



## DATA LINES PROTECTION

### APPLICATIONS

Where transient overvoltage protection in sensitive equipment is required, such as:

- Universal Serial Bus ports
- RS-423 interfaces
- RS-485 interfaces
- ISDN equipment
- T1/E1 line cards
- HDSL / ASDL interfaces

### FEATURES

- Full diode bridge with integrated clamping protection
- Breakdown voltage :  $V_{BR} = 6V$  min.
- Peak pulse power dissipation :  $P_{PP} = 500W$  (8/20 $\mu$ s)
- Very low capacitance, compatible with high debit data or signal rates.

### DESCRIPTION

In order to prevent fast transients from leading to severe damages in a high speed data system, a specific protection has been developed by STMicroelectronics.

The **USB6B1** protects the two input lines against overvoltage. Besides, this device also keeps the power rails in a safe limit thanks to the integrated Transil diode.

### BENEFITS

- Provides protection for each line and between the supply voltage and GND : 25A , 8/20 $\mu$ s.
- High ESD protection level : up to level 3 per MIL STD 883C-Method 3015-6
- Separated inputs and outputs (so-called 4-point structure) to improve ESD susceptibility.
- Comprehensive package pin-out for immediate implementation.

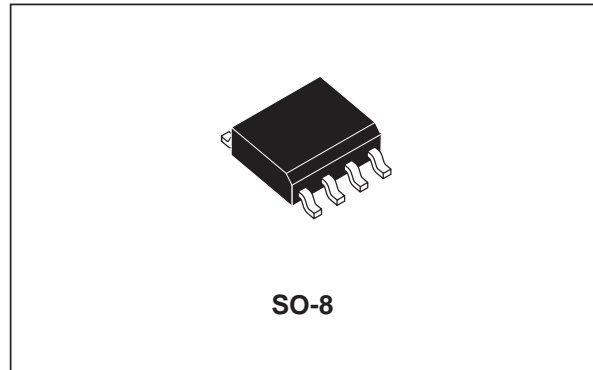
### COMPLIES WITH THE FOLLOWING STANDARDS:

#### MIL STD 883C - Method 3015-6

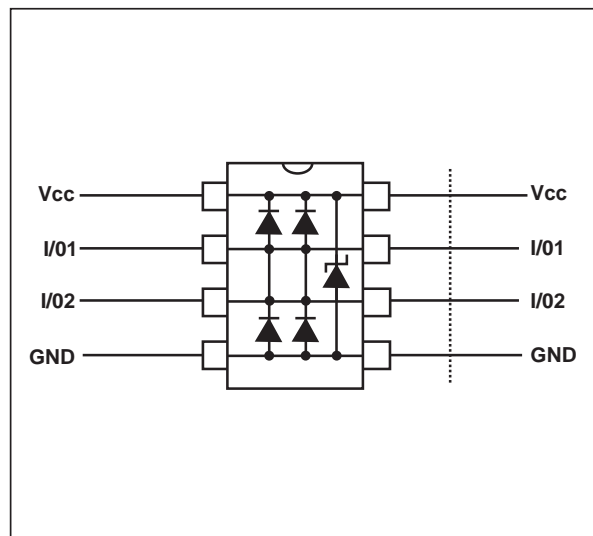
class 3     $C = 100$  pF     $R = 1500$   $\Omega$   
3 positive strikes and 3 negative strikes (F = 1 Hz)

IEC-1000-4-2 level 4

15 kV (air discharge)  
8 kV (contact discharge)



### FUNCTIONAL DIAGRAM



TM: ASD and TRANSIL are trademarks of STMicroelectronics.

# USB6B1

## TECHNICAL INFORMATION

### SURGE PROTECTION

The USB6B1 is particularly optimized to perform surge protection based on the rail to rail topology.

The clamping voltage  $V_{CL}$  can be estimated as follow:

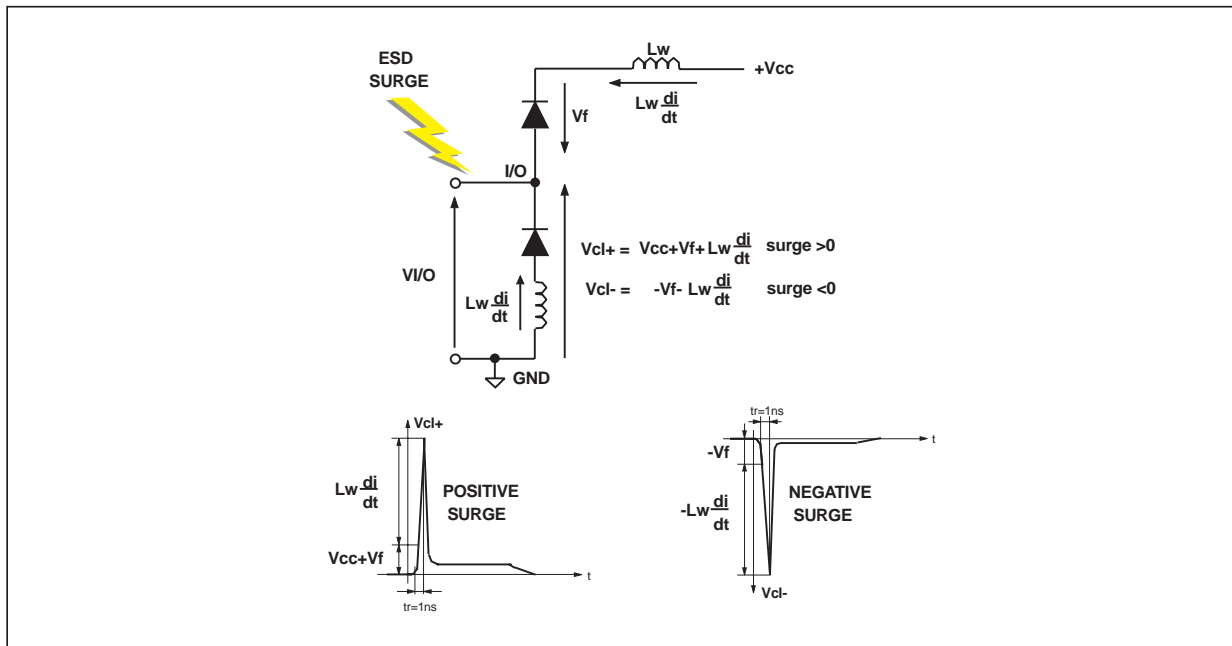
$$\begin{aligned} V_{CL+} &= V_{CC} + V_F && \text{for positive surges} \\ V_{CL-} &= -V_F && \text{for negative surges} \end{aligned}$$

with:  $V_F = V_t + r_d \cdot I_p$

( $V_F$  forward drop voltage) / ( $V_t$  forward drop threshold voltage)

Note: the estimations do not take into account phenomena due to parasitic inductances.

Fig. A1 :



**HOW TO ENSURE A GOOD ESD PROTECTION**

While the USB6B1 provides a high immunity to ESD surge, an efficient protection depends on the layout of the board. In the same way, with the rail to rail topology, the track from the V<sub>CC</sub> pin to the power supply and from the GND pin to GND voltage must be as short as possible to avoid overvoltages due to parasitic phenomena (see Fig A1).

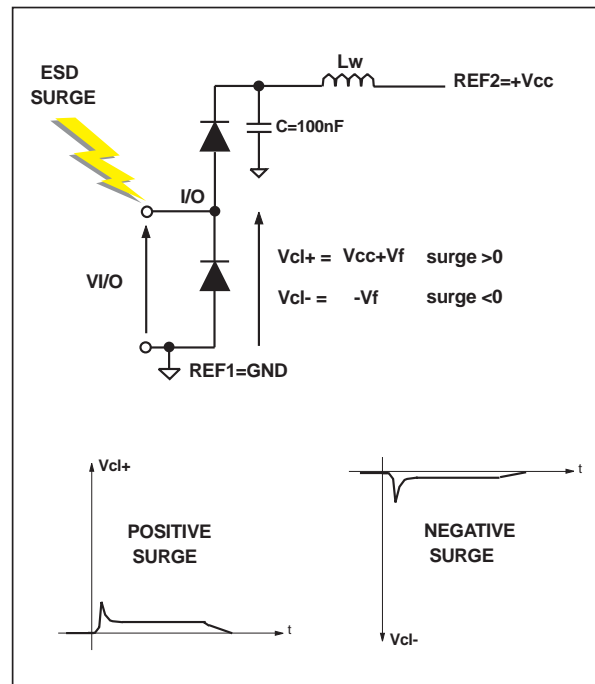
It's often harder to connect the power supply near to the USB6B1 unlike the ground thanks to the ground plane that allows a short connection.

To ensure the same efficiency for positive surges when the connections can't be short enough, we recommend to put close to the USB6B1 between V<sub>CC</sub> and ground, a capacitance of 100nF to prevent from these kinds of overvoltage disturbances (see Fig. A2).

The add of this capacitance will allow a better protection by providing during surge a constant voltage.

Fig. A3 shows the improvement of the ESD protection according to the recommendations described above.

**Fig. A2:** ESD behavior: optimized layout and add of a capacitance of 100nF.



**IMPORTANT:**

A main precaution to take is to put the protection device closer to the disturbance source (generally the connection).

## USB6B1

### TECHNICAL INFORMATION

#### Universal Serial Bus.

The new data transmission standard, Universal Serial Bus (USB) is being driven by market leaders in the world of Computer and Telecommunications, including Compaq, DEC, IBM, Intel, Microsoft, NEC and Nortel, and will become the leading transmission protocol within the next few years.

This standard mainly provides simplified interconnectivity. Specialized ports on the back of the present PC will largely be replaced by USB ports. Many peripherals such as printers, keyboards, monitors and joysticks will also host USB ports.

The USB offers high speed communication rates up to 12 Mbit/s. Only two wires (D+, D-) are required for data transfer. Additionally, limited amount of power for USB devices located on the

downstream can also be transmitted on two separate conductors within the same cable.

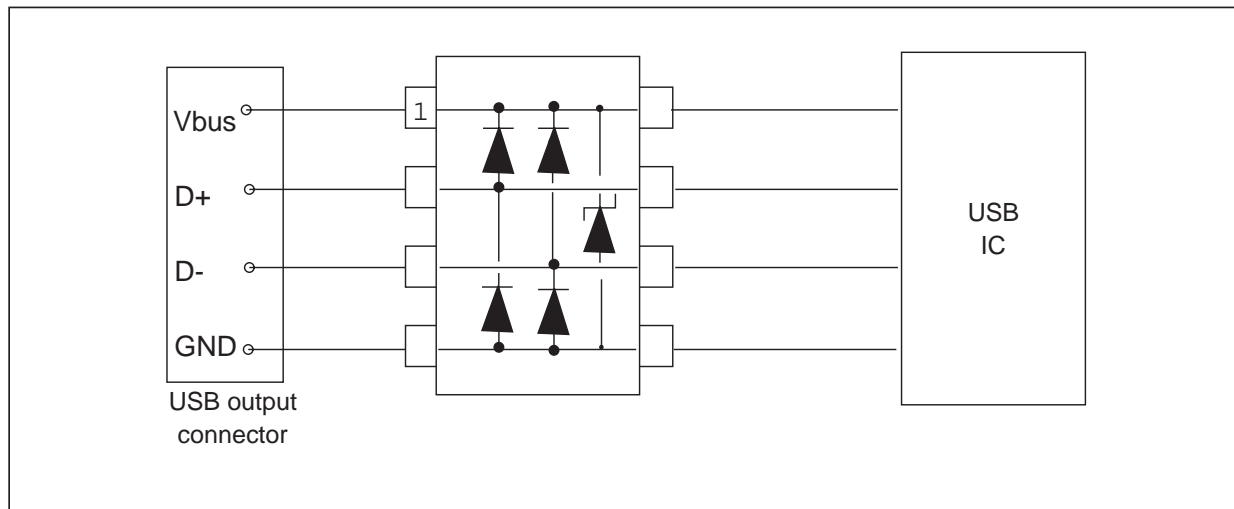
#### Protection to support USB.

Designers dealing with the USB chips are concerned about electrostatic discharge sensitivity (ESD) of their USB controller ICs.

The USB controller is more than just a driver / receiver; it acts as a microcontroller which manages power and direct signal traffic. This complexity increases its cost over conventional devices. Therefore, a failure of a USB port could result in costly computer failure.

In order to prevent these fast transients from leading to severe damages in a system, a specific protection has been developed by STMicroelectronics. The USB6Bx protects not only the two wires of data transmission, but also keep the power rails in a safe limit.

Fig. A3: recommended configuration for USB port protection.

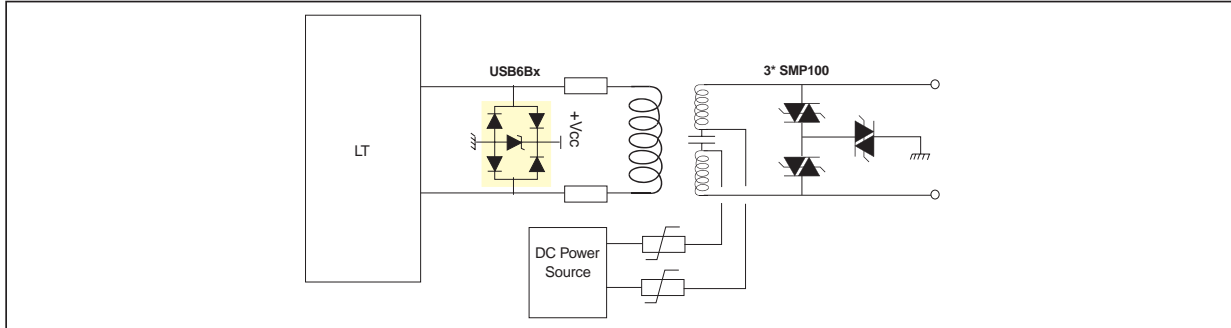


The capacitance between the I/O transmission wires provides no significant signal distortion at the 12 Mbit/s data rate, thus allowing full compatibility with USB standard.

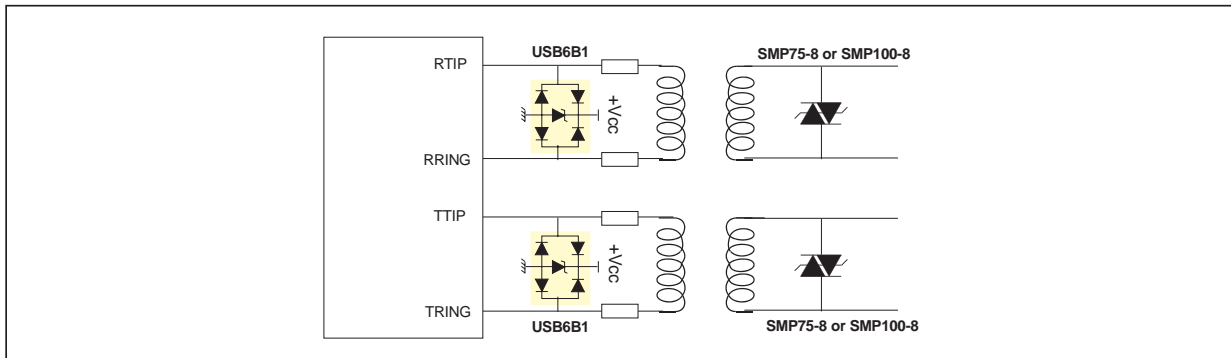
Available in a compact SO-8 this protective element requires minimal board space and eases the PCB layout thanks to its direct compatibility with the USB connector pin-out.

TELECOM AND DATACOM APPLICATIONS

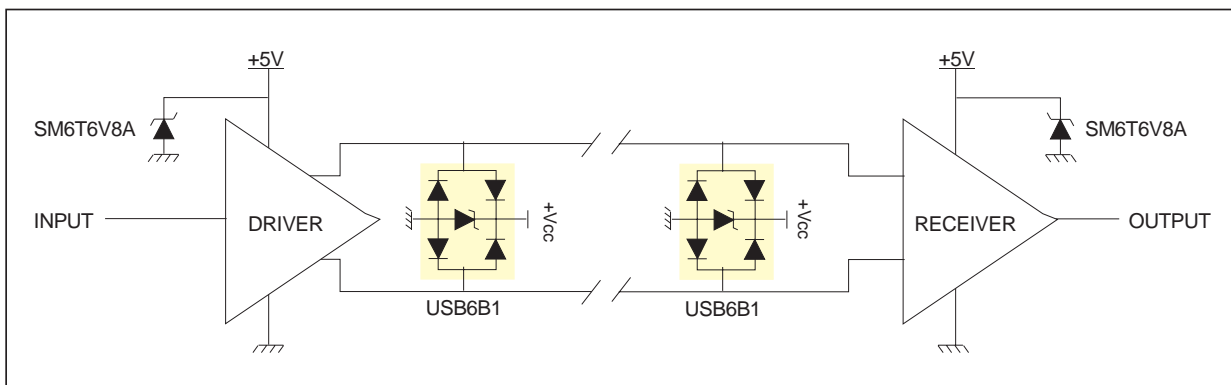
ISDN U interface protection.



T1 / E1 Line Card Protection.



High Speed Line Driver / Receiver Protection.



## USB6B1

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V <sub>PP</sub>	Peak pulse voltage	IEC1000-4-2 contact discharge	8	kV
		IEC1000-4-2 air discharge	15	
		MIL STD883C-Method 3015-6	4	
P <sub>PP</sub>	Peak pulse power	8/20 $\mu$ s	500	W
I <sub>PP</sub>	Peak pulse current	8/20 $\mu$ s	25	A
		2/10 $\mu$ s	40	
T <sub>stg</sub> T <sub>op</sub>	Storage temperature range Operating temperature range		- 55 to + 150 - 40 to + 85	$^{\circ}$ C $^{\circ}$ C
T <sub>L</sub>	Lead solder temperature (10s duration)		260	$^{\circ}$ C

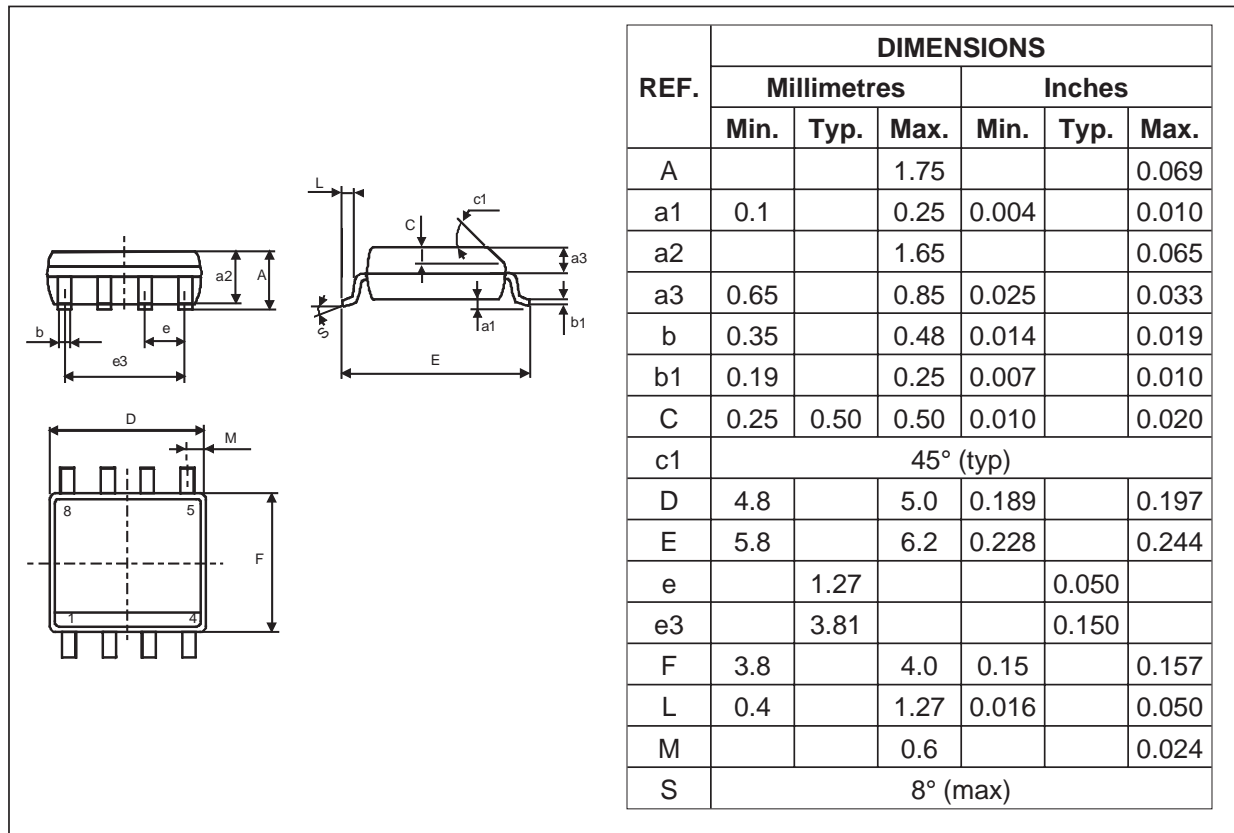
### ELECTRICAL CHARACTERISTICS (T<sub>amb</sub> = 25 $^{\circ}$ C)

Symbol	Parameter		Value			Unit
			min.	typ.	max.	
V <sub>BR</sub>	Breakdown voltage between V <sub>bus</sub> and GND	I <sub>R</sub> =1mA	6			V
I <sub>RM</sub>	Leakage current	V <sub>RM</sub> =5.25V			10	$\mu$ A
C	Capacitance between pins D+ and D- V <sub>OSC</sub> =30mV, F=1MHz, V <sub>R</sub> =0V	V <sub>CC</sub> not connected		15		pF
	Capacitance between pins D+ (or D-) and GND V <sub>OSC</sub> =30mV, F=1MHz, V <sub>R</sub> =5V	V <sub>CC</sub> =5V		25		pF



# USB6B1

## PACKAGE MECHANICAL DATA. SO-8 Plastic



## MARKING

Types	Package	Weight	Marking	ORDER CODE	Base Qty
USB6B1	SO-8	0.077g	USB62	USB6B1	100 pcs (tube)
				USB6B1RL	2500 pcs (tape and reel)

- Epoxy meets UL94, V0

Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a registered trademark of STMicroelectronics.

All other names are the property of their respective owners.

© 2003 STMicroelectronics - All rights reserved.

STMicroelectronics GROUP OF COMPANIES

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States

[www.st.com](http://www.st.com)