PACUSBU

Upstream USB Port Terminator

ON Semiconductor®

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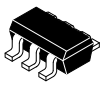
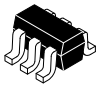


SOT23−6
CASE 527AJ



SC70−6
CASE 419AD

Product Description

The PACUSB−U1, PACUSB−U2, and PACUSB−U3 are single−channel USB upstream−port termination networks.

The PACUSB−U1/U2/U3 integrate EMI/RFI filter components R1 and C1, as recommended by the USB specification. Because these are upstream USB devices, they are terminated with a single 1.5 kW pull−up resistor to $V_{3.3}$ (R2).

There are three options for the value of the series resistor R1:

- For PACUSB−U1, R1 = 15 Ω
- For PACUSB−U2, R1 = 33 Ω
- For PACUSB−U3, R1 = 22 Ω

This series resistance plus the USB driver output resistance must be close to the USB cable's characteristic impedance of 45 Ω (90 Ω balanced) to minimize transmission line reflections.

In addition, these parts provide a very high level of protection for sensitive electronic components that may be subjected to electrostatic discharge (ESD). The input and output pins are designed and characterized to dissipate ESD strikes of ±15 kV safely, a level well beyond the maximum requirements of the IEC 61000−4−2 international standard.

Using the MIL−STD−883D (Method 3015) specification for Human Body Model (HBM) ESD, all pins are protected for contact discharges to greater than ±30 kV.

The PACUSB−U1/U2/U3 is housed in either a 6−pin SC70 or 6−pin SOT23 package and is available with optional lead−free finishing.

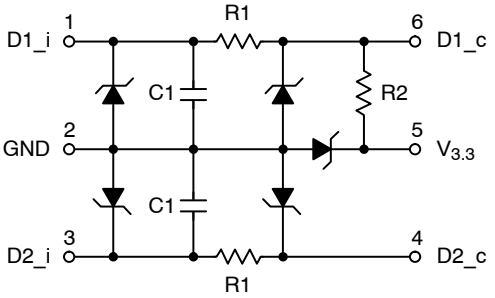
Features

- One Upstream USB Port Terminator, EMI Filter and Transient Overvoltage Protector in a Single Surface−Mount Package
- Compact SC70 or SOT23 Package Saves Board Space and Lowers Manufacturing Costs Compared to Discrete Solutions
- ESD Protection to ±30 kV Contact Discharge per MIL−STD−883D, Method 3015
- ESD Protection to ±15 kV Contact Discharge per IEC 61000−4−2 International Standard
- These Devices are Pb−Free and are RoHS Compliant

Applications

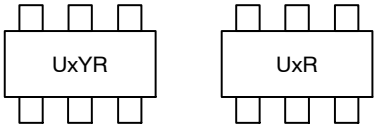
- ESD Protection and Termination of USB Port
- All USB Peripherals (PC Printers, Scanners, Zip Drives, etc.)
- PDAs/Handheld PCs
- Digital Cameras
- Wireless Handsets
- MP3 Players
- Cable Modems

ELECTRICAL SCHEMATIC



i = input; c = connector

MARKING DIAGRAM



UxYR = Specific Device Code
UxR = Specific Device Code
x = 1, 2, 3

ORDERING INFORMATION

Device	Package	Shipping†
PACUSB−U2Y6R	SOT23−6 (Pb−Free)	3000/Tape & Reel
PACUSB−U3Y6R	SOT23−6 (Pb−Free)	3000/Tape & Reel
PACUSB−U1R	SC70−6 (Pb−Free)	3000/Tape & Reel
PACUSB−U2R	SC70−6 (Pb−Free)	3000/Tape & Reel
PACUSB−U3R	SC70−6 (Pb−Free)	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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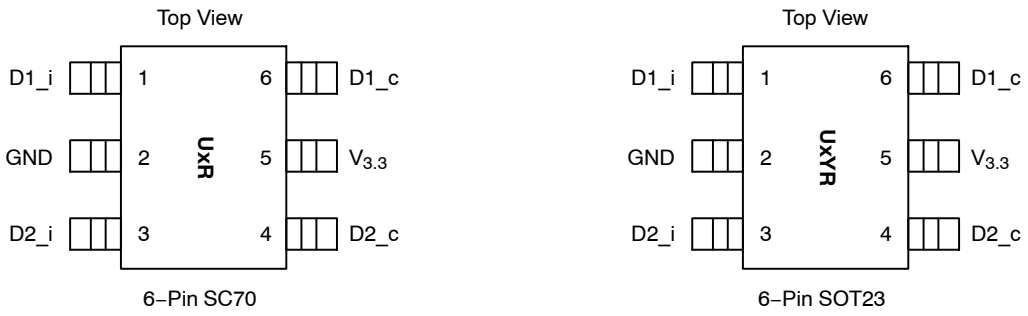
PACKAGE / PINOUT DIAGRAMS



Note 1: The “x” shown in part markings above represents either the digit “1”, “2” or “3.”
Note 2: SOT23 and SC70 package sizes may differ. These drawing are not in scale.

Table 1. PIN DESCRIPTIONS

Pin	Name	Description
1	D1_i	The USB Controller side of the D+ or D− bidirectional transmission line of the differential pair defined by USB standards.
2	GND	The ground reference for the PACUSB−U1/U2/U3 device.
3	D2_i	The USB Controller side of the D− or D+ bidirectional transmission line of the differential pair defined by USB standards.
4	D2_c	The connector side of the D− or D+ bidirectional transmission line of the differential pair defined by USB standards.
5	$V_{3.3}$	The 3.3 V supply voltage for the PACUSB−U1/U2/U3 device.
6	D1_c	The connector side of the D+ or D− bidirectional transmission line of the differential pair defined by USB standards.

SPECIFICATIONS

Table 2. ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Units
$V_{3.3}$ (Supply Voltage)	5.5	V
Operating Temperature Range	−40 to +85	°C
Storage Temperature Range	−65 to +150	°C
DC Power to Resistor	100	mW
Package Power	200	mW

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Table 3. STANDARD OPERATING CONDITIONS

Parameter	Rating	Units
$V_{3.3}$ (Supply Voltage)	3.3	V
Ambient Operating Temperature	−40 to +85	°C

SPECIFICATIONS (Cont'd)

Table 4. ELECTRICAL OPERATING CHARACTERISTICS

Symbol	Parameter	Conditions	Min	Typ	Max	Units
R1	Resistance R1 (PACUSB−U1 Only)	Measured at T_A = 25°C	12	15	18	Ω
R1	Resistance R1 (PACUSB−U2 Only)	Measured at T_A = 25°C	26	33	40	Ω
R1	Resistance R1 (PACUSB−U3 Only)	Measured at T_A = 25°C	18	22	26	Ω
R2	Resistance R2	Measured at T_A = 25°C	1.2	1.5	1.8	kΩ
C1	Capacitance C1	Measured at 1 MHz, 2.5 V DC, T_A = 25°C	38	47	56	pF
I_{LEAK}	Diode Leakage Current to GND	At 3.3 V DC and T_A = 25°C		1	100	nA
V_{D1}	Diode Reverse−Biased Stand−Off Voltage	I = 10 μA, T_A = 25°C	5.5			V
V_{D2}	Signal Clamp Voltage Positive Clamp Negative Clamp	 @ 10 mA, T_A = 25°C @ 10 mA, T_A = 25°C	 5.6 −1.2	 6.8 −0.8	 8.0 −0.4	V
V_{ESD}	In−system ESD Withstand Voltage Human Body Model, MIL−STD−883, Method 3015 IEC 61000−4−2, Contact Discharge Method (I/O pins) IEC 61000−4−2, Contact Discharge Method ($V_{3.3}$ Pin)	 (Note 1) (Note 1) (Note 1)	 ±30 ±15 ±25			kV
V_{CLAMP}	Clamping Voltage during ESD Discharge Positive Negative	MIL−STD−883, Method 3015, 8 kV (Note 1)		 10 −5		V

1. ESD applied to input/output/$V_{3.3}$ 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 (i.e., if ESD is applied to pin 1, then clamping voltage is measured at pin 6). Unused pins are open.

APPLICATION INFORMATION

The PACUSB−U1/U2/U3 is targeted for upstream USB ports (peripherals). It provides series termination, EMI filtering, and ESD protection for the two USB data lines D+ and D−.

The USB Specification revision 1.1 provides for two data rates:

- The Full Speed signaling bit rate at 12 Mbits per second, and
- The Low Speed signaling bit rate at 1.5 Mbits per second.

The speed is selected by connecting one of the data lines (D+ or D−) to a 3.3 V supply voltage via a 1.5 kΩ pull−up resistor (R2).

Connections for Full Speed Operation

Full Speed devices have the pull−up resistor (R2) connected to the D+ data line, as shown in Figure 1. Pin1 is tied to the D+ line of the USB controller. Pin 6 is connected to the D+ line on the USB connector.

Connections for Low Speed Operation

Low Speed devices have the pull−up resistor (R2) connected to the D− data line, as shown in Figure 2. Pin 1 is tied to the D− line of the USB controller; pin 6 is connected to the D− line on the USB connector.

APPLICATION INFORMATION (Cont'd)

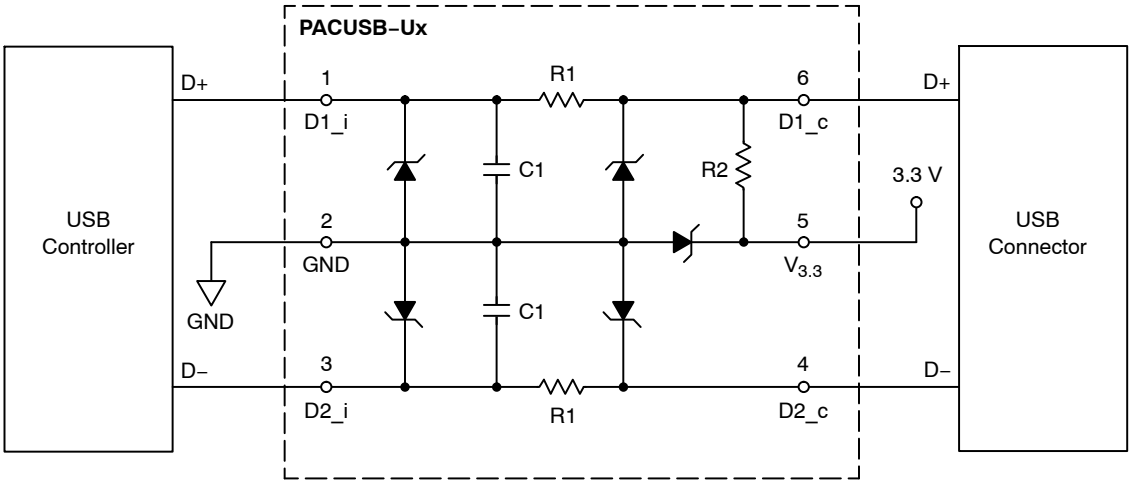


Figure 1. Full Speed Connection

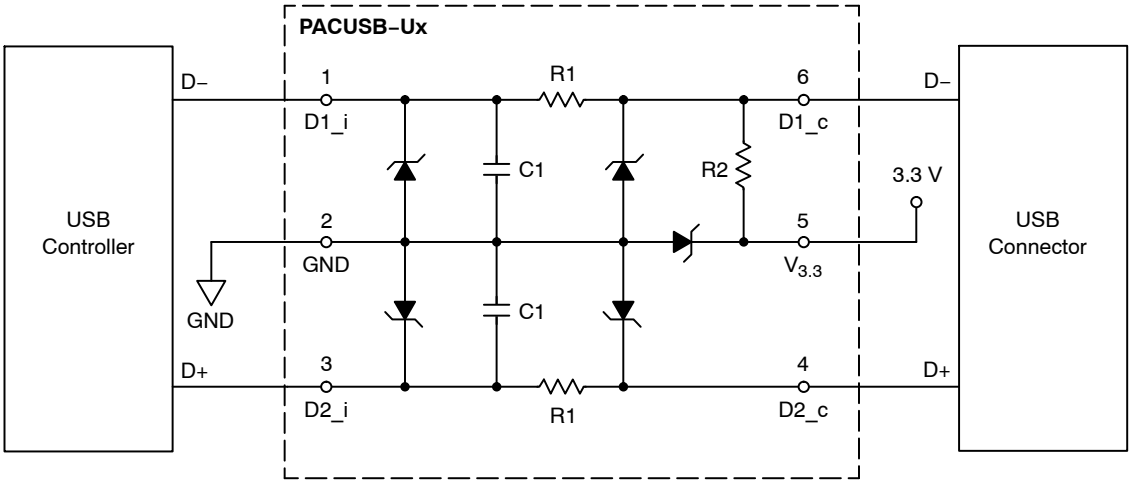
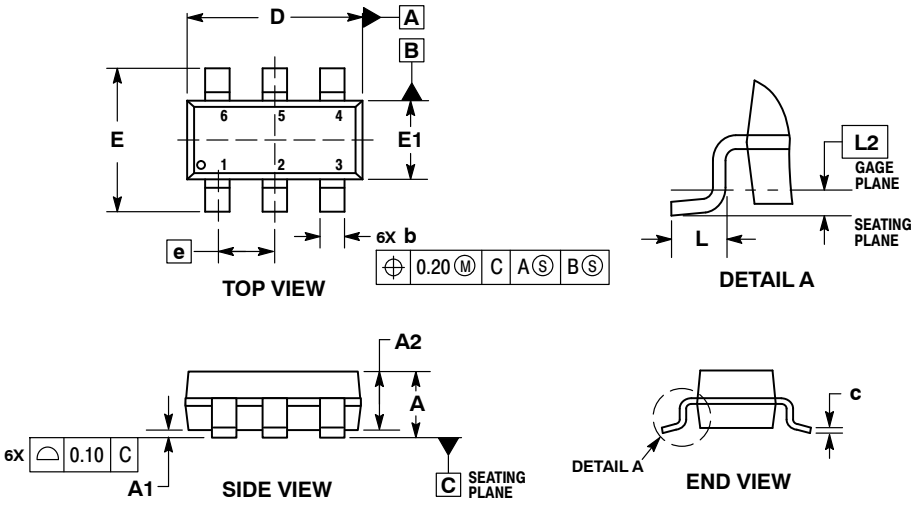


Figure 2. Low Speed Connection

PACKAGE DIMENSIONS

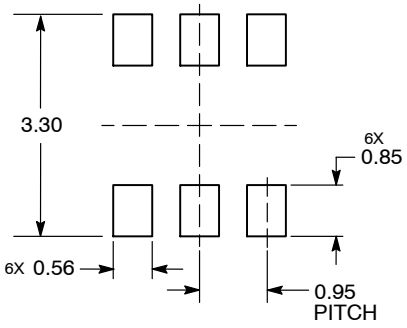
SOT−23, 6 Lead
CASE 527AJ−01
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DATUM C IS THE SEATING PLANE.

	MILLIMETERS	
DIM	MIN	MAX
A	---	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.20	0.50
c	0.08	0.26
D	2.70	3.00
E	2.50	3.10
E1	1.30	1.80
e	0.95 BSC	
L	0.20	0.60
L2	0.25 BSC	

RECOMMENDED SOLDERING FOOTPRINT*



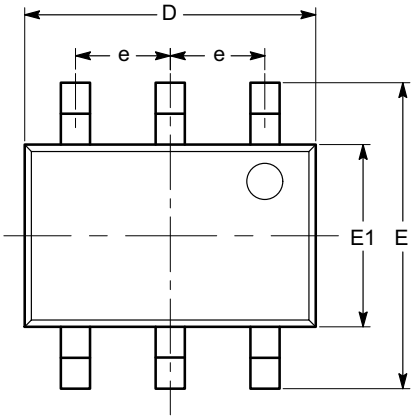
DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACUSBU

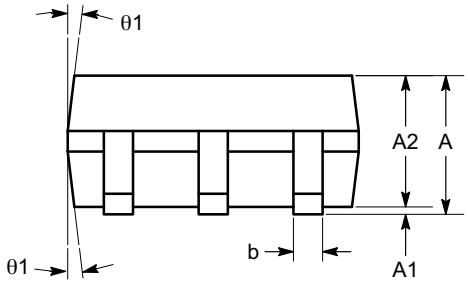
PACKAGE DIMENSIONS

SC−88 (SC−70 6 Lead), 1.25x2
CASE 419AD−01
ISSUE A

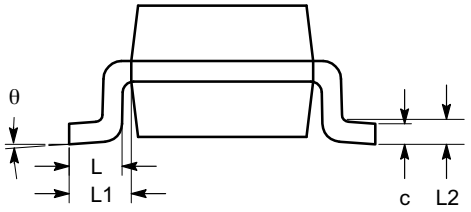


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	0.80		1.10
A1	0.00		0.10
A2	0.80		1.00
b	0.15		0.30
c	0.10		0.18
D	1.80	2.00	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e		0.65 BSC	
L	0.26	0.36	0.46
L1		0.42 REF	
L2		0.15 BSC	
θ	0°		8°
θ1	4°		10°



SIDE VIEW



END VIEW

Notes:
(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC MO-203.

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