

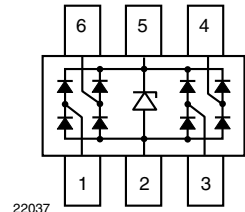
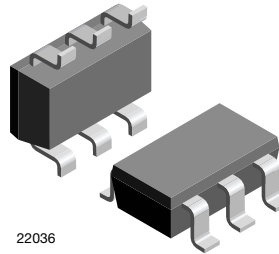
## 4-Line BUS-Port ESD-Protection

### Features

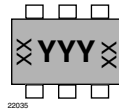
- Ultra compact SOT-23-6L package
- 4-line USB ESD-protection
- Low leakage current
- Low load capacitance  $C_D = 1.2$  pF
- ESD-protection acc. IEC 61000-4-2  
 $\pm 30$  kV contact discharge  
 $\pm 30$  kV air discharge
- High surge current acc. IEC61000-4-5  $I_{PP} > 11$  A
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC



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



### Marking (example only)



YYY = 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 |
|---------------|--------------------|------------------------------------------------|------------------------|
| VBUS054CV-06S | VBUS054CV-06S-G-08 | 3000                                           | 15 000                 |

### Package Data

| Device name   | Package name | Marking code | Weight  | Molding compound flammability rating | Moisture sensitivity level           | Soldering conditions     |
|---------------|--------------|--------------|---------|--------------------------------------|--------------------------------------|--------------------------|
| VBUS054CV-06S | SOT-23-6L    | 4CV          | 15.2 mg | UL 94 V-0                            | MSL level 1<br>(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<br>acc. IEC 61000-4-5; $t_p = 8/20$ $\mu$ s; single shot | $I_{PPM}$ | 11           | A    |
|                       | Pin 5 to pin 2<br>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<br>acc. IEC 61000-4-5; $t_p = 8/20$ $\mu$ s; single shot | $P_{PP}$  | 242          | W    |
|                       | Pin 5 to pin 2<br>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 + 85 | °C   |

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

**Electrical Characteristics**

Ratings at 25 °C, ambient temperature unless otherwise specified

**VBUS054CV-06S**

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

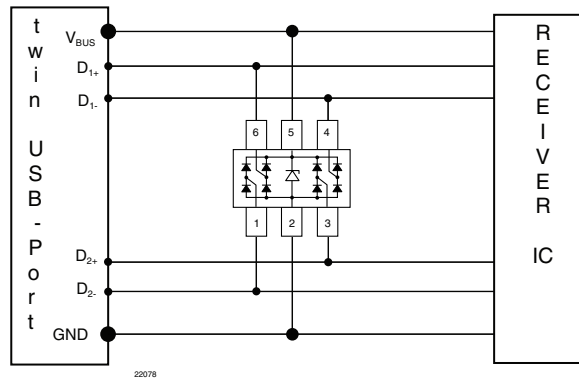
| Parameter                 | Test conditions/remarks                                          | Symbol      | Min. | Typ. | Max. | Unit    |
|---------------------------|------------------------------------------------------------------|-------------|------|------|------|---------|
| Protection paths          | Number of line which can be protected                            | $N_{lines}$ |      |      | 4    | lines   |
| Reverse working voltage   | at $I_R = 0.1 \mu A$                                             | $V_{RWM}$   | 5.5  |      |      | V       |
| Reverse current           | at $V_{IN} = V_{RWM} = 5.5 V$                                    | $I_R$       |      | 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                             | $V_F$       |      | 5    | 6.5  | V       |
| Data line capacitance     | $V_R$ (at I/O pin) = 0 V;<br>$V_R$ (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-06S** $V_{BUS}$ -line: pin 5 to pin 2

| Parameter                 | Test conditions/remarks                 | Symbol    | Min. | Typ. | Max. | Unit    |
|---------------------------|-----------------------------------------|-----------|------|------|------|---------|
| Reverse working voltage   | at $I_R = 0.1 \mu A$                    | $V_{RWM}$ | 5.5  | 6.6  |      | V       |
| Reverse current           | at $V_{IN} = V_{RWM} = 5.5 V$           | $I_R$     |      | 0.01 | 0.1  | $\mu A$ |
| Reverse breakdown voltage | at $I_R = 1 mA$                         | $V_{BR}$  | 6.3  | 7.1  | 8    | 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-06S 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)

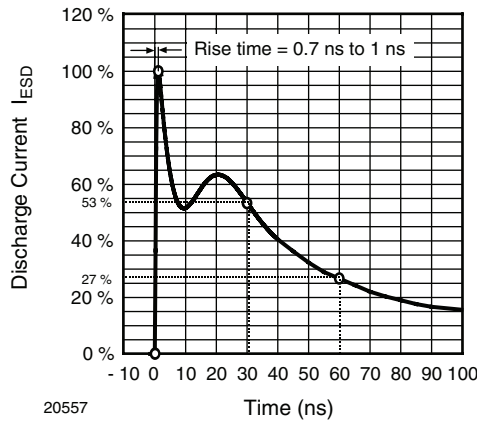


Figure 1. ESD Discharge Current Wave Form  
acc. IEC 61000-4-2 (330  $\Omega$ /150 pF)

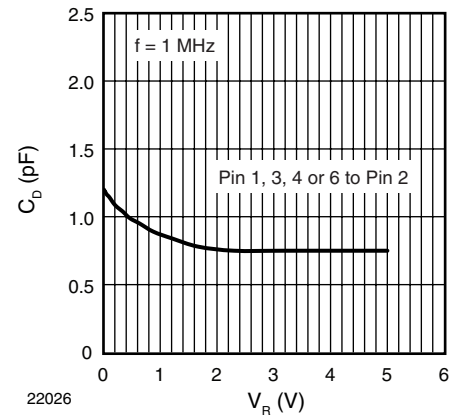


Figure 3. Typical Capacitance  $C_D$  vs. Reverse Voltage  $V_R$

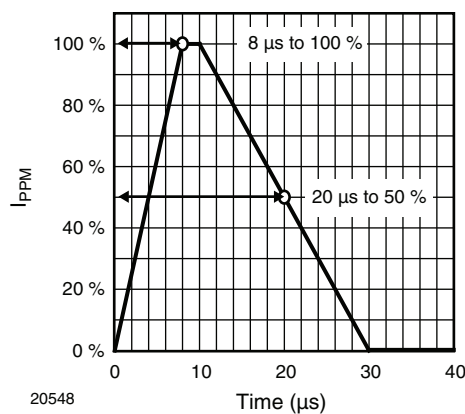


Figure 2. 8/20  $\mu$ s Peak Pulse Current Wave Form  
acc. IEC 61000-4-5

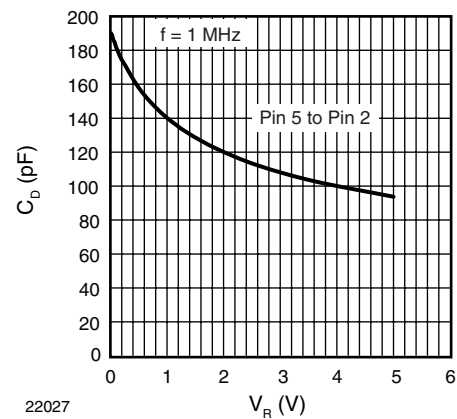


Figure 4. Typical Capacitance  $C_D$  vs. Reverse Voltage  $V_R$

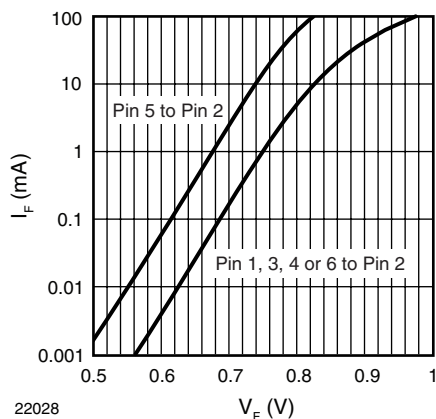


Figure 5. Typical Forward Current  $I_F$  vs. Forward Voltage  $V_F$

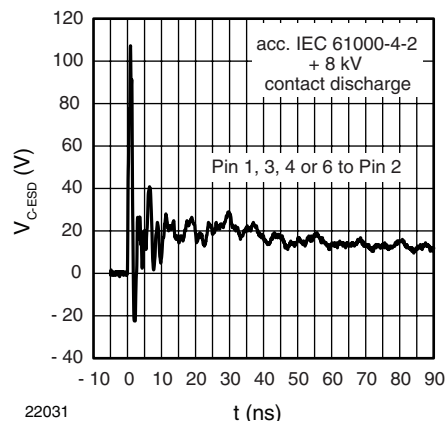


Figure 8. Typical Clamping Performance at +8 kV Contact Discharge (acc. IEC 61000-4-2)

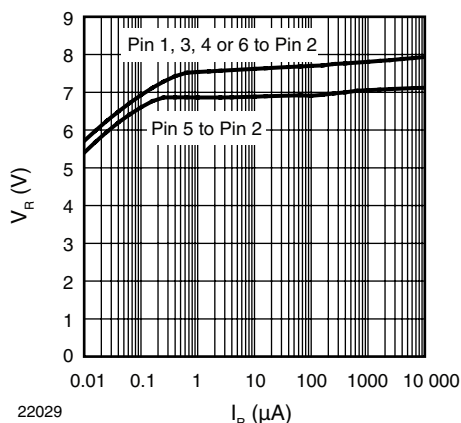


Figure 6. Typical Reverse Voltage  $V_R$  vs. Reverse Current  $I_R$

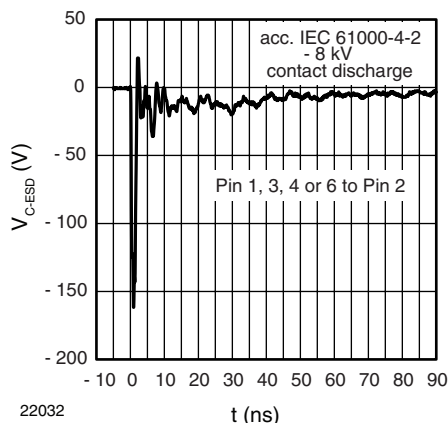


Figure 9. Typical Clamping performance at -8 kV Contact Discharge (acc. IEC 61000-4-2)

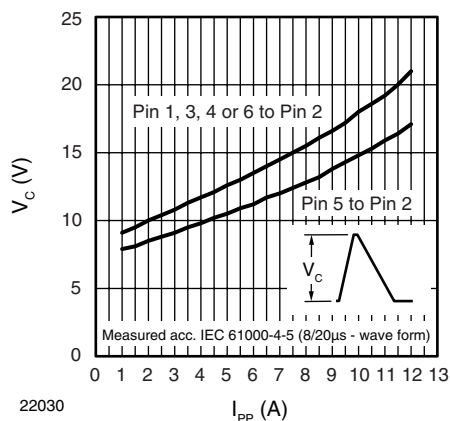


Figure 7. Typical Peak Clamping Voltage  $V_C$  vs. Peak Pulse Current  $I_{PP}$

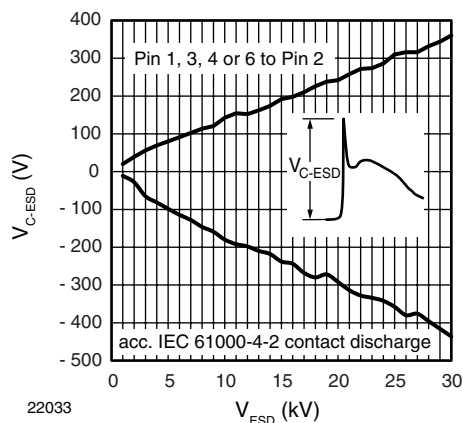
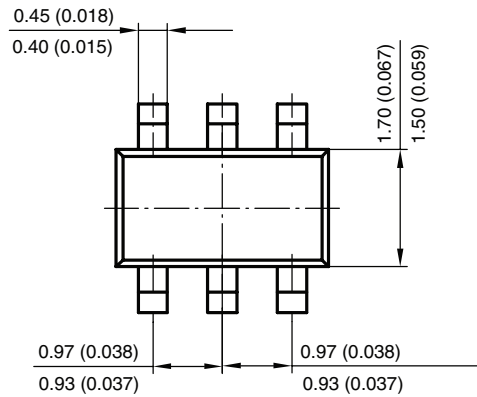
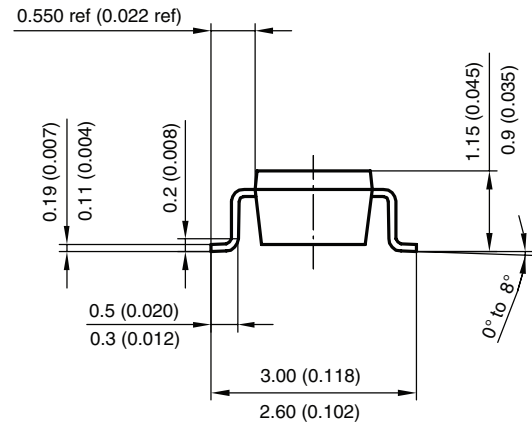
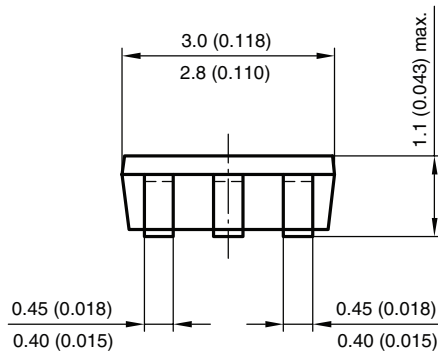
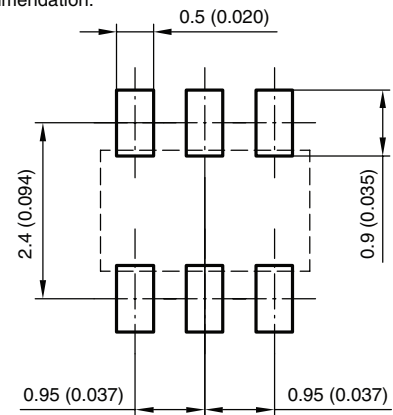


Figure 10. Typical Peak Clamping Voltage at ESD Contact Discharge (acc. IEC 61000-4-2)

## Package Dimensions in millimeters (inches): SOT-23-6L



foot print recommendation:

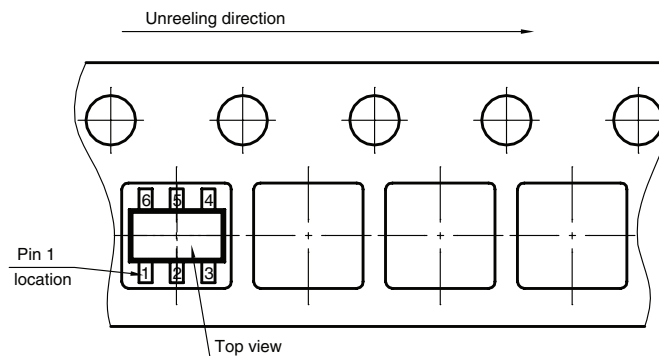


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Rev. 1 - Date: 15.Jan.2010

22034

## Orientation in Blister tape



S8-V-3929.01-003 (4)

Date: 23. 11. 2009

22007



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