USB I/O Data Sheet

802600 USB Chip 16 Bit IO
802300 USB Chip 12 Bit IO
802200 USB Chip 12 Bit IO

Delcom Engineering
200 William Street
Port Chester, NY 10573
914-934-5170
914-934-5171 Fax
www.delcom-eng.com

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Contents

1.0 Functional Overview
2.0 Pin Definitions
3.0 Pin Descriptions
4.0 Features
- **4.1 Write Strobe**
- **4.2 Clock Generator**
- **4.3 Port Setup**
- **4.4 Read Buffer**
- **4.5 Scratch Pad**
- **4.6 Event Counter**
- **4.7 Status LED**
- **4.8 RS232 Serial Port**
- **4.9 I^2C Port**
- **4.10 64 Bit Read/Write command**

5.0 Firmware Commands
- **5.1 General**
- **5.2 Command Packet Format**
- **5.3 Write Commands**
- **5.4 Read Commands**

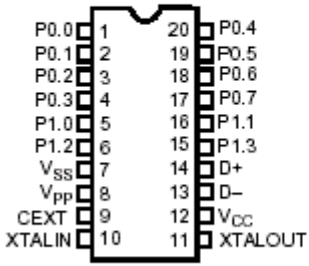
6.0 Typical Schematic
7.0 Specifications
- **7.1 Absolute Maximum Ratings**
- **7.2 Electrical Characteristics**

8.0 Package Diagrams
9.0 Ordering Information
10.0 Firmware Release Notes
11.0 Notes
- **11.1 Power Notes**
- **11.2 Interfacing Notes**

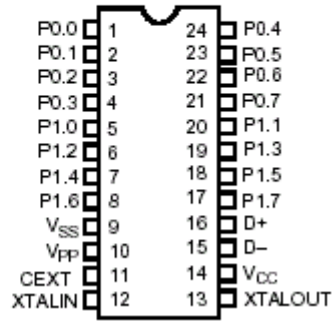
1.0 Functional Overview

The 802600, 802300 and 802200 USB I/O chips provide a preprogrammed low cost solution to USB peripherals. These chips are based on the Cypress™ CY7C63001A and the CY7C63101A chips. The 802600 and 802200 are preprogrammed to accept a rich set of commands. The chips conform to the USB 1.1 standard. The USB chip accepts a 6MHz ceramic resonator as it's clock source and internally doubles this to run at 12MHz. The 802600 has 16 general purposes input outputs (GPIO) pins and the 802300 and 802200 have 12 GPIO pins. Both parts have 8 low current pins on Port0 and the 4 to 8 high current pins on Port1.

20-pin DIP/SOIC



24-pin SOIC/QSOP



For more information on this device see Cypress™ data sheet CY7C63000A, available on our website.

2.0 Pin Definitions

Name	I/O	802200 802300 20-Pin	802600 24-Pin	Description
P0.0	I/O	1	1	Port 0 bit 0
P0.1	I/O	2	2	Port 0 bit 1
P0.2	I/O	3	3	Port 0 bit 2
P0.3	I/O	4	4	Port 0 bit 3
P0.4	I/O	20	24	Port 0 bit 4
P0.5	I/O	19	23	Port 0 bit 5
P0.6	I/O	18	22	Port 0 bit 6
P0.7	I/O	17	21	Port 0 bit 7
P1.0	I/O	5	5	Port 1 bit 0
P1.1	I/O	16	20	Port 1 bit 1
P1.2	I/O	6	6	Port 1 bit 2
P1.3	I/O	15	19	Port 1 bit 3
P1.4	I/O	-	7	Port 1 bit 4
P1.5	I/O	-	18	Port 1 bit 5
P1.6	I/O	-	8	Port 1 bit 6
P1.7	I/O	-	17	Port 1 bit 7
XTALIN	I	10	12	Clock In
XTALOUT	O	11	13	Clock Out
CEXT	I/O	9	11	Wake Up Pin
D+	I/O	14	16	USB Data +
D-	I/O	13	15	USB Data -
Vpp	-	8	10	Programming voltage, Connect to Vss
Vcc	-	12	14	Voltage Supply
Vss	-	7	9	Ground

3.0 Pin Descriptions

Name	Description
Vcc	Voltage Supply. Nominal 5V, Range 4.0Volts to 5.25Volts
Vss	Ground. Connect to ground
XtalIn	Clock Input
XtalOut	Clock Output
P0.0-7	Port 0. Low Current GPIO. Programmable sink current & pullup.
P1.0-7	Port 1. High Current GPIO. Programmable sink current & pullup.
D+,D-	USB data lines. Requires an external 7.5K resistor connected to D- to Vcc.
Vpp, Cext	Unused pins. Vpp connect to ground. Cext leave open.

4.0 Programmed Features

The USB I/O chip provides general 8 bit input output commands as well as individual set and reset commands of each pin.

4.1 Write Strobe

The write strobe feature allows the USB I/O chip to interface to another device by using a standard 8-bit data bus with a strobe pin. The data is placed on port 0 and the strobe is selectable on one of the port 1 pins. Theses functions allow one to eight data bytes to be sent on either a positive and negative strobe (pulse). The write strobe functions support an optional acknowledge signal.

4.2 Clock Generator

This function generates a clock source with variable frequency and duty cycle. Up to four separate clocks can be configured. The clock outputs can be selected on port 1 pins 0 through 3.

4.3 Port Setup

These features allow the user to set the programmable output sink current and enable/disable the port pin pull up resistor. Each port pin is of a open collector type. The sink current level can be set in 16 levels. Each port pin has a pull up resistor of 16Kohms that can be enabled or disabled.

4.4 Read Buffer

This feature allows the USB I/O chip to interface to a device using a standard 8-bit data bus and a read strobe pin. Data is read on port 0 with a read strobe (pulse) on one of the selectable port 1 pins. The data read buffer is 7 bytes deep. If the read data buffer is full, new data will not be accepted and the over flow flag will be set. Note this function cannot be used while the RS232 functions are in uses.

4.5 Scratch Pad

The scratch pad allows the user to write 8 bytes of user defined information in to the USB I/O device. This area can be used for storing user variables, states or other information. Note this function cannot be used while the RS232 functions are in uses.

4.6 Event Counter

The event counter feature allows the counting of events on one of the port 0 pins. The resolution of the counter is 4 bytes. The active level on the count pins is user selectable.

4.7 Status Led

The status led feature toggles a port pin when there is activity on the USB bus. The feature is only available on pin P1.3. The pin goes low while the USB I/O chip is processing the USB command. The active low pulse is short and therefore may requires a pulse stretcher circuit in order to view.

4.8 RS232 Serial Port

The RS232 functions allow the chip to interface to a RS232 compliant device. Currently the baud rate is fixed at 2400bit/sec with 8 data bit, one stop bit and no parity. To use the RS232 function first enable it with commands 10-40, then use command 10-50 to send data and 11-50 to receive data. You can check the internal buffer count with command 11-9. The RS232 pins are fixed with transmit at port 0 pin 7, receive at port 0 pin 6 and clear to send at port 0 pin 5. This commands supports a maximum transfer of 7 bytes per command.

4.9 I^2C Port

The I2C functions allow the chip to interface to an I2C compliant device. The I2C port supports the standard clock rate of 100KHz. The SCLK signal is on port 0 pin 0 and the SDA signal is on port o pin 1. There are four commands associated with the I2C port. They are 10-60 Write, 10-61 Selective read setup, 11-60 Read and 11-61 Selective read. This command supports a maximum transfer of eight bytes per command.

4.10 64 Bit Read/Write command

The 64 bit read/write commands allows the user to read or write 64 bits (8 Bytes) of data with one command. This commands requires extra hardware. See the USB64BIO-Sch.pdf schematic on our website.

5.0 Firmware Commands

5.1 General

All commands are passed to the USB I/O device in a command packet. The command is filled and sent to the USB I/O device using the DeviceIOControl Windows™ command. See the USB I/O Programming Manual for more information. All command packets are at least 8 byte long and all receive data is 8 bytes long.

5.2 Command Packet Format:

Recipient	Byte	Always 8 for the USB IO device.
Device Model	Byte	Always 18 for the USB IO device
Major Command	Byte	See Below
Minor Command	Byte	See Below
Data LSB	Byte	See Below
Data MSB	Byte	See Below
Length	Short (2 Bytes) Length of DataExtension.	
DataExtension	0-8 Bytes – (Optional) Version 5 and up.	

5.3 Write Commands

Command Number		Data		ver
Major	Minor	Length	Command Description	
10	-	-	**WRITE FUNCTIONS**	
-	-	-	**Port Write Functions**	
10	0	0	*Dummy command.* Does nothing, used for testing.	
10	1	0	*Writes the LSB to port 0.* Port 0 is defaulted high after reset.	
10	2	0	*Writes the LSB to port 1.* Port 1 is defaulted high after reset.	
10	10	0	*Writes the LSB to port 0 and the MSB to port* 1.	
10	11	0	*Sets or resets the port 0 pins individually*. The LSB resets the corresponding port pin(s) and the MSB sets the corresponding port pin(s) on port 0. Resetting the port pin(s) takes precedence over setting the bits.	
10	12	0	*Sets or resets the port 1 pins individually*. The LSB resets the corresponding port pin(s) and the MSB sets the corresponding port pin(s) on port 1. Resetting the port pin(s) takes precedence over setting the bits.	
10	13	0	*Write strobe high function*. This commands writes the LSB to port 0 and then toggles the corresponding pin marked in the MSB byte high then low. See Write strobe function sequence below.	
10	14	0	*Write strobe low function*. This commands writes the LSB to port 0 and then toggles the corresponding pin marked in the MSB byte low then high. See Write strobe function sequence below. *Write strobe function sequence.* This command produces the following sequence; 1) Data in LSB is written to Port 0. 2) The strobe pin is set active for 1.5ms. If the acknowledge pin is enabled the strobe pin will wait while the acknowledge pin is held low (See command 10-40 bit 3). 3) Then the strobe pin is made non-active. 4) And finally 0xFF is written to Port 0. The strobe pin and the data on port 0 must be initially preset before using this function.	
10	15	1-8	*Write 8-byte strobe high function*. This commands writes the Data Extension data to port 0 and then toggles the corresponding pin marked in the MSB byte high then low and then delays for the specified time set in the LSB byte. See Write 8-byte strobe function sequence below.	5
10	16	1-8	*Write8-byte strobe low function*. This commands writes the Data Extension data to port 0 and then toggles the corresponding pin marked in the MSB byte low then high and then delays for the specified time set in the LSB byte. See Write 8-byte strobe function sequence below.	5
			Write 8-byte strobe function sequence. This command produces the following sequence; 1) Data in Data Extension is written to Port 0 LSB first. 2) The strobe pin is set active for 1.5us. If the acknowledge pin is enabled the strobe pin will wait while the acknowledge pin is held low (See command 10-40 bit 3). 3) Then the strobe pin is made non-active. 4) And finally 0xFF is written to Port 0. 4) System then delays for the specified time set in Data LSB byte. 5) Then the process is repeated till all data bytes in the Data Extension have been sent. The delay is equal to 8.25us+(0.75us*DelayValue) Example: Command 8,18,10,15,10,1,4,0,0,0,0 will send 4 bytes of data (all zeros here) on a high strobe on pin one of port one with a delay of 15.75us. The strobe pin and the data on port 0 must be initially preset before using this function.	5
10	17	1-8	*Write 64 Bit Command.* This command writes 8 bytes of data to the external hardware latches. The data is passed in the data extension registers. The LSB of the data extension is written to address zero. This commands requires external hardware. See USB64BIO-Sch.pdf on our website.	8
10	19	0	*Loads the Clock Generator Global Pre-scalar value.* Default value is 10, range = 1 to 255. This value is passed in the LSB register. Increasing this number decreases all the clock function frequencies.	

10	20	0	*Enables or disables the clock generator on port 1*. The lower nibble of the LSB disables the corresponding port pin(s) and the lower nibble of the MSB enables the corresponding port pin(s). Disabling the port pin(s) takes precedence over enabling.
10	21	0	*Loads the frequency and duty cycle for port 1 pin 0*. See below for format.
10	22	0	*Loads the frequency and duty cycle for port 1 pin 1*. See below for format.
10	23	0	*Loads the frequency and duty cycle for port 1 pin 2*. See below for format.
10	24	0	*Loads the frequency and duty cycle for port 1 pin 3*. See below for format. *Frequency and duty format.* The LSB sets the period when the port pin is high and the MSB sets the period when the port pin is low. The resolution of the period is 10ms. The resolution of the duty cycle is 0.39 percent. The minimum clock frequency is 25.6 seconds at 50% duty. The maximum clock frequency is 100ms at 50% duty. Clock pins can be preset to a predefined state
10	25	0	*Synchronizes the clock generation.* This command synchronizes all the clock generators to start at an initial phase delay, see below. The lower nibble of the LSB enables this function on the corresponding pins P1.0 to P1.3. The lower nibble of the MSB presets the initial value on the corresponding pins P1.0 to P1.3. Initial phase delay resolution is in 10ms and is passed in the LSB register. Initial phase delay registers are cleared after this command is sent. Therefore the initial phase delay registers must be set each time this command is called.
10	26	0	*Load initial phase delay on port 1 pin 0*. See Synchronies function above.
10	27	0	*Load initial phase delay on port 1 pin 1*. See Synchronies function above.
10	28	0	*Load initial phase delay on port 1 pin 2*. See Synchronies function above.
10	29	0	*Load initial phase delay on port 1 pin 3*. See Synchronies function above.
-	-	-	**Port Setup Functions**
10	30	0	*Enable or disable port 0 pull up resistors*. A low bit in the LSB enable the corresponding port 0 pull up. A high bit in LSB disables the corresponding port 0 pull up. The pull up resistor value is 16K. Default value is 0x00, all port 0 pull ups enabled.
10	31	0	*Enable or disable port 1 pull up resistors*. A low bit in the LSB enables the corresponding port 1 pull up. A high bit in LSB disables the corresponding port 1 pull up. The pull up resistor value is 16K. Default value is 0x00, all port 1 pull ups enabled.
10	32	0	*Setup port 0 pins sink current level*. This functions sets the current sinking level of the port 0. The maximum current sinking ability of port 0 is 1.5mA and the minimum current sinking ability is 0.3mA. The default value for port 0 is 0x00. See below for format.
10	33	0	*Setup port 1 pins sink current level*. This functions sets the current sinking level of the port 0. The maximum current sinking ability of port 1 is 24mA and the minimum current sinking ability is 1.5mA. The default value for port 1 is 0x00. See below for format. *Setup port pin sink current level.* The MSB selects which pin to set the sinking current level on. A zero in the MSB selects the pin 0 and a 7 in the MSB selects pin 7. The lower nibble of LSB sets the current sinking level of the port pin. A LSB of 0x00 sets the lowest current level and a LSB of 0x0F sets the highest current level. Default value is 0x00, lowest current setting. Both ports can only source current at Vcc/16K when the pull up is enabled, for example if the Vcc is 5volts a port pin would source 0.3mA maximum.
-	-	-	**Feature commands**
10	35	0	*Setup read buffer function*. This command sets up the micro to read the current values on port 0 when a read strobe in presented on the configured strobe pin on port 1. The LSB will enable the correspond pin on port 1 to latch data on port 0 on the active edge. The active edge is set up the pull ups command 10-30 and 10-31. If the pull-ups are enabled then the active transition is from high to low. Otherwise the active transition is from low to high. The read buffer is only 7 bytes deep. Default is 0x00, read buffer disabled. See read buffer command below (11-5). Note this function cannot be used while the RS232 functions are in uses.

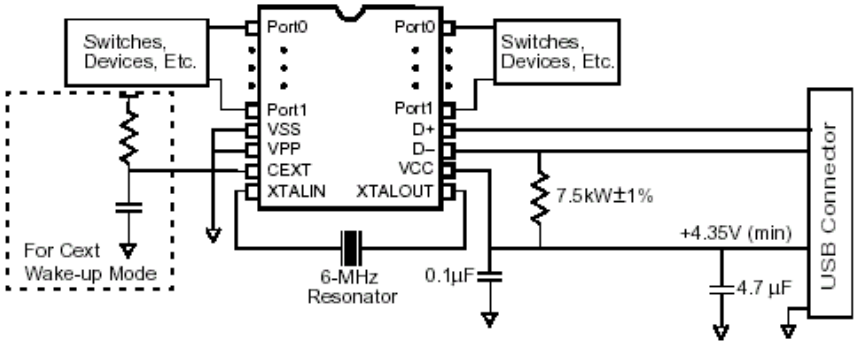
Major	Minor	Length	Command Description	
10	37	0	*Write scratch pad area.* Writes the LSB to the scratch pad. The MSB contains the pointer to the scratch pad. Pointer values can range from 0 to 7. The scratch pad area is 8 bytes deep. This area can be used for storing user variables, states or information. Defaulted to all 0x00 on boot up. Note this function cannot be used while the RS232 functions are in uses.	
10	38	0	*Enable/Disable Events Counter.* This command sets up the event counter. LSB data byte enables this function on the corisponding pin on port 0. The MSB data byte disabled this function on the corresponding pin on port 0. Once enabled the system will count events on the enabled pin on the active edge. The active edge is configured by the pull ups command 10-30 and 10-31. If the pull-ups are enabled then the active transition is from high to low. Otherwise the active transition is from low to high. The event counter value is read with command 11-8. This feature is off by default.	
10	40	0	*Enable/Disable Control Register.* This function sets the control register value. Each bit in this register controls different options. The LSB data byte is written to this control register. Bit 0: Status LED. When set Port1 pin 3 (P1.3) will toggle low when USB communications are present. Only available on this pin. Bit 1: Enables the RS232 Serial port with fixed 2400 baud rate. Version 5. Bit 3: Enables the acknowledge pin in the write strobe functions 13,14,15 &16. The acknowledge pin is only available on pin P1.2 and is active low. The write strobe will be extended while the acknowledge pin is held low. Version 8. Bits7-4,2: Future Implementation. These bits are reserved for future implementation and should be set to zero for future compatibility.	
10	50	1-8	*Writes to the RS232 Serial Port* This commands sends data to the serial port. Both the data count and data are passed in the Data Extension. The data count is in the LSB byte and the data is in the remaining 7 bytes. Issuing this command clears the TX Status register (see 11-9). Example command 8,18,0,0,6,5,1,2,3,4,5 will send 5 bytes of data (1,2,3,4,5) to the serial port.	5
10	60	1-8	*Write to the I2C Port* This command write the data found in the data extension to the I2C device. The device address/command is set in the Data LSB byte and the number of bytes to send is set in the Data MSB byte. If an error occurs bit 4/7 of byte 7 is set, else reset. See command 11-9.	6
10	61	0	*I2C Selective Read Setup* This commands setups the selective read command 11-61. The Data LSB should be set to the device address/command and the Data MSB should be set to the selective read address. See 11-61 for more information.	6

5.4 Read Commands

Command Number		Data		ver
Major	Minor	Length	Command Description	
11	-	-	**READ FUNCTIONS** All read functions return 8 bytes. See individual commands for format.	
11	0	0	*Read ports 0 and port 1*. The first byte (LSB) will contain the current value on port 0 and the second byte (MSB) will contain the current value on port 1.	
11	1	0	*Reads port 0 with High strobe.* Reads the current data on port 0 with a high strobe on pin X on port 1. The LSB sets up which pin is to be used for the high strobe. See Read port 0 with strobe sequence below.	
11	2	0	*Reads port 0 with Low strobe.* Reads the current data on port 0 with a low strobe on pin X on port 1. The LSB sets up which pin is to be used for the low strobe. See Read port 0 with strobe sequence below. *Read port 0 with strobe sequence.* These commands produce the following sequence; 1) The selected strobe pin is made active. 2)Micro waits 1.5ms. 3) Data is latch from port 0 and stored. 4) The strobe pin is released. The strobe pin and the data on port 0 must to preset before using this function. Default is 0x00, command disabled.	
11	5	0	*Reads the Read Buffer.* This command is setup with the read Buffer Setup Command(10-35). The LSB byte returned is the read buffer status byte, it will contain the number of bytes available in the read buffer. The next 7 bytes contain the data. The read data buffer is only 7 bytes deep. Data is filled from byte 1 to byte 7. If the read data buffer is full and another read strobe is presented then the read buffer status byte will be set to 0xFF and the new data byte would be lost. The user must check the read status byte to if; new data is present, not present or present with data over run. This commands resets the read status byte to zero. Note this function cannot be used when the RS232 function is in use.	
11	7	0	*Reads the 8 bytes in the scratch pad area.* Default values are zero.	
11	8	0	*Reads the event counter value.* This command returns the 4 byte event counter value and then resets the counter. If the counter over flows then the over flow status byte will be set to 0xFF otherwise it will be 0x0. The event counter is returned in the first 4 bytes and the over flow byte is in the 5 byte.	
11	9	0	*Reads system variables.* This function returns the following system variables. Byte0: Control Register. Byte1: Clock Generator Pre-Scalar. Byte2: Port 0 Pull Up Register. Byte3: Port 1 Pull Up Register. Byte4: USB Port Address. Byte5: RS232 Rx Status. Returns the available data count in the lower nibble. Bit 7of 7 is set on Rx Buffer overflow and bit 6/7 is set on Rx framing error. Byte6: RS232 Tx Status. The lower nibble returns the number of data bytes still pending in the Tx buffer. Bit 7of 7 is set on a Tx buffer overflow. Byte7: Bit 4/7 is set if an I2C error is detected. This bit is update each time an I2C function is called.	

11	10	0	*Reads the firmware information.* Byte 0-3: Unique Device Serial Number. DWORD Little Endian. Byte 4: Firmware Version. Byte 5: Firmware Date. Byte 6: Firmware Month. Byte 7: Firmware Year.	
11	12	0	*Reads 8 bytes of memory data.* This is peek functions used only for firmware debugging. The LSB data bytes contains the start address of read the 8 returns bytes.	5
11	17	1-8	*Read 64 Bit Command.* This command reads 8 bytes of data from the external hardware. The LSB of the returned data is address zero. This commands requires external hardware. See USB64BIO-Sch.pdf on our website.	8
11	50	0	*Reads the RS232 Rx Buffer.* This byte returns 8 bytes, the first byte is the Rx Buffer Status and data count and the remaining bytes are the RS232 data bytes. The Rx buffer is 7 bytes deep and is in LSB first order. The Rx Status and data count byte are cleared when this command is issued. The lower nibble of the status byte contains the Rx buffer data length count, pin 7of 7 of the rx status byte is set on an Rx overflow and pin 6 of 7 is set on a Rx framing error. Note you can read both the Rx Status and Tx Status bytes with command 11-9 without clearing there content.	5
11	60	0	*Reads from the I2C Port.* Reads 1 to 8 bytes of data from the I2C port. The device address/command is set in the data LSB byte and the number of requested bytes to read is set in the data MSB byte. If an error occurs bit 4/7 of byte 7 is set, else reset. See command 11-9.	6
11	61	0	*Selective Reads from the I2C Port.* This function sends a selective read command to the device, allowing the selective address to be sent before the read command is sent. This command is typically used in nonvolatile RAM type device such as the Xicor X24C04. The device address/command is set in the data LSB and the number of bytes requested is set in the data MSB byte. The selective address is setup with command 10-61. This command produces the following sequence; start, device address from 10-61 LSB byte is sent, selective address byte from 10-61 MSB byte is sent, start is sent again, the device address/command (LSB data from this command) is sent, then the data from the device is read and returned to the user. If an error occurs bit 4/7 of byte 7 is set, else reset. See command 11-9.	6

6.0 Typical Schematic



7.0 Specifications

7.1 Absolute Maximum Ratings

Storage Temperature	-65C to +150C
Operating Temperature	-0C to +70C
Vss relative to Vcc	-0.5V to +7.0V
DC Input Voltage	-0.5V to Vcc+0.5V
DC voltage on HiZ pins	-0.5V to Vcc+0.5V
Max Current Summed on Port1 pins	60ma
Max Current Summed on Port0 pins	10ma
Power Dissipation	300mW
Static Discharge Voltage	>2000V
Latch Up Current	200mA

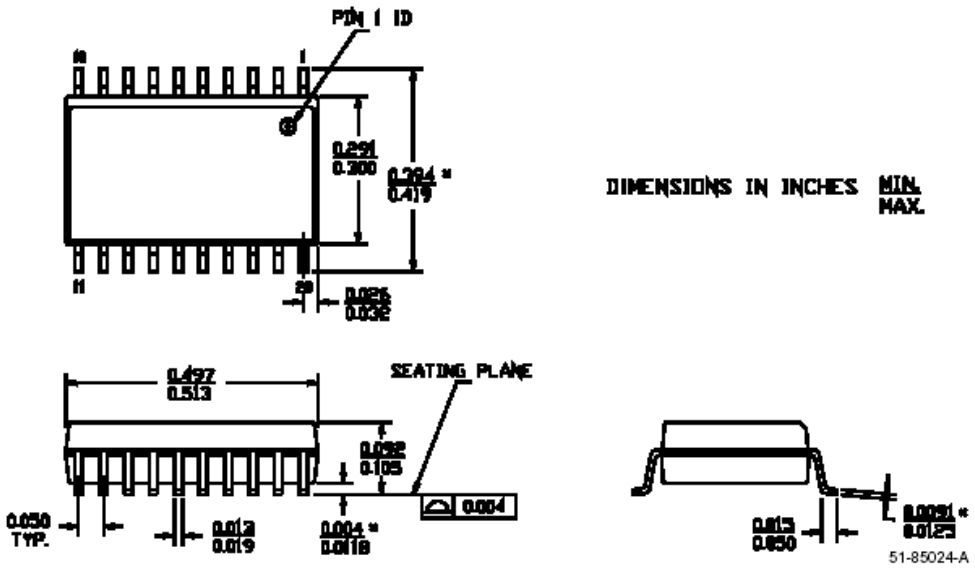
7.2 Electrical Characteristics

Vcc Operating Current	25mA
Vcc Limits	4 to 5.25V
Port 0 Max Current Sink	1.5mA
Port 0 Min Current Sink	0.3mA
Port 1 Max Current Sink	24mA
Port 1 Min Current Sink	4.8mA
Pull Up Resistor	16Kohms
Input Hysteresis Voltages P0 &P1	Min6% Max12% Vcc
Bandwidth	3000 Cmd/sec*

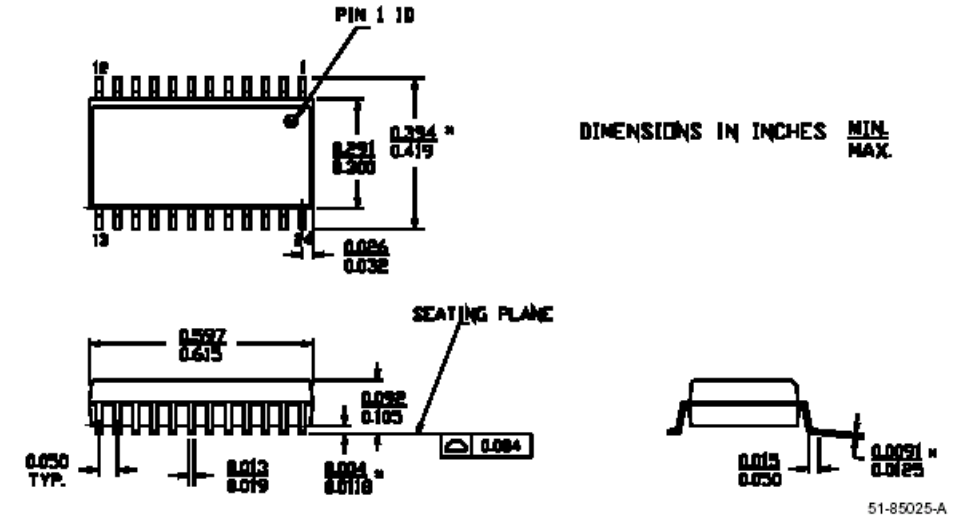
* Note this is the USB maximum transfer speed. Due to Windows overhead this value becomes lower. On W98, ME and W2K typical transfer speeds of 250~330 Cmd/sec and on XP typical speeds of 1000~1100 Cmds/sec have been measured.

8.0 Package Diagrams

20-Lead (300-Mil) Molded SOIC S5



24-Lead (300-Mil) Molded SOIC S13



20 pin DIP also available.

9.0 Ordering Information

Order Number	Number GPIO	Package Type
802600	16	24 Pin (300Mil) SOIC
802300	12	20 Pin (0.300”) DIP
802200	12	20 Pin (300Mil) SOIC

10.0 Firmware Release Notes

Version 1 - Initial Release
Version 2 - Added data strobe functions.
Version 3 - Added event counter function.
Version 4 - Fixed error with USB enumeration
Version 5 - Added RS232 and 8 byte Strobe Functions.
Version 6 - Added I^2C communication functions.
Version 7 - Added buzzer functions.
Version 8 - Added 64 Bit Rd/Wr & Acknowledge pin.
Version 9 - Fixed error with RS232 Rx function.

11.0 Notes

11.1 Power Notes

When the device boots up the total current consumed by the device should be at a minimum to comply with the USB standard.
Cable length and cable size should be selected in order to maintain an operating voltage at the USB I/O chip of at least 4Volts.
This device can be used in a self-powered mode or with an external power supply if more than 450mA is required by user. When using external power supplies, connect the USB I/O chip Vcc to the USB supplied power and run the user added circuitry off the external power supply. Do not connect the USB Vcc and external power supplies together, only connect the grounds.

11.2 Interfacing

When interfacing the USB I/O chip to other circuitry, one must be careful not to over load the current on the pins and not to exceed the voltage on the pins. If the voltage or current is greater than and/or less than the levels on the USB I/O chip, you will have to add some sort of buffering or interfacing. For example most relays require more than 25mA to actuate the relay, and the USB I/O device can only sink 25mA. Therefore a current amplifier is required, such as a transistor. When working with excessive currents, voltages or with high EMI circuits it is recommended that you use relays and/or opto-couplers to isolate the circuits. See 'Interfacing to USB I/O Devices' on the website.