

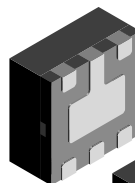
## 4-Line BUS-Port ESD-Protection

### Features

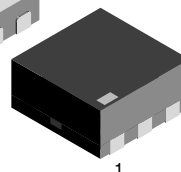
- Ultra compact LLP75-6A package
- 4-line USB ESD-protection
- Low leakage current
- Low load capacitance  $C_D = 1.2 \text{ pF}$
- ESD-protection acc. IEC 61000-4-2  
 $\pm 30 \text{ kV}$  contact discharge  
 $\pm 30 \text{ kV}$  air discharge
- High surge current acc. IEC61000-4-5  $I_{PP} > 11 \text{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



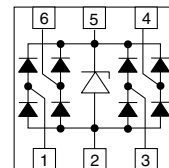
**RoHS**  
COMPLIANT  
**GREEN**  
(5-2008)\*



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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; $t_p = 8/20 \mu\text{s}$ ; single shot	$I_{PPM}$	11	A
	Pin 5 to pin 2 acc. IEC 61000-4-5; $t_p = 8/20 \mu\text{s}$ ; single shot	$I_{PPM}$	13	A
Peak pulse power	Pin 1, 3, 4 or 6 to pin 2 acc. IEC 61000-4-5; $t_p = 8/20 \mu\text{s}$ ; single shot	$P_{PP}$	242	W
	Pin 5 to pin 2 acc. IEC 61000-4-5; $t_p = 8/20 \mu\text{s}$ ; 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

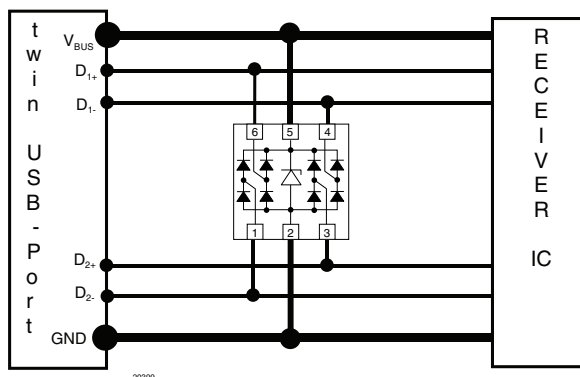
### VBUS054CV-HS3

$V_{BUS}$ -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

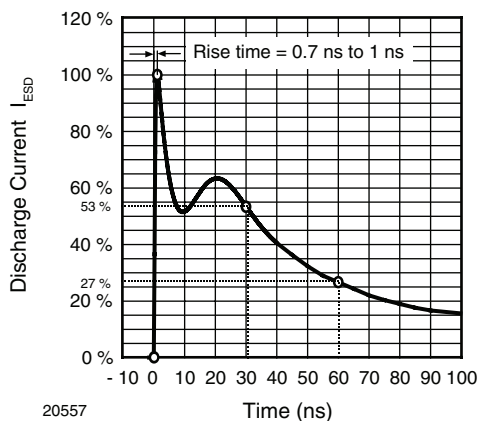


Figure 1. ESD Discharge Current Wave Form  
acc. IEC 61000-4-2 (330  $\Omega$ /150 pF)

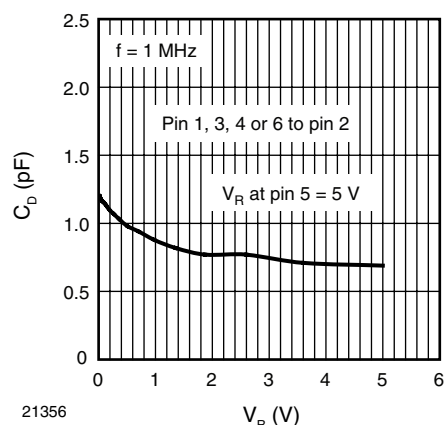


Figure 3. Typical Capacitance  $C_D$  vs. Reverse Voltage  $V_R$

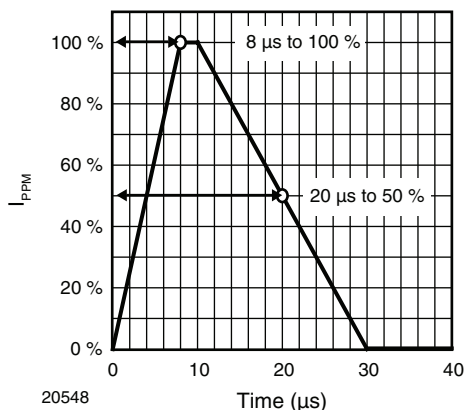


Figure 2. 8/20  $\mu$ s Peak Pulse Current Wave Form  
acc. IEC 61000-4-5

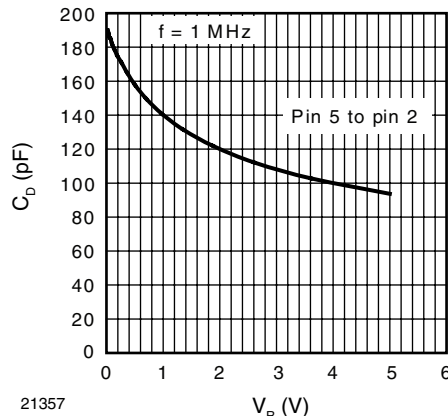


Figure 4. Typical Capacitance  $C_D$  vs. Reverse Voltage  $V_R$

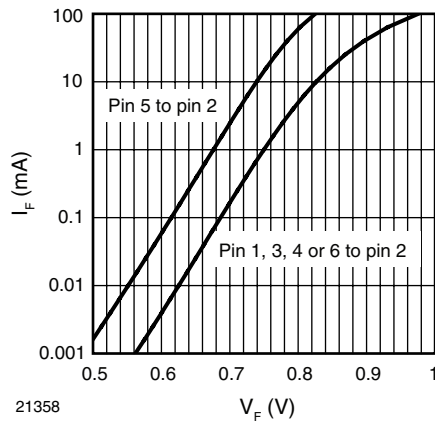


Figure 5. Typical Forward Current  $I_F$  vs. Forward Voltage  $V_F$

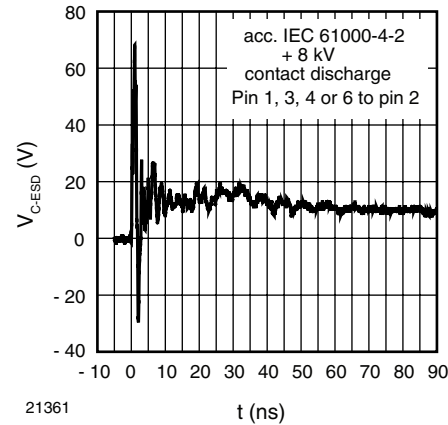


Figure 8. Typical Clamping Performance at +8 kV Contact Discharge (acc. IEC 61000-4-2)

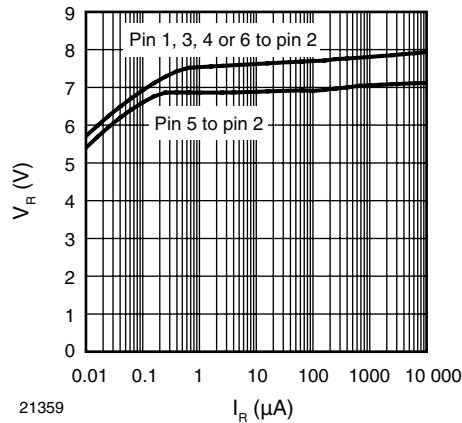


Figure 6. Typical Reverse Voltage  $V_R$  vs. Reverse Current  $I_R$

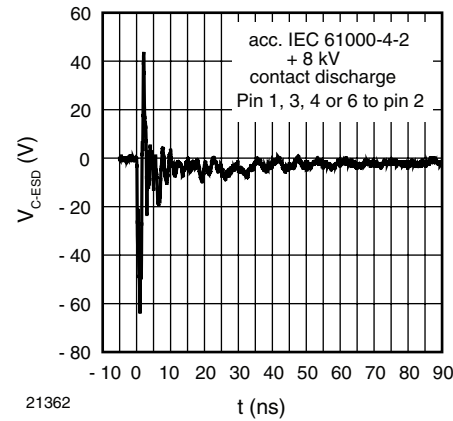


Figure 9. Typical Clamping performance at -8 kV Contact Discharge (acc. IEC 61000-4-2)

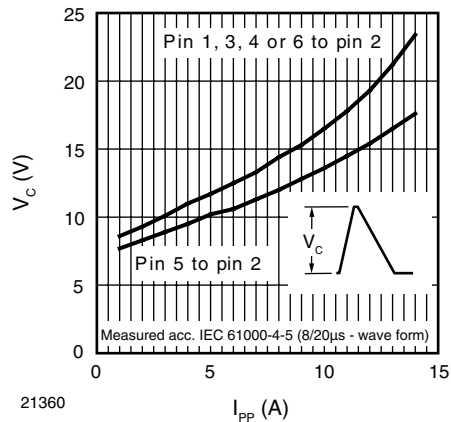


Figure 7. Typical Peak Clamping Voltage  $V_C$  vs. Peak Pulse Current  $I_{PP}$

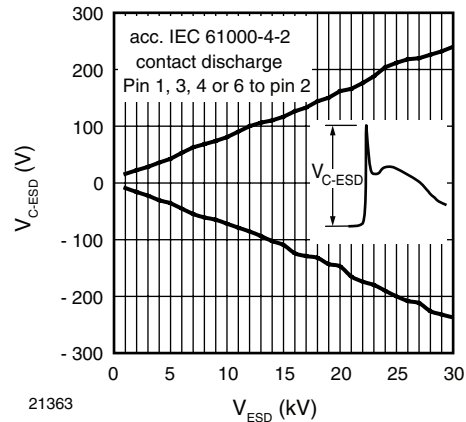
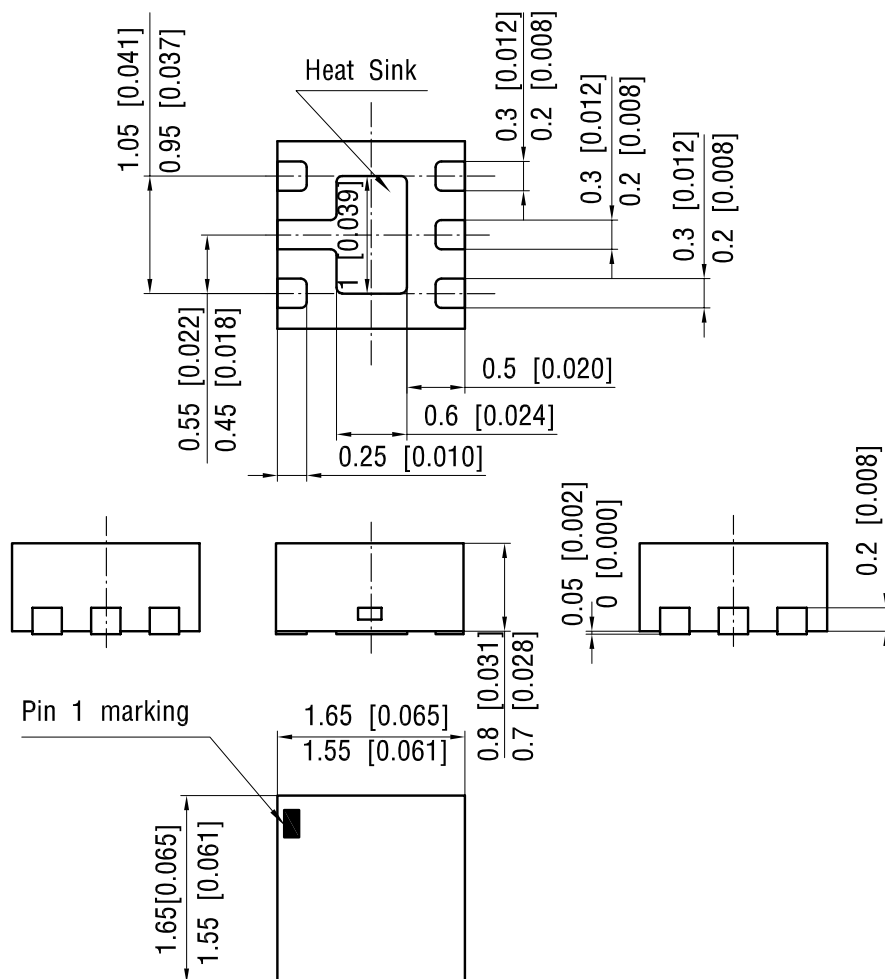
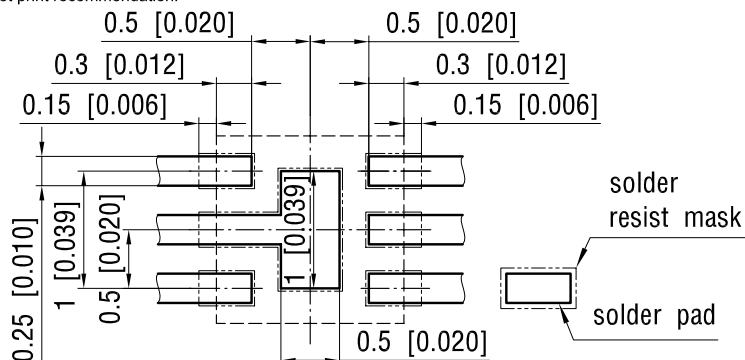


Figure 10. Typical Peak Clamping Voltage at ESD Contact Discharge (acc. IEC 61000-4-2)

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



foot print recommendation:



Document no.: S8-V-3906.02-001 (4)  
 Created - Date: 20.December 2004  
 Rev. b - Date: 12.January 2006  
 18058



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