

TVS Diode Arrays

Upstream USB Port Terminator with ESD Suppression & EMI Filtering

SPUSB1 Series

The Littelfuse SPUSB1 Series is a multifunctional USB port protection network designed to provide ESD protection, EMI/RFI filtering and line termination for a single USB 1.1 port. The SPUSB1 can replace a minimum of ten typically larger “discrete” devices resulting in inventory and placement cost savings.

The SPUSB1 combines a transient voltage suppressor (TVS), avalanche diodes, EMI/RFI filtering components (R1 and C1), and a 1.5kΩ termination resistor for the filter. Components are included to satisfy requirements for the USB 1.1 specification and the 15kΩ resistor (R2) is used as a pull-up resistor to VBUS.

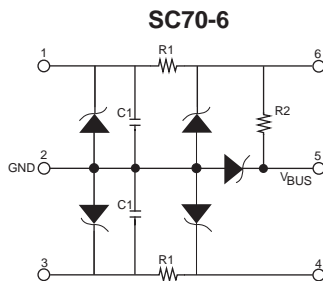
The SPUSB1 Series can be used for termination and protection of “upstream” USB devices such as PDAs, digital cameras, scanners and hubs which are often at risk from transient voltage surges and electromagnetic interference from both internal and external sources.

To support a wide range of circuit conditions, Littelfuse offers three resistance values for the series resistor (R1). The series resistance plus the USB driver output resistance must be close to the USB cable’s characteristic impedance of 45Ω (90Ω balanced) to minimize transmission line reflections.



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Circuit Diagram



Features

- One upstream USB port terminator, EMI filter and transient overvoltage protector in a single surface-mount package
- Compact SC70 package saves board space and lowers manufacturing costs compared to discrete solutions
- ESD protection to 30kV contact discharge per MIL-STD- 883D, method 3015
- ESD protection to 15kV contact discharge per IEC 61000-4-2 international standard

Applications

- Desktop/Laptop PCs
- USB peripherals (printers, scanners, zip drives)
- PDAs / wireless handsets
- Digital cameras
- MP3 Players
- Cable Modems

Ordering Information

| PART NUMBER | R1 (Ohm) | R2 (KOhm) | C1 (pF) | DEVICE BRAND | PKG TYPE | #/REEL |
|-------------|----------|-----------|---------|--------------|----------|--------|
| SPUSB1AJT | 12 | 1.5 | 47 | UFA | SC70-6 | 3000 |
| SPUSB1BJT | 22 | 1.5 | 47 | UFB | SC70-6 | 3000 |
| SPUSB1CJT | 33 | 1.5 | 47 | UFC | SC70-6 | 3000 |

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| Absolute Maximum Ratings | | |
|--------------------------|-------------|--------------------|
| Parameter | Rating | Unit |
| Supply Voltage V_{BUS} | 5.5 | V |
| DC Power per Resistor | 100 | mW |
| Package Power | 200 | mW |
| Temperature Range | -40 to +125 | $^{\circ}\text{C}$ |
| Storage Temperature | -40 to +125 | $^{\circ}\text{C}$ |

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| Specifications (at 25 $^{\circ}\text{C}$ unless specified otherwise) | | | | | |
|---|--|----------------------------------|-------------|-------------|----------------|
| Standard | Parameter | MIN | TYP | MAX | Unit |
| | Resistance R1 (SPUSB1AJT only) | 6% | 12 | 14% | Ω |
| | Resistance R1 (SPUSB1CJT only) | 26% | 33 | 40% | Ω |
| | Resistance R1 (SPUSB1BJT only) | 18% | 22 | 26% | Ω |
| | Resistance R2 | 1.2% | 1.5 | 18% | k Ω |
| | Capacitance C1 @ 2.5 v DC, 1MHz | 38% | 47 | 56% | pF |
| | Diode Leakage at 3.3V | | 1 | 100 | nA |
| | Diode Reverse Bias Stand-off Voltage, $I = 10\mu\text{A}$ | 5.5 | | | V |
| | Signal Clamp Voltage: Positive Clamp, 10mA Negative Clamp, 10mA | 5.6 -1.2 | 6.8 -0.8 | 8.0 -0.4 | V V |
| | In-system ESD Withstand Voltage ⁽¹⁾ Human Body Model (MIL-STD-883D, method 3015) IEC 81000-4-2, contact discharge method (I/O pins) IEC 81000-4-2, contact discharge method (V_{BUS} pin) | ± 30 ± 15 ± 25 | | | kV kV kV |
| | Clamping Voltage During ESD Discharge ⁽¹⁾ MIL-STD-883D (Method 3015), 8kV | | 10 -5 | | V V |

Note:

(1) ESD applied to input/output V_{DD} pins with respect to GND, one at a time.

Clamping Voltage is measured at the opposite side of the EMI filter to the ESD pin (ie: if ESD is applied to pin1 then clamping voltage is measured at pin 6). Unused pins are open.

These parameters guaranteed by design.

APPLICATIONS INFORMATION

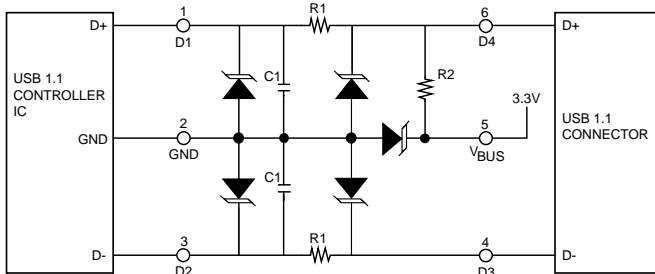


Figure 1. Full-Speed Devices (12Mbps per second)

For full speed operation the pull-up resistor R2 is connected to the D+ pin.

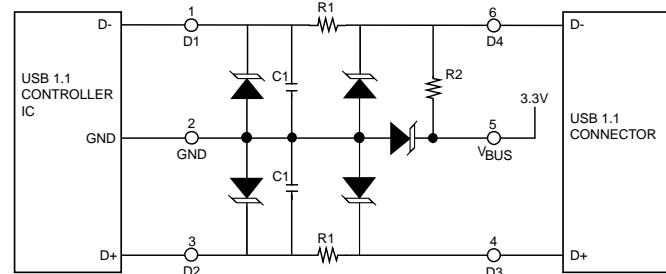


Figure 2. Low-Speed Devices (1.5Mbps per second)

Low speed connection requires the pull-up resistor R2 to be connected to the D- pin. Please note the reversal of the D- and D+ pins on Figure 2 versus Figure 1.

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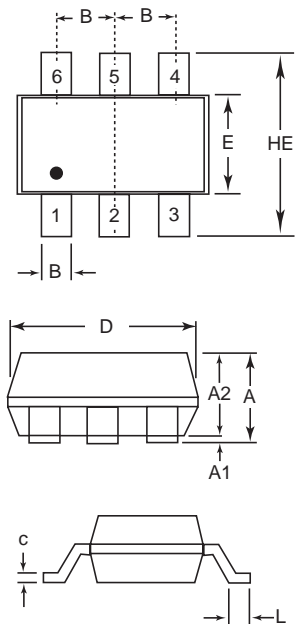
SPUSB1 Series

PACKAGING INFORMATION

| Mechanical Specifications | |
|---------------------------|------------------------|
| Lead Plating | Tin-Lead |
| Lead Material | Copper Alloy |
| Lead Coplanarity | 0.004 inches (0.102mm) |
| Substrate Material | Silicon |
| Body Material | Printed Ep |
| Flammability | UL94 |

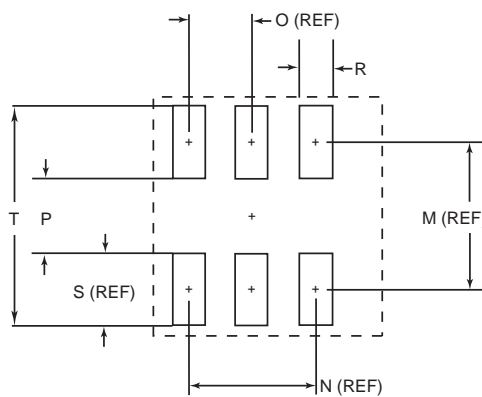
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Outline Drawings



SPUSB1AJT - SC70-6
 SPUSB1BJT - SC70-6
 SPUSB1CJT - SC70-6

Recommended Pad Layout



| Package | SC70-6 | | | |
|----------------------------|------------------|------|-----------|-------|
| Pins | 6 | | | |
| JEDEC | MO-203 Issue A | | | |
| | mm | | inches | |
| | min | max | min | max |
| A | 0.80 | 1.10 | 0.031 | 0.043 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.70 | 1.00 | 0.028 | 0.039 |
| B | 0.15 | 0.30 | 0.006 | 0.012 |
| c | 0.08 | 0.25 | 0.003 | 0.010 |
| D | 1.85 | 2.25 | 0.073 | 0.089 |
| E | 1.15 | 1.35 | 0.045 | 0.053 |
| e | 0.65 BSC | | 0.026 BSC | |
| HE | 2.00 | 2.40 | 0.079 | 0.094 |
| L | 0.26 | 0.46 | 0.010 | 0.018 |
| M | - | 1.60 | - | 0.063 |
| N | - | 1.30 | - | 0.052 |
| O | - | 0.65 | - | 0.026 |
| P | - | 0.70 | - | 0.058 |
| R | - | 0.35 | - | 0.014 |
| S | - | 0.90 | - | 0.035 |
| T | - | 2.50 | - | 0.098 |
| P_D@70°C | 0.2W | | | |
| # / bag | 1000 pcs | | | |
| # / tape & reel | 3,000 pcs | | | |

*See device brand for marking information.

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