PL-2303HX Edition (Chip Rev A)
USB to Serial Bridge Controller
Product Datasheet

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Revision History

Revision	Description	Date
1.6	➢ Added Chip Part Number Information in Ordering Information	October 5, 2011
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1.5F	➢ Modify Features section for Lead (Pb) Free information	May 23, 2006
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1.5	➢ Added List of Figures and List of Tables ➢ Modify Features section (Sec 1.0) ➢ Improve clarity of Functional Block diagram (Sec 2.0) and Pin Assignment diagram (Sec 4.0) ➢ Change Minimum Operating Temperature to 0°C.	January 27, 2005
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1.1	➢ Added notes on Pin Assignment and Description section regarding level and driving capabilities ➢ Modify DC Characteristics table	February 18, 2004
1.0	➢ PL-2303HX Product Datasheet – Formal Release	February 2004

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1.0 Features

- Fully Compliant with USB Specification v2.0 (Full-Speed)
- On Chip USB 1.1 transceiver, 5V→3.3V regulator, and 12 MHz crystal oscillator
- Supports RS232-like Serial 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 6 Mbps
  - External RS232 driver power down control
  - Independent power source for serial interface
- Extensive Flow Control Mechanism
  - Adjustable high/low watermark level
  - Automatic hardware flow control with CTS/RTS
  - 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 MODEM input signals
- Two general purpose I/O (GPIO) pins
- Optional external EEPROM for startup device configurations
- Provides drivers support for Windows, Mac OS, Linux, and WinCE
- Designed for Windows XP, Vista, 7 Certified Logo Drivers
- USB-IF Logo Compliant with TID 40002448
- Small footprint 28-pin SSOP IC package
- RoHS compliant

2.0 Functional Block Diagram

Figure 2-1 Block Diagram of PL-2303HX (Chip Rev A)

3.0 Introduction

PL-2303HX provides a convenient solution for connecting an RS232-like full-duplex asynchronous serial device to any Universal Serial Bus (USB) capable host. PL-2303HX highly compatible drivers could 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.

By taking advantage of USB bulk transfer mode, large data buffers, and automatic flow control, PL-2303HX is capable of achieving higher throughput compared to traditional UART (Universal Asynchronous Receiver Transmitter) ports. When real RS232 signaling is not required, baud rate higher than 115200 bps could be used for even higher performance. The flexible baud rate generator of PL-2303HX could be programmed to generate any rate between 75 bps and 6M bps.

PL-2303HX 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, PL-2303HX is perfect for bus powered operation with plenty of power left for the attached devices. Flexible signal level requirement on the RS232-like serial port side also allows PL-2303HX to connect directly to any 3.3V~1.8V range devices.

4.0 Pin Assignment Outline

Figure 4-1 Pin Assignment Outline of PL-2303HX (Chip Rev A)

5.0 Pin Assignment & Description

Table 5-1 Pin Assignment & Description

Pin #	Name	Type	Description
1	TXD	O (1)	Serial port (Transmitted Data)
2	DTR_N	O (1)	Serial port (Data Terminal Ready)
3	RTS_N	O (1)	Serial port (Request To Send)
4	VDD_325	P	RS232 VDD. The power pins for the serial port signals. When the serial port is 3.3V, this should be 3.3V. When the serial port is 2.5V, this should be 2.5V.
5	RXD	I (2)	Serial port (Received Data)
6	RI_N	I/O (3)	Serial port (Ring Indicator)
7	GND	P	Ground
8	NC		No Connect
9	DSR_N	I/O (3)	Serial port (Data Set Ready)
10	DCD_N	I/O (3)	Serial port (Data Carrier Detect)
11	CTS_N	I/O (3)	Serial port (Clear To Send)
12	SHTD_N	O (4)	RS232 Transceiver Shut Down Control
13	EE_CLK	I/O (5)	2-Wire Serial EEPROM Clock
14	EE_DATA	I/O (5)	2-Wire Serial EEPROM Data
15	DP	I/O	USB port D+ signal
16	DM	I/O	USB port D- signal
17	VO_33	P	Regulator Power Output, 3.3V
18	GND	P	Ground
19	NC		No Connect
20	VDD_5	P	USB port V_{BUS}, 5V Power.
21	GND	P	Ground
22	GP0	I/O (7)	General Purpose I/O Pin 0
23	GP1	I/O (7)	General Purpose I/O Pin 1
24	NC		No Connect
25	GND_A	P	Analog Ground for PLL
26	PLL_TEST	I (6)	PLL test mode control
27	OSC1	I	Crystal oscillator input
28	OSC2	I/O	Crystal oscillator output

Notes:

(1) – CMOS Out, Output Pad. Level and Driving Capability decided by VDD_325.

(2) – SCHMITT In, 5V Tolerant, Input Pad. Level and Driving Capability decided by VDD_325.

(3) – SCHMITT In/CMOS Out, 5V Tolerant, Bi-directional Pad. Level and Driving Capability decided by VDD_325.

(4) – CMOS Out, 3.3V, Output Pad, 4mA Output Driving Capability.

(5) – SCHMITT In/CMOS Out, 5V Tolerant, Bi-directional Pad with internal resistor pulling-up to 3.3V, 4mA Output Driving Capability.

(6) – LVTTL In, 3.3V, Input Pad.

(7) – SCHMITT In/CMOS Out, 5V Tolerant, Bi-directional Pad, 4mA Output Driving Capability.

6.0 USB Standard Descriptors

PL-2303HX supports one configuration with one interface and four endpoints. The descriptors are basically stored in an internal Mask ROM. However, some fields could be optionally modified by properly programmed external 2-wire serial EEPROM. The contents of all descriptors are shown in the following sections.

6.1 Device Descriptor

Table 6-1 Device Descriptor

Offset	Field	Size	Value	Description
0	*bLength*	Byte	12H	Size of this descriptor (in bytes)
1	*bDescriptorType*	Byte	01H	DEVICE descriptor type
2	*bcdUSB*	Word	0110H	USB Specification Release Number 1.1
4	*bDeviceClass*	Byte	00H	
5	*bDeviceSubClass*	Byte	00H	
6	*bDeviceProtocol*	Byte	00H	
7	*bMaxPacketSize0*	Byte	40H	Maximum packet size for endpoint zero is 64
8	*idVender*	Word	067BH	Vender ID (1)
10	*idProduct*	Word	2303H	Product ID (1)
12	*bcdDevice*	Word	0300H	Device Release Number (1)
14	*iManufacturer*	Byte	01H	Manufacturer string descriptor index
15	*iProduct*	Byte	02H	Product name string descriptor index
16	*iSerialNumber*	Byte	00H/03H	Serial number string descriptor index (2)
17	*bNumConfigurations*	Byte	01H	One configuration.

Notes:

(1) – The Vender ID, Product ID, and Device Release Number could be replaced by the contents of external EEPROM.

(2) – The serial number string descriptor index could be defined by the contents of external EEPROM. If specified, the index will be 3 instead of 0.

6.2 Configuration Descriptor

Table 6-2 Configuration Descriptor

Offset	Field	Size	Value	Description
0	*bLength*	Byte	09h	Size of this descriptor (in bytes)
1	*bDescriptorType*	Byte	02h	CONFIGURATION descriptor type
2	*wTotalLength*	Word	0027h	Total length of data returned for this configuration.
4	*bNumInterface*	Byte	01h	One interface for this device.
5	*bConfigurationValue*	Byte	01h	
6	*iConfiguration*	Byte	00h	
7	*bmAttributes*	Byte	A0h/80h	Characteristic attributes (3)
8	*MaxPower*	Byte	32h/FAh	Maximum power consumption (4)

Notes:

(3) – The Remote Wakeup attribute (bit 5) depends on the settings of the Remote Wakeup Enable (Setting in the Device Configuration Registers, DCR, of PL-2303HX). If all remote wakeup sources are disabled, the bmAttributes will be 80h. Otherwise, A0h is returned to indicate that this device is Remote Wakeup capable.

(4) – The value of maximum power consumption can be configured initially by setting DCR on the external EEPROM. If it is set to 1, the MaxPower byte will be FAh to indicate 500mA required from the USB host. Otherwise, it is 32h that indicates 100mA required.

6.3 Interface Descriptor

Table 6-3 Interface Descriptor

Offset	Field	Size	Value	Description
0	*BLength*	Byte	09h	Size of this descriptor (in bytes)
1	*BDescriptorType*	Byte	04h	INTERFACE descriptor type
2	*BInterfaceNumber*	Byte	00h	One interface only
3	*BAlternateSetting*	Byte	00h	No alternate interface
4	*BNumEndpoints*	Byte	03h	Three endpoints (excluding control endpoint)
5	*BInterfaceClass*	Byte	FFh	Vendor Specific Class
6	*BInterfaceSubClass*	Byte	00h	
7	*BInterfaceProtocol*	Byte	00h	
8	*IInterface*	Byte	00h	

6.4 Endpoint 1 Descriptor: Interrupt Input Endpoint

Table 6-4 Endpoint1 Descriptor

Offset	Field	Size	Value	Description
0	*bLength*	Byte	07h	Size of this descriptor (in bytes)
1	*bDescriptorType*	Byte	05h	ENDPOINT descriptor type
2	*bEndpointAddress*	Byte	81h	Input endpoint
3	*bmAttributes*	Byte	03h	Transfer type is INTERRUPT
4	*wMaxPacketSize*	Word	000Ah	Ten Bytes
6	*bInterval*	Byte	01h	Polling on every 1 ms interval

6.5 Endpoint 2 Descriptor: Bulk Data Output endpoint

Table 6-5 Endpoint2 Descriptor

Offset	Field	Size	Value	Description
0	*bLength*	Byte	07h	Size of this descriptor (in bytes)
1	*bDescriptorType*	Byte	05h	ENDPOINT descriptor type
2	*bEndpointAddress*	Byte	02h	Output endpoint
3	*bmAttributes*	Byte	02h	Transfer type is BULK
4	*wMaxPacketSize*	Word	0040h	64 bytes
6	*bInterval*	Byte	00h	Ignored field

6.6 Endpoint 3 Descriptor: Bulk Data Input endpoint

Table 6-6 Endpoint3 Descriptor

Offset	Field	Size	Value	Description
0	*bLength*	Byte	07h	Size of this descriptor (in bytes)
1	*bDescriptorType*	Byte	05h	ENDPOINT descriptor type
2	*bEndpointAddress*	Byte	83h	Input endpoint
3	*bmAttributes*	Byte	02h	Transfer type is BULK
4	*wMaxPacketSize*	Word	0040h	64 bytes
6	*bInterval*	Byte	00h	Ignored field

6.7 String Descriptors

PL-2303HX supports four string descriptors:

- Language ID
- Manufacturer
- Product
- Serial Number

Except for Serial Number, the other three string descriptors are stored in the internal Mask ROM, i.e. their contents are fixed. Serial Number is a special case. If the External EEPROM were not present, or not properly programmed, then Serial Number would be hidden from the system. If the External EEPROM is presented and properly programmed, then Serial Number will be read from the EEPROM.

The following tables demonstrate the current defined value for each descriptor:

6.7.1 String Descriptor 0 – Language ID

Table 6-7-1 String Descriptor – Language ID

Offset	Field	Size	Value	Description
0	*bLength*	Byte	04h	Size of this descriptor (in bytes)
1	*bDescriptorType*	Byte	03h	STRING descriptor type
2	*bLANGID[0]*	Word	0409h	English (United States)

6.7.2 String Descriptor 1 – Manufacturer

Table 6-7-2 String Descriptor – Manufacturer

Offset	Field	Size	Value	Description
0	*BLength*	Byte	32h	Size of this descriptor (in bytes)
1	*bDescriptorType*	Byte	03h	STRING descriptor type
2	*bSTRING*	—	⇒	“Prolific Technology Inc.” in UNICODE

6.7.3 String Descriptor 2 - Product

Table 6-7-3 String Descriptor – Product

Offset	Field	Size	Value	Description
0	*Blength*	Byte	2Ch	Size of this descriptor (in bytes)
1	*bDescriptorType*	Byte	03h	STRING descriptor type
2	*bSTRING*	—	⇒	"USB-Serial Controller" in UNICODE

6.7.4 String Descriptor 3 – Serial Number

Table 6-7-4 String Descriptor – Serial Number

Offset	Field	Size	Value	Description
0	*bLength*	Byte	12h	Size of this descriptor (in bytes)
1	*bDescriptorType*	Byte	03h	STRING descriptor type
2	*bSTRING*	—	⇒	"$X_7X_6X_5X_4X_3X_2X_1X_0$" in UNICODE

Note:

The size of Serial Number is fixed in PL-2303HX design. It must be exactly 8 UNICODE characters (or 16 bytes). Note that in USB Specification, this serial number must be unique for each device.

7.0 USB Standard Requests

PL-2303HX supports the following USB standard requests. For non-supported requests or requests with invalid parameters, PL-2303HX will respond with STALL packet.

- Clear Feature
- Get Configuration
- Get Descriptor
- Get Status
  - Device Status
  - Interface Status
  - Endpoint 0, 1, 2, and 3 Status
- Set Address
- Set Configuration
- Set Feature

8.0 DC & Temperature Characteristics

8.1 Absolute Maximum Ratings

Table 8-1 Absolute Maximum Ratings

Items	Ratings
Power Supply Voltage	-0.3 to 5.5 V
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 VO_33 + 0.3 V
Storage Temperature	-40 to 150 ^{o}C

8.2 DC Characteristics

Table 8-2 Operating Voltage and Suspend Current

Parameter	Symbol	Min	Typ	Max	Unit
Operating Voltage Range	VDD_5	3.6	5	5.5	V
Regulator Output Driving Current (VDD_5= 5V)	I_{LOAD}	-	-	150	mA
Operating Current(1) (Power Consumption)	I_{DD}	-	10	15	mA
Suspend Current	I_{SUS}	-	400	450	µA

Note: (1) – No device connected.

8.2.1 3.3V I/O Pins

Table 8-2-1 3.3V I/O Pins

Parameter	Symbol	Min	Typ	Max	Unit
Output Driving Capability	I_{DD}	--	4	--	mA
Output Voltage of Regulator	VO_33	3.0	3.3	3.6	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
Schmitt Trigger Threshold Voltage					
Negative going	V_{t-}	0.9	1.2	--	V
Positive going	V_{t+}	--	2.1	2.5	V
Output Voltage, 3.3V					
Low	V_{OL}	--	--	0.4	V
High	V_{OH}	2.4	--	--	V

8.2.2 Serial I/O Pins

Table 8-2-2a VDD_325@3.3V Serial I/O Pins

Parameter	Symbol	Min	Typ	Max	Unit
Output Driving Capability	I_{DD}	--	4	--	mA
Power Supply for Serial I/O Pins	VDD_325	3.0	3.3	3.6	V
Input Voltage					
Low	V_{IL}	--	--	0.8	V
High	V_{IH}	2.0	--	--	V
Schmitt Trigger Threshold Voltage					
Negative going	V_{t-}	0.8	1.1	--	V
Positive going	V_{t+}	--	1.6	2.0	V
Output Voltage					
Low	V_{OL}	--	--	0.4	V
High	V_{OH}	2.4	--	--	V

Table 8-2-2b VDD_325@2.5V Serial I/O Pins

Parameter	Symbol	Min	Typ	Max	Unit
Output Driving Capability	I_{DD}	--	2.6	--	mA
Power Supply for Serial I/O Pins	VDD_325	2.25	2.5	2.75	V
Input Voltage					
Low	V_{IL}	--	--	0.25* VDD_325	V
High	V_{IH}	0.7* VDD_325	--	--	V
Schmitt Trigger Threshold Voltage					
Negative going	V_{t-}	0.25* VDD_325	0.84	--	V
Positive going	V_{t+}	--	1.31	0.7* VDD_325	V
Output Voltage					
Low	V_{OL}	--	--	0.4	V
High	V_{OH}	1.85	--	--	V

Table 8-2-2c VDD_325@1.8V Serial I/O Pins

Parameter	Symbol	Min	Typ	Max	Unit
Output Driving Capability	I_{DD}	--	1.4	--	mA
Power Supply for Serial I/O Pins	VDD_325	1.65	1.8	1.95	V
Input Voltage					
Low	V_{IL}	--	--	0.25* VDD_325	V
High	V_{IH}	0.7* VDD_325	--	--	V
Schmitt Trigger Threshold Voltage					
Negative going	V_{t-}	0.25* VDD_325	0.6	--	V
Positive going	V_{t+}	--	1.04	0.7* VDD_325	V
Output Voltage					
Low	V_{OL}	--	--	0.4	V
High	V_{OH}	1.25	--	--	V

8.3 Clock Characteristics

Table 8-3 Clock Characteristics

Parameter	Min	Typ	Max	Units
Frequency of Operation	11.976	12.000	12.024	MHz
Clock Period	83.1	83.3	83.5	ns
Duty Cycle	45	50	55	%

8.4 Temperature Characteristics

Table 8-4 Temperature Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Operating Temperature	--	-40	--	85	^{o}C
Junction Operation Temperature	T_J	-40	25	125	^{o}C

8.5 Leakage Current and Capacitance

Table 8-5 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

Note:

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

8.6 Power-On Reset

Figure 8-1 Power-On Reset Diagram

Table 8-6 Power-On Reset

Description and Condition	Symbol	Min	Typ	Max	Unit
Power supply voltage	VCC	2.8	3.3	4.0	V
VCC rise relax voltage	V_{rr}	1.8	2.3	2.8	V
Power output low duration VCC $\mid_{rise}$ @ V_{rr} to POR $\mid_{rise}$ @ 1/2*VCC (VCC slew rate = 1V/1us)	T_{por1}	2.6	3.7	4.8	µS

9.0 Outline Diagram

9.1 SSOP28 Package

Table 9-1 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 9-1 Outline Diagram of PL-2303HX (Chip Rev A) SSOP28

10.0 Reel Packing Information

10.1 Carrier Tape (SSOP-28)

Figure 10-1a SSOP28 Carrier Tape

Notes:
1. 10 sprocket hole pitch cumulative tolerance ±0.2
2. Camber not to exceed 1mm in 100mm.
3. Material: Black Polystyrene.
4. Ao and Bo measured on a plane 0.3mm above the bottom of the pocket.
5. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
7. IC quantity per one reel: 2,000 pieces

Figure 10-1b IC Reel Placements

10.2 Reel Dimension

Figure 10-2 Reel Dimension

Table 10-2 Reel Part Number Information

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

11.0 Ordering Information

Table 11-1 Ordering Information

Part Number	Package Type
PL-2303HX LF	28-pin SSOP (Lead-Free or Pb-Free)

Figure 11-1 Chip Part Number Information

Note: The chip datecode and version are found on the second line of the top chip marking:

Where: *LF* – Lead-Free
YY – last two digits of the year
WW – week of the year
3A – chip version

Example: "*LF10123A*" – means Lead-Free + year 2010 + week no. 12 + 3A chip version.