



PL2303RA

USB to Serial Bridge Controller

(with Built-in RS232 Transceiver)

Product Datasheet

Document Revision: 1.0.2

Document Release: December 7, 2012



Prolific Technology Inc.

7F, No. 48, Sec. 3, Nan Kang Rd.

Nan Kang, Taipei 115, Taiwan, R.O.C.

Telephone: +886-2-2654-6363

Fax: +886-2-2654-6161

E-mail: sales@prolific.com.tw

Website: <http://www.prolific.com.tw>

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Revision History

Revision	Description	Date
1.0.2	<ul style="list-style-type: none">➤ Added USB-IF Certification TID➤ Modified DC & Temperature Characteristics	December 7, 2012
1.0.1	<ul style="list-style-type: none">➤ Modify Features➤ Modify Reference Schematic➤ Modify Ordering Information	May 4, 2012
1.0.0	<ul style="list-style-type: none">➤ Formal Release Datasheet – PL2303RA	March 22, 2012

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1.0 Features

- Single-chip USB to Serial (RS232) asynchronous serial data transfer interface
- Fully Compliant with USB Specification v2.0 (Full-Speed)
- [USB-IF Logo Compliant with TID 40001367](#)
- UHCI/OHCI (USB1.1), EHCI (USB 2.0), xHCI (USB 3.0) Host Controller Compatible
- On-chip USB 1.1 transceiver, 5V→3.3V regulator, and 96MHz Clock Generator
- Built-in RS232 Transceiver
 - Meets EIA/TIA-232F standards with 5.0V power supply
 - Guaranteed 1000kbps transmission rate under loading
 - Three RS232 Drivers design
 - Five RS232 Receivers (always active)
 - Latch-up free
- RS232 Serial Port Output Interface
 - Full-duplex transmitter and receiver (TXD and RXD)
 - Six MODEM control pins (RTS, CTS, DTR, DSR, DCD, and RI)
 - 5, 6, 7 or 8 data bits
 - Odd, Even, Mark, Space, or None parity mode
 - One, one and a half, or two stop bits
 - Parity error, frame error, and serial break detection
 - Programmable baud rate from 75 bps to 1M bps
 - Provides RS232 power down indicator pin
 - Works with existing PC COM Port software applications
- Extensive Flow Control Mechanism
 - Adjustable high/low watermark level
 - Automatic hardware flow control with CTS/RTS or DSR/DTR
 - Automatic software flow control with XON/XOFF
 - Inbound data buffer overflow detection
- Configurable 512-byte bi-directional data buffer
 - 256-byte outbound buffer and 256-byte inbound buffer; or
 - 128-byte outbound buffer and 384-byte inbound buffer
- Supports Remote Wake-up from RS232 input pin signals (RI, RXD, DSR, DCD, CTS)
- Four (4) General Purpose I/O (GP0, GP1, GP2, & GP3) pins
- On-chip OTP (One Time Programmable) ROM for writing startup device configurations
- Provides royalty-free Virtual COM Port (VCP) drivers for:
 - [Windows 8, 7, Vista, XP, 2000 \(Microsoft Certified WHQL Logo Drivers\)](#)
 - Windows Server 2003, 2008, 2008 R2, 2012
 - Windows CE 4.2, 5.0, 6.0, and Windows Embedded Compact 7
 - Windows XP Embedded (XPe), Point-of-Service (WEPOS), and POSReady
 - Mac OS 8/9, OS X
 - Linux/Android kernel 2.4.31 and above includes built-in virtual serial port drivers
 - [Android Java Driver Library for USB Host API Devices](#) (no root permission needed)
 - Provides Driver Customization for Customer USB VID/PID and special baud rates
- -40°C to 85°C Operating Temperature
- Small footprint 28-pin SSOP IC package (RoHS compliant and Pb-free Green Compound)

2.0 Functional Block Diagram

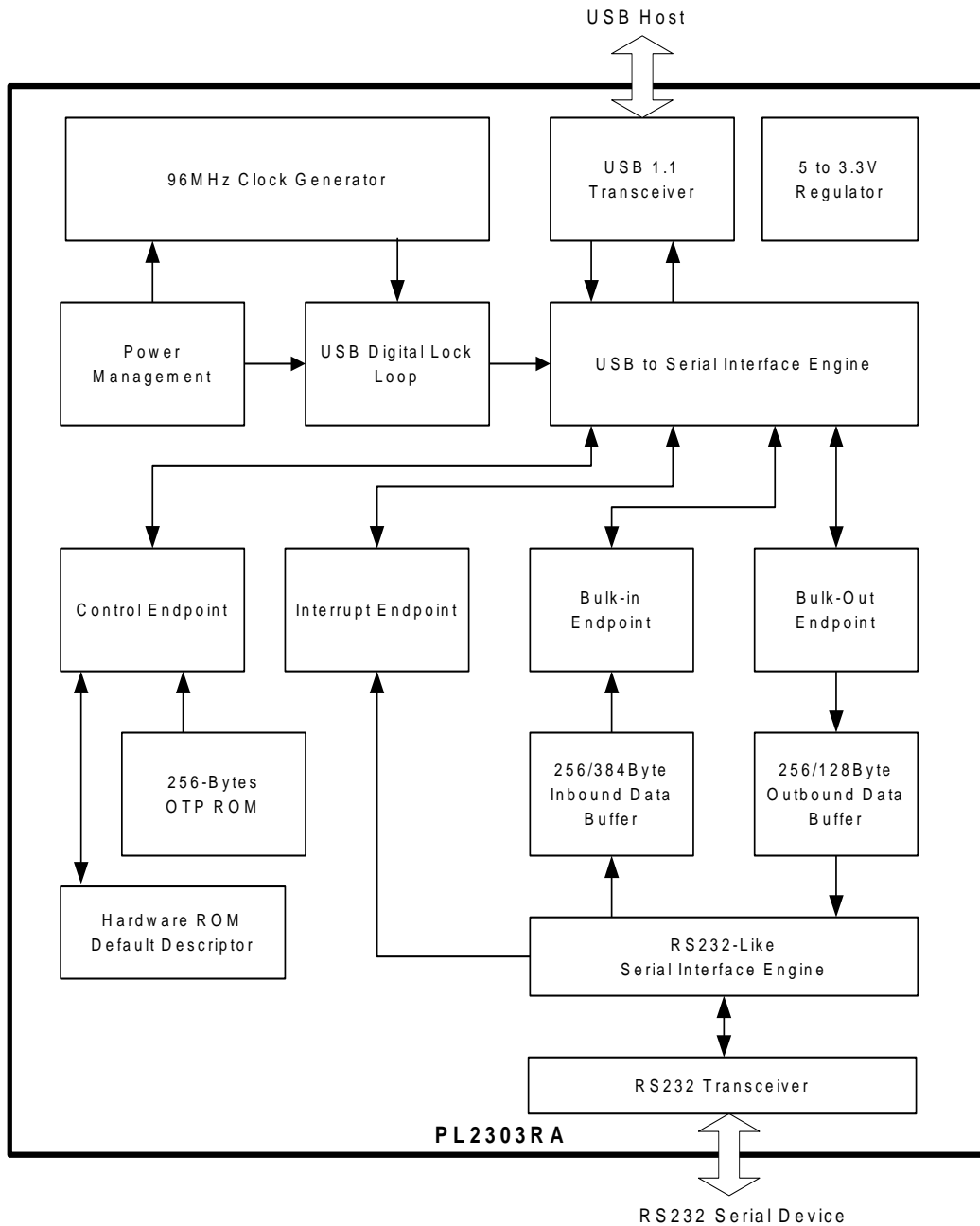


Figure 2-1 Block Diagram of PL2303RA

3.0 Introduction

PL2303RA provides a convenient solution for connecting an RS232 full-duplex asynchronous serial device to any Universal Serial Bus (USB) capable host. Prolific provides highly compatible Virtual COM Port drivers that simulate the traditional COM port on most operating systems allowing the existing applications based on COM port to easily migrate and be made USB ready.

PL2303RA also integrates a high baud rate RS-232 transceiver that meets the EIA/TIA-232F and CCITT V.28 communications interface specifications. The RS-232 transceiver is a 3-transmitters and 5-receivers device with a high-efficient charge pump circuit embedded. This high-efficient charge pump circuit with 1uF external capacitors provides the bipolar output to the transmitters, and makes the transmitters to deliver the RS-232 output voltage levels. Under normal operation, PL2303RA operates at very low power consumption with guaranteed data rate up to 1000kbps. PL2303RA also has an active-low shutdown indicating pin that can serve as a shutdown indicator for special application purposes.

By taking advantage of USB bulk transfer mode, large data buffers, and automatic flow control, PL2303RA is capable of achieving higher throughput compared to traditional UART (Universal Asynchronous Receiver Transmitter) ports. The flexible baud rate generator of PL2303RA could be programmed to generate any rate between 75 bps to 1M bps.

PL2303RA is exclusively designed for mobile and embedded solutions in mind, providing a small footprint that could easily fit in to any connectors and handheld devices. With very small power consumption in either operating or suspend mode, PL2303RA is perfect for bus powered operation with plenty of power left for the attached devices.

4.0 Pin Assignment Outline

4.1 SSOP28 Package

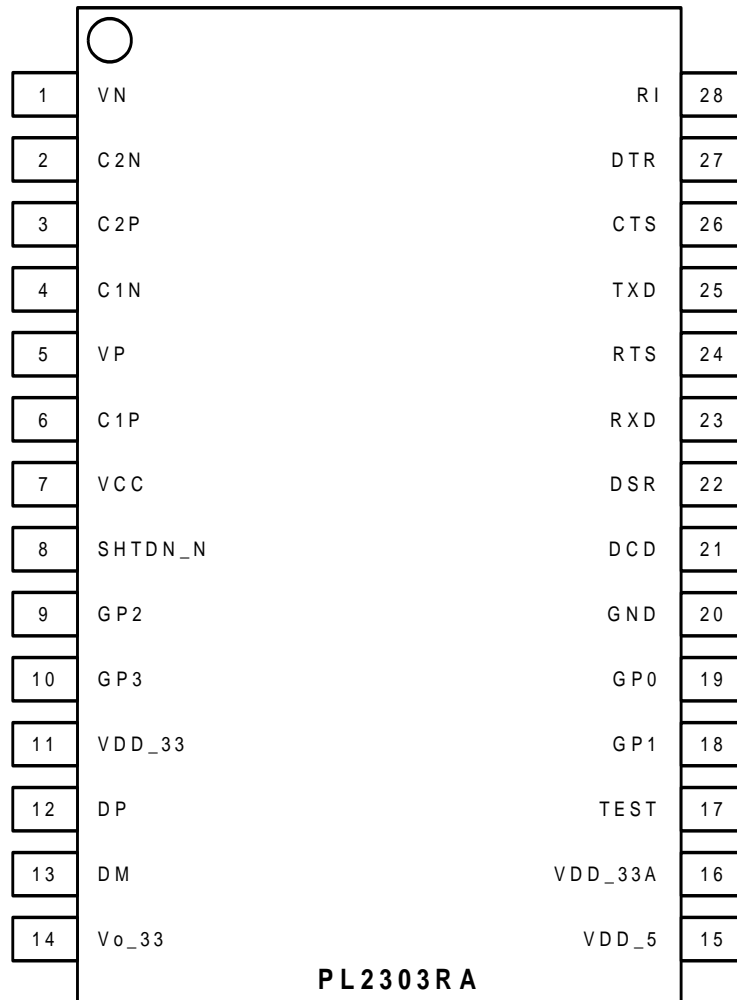


Figure 4-1 Pin Assignment Outline of PL2303RA SSOP28

5.0 Pin Assignment & Description

Pin Type Abbreviation:

I: Input

O: Output

B: Bidirectional I/O

P: Power/Ground

5.1 SSOP28 Package

Table 5-1 Pin Assignment & Description (SSOP28)

Pin #	Name	Type	Description
1	VN	P	Internal generated negative supply
2	C2N	P	External capacitor (- terminal) is connected to this pin
3	C2P	P	External capacitor (+ terminal) is connected to this pin
4	C1N	P	External capacitor (- terminal) is connected to this pin
5	VP	P	Internal generated positive supply
6	C1P	P	External capacitor (+ terminal) is connected to this pin
7	VCC	P	Power supply input +5V for RS232 transceiver
8	SHTDN_N	O ⁽¹⁾	PL2303RA shutdown indicator pin
9	GP2	I/O	Auxiliary GPIO Pin 2 (Default output high mode) ⁽²⁾
10	GP3	I/O	Auxiliary GPIO Pin 3 (Default output high mode) ⁽²⁾
11	VDD_33	P	Power Supply input +3.3V
12	DP	B	USB Port D+ signal
13	DM	B	USB Port D- signal
14	Vo_33	P	Regulator Power Output, +3.3V
15	VDD_5	P	USB Port V _{BUS} , +5V Power. (6.5V for OTPROM writing voltage).
16	VDD_33A	P	Power Supply input +3.3V
17	TEST	I	Test mode control
18	GP1	B ⁽³⁾	General Purpose I/O Pin 1
19	GP0	B ⁽³⁾	General Purpose I/O Pin 0
20	GND	P	Ground
21	DCD	I ⁽⁴⁾	RS232 Receiver input, Data Carrier Detect
22	DSR	I ⁽⁴⁾	RS232 Receiver input, Data Set Ready
23	RXD	I ⁽⁴⁾	RS232 Receiver input, Received Data
24	RTS	O ⁽⁴⁾	RS232 Transmitter output, Request To Send
25	TXD	O ⁽⁴⁾	RS232 Transmitter output, Transmitted Data
26	CTS	I ⁽⁴⁾	RS232 Receiver input, Clear to Send
27	DTR	O ⁽⁴⁾	RS232 Transmitter output, Data Terminal Ready
28	RI	I ⁽⁴⁾	RS232 Receiver input, Ring Indicator

Notes:

(1) – CMOS Output Pad.

(2) – Default output high mode; do not connect to ground.

(3) – Tri-State, CMOS Input/Output Pad. (Default mode: Input)

(4) – RS232 level

6.0 EEPROM Configuration

The default configuration descriptors are stored in the chip internally which will be loaded during power-on reset or USB bus reset whenever OTPROM (One-Time Programmable ROM) is empty. Several of the USB descriptors could be modified and stored to the OTPROM during device startup like Vendor ID (VID), Product ID (PID), Serial Number, Product String, and other configuration descriptors. The OTPROM can be programmed twice using the dedicated PL2303RA EEPROM Writer software and PL2303RA OTPROM USB Voltage Converter. Contact Prolific or authorized distributors.

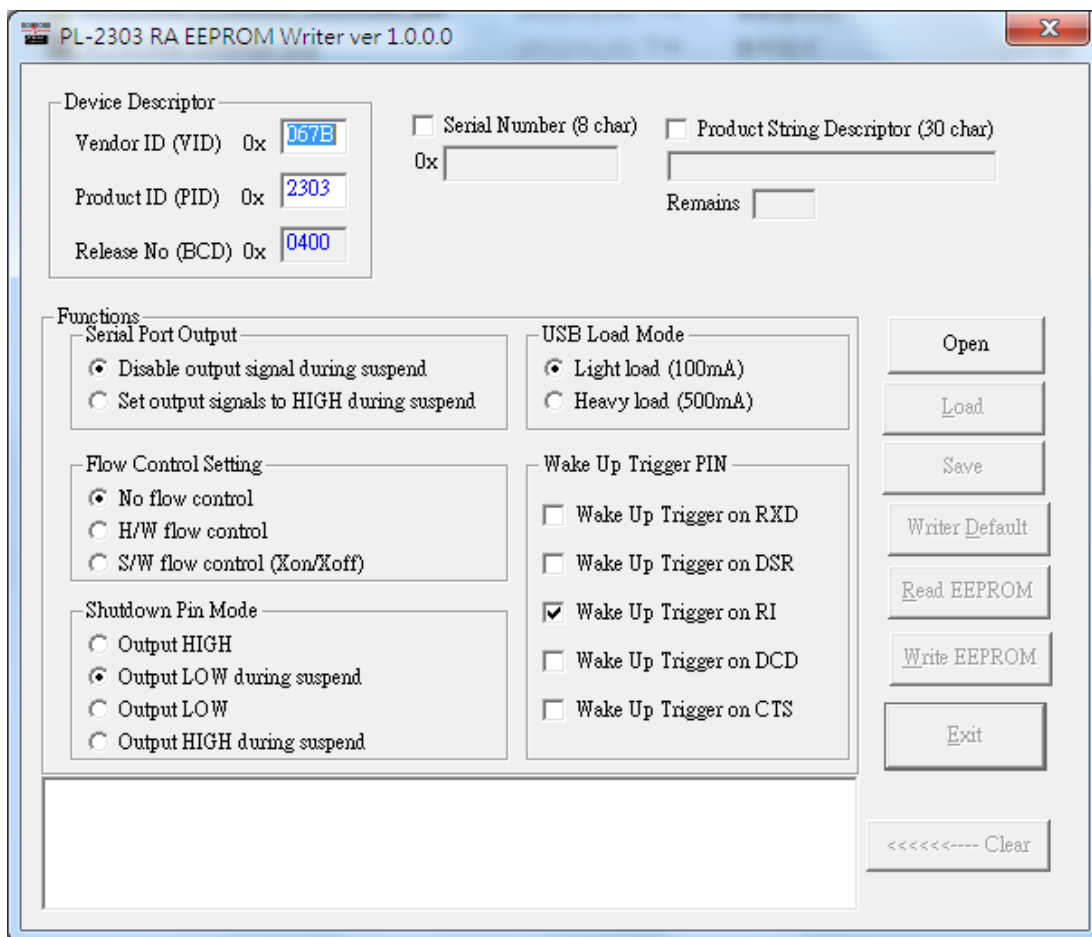


Figure 6-1 PL2303RA EEPROM Writer Program

Table 6-1 EEPROM Writer Configuration

Descriptors	Default Value	Description
Vendor ID (VID)	067B (hex)	USB unique Vendor ID of Company or Manufacturer. This ID is applied and registered from USB-IF. Refer to this website for applying VID: http://www.usb.org/developers/vendor/
Product ID (PID)	2303 (hex)	USB Product ID assigned by Company or Manufacturer.

Rel. No. (BCD)	0400	This field reports the release number of the PL2303RA USB device. This item is fixed and cannot be modified.
Serial No. (8 hex characters)	Disabled	This field sets the product USB serial number. Entering a unique serial number allows the device to be assigned the same COM Port number even when plug to other USB ports of the same PC.
Product String Descriptor	None	This field when entered will be the string displayed by Windows and other OS when device is first detected and before driver is loaded or driver not installed.
Remains	2	The PL2303RA has an integrated OTPROM (One-Time Programmable ROM) which allows to write EEPROM settings without the use of an external one. However, the OTPROM can only be written twice and cannot be erased. PL2303RA does not support external EEPROM.

Functions	Default Value	Description
Serial Port Output	Disable	This option allows setting the serial port output pin signals (TXD, RTS, DTR) to HIGH during suspend mode.
USB Load Mode	Light Load (100mA)	This option sets the USB device maximum power if 100mA (low-power) or 500mA (high power).
Flow Control Setting	No Flow Control	This option allows to set the flow control initial setting to none, H/W, or S/W control. Note: H/W and S/W flow control can also be set and configured on customer/user serial communication software.
Wakeup Trigger Pin	Wakeup trigger on RI	This option allows setting the trigger pin for remote wakeup function. When in suspend mode, changes on the enabled serial port input signals could trigger a wakeup event.
Shutdown Pin Mode	Output LOW during suspend	This option allows setting the Shutdown pin (Pin 8) mode to Output HIGH or LOW on normal mode or Suspend mode.

7.0 Data Formats & Programmable Baud Rate Generator

The PL2303RA supports versatile data formats and has a programmable baud rate generator. The supported data formats are shown on Table 7-1. The programmable baud rate generator supports baud rates up to 1Mbps and standard driver already supports several baud rate settings shown in Table 7-2.

Table 7-1 Supported Data Formats

	Description
Stop bits	1 1.5 2
Parity type	None Odd Even Mark Space
Data bits	5, 6, 7, 8

Table 7-2 Baud Rate Settings (Supported by Standard Driver)

Baud Rates (bps)	Baud Rates (bps)	Baud Rates (bps)	Baud Rates (bps)	Baud Rates (bps)
	460800	134400	19200	1800
	403200	128000	14400	1200
	268800	115200	9600	600
	256000	57600	7200	300
921600	230400	56000	4800	150
806400	201600	38400	3600	110
614400	161280	28800	2400	75

Note: For other special baud rate requirements, please contact Prolific FAE for driver customization support. The baud rates listed on the above table are already supported by the standard driver and only needs to be set by the COM port configuration of the application software on the PC.

8.0 Application Reference Circuit Diagram

Following is an example of using the PL2303RA as a USB to RS232 converter. The PL2303RA already includes an integrated RS232 transceiver to convert the TTL levels USB serial interface to RS232 levels as well as converting the +5V nominal VCC to the $\pm 6.5V$ required by RS232. The PL2303RA built-in transceiver supports up to 1Mbps baud rate transmission which is very ideal for many designs requiring high speed performance. Contact Prolific FAE for more PCB design support.

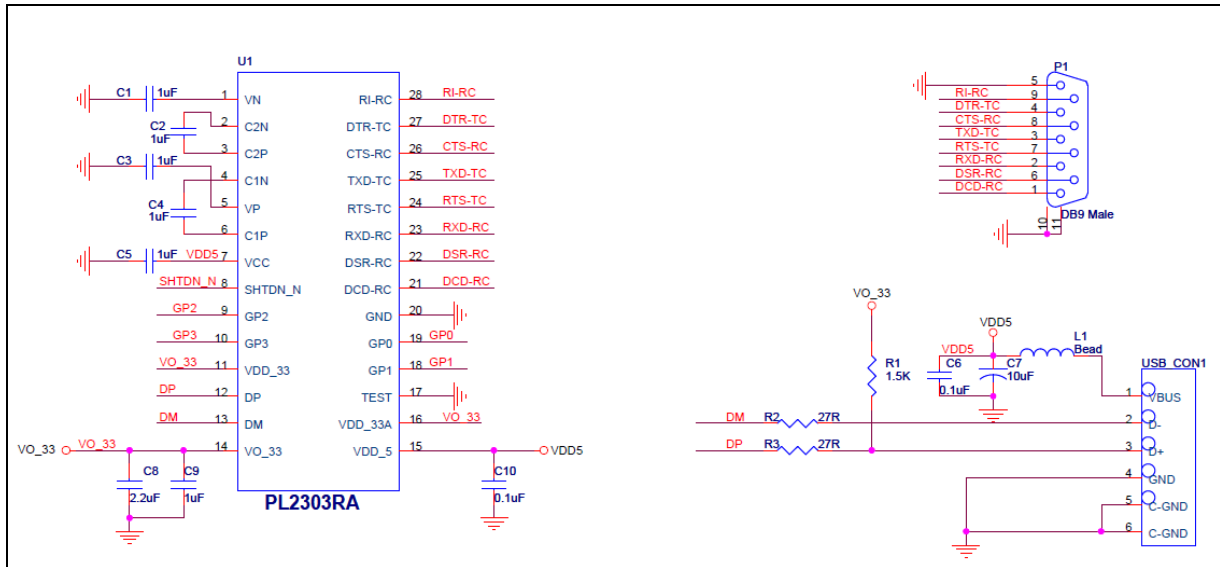


Figure 8-1 PL2303RA USB to RS232 Reference Schematic Diagram

9.0 DC & Temperature Characteristics

9.1 Absolute Maximum Ratings

Table 9-1 Absolute Maximum Ratings

Items	Ratings
Power Supply Voltage - VDD_5	-0.3 to 6.5 V
Power Supply Voltage - VCC	-0.3 to 6.5V
Charge Pump Positive Output (V+)	(Vcc-0.3) to 13.2V
Charge Pump Negative Output (V-)	+0.3 to -13.2V
RS232 Receiver Input (RXD, CTS, DSR, RI, DCD)	20V
RS232 Transmitter Output (TXD, RTS, DTR)	(V+,+ 0.3V) to (V,- 0.3V)
Input Voltage of 3.3V I/O	-0.3 to VO_33 +0.3 V
Input Voltage of 3.3V I/O with 5V Tolerance I/O	-0.3 to VDD_5 +0.3V
Output Voltage of 3.3V I/O	-0.3 to VDD_5 +0.3 V
Storage Temperature	-40 to 150 °C

9.2 DC Characteristics

9.2.1 Operating Voltage and Suspend Current

Table 9-2a Operating Voltage and Suspend Current

Parameter	Symbol	Min	Typ	Max	Unit
Operating Voltage Range	VDD_5	4.5	5	6.5	V
Output Voltage of Regulator	VO_33	2.97	3.3	3.63	V
Operating Current ⁽¹⁾ (Power Consumption)	I _{DD}	-	26	30	mA
Suspend Current	I _{SUS}	-	260	450	μA

Note: (1) – No RS232 device attached.

9.2.2 3.3V I/O Pins

Table 9-2b 3.3V I/O Pins

Parameter	Symbol	Min	Typ	Max	Unit
Output Driving Capability	I _{DD}		4		mA
Power Supply for 3.3V I/O Pins	VO_33	2.97	3.3	3.63	V
Input Voltage (CMOS)					
Low	V _{IL}	--	--	0.3* VO_33	V
High	V _{IH}	0.7* VO_33	--	--	V
Input Voltage (LVTTL)					
Low	V _{IL}	--	--	0.8	V
High	V _{IH}	2.0	--	--	V
Output Voltage, 3.3V					
Low	V _{OL}	--	--	0.4	V
High	V _{OH}	2.4	--	--	V

9.2.3 RS232 Transceiver Pins

Table 9-2c RS232 Transceiver Pins

Parameter	Condition	Min	Typ	Max	Unit
DC Characteristic					
Supply Current	no load, $T_{AMB}=+25\text{ }^{\circ}\text{C}$		11		mA
Shutdown Supply Current	SHTDN_N=GND, $T_{AMB} = +25\text{ }^{\circ}\text{C}$,		0.6		μA
Transmitter Outputs					
Output Voltage Swing	3k Ω load to ground at all transmitter outputs, $T_{AMB} = +25\text{ }^{\circ}\text{C}$		± 6.5		V
Output Resistance	$V_{CC}=V+=V-=0\text{V}$, $T_{OUT} = \pm 2\text{V}$		0.05		μA
Output Short-Circuit Current	$T_{OUT} = 0\text{V}$		17		mA
Output Leakage Current	Transmitter disable, $T_{OUT} = \pm 12\text{V}$		0.12		μA
Receiver Inputs					
Input Voltage Range		-22		22	V
Input Threshold LOW	$V_{CC}=5.0\text{V}$		1.25		V
Input Threshold HIGH	$V_{CC}=5.0\text{V}$		1.5		V
Input Hysteresis			0.25		V
Input Resistance			4.6		k Ω
Timing Characteristics					
Maximum Data Rate	$R_L=3\text{K}\Omega$, $C_L=1000\text{pF}$, one transmitter switching			1000	kbps
Receiver Propagation Delay	t_{PHL} , RxIN to RxOUT, $C_L=150\text{pF}$		0.5		μs
	t_{PLH} , RxIN to RxOUT, $C_L=150\text{pF}$		1		μs
Transmitter Propagation Delay	t_{PHL} , $R_L = 3\text{K}$, $C_L=1000\text{pF}$		1.9		μs
	t_{PLH} , $R_L = 3\text{K}$, $C_L=1000\text{pF}$		1.3		μs

Note: Unless otherwise noted, the above specifications apply for $V_{CC}=5\text{V} \pm 10\%$ with $T_{AMB}=T_{MIN}$ to T_{MAX} , C1 to C4= 1 μF .

9.3 Clock Characteristics

Table 9-3 Clock Characteristics

Parameter	Min	Typ	Max	Units
Frequency of Operation	11.97	12.0	12.03	MHz
Clock Period	83.1	83.3	83.5	ns
Duty Cycle	45	50	55	%

9.4 Temperature Characteristics

Table 9-4 Temperature Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Operating Temperature	--	-40	--	85	$^{\circ}\text{C}$
Junction Operation Temperature	T_J	-40	25	105	$^{\circ}\text{C}$

9.5 Leakage Current and Capacitance

Table 9-5 Leakage Current and Capacitance

Parameter	Symbol	Min	Typ	Max	Unit
Input Leakage Current ^{*1}	I_L	-10	± 1	10	μA
Tri-state Leakage Current	I_{OZ}	-10	± 1	10	μA
Input Capacitance	C_{IN}	--	2.8	--	pF
Output Capacitance	C_{OUT}	2.7	--	4.9	pF
Bi-directional Buffer Capacitance	C_{BID}	2.7	--	4.9	pF

*1. No pull-up or pull-down resistor.

10.0 Outline Diagram

10.1 SSOP28 Package

Table 10-1 Package Dimension

Symbol	Millimeter			Inch		
	Min	Nom	Max	Min	Nom	Max
b	0.22		0.38	0.009		0.015
E	7.40	7.80	8.20	0.291	0.307	0.323
E1	5.00	5.30	5.60	0.197	0.209	0.220
L	0.55	0.75	0.95	0.021	0.030	0.037
R1	0.09			0.004		
D	9.9	10.2	10.5	0.390	0.402	0.413
A			2.0			0.079
e		0.65			0.0256	
L1		1.25			0.050	
A1	0.05			0.020		
A2	1.65	1.75	1.85	0.065	0.069	0.073

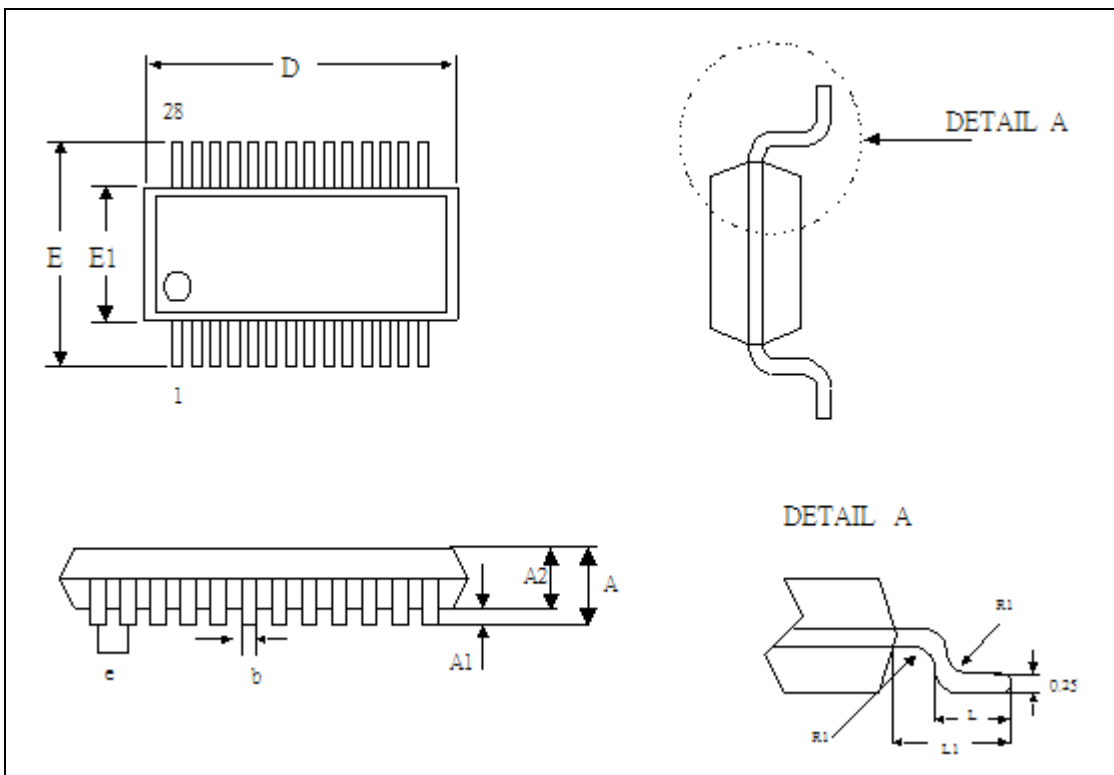


Figure 10-1 Outline Diagram of PL2303RA SSOP28

11.0 Packing Information

11.1 Reel Packing

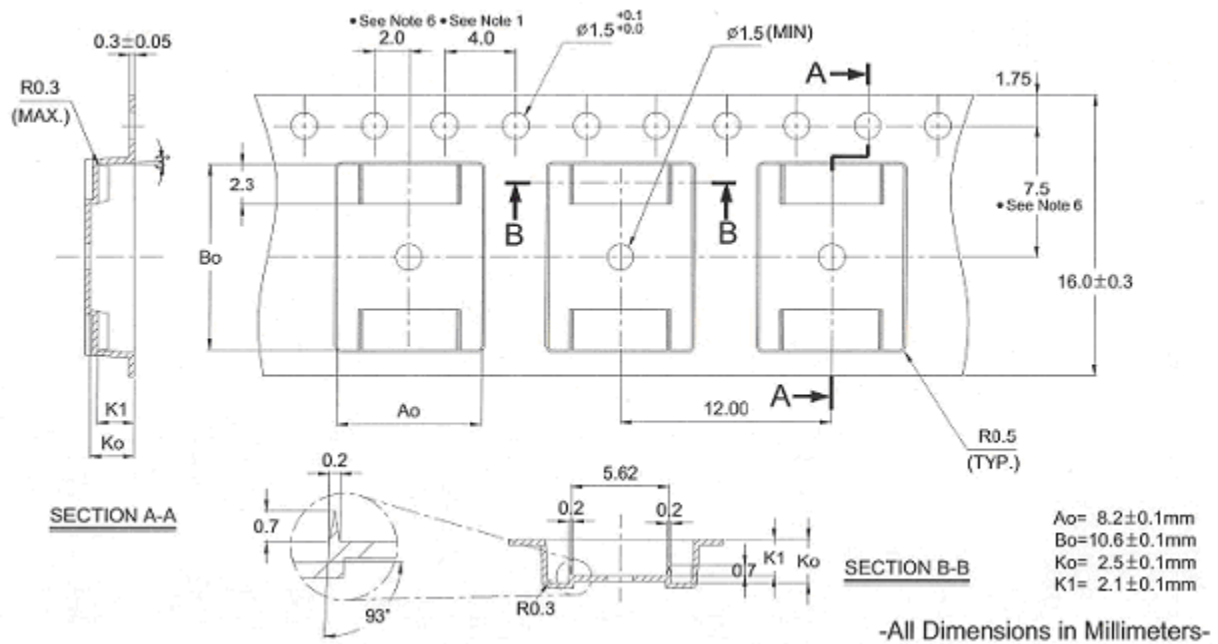


Figure 11-1 SSOP28 Carrier Tape

Notes:

- 10 sprocket hole pitch cumulative tolerance ± 0.2
- Camber not to exceed 1mm in 100mm.
- Material: Black Polystyrene.
- A_o and B_o measured on a plane 0.3mm above the bottom of the pocket.
- K_o measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
- Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
- IC quantity per one reel: 2,000 pieces

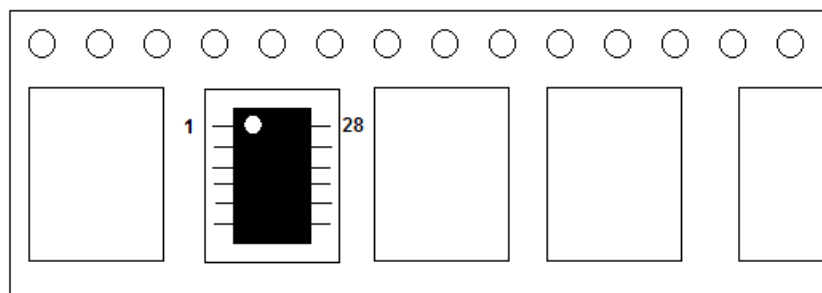
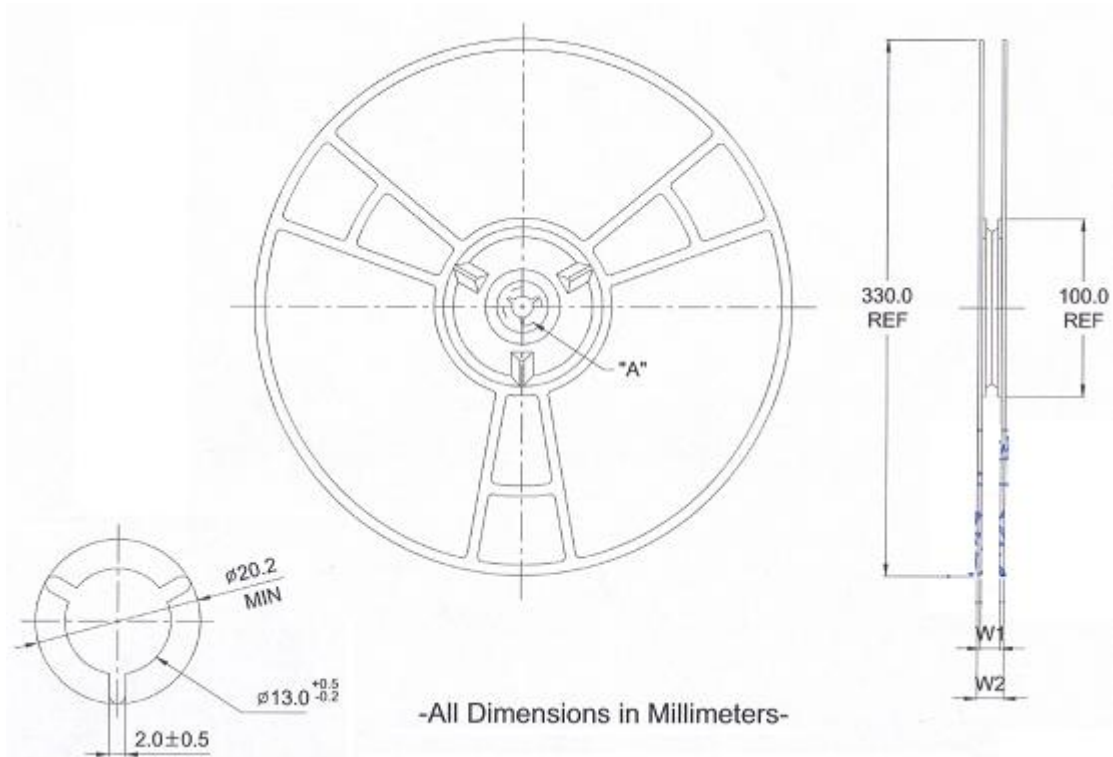


Figure 11-2 IC Reel Placements

Table 11-1 Reel Packing Part Number Information

Part Number	Normal Hub Width	W1 +0.3mm -0.2mm	W2 Max
RD33008SW-T + RD33008SW-T	16mm	16.8mm	22.2mm


Figure 11-3 Reel Dimension

11.2 Tube Packing

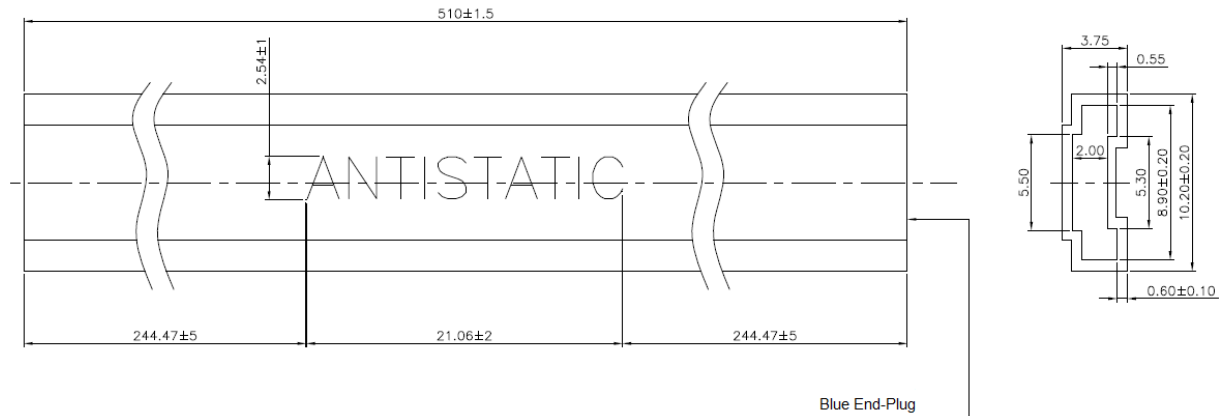


Figure 11-4 Tube Packing Dimension

REMARK :

- 1.TUBE MT'L : PVC,COATING WITH ANTISTATIE LIQUID.
- 2.COLOR : TUBE - TRANSPARENT ; MARK - BLUE
- 3.SURFACE RESISTANCE : $10^8 \sim 10^{11} \cdot / \square$
- 4.NO BURR AT CUTTING AREA.
- 5.THE TUBE SHALL WITH BLUE END-PLUG(3088-060-01681) FROM VENDOR, TAIL DOWNWARD AND THE OTHER ONE ENCLOSE TOGETHER WITH SHIPMENT.

12.0 Ordering and Chip Marking Information

This section provides the chip ordering part number information and the chip marking information.

Table 12-1 Ordering Information

Part Number	Package Type
PL-2303RA LF	28-pin SSOP Lead-Free

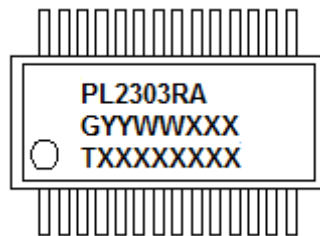


Figure 12-1 Chip Part Number Information

Table 12-2 Chip Marking Information

Line	Marking	Description
First Line	PL2303RA	Chip Product Name
Second Line (GYYWWXXX)	G	Green compound packing material (Pb-free)
	YY	Last two digits of the manufacturing year
	WW	Week number of the manufacturing year
	XXX	Chip Version (2DA)
Third Line	TXXXXXXXX	Manufacturing LOT code

Example: "G12022DA" – means Green packing + Year 2012 + Week no. 02 + 2DA chip version.

13.0 Contact Information

Taiwan Headquarter

7F, No.48, Sec. 3, Nan Kang Rd.,
Nan Kang, Taipei, Taiwan 115, R.O.C.
Tel: +886-2-2654-6363 Fax: +886-2-2654-6161
Website: www.prolific.com.tw
E-mail: sales@prolific.com.tw

Shenzhen Office

Room 1908, Building, No.A. jiahehuaqiang Building,
Shennanzhong Rd. Futian District, Shenzhen, China
Tel: +86-1350-285-4191
E-mail: alexyang@prolific.com.tw

Distributors Contact: <http://www.prolific.com.tw/eng/contact-distributors.asp>

Taiwan Distributors

Maxtek Technology Co., Ltd.

5F, No. 13-20, Sec. 6, Ming-Chuang E.RD., Nei-Hu, Taipei, Taiwan, R.O.C.
Tel: +886-2-2794-6060 Ext.662
Fax: +886-2-8792-8921
Website: <http://www.maxtek-icrep.com.tw>
E-mail: sales@maxtek.icrep.com.tw

Morrihan International Corp.

4F, No. 3-2, YuanCyu Street, NanKang District , Taipei 115, Taiwan, R.O.C.
Tel: +886-2-2788-5511
Fax: +886-2-2788-9366
Website: <http://www.morrihan.com>

U-CHEER Company Co., Ltd.

4F, No. 48, Chow-Tze ST., Nei-Hu, Taipei, Taiwan, R.O.C.
Tel: +886-2-8797-6789
Fax: +886-2-8797-3388
E-mail: arthur.lu36@ucheer.com.tw

USA and Canada

ProlificUSA.com / Tectona Electronics Inc.

250 Wyecroft Road, Unit 6, Oakville, Ontario, Canada L6K 3T7
Tel: +905-827-2206
Fax: +905-847-9412
Corporate Website: <http://www.tectona.com>
Product Website: <http://www.prolificUSA.com>

Japan

Hitachi High-Tech Trading Corporation

1-24-14, Nishi-Shimbashi, Minato-ku, Tokyo, 105-8418 Japan
Dept.: Electronic Devices 4th Dept., Electronic Devices Sales Div
Tel: +81-3-3504-3859
Fax: +81-3-3504-7903
Website: <http://www.hitachi-hitec-trading.com>

China

Lacewood International Corp.

Hong Kong Office

Unit B1-B3, 21/F, Block B, Kong Nam Industrial Building, 603-609 Castle peak Road,

Tsuen Wan N.T, Hong Kong

Tel: +852-2690-9898

Fax: +852-2690-9300

Shenzhen Office

Room401-3,East, CEC Information Building, No.1 Xin Wen Road, Shenzhen, P.R.C.,
518034

Tel:+86-755-8296-7018

Fax: +86-775-8330-7119

Shanghai Office

Rm 208, District B, Building 3, NO.7, Guiqin Rd, Xuhui Area, Shanghai

Tel : +86-21-5426-2182 ~6

Fax: +86-21-5426-2180

China Fremlink Asia Limited

Room 307, 3F Block6, AnHua Industrial Zone, Tairan 8th Road,

CheGongMiao, Futian District, Shenzhen, China

Tel: +86-755-8302-0469

China Shenzhen Shiqixinji Science and Technology Co., Ltd.

Room 1908, Building NO.A, Jiahehuaqiang Building,

Shennanzhong Rd., Futian District, Shenzhen, China

Tel: +86-755-8329-5310

Korea

Nevora Technology

Rm 502, Citylife, 441, Amsa-Dong, Kangdong-Gu, Seoul, 134-855, Korea

Tel: +82-2-3426-0050

Fax: +82-2-3426-0070

Website: <http://www.nevora.co.kr>

T&C Semitech Co.,LTD

#703 J-dong, Gongku-sangga, 636-62, Kuro-dong, Kuro-ku, Seoul. Korea

Tel: +82-2-2672-9531

Fax: +82-2-2672-9532

Website: <http://www.tncsemi.co.kr>