

# PACUSBU

## Upstream USB Port Terminator

### 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<sub>3.3</sub> (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

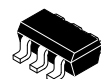
### Applications

- 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

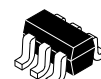


ON Semiconductor®

<http://onsemi.com>

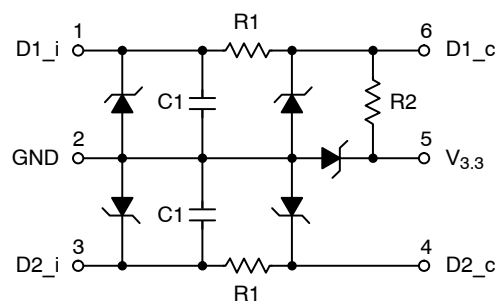


SOT23-6  
CASE 527AJ



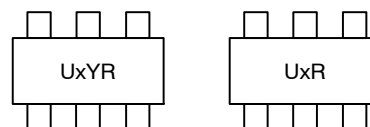
SC70-6  
CASE 419AD

### ELECTRICAL SCHEMATIC



i = input; c = connector

### MARKING DIAGRAM



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

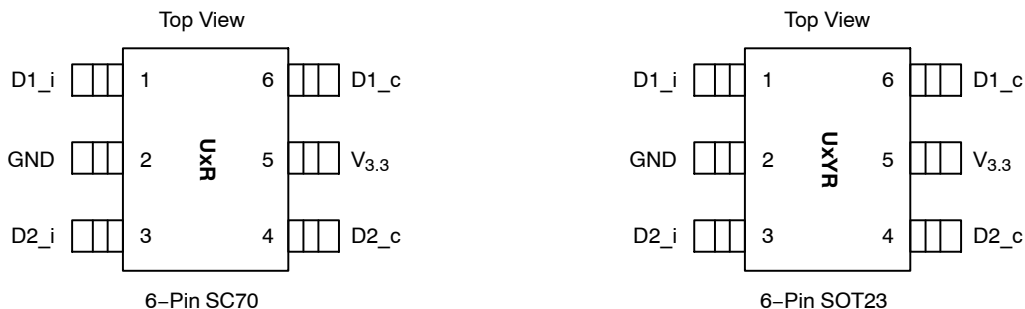
### ORDERING INFORMATION

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.

# PACUSBU

## 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 <sub>3.3</sub>	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 <sub>3.3</sub> (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 <sub>3.3</sub> (Supply Voltage)	3.3	V
Ambient Operating Temperature	-40 to +85	°C

# PACUSB

## SPECIFICATIONS (Cont'd)

**Table 4. ELECTRICAL OPERATING CHARACTERISTICS**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
R1	Resistance R1 (PACUSB-U1 Only)	Measured at $T_A = 25^\circ\text{C}$	12	15	18	$\Omega$
R1	Resistance R1 (PACUSB-U2 Only)	Measured at $T_A = 25^\circ\text{C}$	26	33	40	$\Omega$
R1	Resistance R1 (PACUSB-U3 Only)	Measured at $T_A = 25^\circ\text{C}$	18	22	26	$\Omega$
R2	Resistance R2	Measured at $T_A = 25^\circ\text{C}$	1.2	1.5	1.8	$\text{k}\Omega$
C1	Capacitance C1	Measured at 1 MHz, 2.5 V DC, $T_A = 25^\circ\text{C}$	38	47	56	pF
$I_{\text{LEAK}}$	Diode Leakage Current to GND	At 3.3 V DC and $T_A = 25^\circ\text{C}$		1	100	nA
$V_{\text{D1}}$	Diode Reverse-Biased Stand-Off Voltage	$I = 10 \mu\text{A}$ , $T_A = 25^\circ\text{C}$	5.5			V
$V_{\text{D2}}$	Signal Clamp Voltage Positive Clamp Negative Clamp	@ 10 mA, $T_A = 25^\circ\text{C}$ @ 10 mA, $T_A = 25^\circ\text{C}$	5.6 -1.2	6.8 -0.8	8.0 -0.4	V
$V_{\text{ESD}}$	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)	$\pm 30$ $\pm 15$ $\pm 25$			kV
$V_{\text{CLAMP}}$	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 k $\Omega$  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.

# PACUSBU

## APPLICATION INFORMATION (Cont'd)

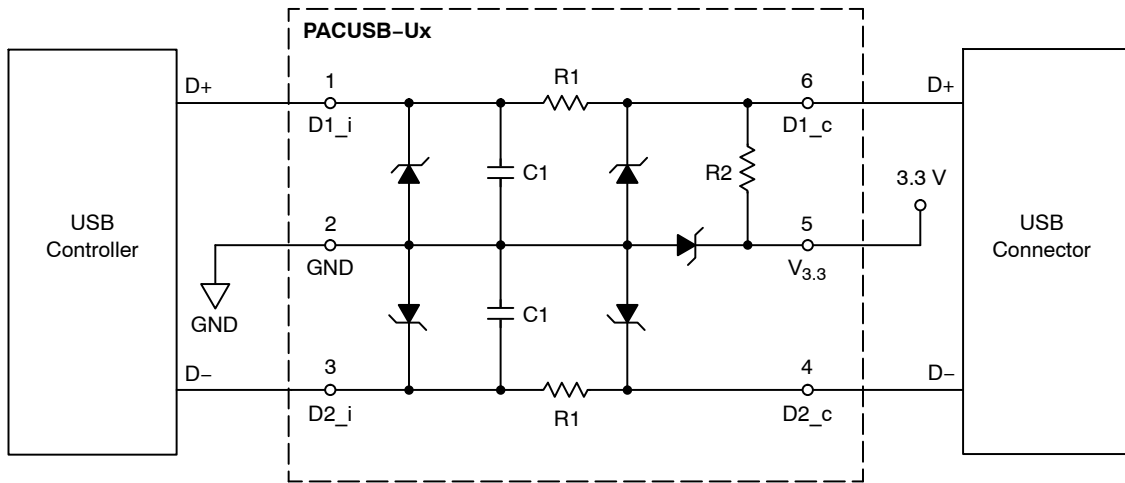


Figure 1. Full Speed Connection

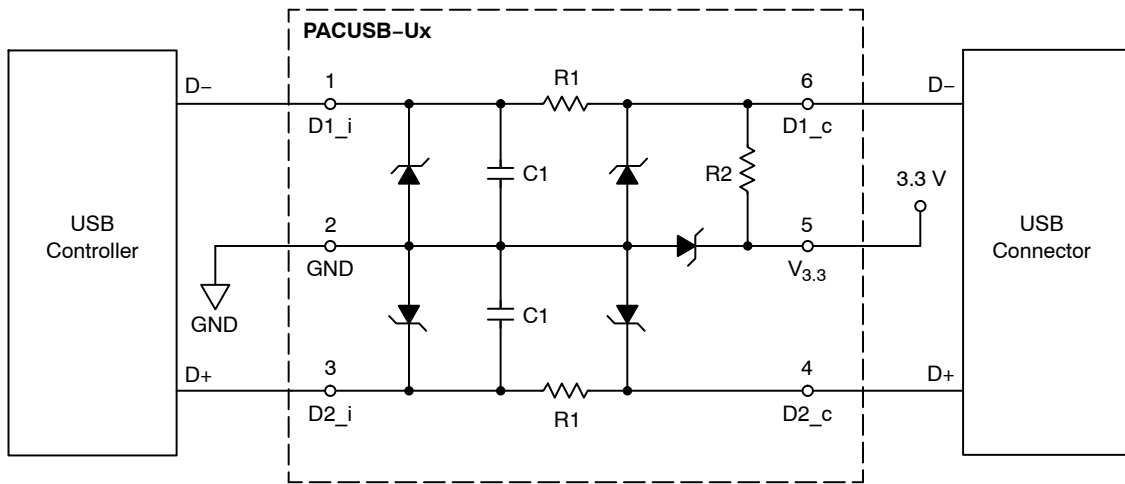
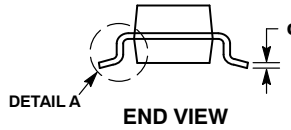
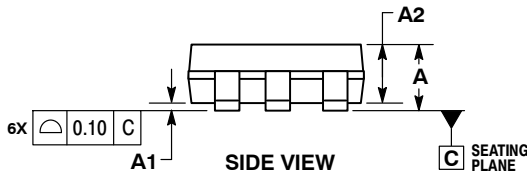
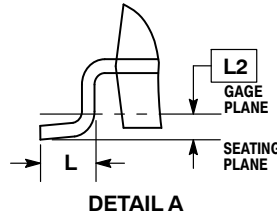
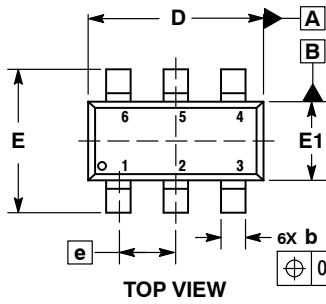


Figure 2. Low Speed Connection

# PACUSBU

## PACKAGE DIMENSIONS

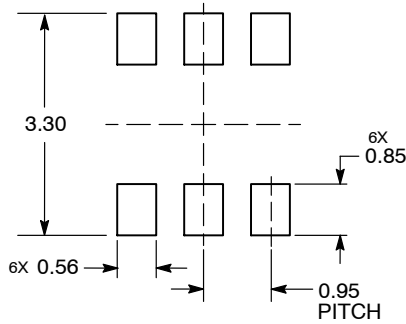
SOT-23, 6 Lead  
CASE 527AJ-01  
ISSUE A



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

DIM	MILLIMETERS	
	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\*



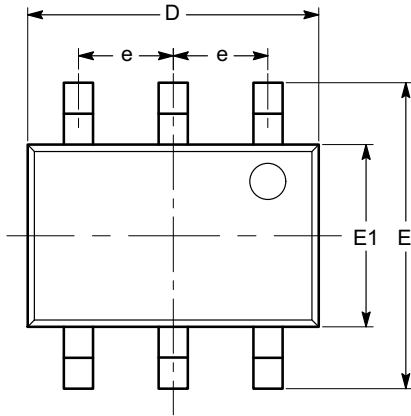
DIMENSIONS: MILLIMETERS

\*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

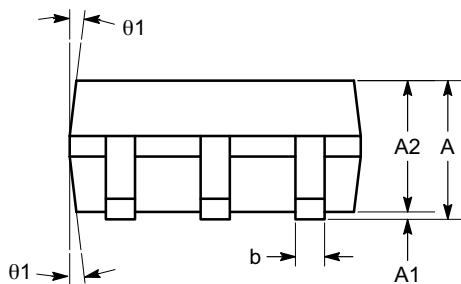
## PACKAGE DIMENSIONS

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

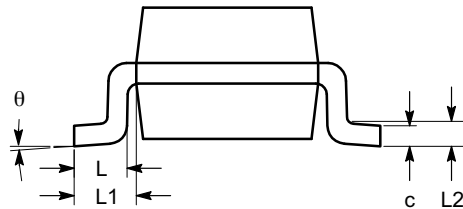


TOP VIEW

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		
$\theta$	0°		8°
$\theta_1$	4°		10°




SIDE VIEW



END VIEW

### Notes:

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

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local Sales Representative