



PL-2506B Hi-Speed USB to IDE Bridge Controller

Product Datasheet

Document Revision: 1.2

Document Release: April 17, 2007

Prolific Technology Inc.

7F, No. 48, Sec. 3, Nan Kang Rd.
Nan Kang, Taipei 115, Taiwan, R.O.C.

Tel: 886-2-2654-6363

Fax: 886-2-2654-6161

Email: sales@prolific.com.tw

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



Disclaimer

All the information in this document is subject to change without prior notice. Prolific Technology Inc. does not make any representations or any warranties (implied or otherwise) regarding the accuracy and completeness of this document and shall in no event be liable for any loss of profit or any other commercial damage, including but not limited to special, incidental, consequential, or other damages.

Trademarks

The Prolific logo is a registered trademark of Prolific Technology Inc. All brand names and product names used in this document are trademarks or registered trademarks of their respective holders.

Copyrights

Copyright © 2007 Prolific Technology Inc. All rights reserved.

No part of this document may be reproduced or transmitted in any form by any means without the express written permission of Prolific Technology Inc.

Revision History

Revision	Description	Date
1.2	<ul style="list-style-type: none">➤ Added Windows Vista and USB-IF Logo Certification.➤ Remove 64-pin LQFP information.	April 17, 2007
1.1	<ul style="list-style-type: none">➤ Section 5.3: Updated information.	February 12, 2007
1.0	<ul style="list-style-type: none">➤ Formal Release	October 2, 2006
0.1	<ul style="list-style-type: none">➤ Preliminary Draft Release	July 31, 2006

Table of Contents

1.0 PRODUCT OVERVIEW	6
1.1 Overview	6
1.2 Features	6
1.3 Block Diagram	7
2.0 PIN ASSIGNMENT & DESCRIPTION	8
2.1 LQFP48 Package	8
3.0 USB PORT DESCRIPTOR	11
3.1 Device Descriptor	11
3.2 Configuration Descriptor.....	12
3.3 Interface Descriptors	12
3.4 Endpoint Descriptors	13
3.5 Device_Qualifier Descriptors.....	14
3.6 Other_Speed_Configuration Descriptors.....	14
4.0 EXTERNAL SERIAL MEMORY.....	15
4.1 Data Structure of External Serial Memory Contents.....	15
5.0 DC CHARACTERISTICS.....	17
5.1 Absolute Maximum Ratings.....	17
5.2 Operating Current Parameters	17
5.3 Recommended Operating Conditions	17
5.4 Leakage Current and Capacitance.....	18
5.5 DC Characteristics of 3.3V Programmable I/O Cells.....	18
6.0 ORDERING INFORMATION.....	18
7.0 OUTLINE DIAGRAM	19
7.1 LQFP48pin Package (7mm x 7mm)	19

List of Figures

Figure 1-1 Block Diagram of PL-2506.....	7
Figure 2-1 Pin Assignment Diagram of PL-2506 (Rev B) LQFP48	8
Figure 7-1 Outline Diagram of PL-2506 LQFP48 (7mm x 7mm)	19

List of Tables

Table 2-1 USB2.0 PHY Related Pins (LQFP48)	9
Table 2-2 IDE Interface Related Pins (LQFP48)	9
Table 2-3 System Pins (LQFP48)	10
Table 3-1 Device Descriptor.....	11
Table 3-2 Configuration Descriptor	12
Table 3-3 Interface Descriptors	12
Table 3-4a High-Speed Mode: Bulk Out Endpoint Descriptor (Endpoint 1).....	13
Table 3-4b High-Speed Mode: Bulk In Endpoint Descriptor (Endpoint 2)	13
Table 3-4c Full-Speed Mode: Bulk Out Endpoint Descriptor (Endpoint 1)	13
Table 3-4d Full-Speed Mode: Bulk In Endpoint Descriptor (Endpoint 2).....	13
Table 3-5 Device Qualifier Descriptors.....	14
Table 3-6 Other Speed Configuration Descriptors	14
Table 4-1 Data Structure of EEPROM Contents	15
Table 4-2 String Descriptor Entries Data Structure	15
Table 4-3 Example of Valid EEPROM Contents.....	16
Table 5-1 Absolute Maximum Ratings.....	17
Table 5-2 Operating Current Parameters.....	17
Table 5-3 Recommended Operating Conditions	17
Table 5-4 Leakage Current and Capacitance.....	18
Table 5-5 DC Characteristics of 3.3V Programmable I/O Cells.....	18
Table 6-1 Ordering Information	18

1.0 Product Overview

1.1 Overview

The PL-2506 is a single chip Hi-Speed USB-to-IDE bridge controller that is designed to perform seamless protocol transfer between the USB and ATA interface. The operating speed is determined by the capability of the host/hub it is connected to. PIO mode 0 to mode 4, Multi Word DMA mode 0 to mode 2, and Ultra DMA mode 0 to mode 6 (Ultra DMA 133 or ATA/133) are implemented to support broad range of standard ATA and ATAPI devices. The PL-2506 can support two devices at the same time using Master/Slave mode. To obtain the best performance possible, the PL-2506 will negotiate with the connected device(s) to select the proper mode supported by the device. The PL-2506 is implemented according to the USB Bulk-Only Mass Storage Class specification ver1.0. The USB mass storage driver is integrated in most OSes so no additional driver is needed.

1.2 Features

- AT Attachment with Packet Interface Extension (ATA/ATAPI-7) Compliant
- ATA interface support PIO mode 0~4, Multiword DMA mode 0~2, and Ultra-DMA mode 0~6 (Ultra DMA 133 or ATA/133) to work with ATA/ATAPI devices.
- Universal Serial Bus Specification 2.0 Compliant
- [USB-IF Hi-Speed Logo Certified \(TID No. 40000296\)](#)
- USB Mass Storage Class Bulk-Only Transport Specification Compliant. No driver installation needed in Linux (kernel 2.4.18 or above), Mac OS 9.x or above, and Windows ME or above. Windows 98 requires additional driver installation provided by Prolific. Apple provides the USB mass storage driver download for Mac OS 8.6.
- [Windows Vista Basic Logo Certified](#)
- Integrated the full speed (12Mbps) and high speed (480Mbps) transceiver
- Sufficient 4K bytes data buffer for both the downstream and upstream data transfer for optimized performance.
- Single or Two simultaneous ATA/ATAPI devices are supported
- Master or Slave ATA/ATAPI device(s) is detected automatically. Single device can be configured as master or slave device.
- Supports Multiple LUN
- Vendor/Product related information could be customized by external SPI serial Flash or external I2C compatible serial EEPROM.
- Contents of serial EEPROM or serial Flash can be updated through USB interface
- Multi-function General Purpose IO pins has defined for USB speed LED, button inputs, etc.
- GPIO pins can also be customized by external serial memory or through USB interface
- Low power consumption allows for bus-powered or self-powered operation
- Low power 1.8V core operating voltage
- On-chip 5V to 3.3V/1.8V regulator to supply the power for core circuit
- 5V tolerant inputs, 3.3V output drive
- Single inexpensive 12-MHz crystal for clock source
- Inexpensive LQFP package type: LQFP48pin (7x7mm)

1.3 Block Diagram

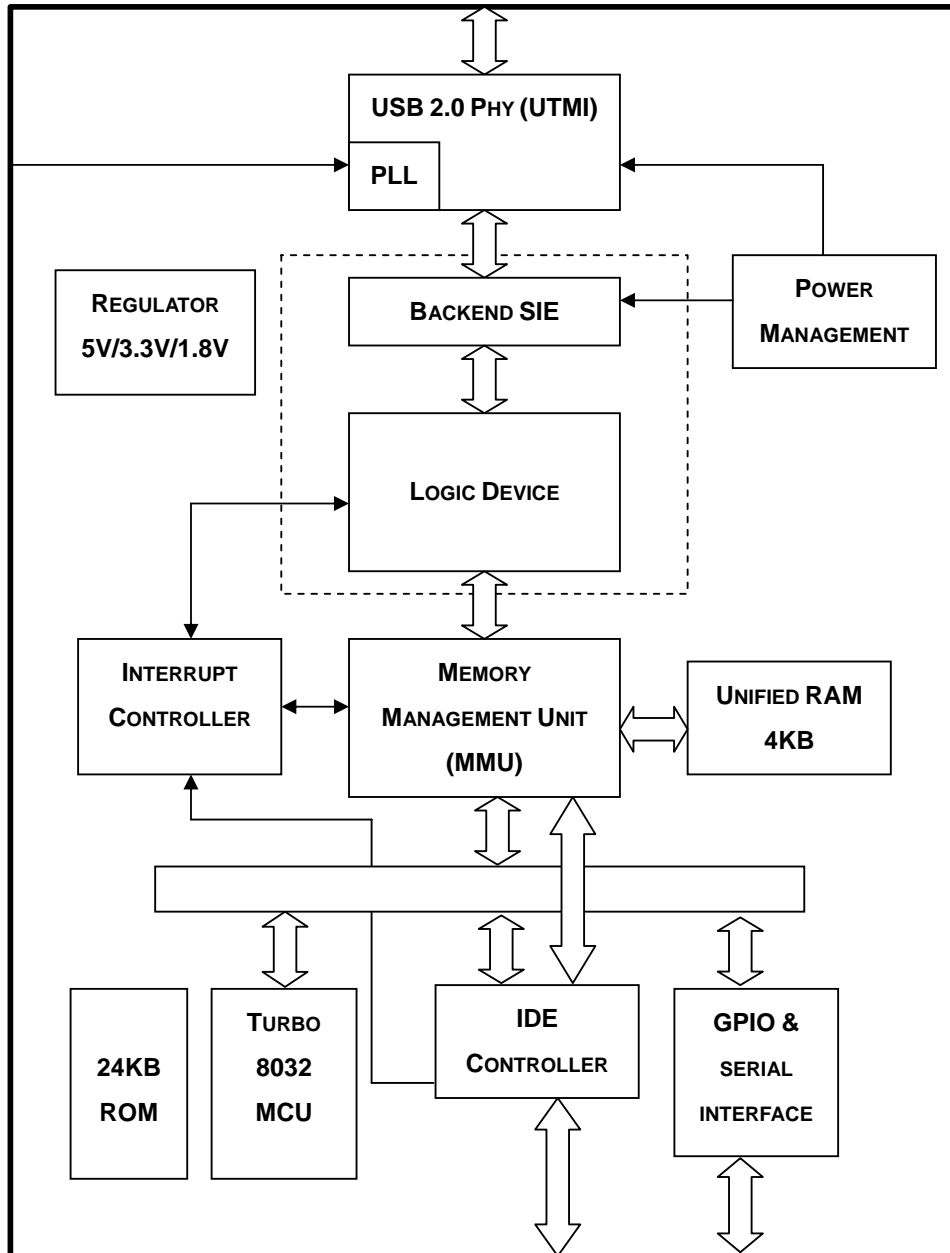


Figure 1-1 Block Diagram of PL-2506

2.0 Pin Assignment & Description

2.1 LQFP48 Package

2.1.1 LQFP48 Pin Diagram

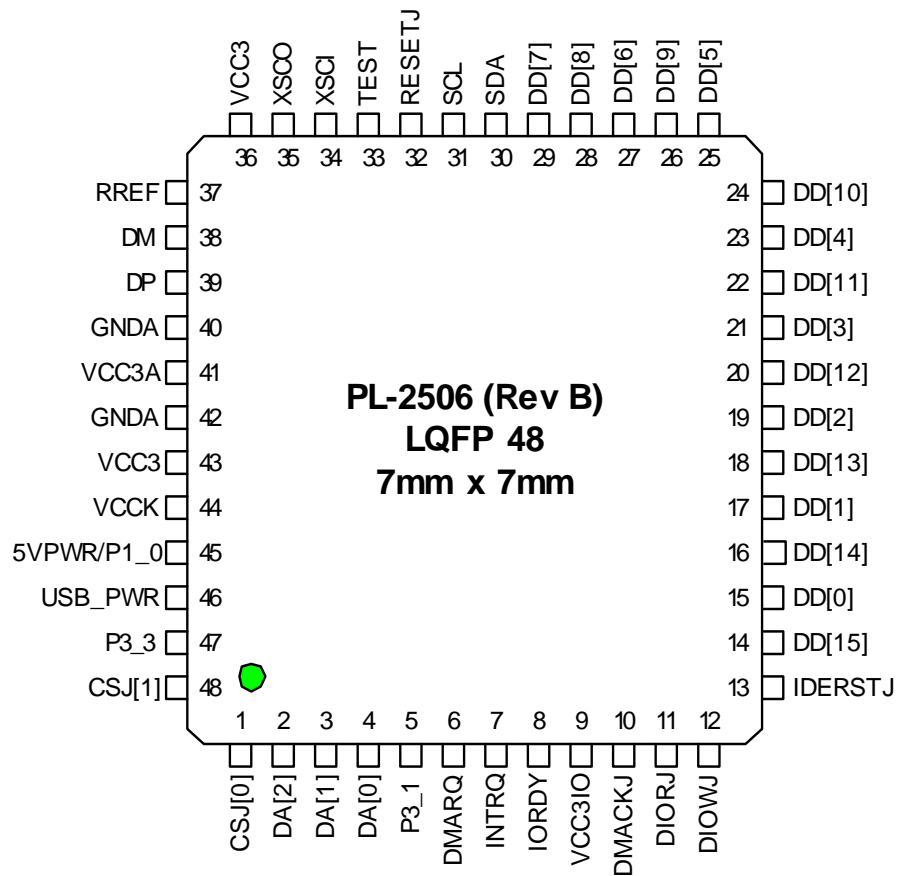


Figure 2-1 Pin Assignment Diagram of PL-2506 (Rev B) LQFP48

2.1.2 LQFP48 Pin Description

Pin Type Abbreviation:

I: Input O: Output B: Bidirectional A: Analog P: Power/Ground T: Tri-state

USB2.0 PHY Related Pins

Table 2-1 USB2.0 PHY Related Pins (LQFP48)

Symbol	Type	Pin No	Description
XSCI	I	34	Clock in or CMOS oscillator input
XSCO	O	35	CMOS oscillator output
RREF	A	37	PLL Reference level
DP	B	39	High speed DPLUS signal
DM	B	38	High speed DMINUS signal
VCC3A	P	41	Analog Power 3.3V for on-chip PHY
GNDA	P	40, 42	Analog Ground for on-chip USB PHY

IDE Interface Related Pins

Table 2-2 IDE Interface Related Pins (LQFP48)

Symbol	Type	Pin No	Description
DD[15:0]	B	14, 16, 18, 20, 22, 24, 26, 28, 29, 27, 25, 23, 21, 19, 17, 15	16 pins Data bus of IDE interface
DA[2:0]	T	2, 3, 4	DA, Data Address pins of IDE interface. Will be in high impedance state until USB connection.
CSJ[1:0]	T	48, 1	CS_, Chip Select pins of IDE interface. Will be in high-impedance state until USB connection.
USB_PWR	I	46	USB VCC signal from USB connection
IDERSTJ	T	13	Hardware reset pin of IDE interface. Will be in high impedance state until USB connection.
DIOWJ	T	12	ATA control. Will be in high impedance state until USB connection.
DIORJ	T	11	ATA control. Will be in high impedance state until USB connection.
DMACKJ	T	10	ATA control. Will be in high impedance state until USB connection.
IORDY	I	8	ATA control
INTRQ	I	7	ATA control
DMARQ	I	6	ATA control

System Pins

Table 2-3 System Pins (LQFP48)

Symbol	Type	Pin No	Description
VCC3IO	P	9	3.3V Power pins
VCC3	P	36, 43	3.3V Power pin for on-chip 3.3V/1.8V regulator
VCKK	P	44	1.8V power output of 5V/3.3V/1.8V regulator
RESETJ	I	32	External reset pin. Low active.
TEST	I	33	Chip Test mode enable. It shall be tie to ground for normal operation.
5VPWR	B	45	5V power pin for on-chip 5V/3.3V/1.8V regulator, If 5V is applied, the function of PORT1_0 is negated.
P1_0			SPI serial interface CS (chip select) signal or general purpose I/O pin
P3_1	B	5	General Purpose I/O pin
P3_3	B	47	USB speed LED output or general purpose I/O pin
SCL	O	31	Clock pin of SPI or two-wire serial EEPROM or serial Flash interface.
SDA	B	30	Data pin of SPI or two-wire serial EEPROM or serial Flash interface.

3.0 USB Port Descriptor

PL-2506 supports the following standard USB descriptors:

- Device descriptor.
- Configuration descriptor that supports one interface.
- String descriptors. Three string descriptors are implemented namely, language ID, Vendor String, and Product String.

3.1 Device Descriptor

Table 3-1 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	0200h	USB Specification version 2.0
4	bDeviceClass	Byte	00h	Interface Specific
5	bDeviceSubclass	Byte	00h	Interface Specific
6	bDeviceProtocol	Byte	00h	Interface Specific
7	wMaxPacketSize0	Byte	40h	Maximum packet size for endpoint 0 is 64
8	idVendor	Word	067Bh	Vendor ID for Prolific Technologies ⁽¹⁾
10	idProduct	Word	2506h	Product ID for PL-2506 ⁽¹⁾
12	bcdDevice	Word	0100h	Device Release 1.0 ⁽¹⁾
14	iManufacturer	Byte	01h	String index 1 describes manufacturer ⁽²⁾
15	iProduct	Byte	02h	String index 2 describes product ⁽³⁾
16	iSerialNumber	Byte	03h	No serial number string. ⁽⁴⁾
17	bNumConfigurations	Byte	01h	One possible configuration

Notes:

⁽¹⁾ – These default values shown here could be modified by external EEPROM.

⁽²⁾ – The default string is “Prolific Technology Inc.” in UNICODE format and could be replaced by the contents of external EEPROM.

⁽³⁾ – The default string is “ATAPI-6 Bridge Controller” in UNICODE format and could be replaced by the contents of external EEPROM.

⁽⁴⁾ – The default serial number is “0” unless modified in external EEPROM by entering serial number.

3.2 Configuration Descriptor

Table 3-2 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	bTotalLength	Word	0020h	32 bytes of all Interface and Endpoint
4	bNumInterfaces	Byte	01h	The PL-2506 has one interface
5	bConfigurationValue	Byte	01h	Value to write to the Device Configuration Register (DCR) to select this configuration.
6	iConfiguration	Byte	00h	No string description for this
7	bmAttributes	Byte	C0h	Configuration characteristics: ⁽⁵⁾ Self-Powered & No Remote Wakeup
8	MaxPower	Byte	32h	Maximum power consumption is 100 mA ⁽⁵⁾

Notes:

⁽⁵⁾ – The default value could be replaced by the contents of external EEPROM.

3.3 Interface Descriptors

Table 3-3 Interface Descriptors

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	Interface 0
3	bAlternateSetting	Byte	00h	Alternate 0
4	bNumEndpoints	Byte	02h	Supports endpoint 0, 1, and 2
5	bInterfaceClass	Byte	08h	MASS STORAGE class
6	iInterfaceSubClass	Byte	06h	SCSI transparent commend set
7	bInterfaceProtocol	Byte	50h	Bulk-Only Transport protocol
8	iInterface	Byte	00h	No String descriptor for this interface

3.4 Endpoint Descriptors

3.4.1 High-Speed mode

Table 3-4a High-Speed Mode: Bulk Out Endpoint Descriptor (Endpoint 1)

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	01h	Out Endpoint 1
3	bmAttributes	Byte	02h	BULK Endpoint
4	wMaxPacketSize	Word	0200h	Maximum packet size is 512
6	bInterval	Byte	00h	N/A

Table 3-4b High-Speed Mode: Bulk In Endpoint Descriptor (Endpoint 2)

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	82h	In Endpoint 2
3	bmAttributes	Byte	02h	BULK Endpoint
4	wMaxPacketSize	Word	0200h	Maximum packet size is 512
6	bInterval	Byte	00h	N/A

3.4.2 Full-Speed mode

Table 3-4c Full-Speed Mode: Bulk Out Endpoint Descriptor (Endpoint 1)

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	01h	Out Endpoint 1
3	bmAttributes	Byte	02h	BULK Endpoint
4	wMaxPacketSize	Word	0040h	Maximum packet size is 64
6	bInterval	Byte	00h	N/A

Table 3-4d Full-Speed Mode: Bulk In Endpoint Descriptor (Endpoint 2)

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	82h	In Endpoint 2
3	bmAttributes	Byte	02h	BULK Endpoint
4	wMaxPacketSize	Word	0040h	Maximum packet size is 64
6	bInterval	Byte	00h	N/A

3.5 Device_Qualifier Descriptors

Table 3-5 Device Qualifier Descriptors

Offset	Field	Size	Value	Description
0	bLength	Byte	0Ah	Size of this descriptor in bytes
1	bDescriptorType	Byte	06h	DEVICE Qualifier descriptor type
2	bcdUSB	Word	0200h	USB Specification version 2.0
4	bDeviceClass	Byte	00h	Interface Specific
5	bDeviceSubclass	Byte	00h	Interface Specific
6	bDeviceProtocol	Byte	00h	Interface Specific
7	wMaxPacketSize0	Byte	40h	Maximum packet size for endpoint 0 is 64
8	bNumConfigurations	Byte	01h	Number of other-speed configurations
9	bReserved	Byte	00h	Reserved for future use – must be zero

3.6 Other_Speed_Configuration Descriptors

Table 3-6 Other Speed Configuration Descriptors

Offset	Field	Size	Value	Description
0	bLength	Byte	09h	Size of this descriptor in bytes
1	bDescriptorType	Byte	07h	CONFIGURATION descriptor type
2	bTotalLength	Word	0020h	32 bytes of all INTERFACE & ENDPOINT
4	bNumInterfaces	Byte	01h	Number of interface supported, one interface
5	bConfigurationValue	Byte	01h	Value to write to the Device Configuration Register (DCR) to select this configuration.
6	iConfiguration	Byte	00h	No string description for this
7	bmAttributes	Byte	C0h	Configuration characteristics: Self-Powered & No Remote Wakeup
8	MaxPower	Byte	32h	Maximum power consumption is 100 mA

4.0 External Serial Memory

4.1 Data Structure of External Serial Memory Contents

Table 4-1 Data Structure of EEPROM Contents

Address	Content	Note
1:0	Check Word – 0x067B (Predefined constant)	
3:2	Vendor ID (idVendor field of Device Descriptor)	
5:4	Product ID (idProduct field of Device Descriptor)	
7:6	Device Release Number (bcdDevice field of Device Descriptor)	
8	Attributes (bmAttributes field of Configuration Descriptor)	
9	Max Power (MaxPower field of Configuration Descriptor)	
10	Chip operation settings	
14:11	External firmware control	
15	IDE transfer mode control	
N:16	String Descriptor Table	
222:225	Miscellaneous (Reserved)	
226:228	IDE Device Configuration	
229	GPIO settings	
256:-	External firmware	

From byte 16 to byte 230 are used for USB string descriptors. The String Descriptor table is a linked data structure that holds all string descriptors recognized by this chip in the order of its index. The first entry, String 0, represents the Language ID, as defined by the USB specification. The second entry, String 1, is the Manufacturer Descriptor, as defined by the Device Descriptor of PL-2506. The third and fourth entries, String 2 and 3, are the Product Descriptor and Serial Number, respectively, also defined by the Device Descriptor. The user has the option to define String 4, 5, and 6 for their own private use. Each of these String Descriptor Entries is of the following data structure:

Table 4-2 String Descriptor Entries Data Structure

Offset	Field	Size	Value	Note
0	bLength	1	Length of the string plus 2, i.e. (N + 2).	
1	bDescriptorType	1	03h – STRING Descriptor type.	
2	bString	N	UNICODE encoded string.	

The last entry of this table must have a bLength of 0 to indicate the end of this table. If the host tries to access to the string descriptor beyond the last one, a zero-length data will be returned. The following table shows one example of valid EEPROM contents:

Table 4-3 Example of Valid EEPROM Contents

Offset	Content	Note
0:1	Check Word – 0x067B	Constant
2:3	Vendor ID – 0x067B	
4:5	Product ID – 0x2506	
6:7	Device Release Number – 0x0100	
8		
9		
15:10		
16	0x04	String Index 0 (4 Bytes)
17	0x03	
19:18	0x0409	Language ID for English (United States).
20	0x32	String Index 1 (50 Bytes)
21	0x03	
69:22	'P', 0x00, 'r', 0x00, 'o', 0x00, 'l', 0x00, 'i', 0x00, 'f', 0x00, 'i', 0x00, 'c', 0x00, ' ', 0x00, 'T', 0x00, 'e', 0x00, 'c', 0x00, 'h', 0x00, 'n', 0x00, 'o', 0x00, 'l', 0x00, 'o', 0x00, 'g', 0x00, 'y', 0x00, ' ', 0x00, 'l', 0x00, 'n', 0x00, 'c', 0x00, ' ', 0x00	"Prolific Technology Inc." – manufacturer description. 0x00 is padded for UNICODE.
70	0x34	String Index 2 (52 Bytes)
71	0x03	
121:72	'A', 0x00, 'T', 0x00, 'A', 0x00, 'P', 0x00, 'l', 0x00, '-', 0x00, '6', 0x00, ' ', 0x00, 'B', 0x00, 'r', 0x00, 'i', 0x00, 'd', 0x00, 'g', 0x00, 'e', 0x00, ' ', 0x00, 'C', 0x00, 'o', 0x00, 'n', 0x00, 't', 0x00, 'r', 0x00, 'o', 0x00, 'l', 0x00, 'l', 0x00, 'e', 0x00, 'r', 0x00	"ATAPI-6 Bridge Controller" – device description. 0x00 is padded for UNICODE.
122	0x0A	String Index 3 (10 bytes)
123	0x03	
131:124	'0', 0x00, '1', 0x00, '2', 0x00, '3', 0x00	"3210" – serial number,
132	0x00	End of String Descriptor Table.

The user could also define other strings, 4 to 6, to hold useful information for the drivers and/or applications, such as software authorization codes, symbolic names, just to name a few. However, the total length of this table must not exceed 256 bytes, the supported maximum size of the external EEPROM.

5.0 DC Characteristics

5.1 Absolute Maximum Ratings

Table 5-1 Absolute Maximum Ratings

SYMBOL	PARAMETER	RATING	UNITS
V_{CC}	1.8V Power Supply	-0.3 to 2.16	V
	3.3V Power Supply	-0.3 to 4.0	
V_{IN3}	Input Voltage of 3.3V I/O	-0.3 to 4.0	V
	Input Voltage of 3.3V I/O with 5V Tolerance	-0.3 to 5.8	
T_{STG}	Storage Temperature	-40 to 150	°C

5.2 Operating Current Parameters

Table 5-2 Operating Current Parameters

SYMBOL	PARAMETER	Conditions	TYP	UNITS
I_{DD}	USB High-Speed Supply Current	Write large files to HDD	60	mA
		VCD Playback using DVD-ROM	45	mA
	USB Full-Speed Supply Current	Write large files to HDD	35	mA
		VCD Playback using DVD-ROM	33	mA
I_{SUS}	Suspend Current		300	uA

5.3 Recommended Operating Conditions

Table 5-3 Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
V_{CCK}	Power Supply of 1.8V I/O	1.62	1.8	1.98	V
V_{CC}	Power Supply of 3.3V I/O	2.97	3.3	3.63	V
T_J	Junction Operating Temperature	-40	25	125	°C

5.4 Leakage Current and Capacitance

Table 5-4 Leakage Current and Capacitance

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I_{IL}	Input Leakage Current	No pull-up or pull-down	-10	± 1	10	μA
C_{IN2}	Input Capacitance			2.2		pF
C_{OUT2}	Output Capacitance			2.2		pF

Notes:

- (1) Permanent device damage may occur if Absolute Maximum Ratings are exceeded.
- (2) The pull up/pull down input leakage current can be derived from the pull up/pull down resistance (R_{pu}/R_{pd}) in the DC characteristics table for each type I/O buffer.
- (3) The capacitances listed above do not include PAD capacitance and package capacitance. One can estimate pin capacitance by adding pad capacitance's that is about 0.1pF and the package capacitance.

5.5 DC Characteristics of 3.3V Programmable I/O Cells

Table 5-5 DC Characteristics of 3.3V Programmable I/O Cells

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{CC31}	Power Supply	3.3V I/O	2.97	3.3	3.63	V
V_{IL}	Input Low Voltage*	CMOS/LVTTL			0.8	V
V_{IH}	Input High Voltage*	CMOS/LVTTL	2.0			V
I_{IN}	Input Leakage Current	$V_{in}=0$ or V_{CC31}	-10	± 1	10	μA

6.0 Ordering Information

Table 6-1 Ordering Information

Part Number	Package Type
PL-2506	48-pin LQFP (7x7mm)

Note: Please contact Prolific Sales office for Lead-Free ordering information.

7.0 Outline Diagram

7.1 LQFP48pin Package (7mm x 7mm)

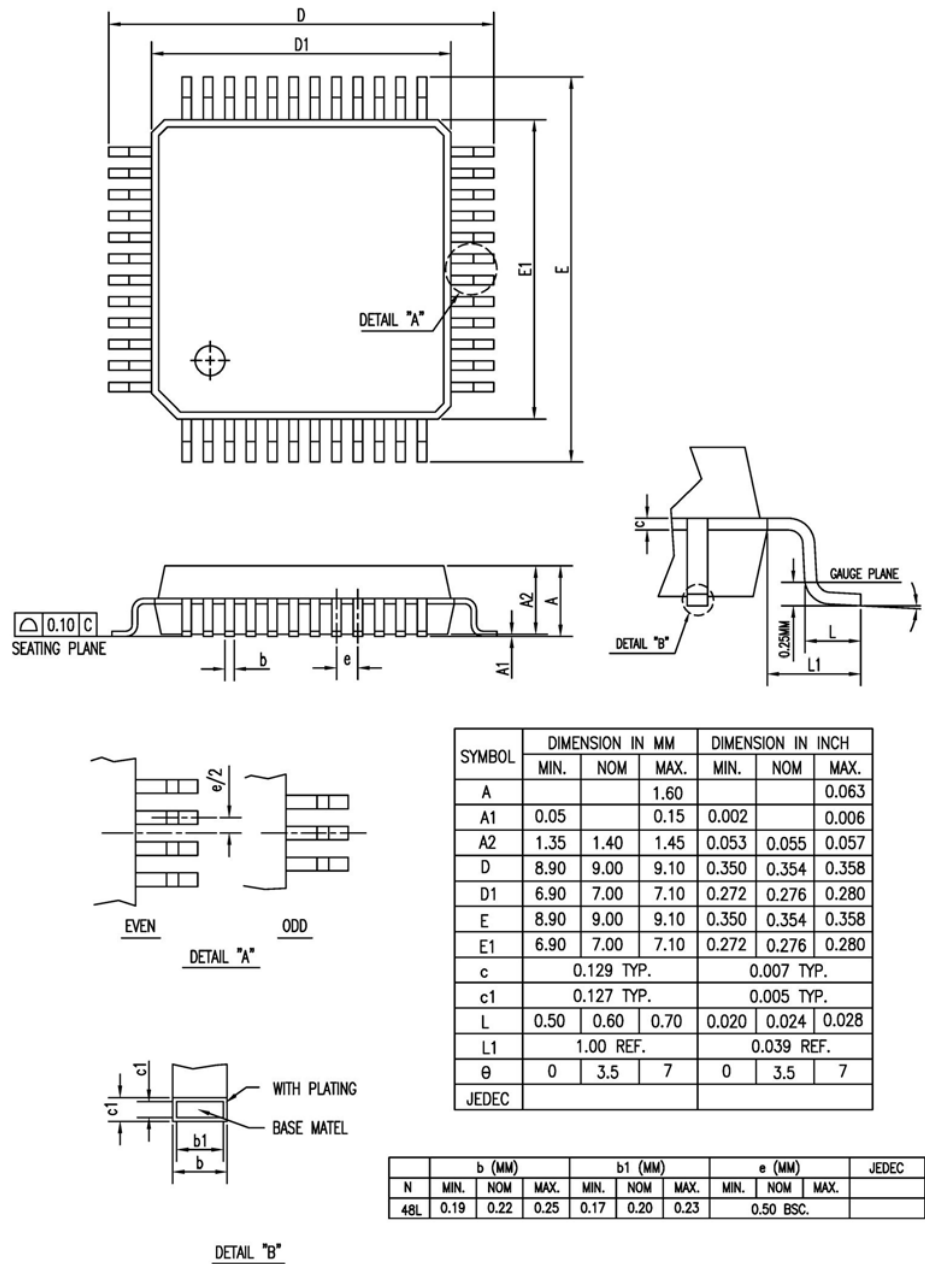


Figure 7-1 Outline Diagram of PL-2506 LQFP48 (7mm x 7mm)