PL-2506 Hi-Speed USB to IDE Bridge Controller

Product Datasheet

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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
Support: http://tech.prolific.com.tw

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Revision History

Revision	Description	Date
1.2B	Section 2.1.2: Added Pin Type Abbreviation Section 2.2.2: Added Pin Type Abbreviation Section 6.0: Modify DC Characteristics	July 19, 2005
1.2	Sec. 2.2: Added LQFP48 Pin Assignment & Description Sec. 8.3: Added LQFP48 (7x7mm) Outline Diagram	June 16, 2005
1.1C	Sec. 8.1: Correct LQFP64 (10x10mm) Outline Diagram Sec. 8.2: Correct LQFP64 (7x7mm) Outline Diagram	May 17, 2005
1.1B	Sec. 8.1: Remove watermark on Outline Diagram	March 1, 2005
1.1A	Sec. 6.2: Modify Operating Current Parameters	February 25, 2005
1.0	Formal Release of Datasheet	January 26, 2005

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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 4 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-6) Compliant
- ATA interface support PIO mode 0~4, Multiword DMA mode 0~2, and Ultra-DMA mode 0~4 to work with ATA/ATAPI devices.
- Universal Serial Bus Specification 2.0 Compliant
- USB Mass Storage Class Bulk-Only Transport Specification Compliant
- Integrated the full speed (12Mbps) and high speed (480Mbps) transceiver
- Sufficient 2K 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 2.5V core operating voltage
- On-chip 3.3V to 2.5V regulator to supply the power for core circuit
- 5V tolerant inputs, 3.3V output drive
- Single inexpensive 12-MHz crystal for clock source
- USB-IF Hi-Speed Logo and Microsoft Windows WHQL Logo Certified
- Inexpensive LQFP package type:
    - LQFP64pin (10x10mm)
    - LQFP64pin (7x7mm)
    - LQFP48pin (7x7mm)

1.3 Block Diagram

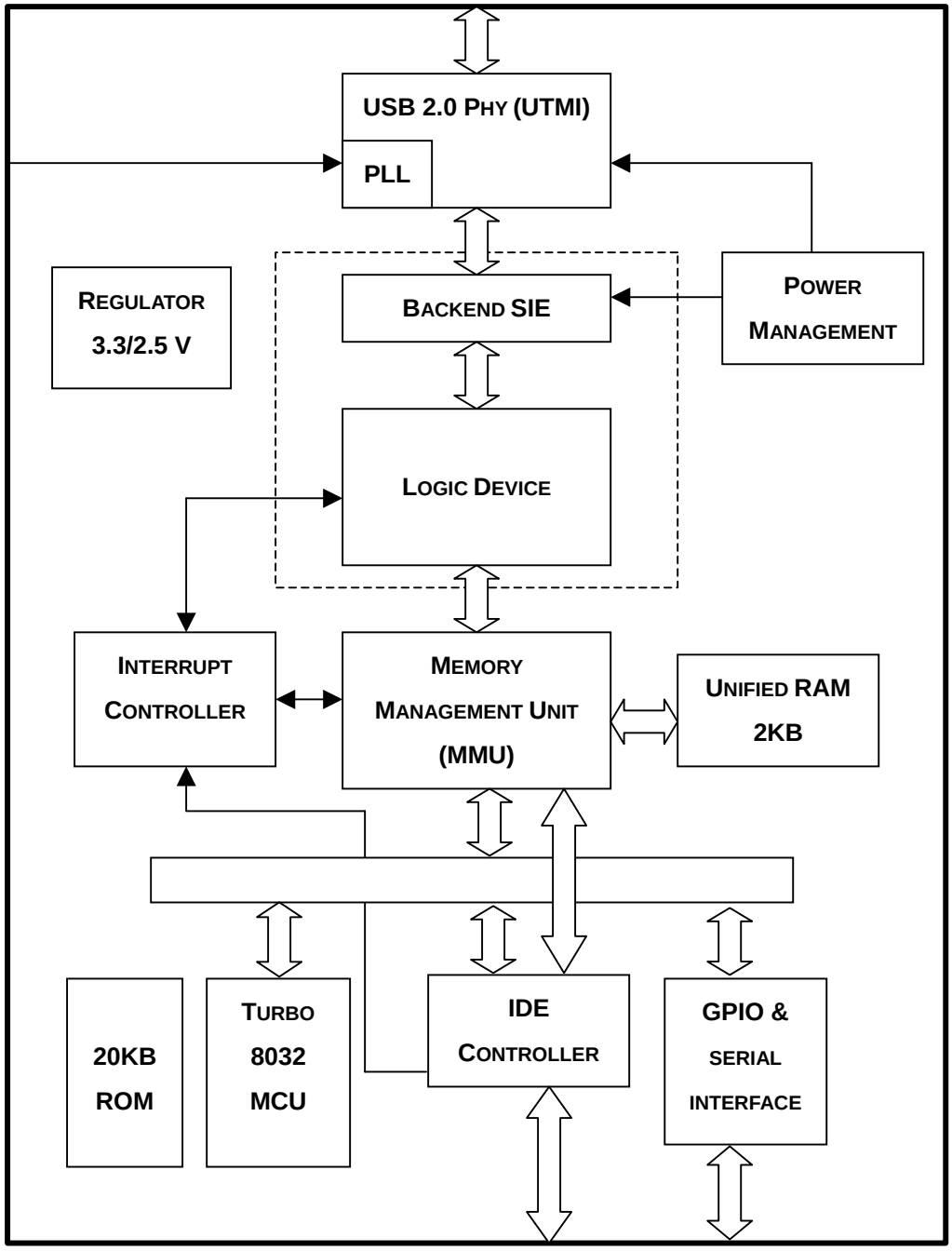


Figure 1-1 Block Diagram of PL-2506

2.0 Pin Assignment & Description

2.1 LQFP64 Package

2.1.1 LQFP64 Pin Diagram

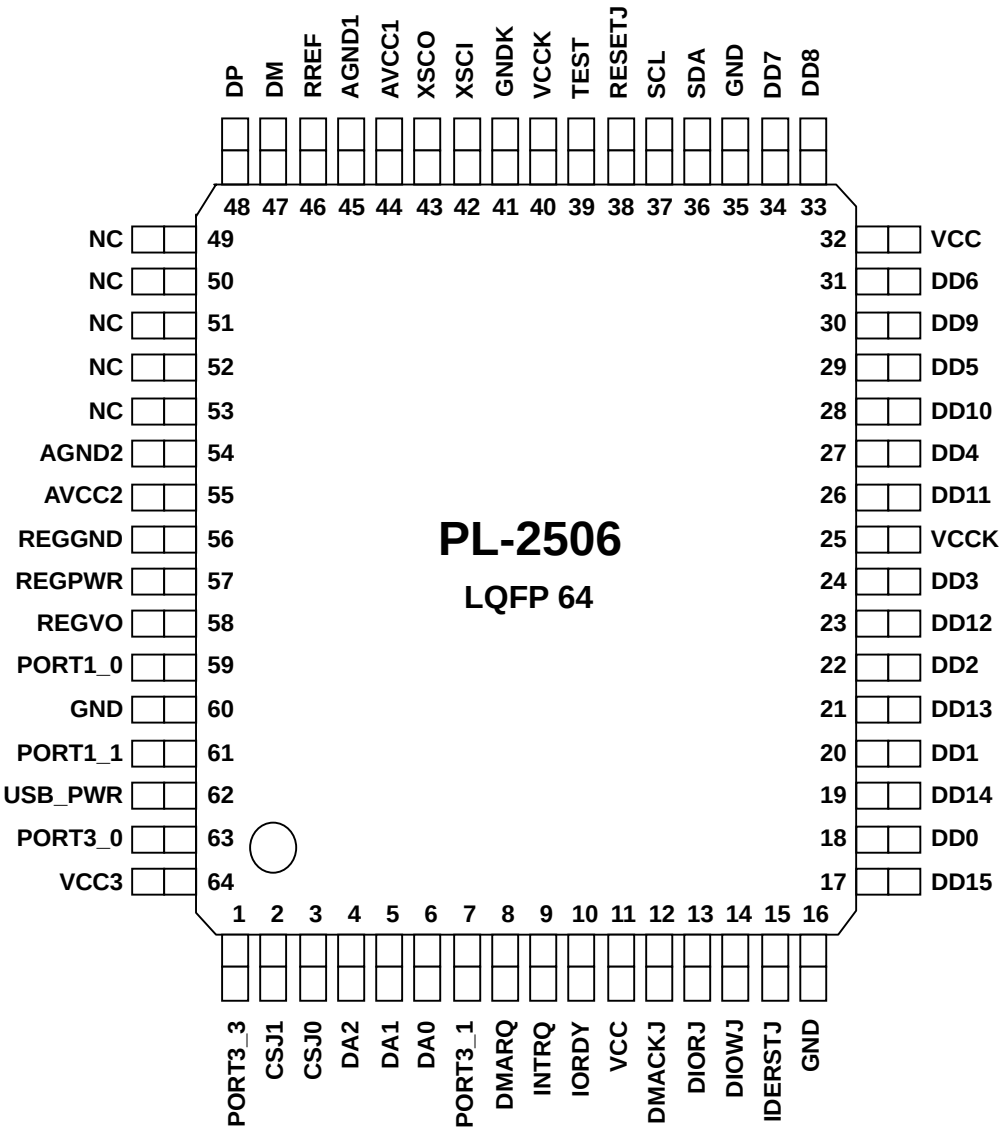


Figure 2-1 Pin Assignment Diagram of PL-2506 LQFP64

2.1.2 LQFP64 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 (LQFP64)

Symbol	Type	Pin No	Description
XSCI	I	42	Clock in or CMOS oscillator input
XSCO	O	43	CMOS oscillator output
RREF	A	46	PLL Reference level
DP	B	48	High speed DPLUS signal
DM	B	47	High speed DMINUS signal
VCCK	P	40	Digital Power 2.5V
GNDK	P	41	Digital Ground
AVCC1, AVCC2	P	44, 55	Analog Power 3.3V for on-chip PHY
AGND1, AGND2	P	45, 54	Analog Ground for on-chip USB PHY

IDE Interface Related Pins

Table 2-2 IDE Interface Related Pins (LQFP64)

Symbol	Type	Pin No	Description
DD[15:0]	B	17,19, 21,23, 26,28, 30,33, 34,31, 29,27, 24,22, 20,18	16 pins Data bus of IDE interface
DA[2:0]	T	4,5,6	DA, Data Address pins of IDE interface. Will be in high impedance state until USB connection.
CSJ[1:0]	T	2,3	CS_, Chip Select pins of IDE interface. Will be in high-impedance state until USB connection.
USB_PWR	I	62	USB VCC signal from USB connection
IDERSTJ	T	15	Hardware reset pin of IDE interface. Will be in high impedance state until USB connection.
DIOWJ	T	14	ATA control. Will be in high impedance state until USB connection.
DIORJ	T	13	ATA control. Will be in high impedance state until USB connection.
DMACKJ	T	12	ATA control. Will be in high impedance state until USB connection.
IORDY	I	10	ATA control
INTRQ	I	9	ATA control
DMARQ	I	8	ATA control

System Pins

Table 2-3 System Pins (LQFP64)

Symbol	Type	Pin No	Description
REGPWR	P	57	3.3v Power pin for on-chip 3.3v/2.5v regulator
REGGND	P	56	Ground pin for on-chip 3.3v/2.5v regulator
REGVO	P	58	2.5v power output of 3.3v/2.5v regulator
RESETJ	I	38	External reset pin. Low active.
SCL	O	37	Clock pin of SPI or two-wire serial EEPROM or serial Flash interface.
SDA	B	36	Data pin of SPI or two-wire serial EEPROM or serial Flash interface.
TEST	I	39	Chip Test mode enable. It shall be tie to ground for normal operation.
PORT1_0	B	59	SPI serial interface CS (chip select) signal or general purpose I/O pin.
PORT1_1	B	61	General Purpose I/O pin
PORT3_0	B	63	USB speed LED output or general purpose I/O pin
PORT3_1	B	7	When bus powered, control external power switch. Or general purpose I/O pin.
PORT3_3	B	1	Press button input or general purpose I/O pin
VCC	P	11,32,64	3.3v Power pins
VCCK	P	25	2.5v Power pins
GND	P	16,35,60	Digital ground pins

2.2 LQFP48 Package

2.2.1 LQFP48 Pin Diagram

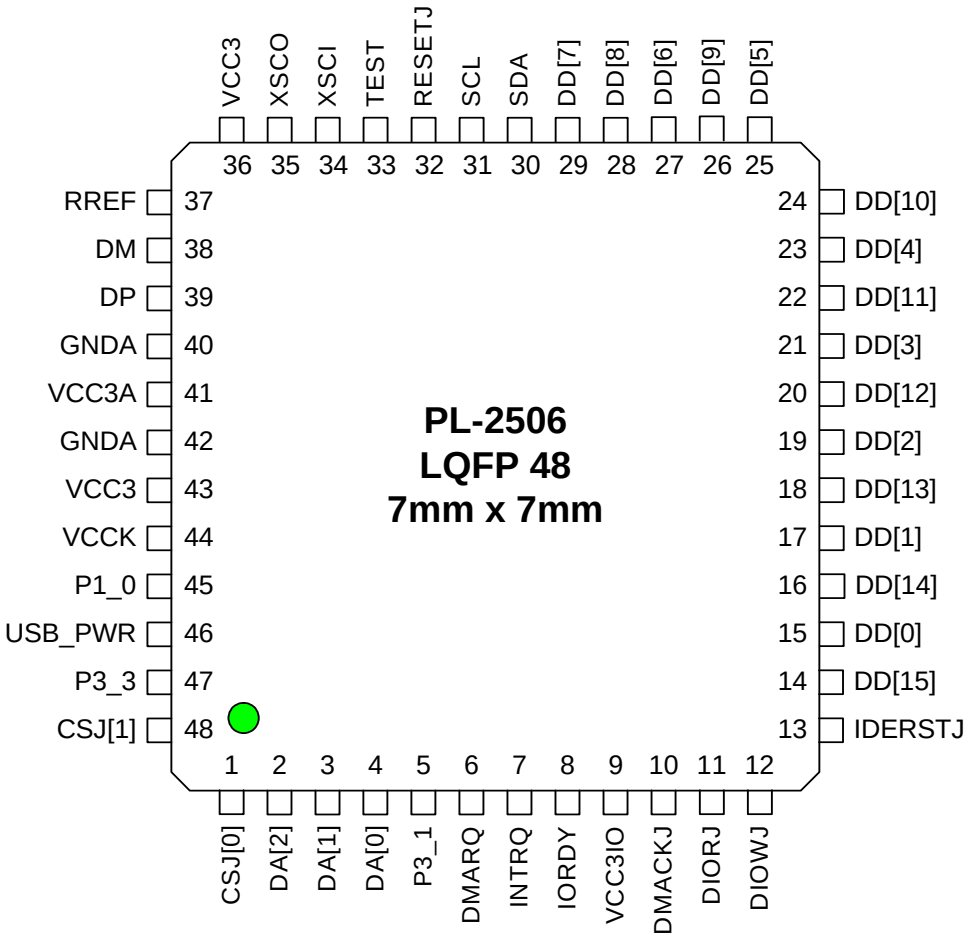


Figure 2-2 Pin Assignment Diagram of PL-2506 LQFP48

2.2.2 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 2-4 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 2-5 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 2-6 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/2.5v regulator
VCCK	P	44	2.5v power output of 3.3v/2.5v 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.
P1_0	B	45	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	2507h	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	00h	No serial number string
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.

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: (4) Self-Powered & No Remote Wakeup
8	MaxPower	Byte	32h	Maximum power consumption is 100 mA (5)

Notes:
(4) (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 Device Control Requests

- Standard USB device request set that perform general functions for supporting the bus and bus related functions.
- Mass Storage class request set that is USB class defined to implement storage device over USB protocol.
- Vendor specific requests that are implemented to provide additional control and verification method upon the optional external serial EEPROM.

4.1 Standard Device Control Requests

- SET_FEATURE/CLEAR_FEATURE: Supports DEVICE_REMOTE_WAKEUP and ENDPOINT_STALL for all endpoints. Requests with incorrect bmRequestType or endpoint number will be stalled.
- SET_CONFIGURATION/GET_CONFIGURATION
- GET_INTERFACE/SET_INTERFACE
- SET_ADDRESS
- GET_STATUS
- GET_DESCRIPTOR

Note: SET_DESCRIPTOR and SYNCH_FRAME are not supported by the PL-2506.

4.2 Class Specific Requests

Table 4-1 Class Specific Requests

Command	bmType	bRequest	wValue	wIndex	wLength	Data	Note
Bulk-Only Mass Storage Reset	0x21	0xFF	0	interface	0	None	
Get Max LUN	0xA1	0xFE	0	interface	1	1 byte	

4.2.1 Bulk-Only Mass Storage Reset

This request is used to reset the mass storage device and its associated interface. This class-specific request readies the device for the next CBW (Command Block Wrapper) from the host. The host shall send this request via the default pipe to the device. The device shall preserve the value of its bulk data toggle bits and endpoint STALL conditions despite the Bulk-Only Mass Storage Reset. The device shall NAK the status stage of the device request until the Bulk-Only Mass Storage Reset is complete.

4.2.2 Get Max LUN

The device may implement several logical units that share common device characteristics. The host uses bCBWLUN (Section 5.1) to designate which logical unit of the device is the destination of the CBW. The Get Max LUN device request is used to determine the number of logical units supported by the device. Logical Unit Numbers on the device shall be numbered contiguously starting from LUN 0 to a maximum LUN of 15 (Fh).

4.3 Vendor Specific Requests

Table 4-2 Vendor Specific Requests

Command	bmType	bRequest	wValue	wIndex	wLength	Data	Note
SET_EEPROM_STR	0x41	0x05	0	0	BL	Data String	
GET_EEPROM_STR	0xC1	0x06	0	0	BL	Data String	

Note: The BL shall not exceed 255, the requests will be stalled otherwise.

4.3.1 SET_EEPROM_STRING Request

The PL-2506 supports the option to store the Vendor ID, Product ID, and Device Release Number in the device descriptor, as well as Attributes and Max Power setting in the configuration descriptor, and Strings in the String Descriptor through an optional external Serial EEPROM. The PL-2506 will detect the existence of the EEPROM automatically after reset. If the first word retrieved from the EEPROM matches the predefined check byte, 0x067B, it would use the data from this external EEPROM instead of the data from the internal ROM.

The vendor specific SET_EEPROM_STRING request is used to change the contents of the EEPROM. The data part of this request is written to the EEPROM from address 0 all the way up to address 255. Therefore, it is necessary for the software to prepare the whole table first and then write it to the EEPROM in one single SET_EEPROM_STRING request.

4.3.2 GET_EEPROM_STRING Request

This request allows the driver on the host side to retrieve the whole data table residing in the external serial EEPROM. The returned data is retrieved starting from address 0 to the end of data table from EEPROM. It is mostly used as a verification method to check the data integrity of the previous write.

5.0 External Serial Memory

5.1 Data Structure of External Serial Memory Contents

Table 5-1 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 (bdcDevice 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	
255:16	String Descriptor Table	
-: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 forth 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 5-2 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 5-3 Example of Valid EEPROM Contents

Offset	Content	Note
0:1	Check Word – 0x067B	Constant
2:3	Vendor ID – 0x067B	
4:5	Product ID – 0x2507	
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, ‘I’, 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, ‘I‘, 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.

6.0 DC Characteristics

6.1 Absolute Maximum Ratings

Table 6-1 Absolute Maximum Ratings

SYMBOL	PARAMETER	RATING	UNITS
V_{CC}	2.5V Power Supply	-0.3 to 3.0	V
	3.3V Power Supply	-0.3 to 3.9	
V_{IN3}	Input Voltage of 3.3V I/O	-0.3 to V_{cc3I} +0.3	V
	Input Voltage of 3.3V I/O with 5V Tolerance	-0.3 to 5.5	
T_{STG}	Storage Temperature	-40 to 150	^{o}C

6.2 Operating Current Parameters

Table 6-2 Operating Current Parameters

SYMBOL	PARAMETER	Conditions	TYP	UNITS
I_{DD}	USB High-Speed Supply Current	8051 running	53	mA
		Write large files to HDD	63	mA
		VCD Playback using DVD-ROM	58	mA
	USB Full-Speed Supply Current	8051 running	39	mA
		Write large files to HDD	42	mA
		VCD Playback using DVD-ROM	42	mA
I_{SUS}	Suspend Current		< 500	uA

6.3 Recommended Operating Conditions

Table 6-3 Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
V_{CCK}	Power Supply of 2.5V I/O	2.25	2.5	2.75	V
V_{CC}	Power Supply of 3.3V I/O	3.0	3.3	3.6	V
T_J	Junction Operating Temperature	0	25	115	^{o}C

6.4 Leakage Current and Capacitance

Table 6-4 Leakage Current and Capacitance

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I_{IL}	Input Leakage Current(2)	No pull-up or pull-down	-10		10	μA
C_{IN2}	Input Capacitance			3.1		pF
C_{OUT2}	Output Capacitance			3.1		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 (Rpu/Rpd) 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.

6.5 DC Characteristics of 3.3V Programmable I/O Cells

Table 6-5 DC Characteristics of 3.3V Programmable I/O Cells

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{CC31}	Power Supply	3.3V I/O	3.0	3.3	3.6	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	Vin=0 or VCC_{31}	-10		10	uA

7.0 Ordering Information

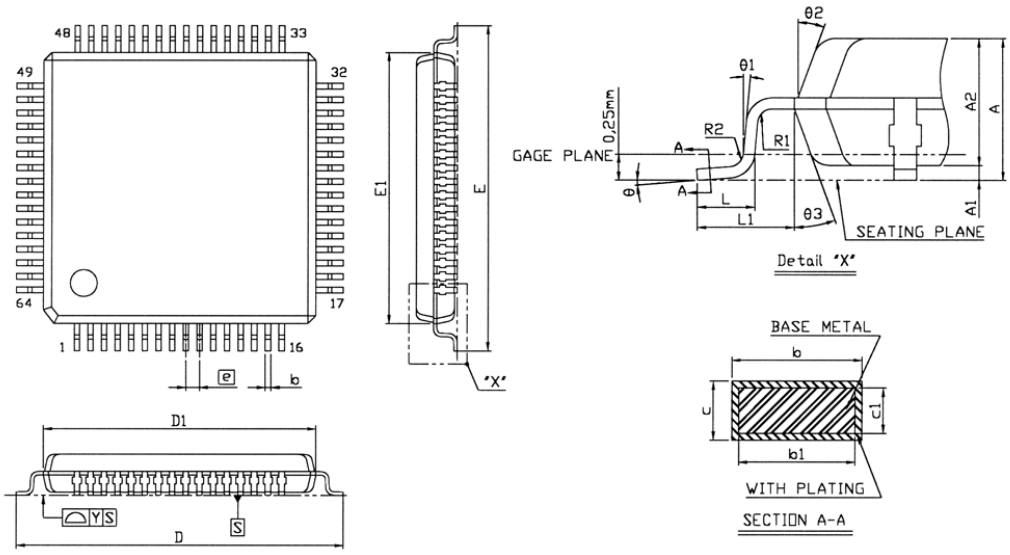
Table 7-1 Ordering Information

Part Number	Package Type
PL-2506	64-pin LQFP (10x10mm)
PL-2506	64-pin LQFP (7x7mm)
PL-2506	48-pin LQFP (7x7mm)

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

8.0 Outline Diagram

8.1 LQFP64pin Package (10mm x 10mm)

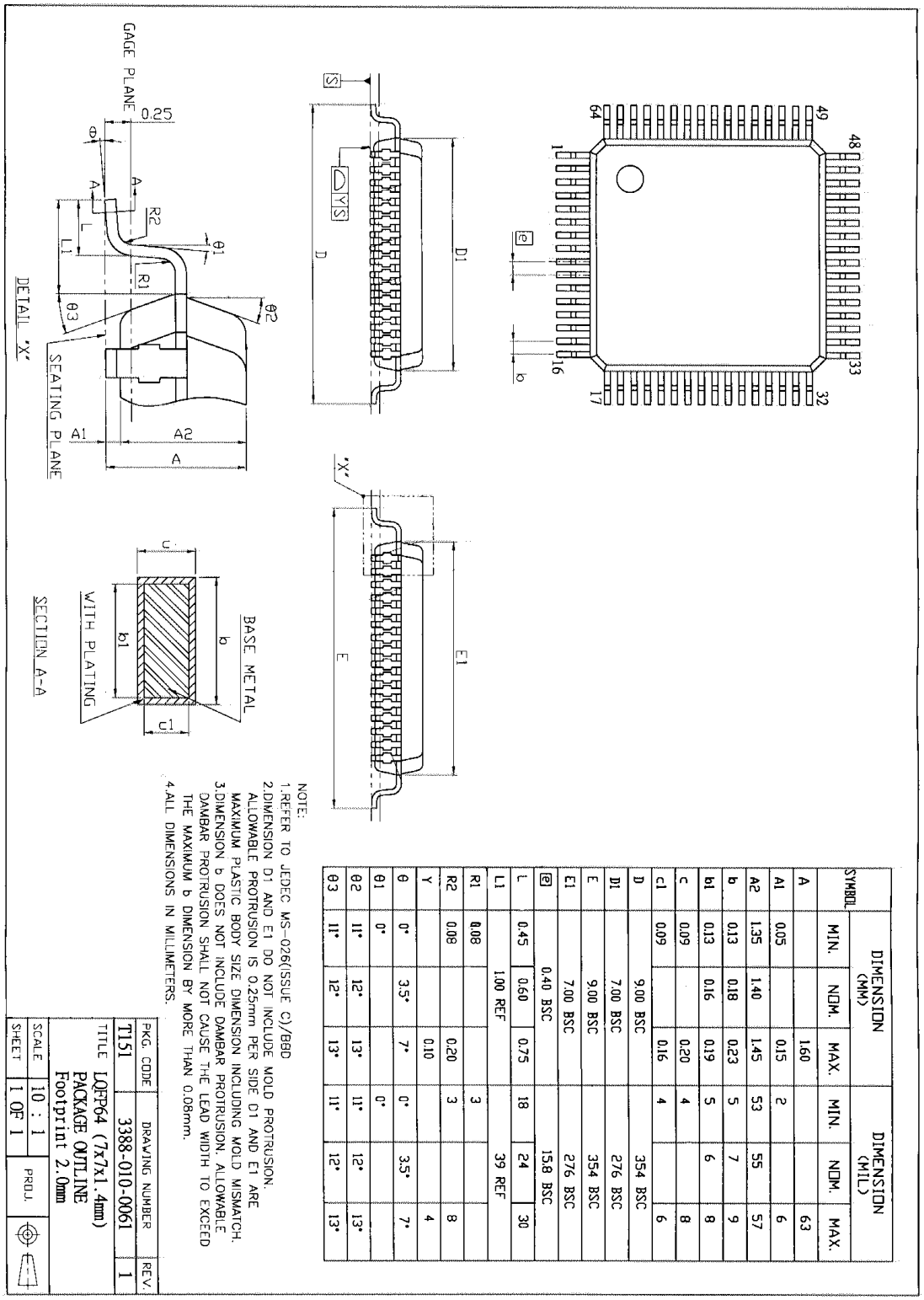


SYMBOL	DIMENSION (MM)			DIMENSION (MIL)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A			1,60			63
A1	0,05		0,15	2		6
A2	1,35	1,40	1,45	53	55	57
b	0,17	0,22	0,27	7	9	11
b1	0,17	0,20	0,23	7	8	12
c	0,09		0,20	4		8
c1	0,09		0,16	4		6
D	12,00 BSC			472 BSC		
D1	10,00 BSC			394 BSC		
E	12,00 BSC			472 BSC		
E1	10,00 BSC			394 BSC		
e	0,50 BSC			20 BSC		
L	0,45	0,60	0,75	18	24	30
L1	1,00 REF			39 REF		
R1	0,08			3		
R2	0,08		0,20	3		8
Y			0,075			3
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°			0°		
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°

NOTES:
1.REFER TO JEDEC MS-026/BCD
2.DIMENSION D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION.
ALLOWABLE PROTRUSION IS 0.25mm PER SIDE D1 AND E1 ARE
MAXIMUM PLASTIC BODY SIZE DIMENSION INCLUDING MOLD MISMATCH.
3.DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE
DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED
THE MAXIMUM b DIMENSION BY MORE THAN 0.08mm.
4.ALL DIMENSIONS IN MILLIMETERS.

Figure 8-1 Outline Diagram of PL-2506 LQFP64 (10mm x 10mm)

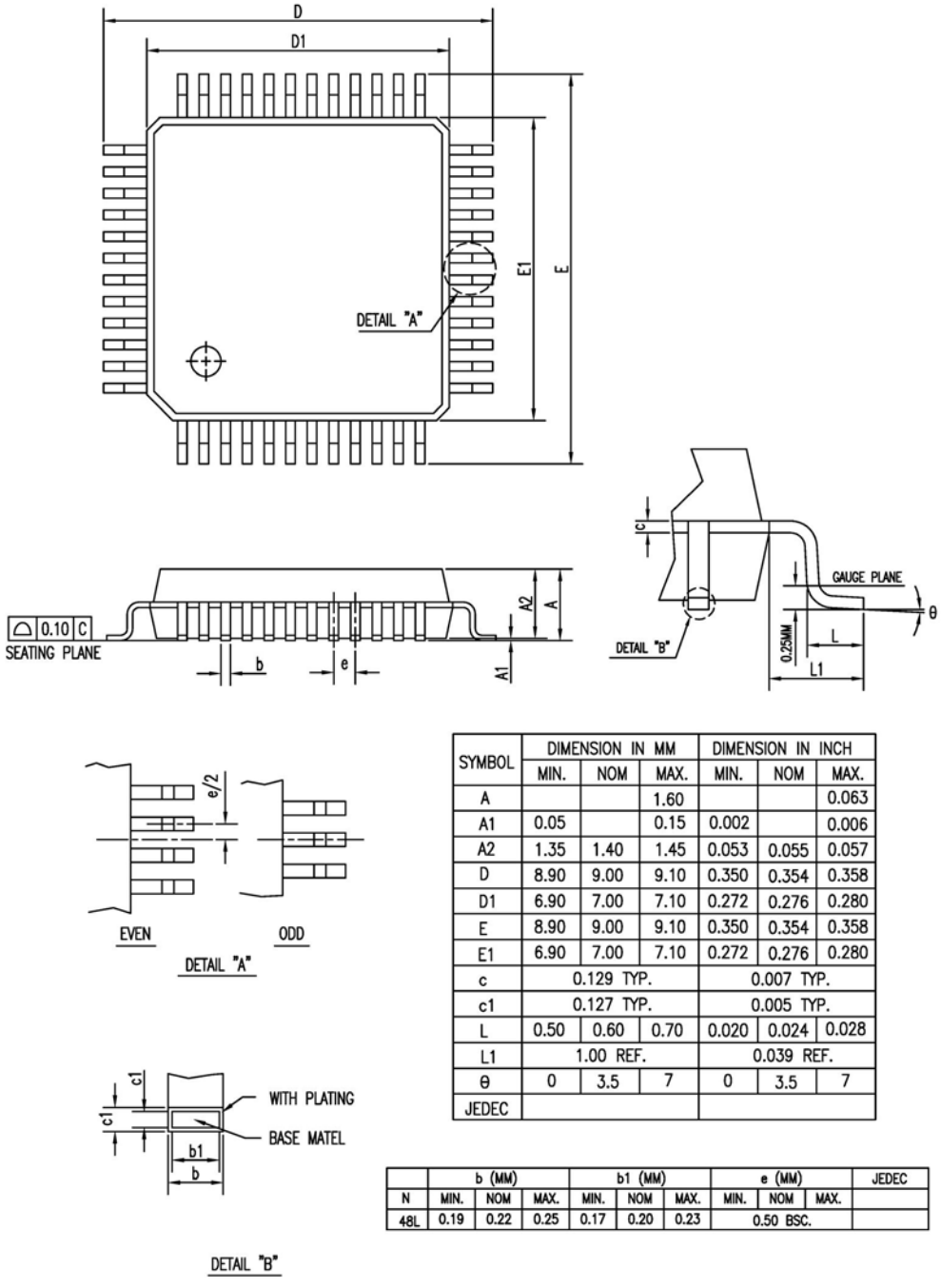
8.2 LQFP64pin Package (7mm x 7mm)



SYMBOL	DIMENSION (MM) MIN.	NOM.	MAX.	DIMENSION (MIL) MIN.	NOM.	MAX.
A			1.60			63
A1	0.05		0.15	2		6
A2	1.35	1.40	1.45	53	55	57
b	0.13	0.18	0.23	5	7	9
b1	0.13	0.16	0.19	5	6	8
c	0.09		0.20	4		8
c1	0.09		0.16	4		6
D		9.00 BSC			354 BSC	
D1		7.00 BSC			276 BSC	
E		9.00 BSC			354 BSC	
E1		7.00 BSC			276 BSC	
e		0.40 BSC			15.8 BSC	
L	0.45	0.60	0.75	18	24	30
L1		1.00 REF			39 REF	
R1	0.08			3		
R2	0.08		0.20	3		8
Y			0.10			4
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°			0°		
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°

Figure 8-2 Outline Diagram of PL-2506 LQFP64 (7mm x 7mm)

8.3 LQFP48pin Package (7mm x 7mm)



SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM	MAX.	MIN.	NOM	MAX.
A			1.60			0.063
A1	0.05		0.15	0.002		0.006
A2	1.35	1.40	1.45	0.053	0.055	0.057
D	8.90	9.00	9.10	0.350	0.354	0.358
D1	6.90	7.00	7.10	0.272	0.276	0.280
E	8.90	9.00	9.10	0.350	0.354	0.358
E1	6.90	7.00	7.10	0.272	0.276	0.280
c	0.129 TYP.			0.007 TYP.		
c1	0.127 TYP.			0.005 TYP.		
L	0.50	0.60	0.70	0.020	0.024	0.028
L1	1.00 REF.			0.039 REF.		
θ	0	3.5	7	0	3.5	7
JEDEC						

	b (MM)			b1 (MM)			e (MM)			JEDEC
N	MIN.	NOM	MAX.	MIN.	NOM	MAX.	MIN.	NOM	MAX.	
48L	0.19	0.22	0.25	0.17	0.20	0.23	0.50 BSC.			

Figure 8-3 Outline Diagram of PL-2506 LQFP48 (7mm x 7mm)