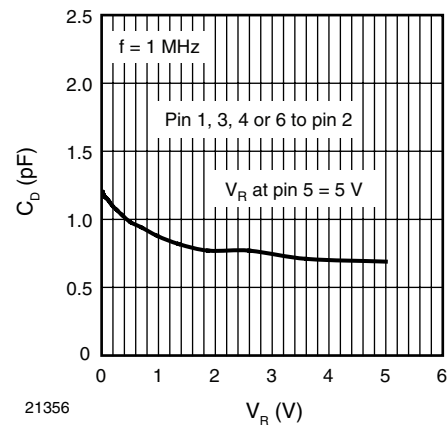


Figure 3. Typical Capacitance  $C_D$  vs. Reverse Voltage  $V_R$

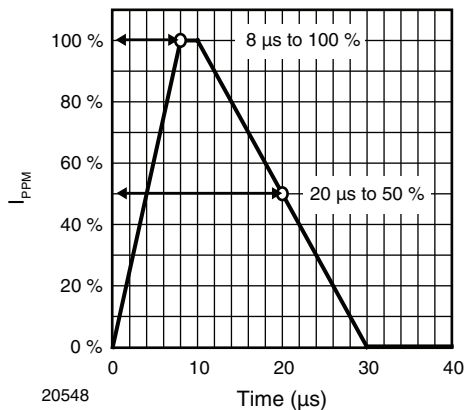


Figure 2. 8/20  $\mu\text{s}$  Peak Pulse Current Wave Form acc. IEC 61000-4-5

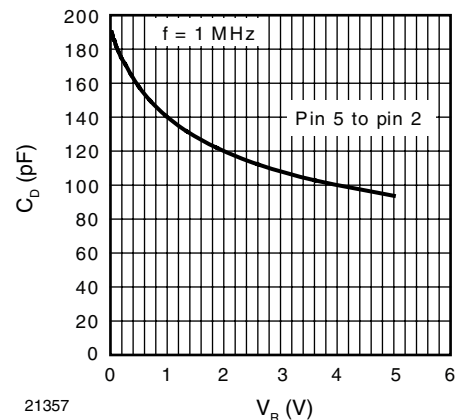


Figure 4. Typical Capacitance  $C_D$  vs. Reverse Voltage  $V_R$

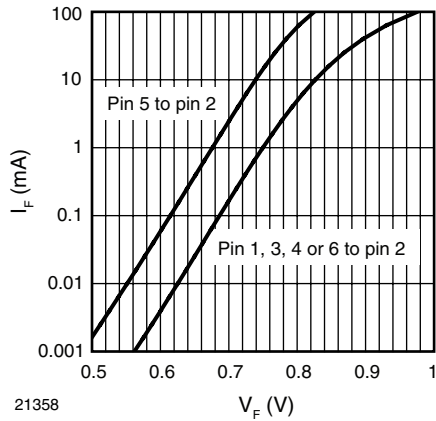


Figure 5. Typical Forward Current  $I_F$  vs. Forward Voltage  $V_F$

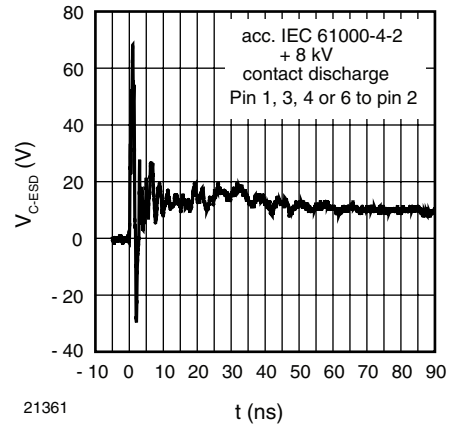


Figure 8. Typical Clamping Performance at + 8 kV Contact Discharge (acc. IEC 61000-4-2)

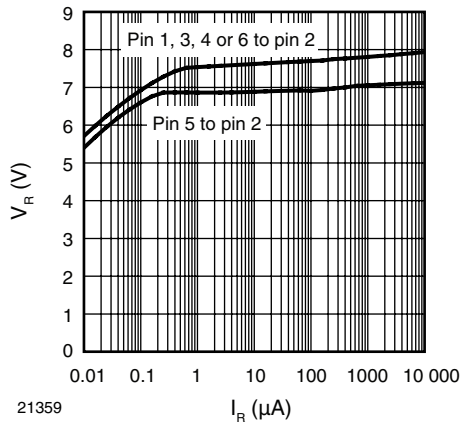


Figure 6. Typical Reverse Voltage  $V_R$  vs. Reverse Current  $I_R$

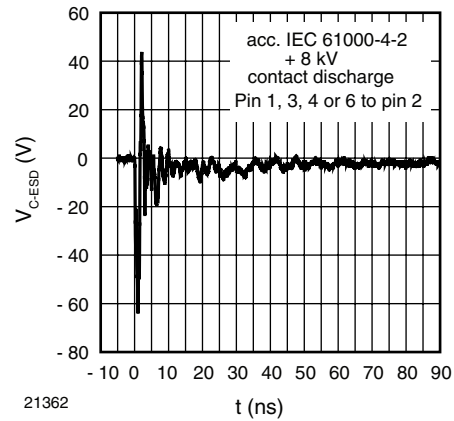


Figure 9. Typical Clamping performance at - 8 kV Contact Discharge (acc. IEC 61000-4-2)

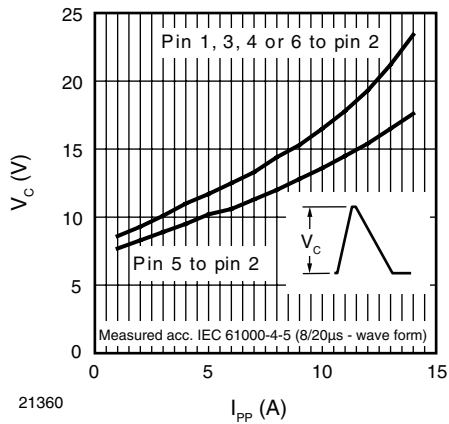


Figure 7. Typical Peak Clamping Voltage  $V_C$  vs. Peak Pulse Current  $I_{PP}$

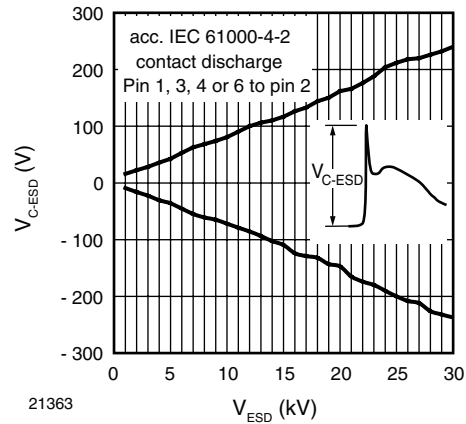
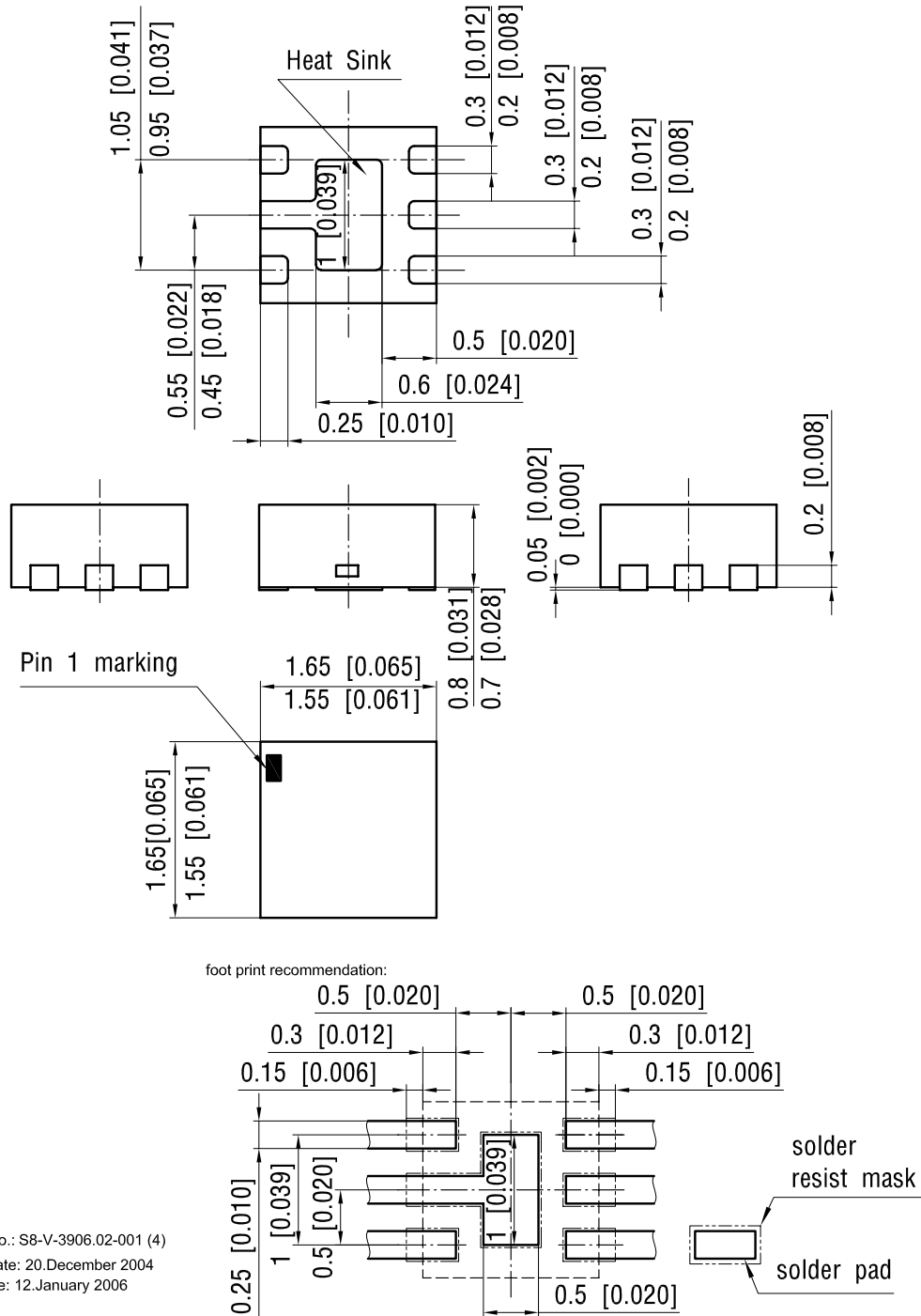


Figure 10. Typical Peak Clamping Voltage at ESD Contact Discharge (acc. IEC 61000-4-2)

**Package Dimensions** in millimeters (inches): **LLP75-6A**



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 Created - Date: 20.December 2004  
 Rev. b - Date: 12.January 2006  
 18058

### 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.

We reserve the right to make changes to improve technical design  
and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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