



**CY7C68300A**

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# **EZ-USB AT2™ USB 2.0 to ATA/ATAPI Bridge**

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## **1.0 Introduction**

The CY7C68300A implements a fixed-function bridge between one USB port and one ATA- or ATAPI-based mass storage device port. This bridge adheres to the *Mass Storage Class Bulk-Only Transport Specification* and is intended for self-powered devices.

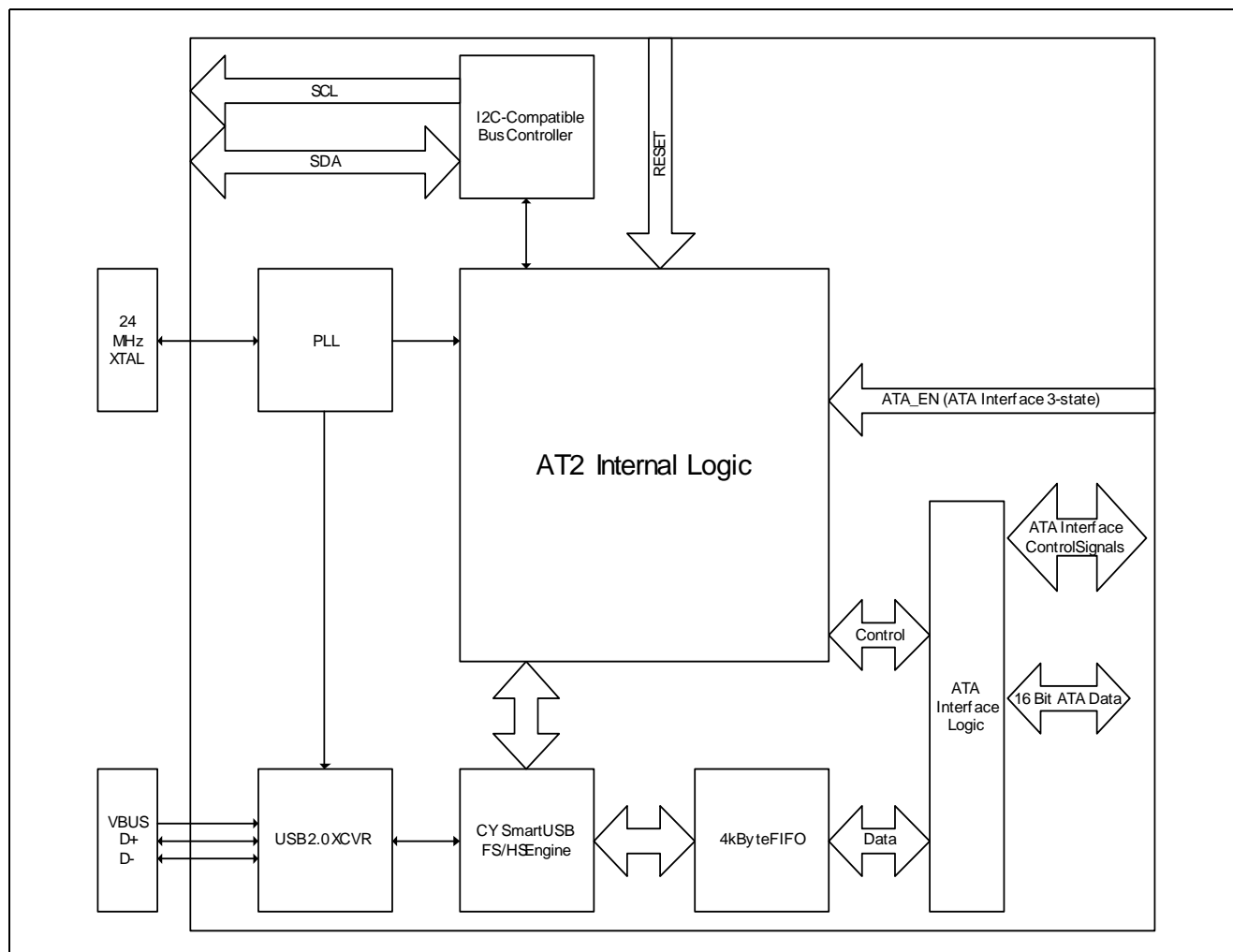
The USB port of the CY7C68300A is connected to a host computer directly or via the downstream port of a USB hub. Host software issues commands and data to the CY7C68300A and receives status and data from the CY7C68300A using standard USB protocol.

The ATA/ATAPI port of the CY7C68300A is connected to a mass storage device. A 4-Kbyte buffer maximizes ATA/ATAPI data transfer rates by minimizing losses due to device seek times. The ATA interface supports ATA PIO modes 0, 3, and 4, and Ultra DMA modes 2 and 4.

The device initialization process is configurable, enabling the CY7C68300A to initialize ATA/ATAPI devices without software intervention.

## **1.1 Features**

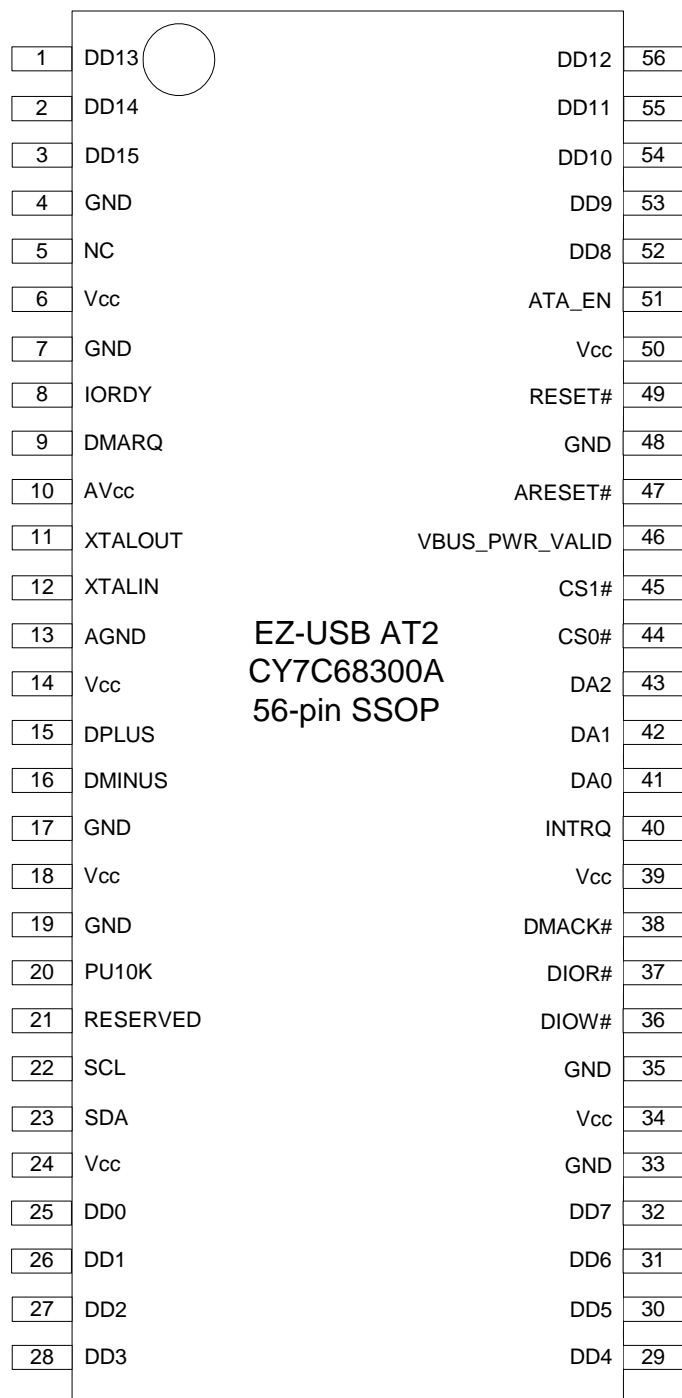
- **Complies with USB-IF specifications for USB 2.0, the USB *Mass Storage Class*, and the USB *Mass Storage Class Bulk-Only Transport Specification***
- **Operates at high (480-Mbps) or full (12-Mbps) speed**
- **Complies with T13's ATA/ATAPI-6 Draft Specification**
- **Supports 48-bit addressing for large hard drives**
- **Supports PIO modes 0, 3, 4, and UDMA modes 2, 4**
- **Uses one external serial EEPROM containing the USB device serial number, vendor and product identification data, and device configuration data**
- **ATA interface IRQ signal support**
- **Support for a single ATA/ATAPI device configured either as master or slave**
- **"ATA-Enable" input signal, which three-states all signals on the ATA interface in order to allow sharing of the bus with another controller (e.g., an IEEE-1394 to ATA bridge chip)**
- **Support for board-level manufacturing test via USB interface**
- **3.3V operation for self-powered devices**
- **56-pin SSOP and 56-pin QFN packages.**



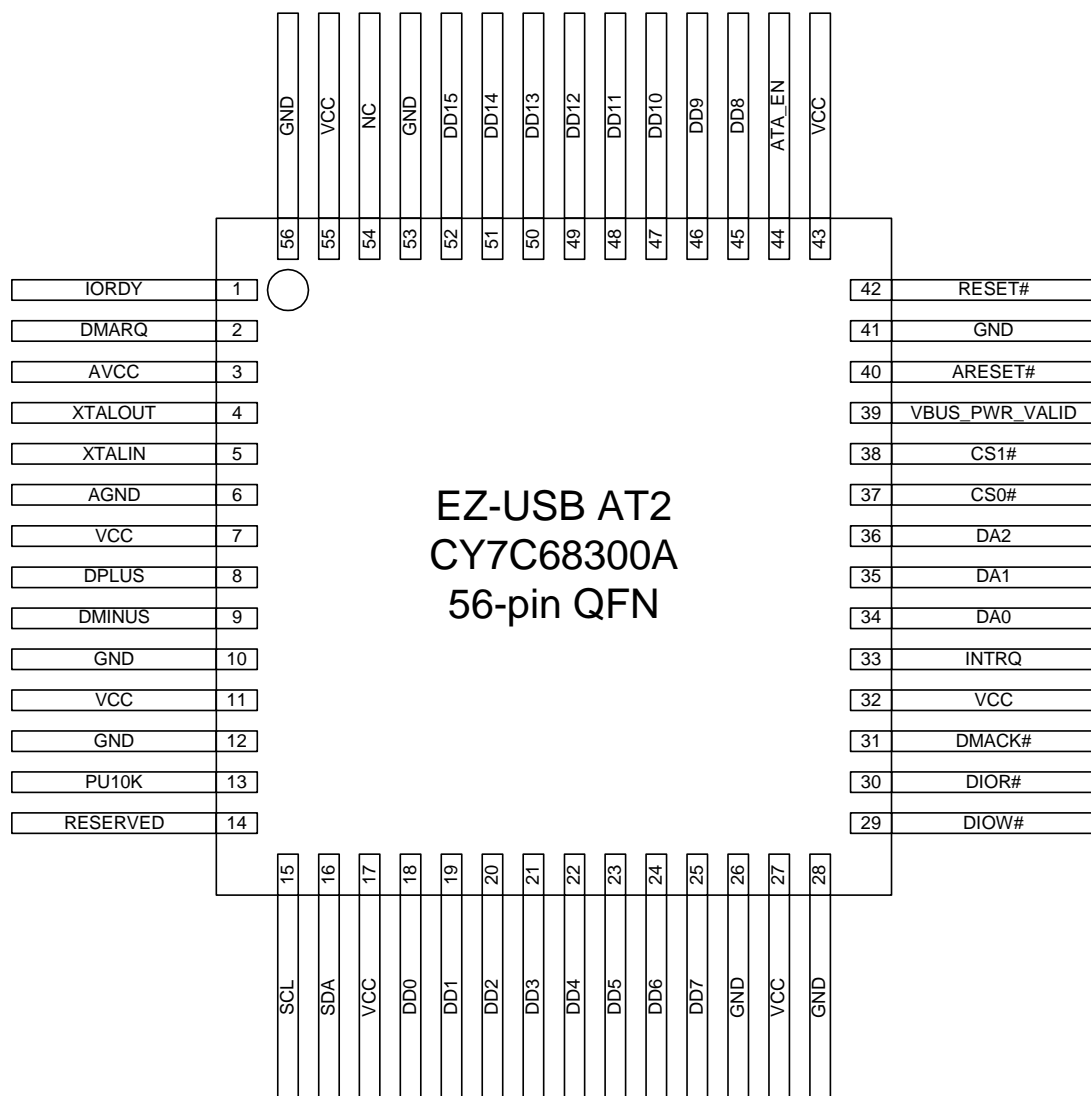
**Figure 1-1. Block Diagram**

## 2.0 Pin Assignments

### 2.1 Pin Diagram



**Figure 2-1. 56-pin SSOP**



**Figure 2-2. 56-pin QFN**

## 2.2 Pin Descriptions

| SSOP Pin | QFN Pin | Pin Name         | Pin Type           | Default State at Start-up   | Pin Description  |
|----------|---------|------------------|--------------------|---|--|
| 1        | 50      | DD13             | I/O <sup>[1]</sup> | Hi-Z  | ATA Data bit 13.   |
| 2        | 51      | DD14             | I/O <sup>[1]</sup> | Hi-Z  | ATA Data bit 14.   |
| 3        | 52      | DD15             | I/O <sup>[1]</sup> | Hi-Z  | ATA Data bit 15.   |
| 4        | 53      | GND              | GND                |   | Ground.  |
| 5        | 54      | NC               |                    | Hi-Z  | Reserved. This pin should remain a no-connect.   |
| 6        | 55      | V <sub>CC</sub>  | PWR                |   | V <sub>CC</sub> . Connect to 3.3V power source.  |
| 7        | 56      | GND              | GND                |   | Ground.  |
| 8        | 1       | IORDY            | I <sup>[1]</sup>   | I   | ATA Control.   |
| 9        | 2       | DMARQ            | I <sup>[1]</sup>   | I   | ATA Control.   |
| 10       | 3       | AV <sub>CC</sub> | PWR                |   | Analog V <sub>CC</sub> . Connect the V <sub>CC</sub> through the shortest path possible. |
| 11       | 4       | XTALOUT          | Xtal               | Xtal  | 24-MHz Crystal Output (see section 2.3.3).   |
| 12       | 5       | XTALIN           | Xtal               | Xtal  | 24-MHz Crystal Input (see section 2.3.3).  |
| 13       | 6       | AGND             | GND                |   | Analog Ground. Connect to ground with as short a path as possible.                       |
| 14       | 7       | V <sub>CC</sub>  | PWR                |   | V <sub>CC</sub> . Connect to 3.3V power source.  |
| 15       | 8       | DPLUS            | I/O                | Pulled high when Reset is active. When Reset is released, the pull-up is controlled by pin 46(SSOP)/39(QFN). When VBUS_PWR_VALID is high, the line is pulled up. VBUS_PWR_VALID is polled at start-up and then every 20 ms. | USB D+ Signal (see section 2.3.1).   |
| 16       | 9       | DMINUS           | I/O                | Hi-Z  | USB D- Signal (see section 2.3.1).   |
| 17       | 10      | GND              | GND                |   | Ground.  |
| 18       | 11      | V <sub>CC</sub>  | PWR                |   | V <sub>CC</sub> . Connect to 3.3V power source.  |
| 19       | 12      | GND              | GND                |   | Ground.  |
| 20       | 13      | PU10K            |                    | Hi-Z  | Tied to 10k ± 5% pull-up resistor.   |
| 21       | 14      | RESERVED         |                    |   | Reserved. Tie to GND.  |
| 22       | 15      | SCL              | O                  | SCL/SDA will be active for several ms at start-up. Then driven high.  | Clock signal for I <sup>2</sup> C-compatible interface (see section 2.3.2).              |
| 23       | 16      | SDA              | I/O                |   | Data signal for I <sup>2</sup> C-compatible interface (see section 2.3.2).               |
| 24       | 17      | V <sub>CC</sub>  | PWR                |   | V <sub>CC</sub> . Connect to 3.3V power source.  |
| 25       | 18      | DD0              | I/O                | Hi-Z  | ATA Data bit 0.  |
| 26       | 19      | DD1              | I/O                | Hi-Z  | ATA Data bit 1.  |
| 27       | 20      | DD2              | I/O                | Hi-Z  | ATA Data bit 2.  |
| 28       | 21      | DD3              | I/O                | Hi-Z  | ATA Data bit 3.  |
| 29       | 22      | DD4              | I/O                | Hi-Z  | ATA Data bit 4.  |
| 30       | 23      | DD5              | I/O                | Hi-Z  | ATA Data bit 5.  |
| 31       | 24      | DD6              | I/O                | Hi-Z  | ATA Data bit 6.  |
| 32       | 25      | DD7              | I/O                | Hi-Z  | ATA Data bit 7.  |
| 33       | 26      | GND              | GND                |   | Ground.  |
| 34       | 27      | V <sub>CC</sub>  | PWR                |   | V <sub>CC</sub> . Connect to 3.3V power source.  |

**Note:**

- ATA interface pins are not active when ATA\_EN is not asserted.



## 2.2 Pin Descriptions (continued)

| SSOP Pin | QFN Pin | Pin Name             | Pin Type           | Default State at Start-up  | Pin Description  |
|----------|---------|----------------------|--------------------|--|--|
| 35       | 28      | GND                  | GND                |  | <b>Ground.</b>   |
| 36       | 29      | DIOW# <sup>[2]</sup> | O/Z <sup>[1]</sup> | Driven high (CMOS)   | <b>ATA Control.</b>  |
| 37       | 30      | DIOR#                | O/Z <sup>[1]</sup> | Driven high (CMOS)   | <b>ATA Control.</b>  |
| 38       | 31      | DMACK#               | O/Z <sup>[1]</sup> | Driven high (CMOS)   | <b>ATA Control.</b>  |
| 39       | 32      | V <sub>CC</sub>      | PWR                |  | <b>V<sub>CC</sub>.</b> Connect to 3.3V power source.   |
| 40       | 33      | INTRQ                | I <sup>[1]</sup>   | Input  | <b>IDE ATA Interrupt request.</b>  |
| 41       | 34      | DA0                  | O/Z <sup>[1]</sup> | Driven high after 2 ms delay   | <b>ATA Address.</b>  |
| 42       | 35      | DA1                  | O/Z <sup>[1]</sup> | Driven high after 2 ms delay   | <b>ATA Address.</b>  |
| 43       | 36      | DA2                  | O/Z <sup>[1]</sup> | Driven high after 2 ms delay   | <b>ATA Address.</b>  |
| 44       | 37      | CS0#                 | O/Z <sup>[1]</sup> | Driven high after 2 ms delay   | <b>ATA Chip Select.</b>  |
| 45       | 38      | CS1#                 | O/Z <sup>[1]</sup> | Driven high after 2 ms delay   | <b>ATA Chip Select.</b>  |
| 46       | 39      | VBUS_PW<br>R_VALID   | I                  | Input  | <b>VBUS detection.</b> Indicates to the CY7C68300A that VBUS power is present.   |
| 47       | 40      | ARESET#              | O/Z <sup>[1]</sup> |  | <b>ATA Reset.</b>  |
| 48       | 41      | GND                  | GND                |  | <b>Ground.</b>   |
| 49       | 42      | RESET#               | I                  |  | <b>Active LOW Reset.</b> Resets the entire chip. This pin is normally tied to VCC through a 100K resistor, and to GND through a 0.1-μF capacitor, supplying a 10-ms reset.   |
| 50       | 43      | V <sub>CC</sub>      | PWR                |  | <b>V<sub>CC</sub>.</b> Connect to 3.3V power source.   |
| 51       | 44      | ATA_EN               | I                  | Input – If CY7C68300A is not in mfg mode, polled every 20 ms after start-up. If LOW, SSOP pins 36–38, 41–45 and 47 or QFN pins 29–31, 34–38 and 40 are three-stated. | <b>Active HIGH.</b> ATA interface enable. Allows ATA bus sharing with other host devices. Setting ATA_EN=1 enables the ATA interface for normal operation. Disabling ATA_EN three-states (High-Z) the ATA interface and halts the ATA interface state machine logic. |
| 52       | 45      | DD8                  | I/O <sup>[1]</sup> | Hi-Z   | <b>ATA Data bit 8.</b>   |
| 53       | 46      | DD9                  | I/O <sup>[1]</sup> | Hi-Z   | <b>ATA Data bit 9.</b>   |
| 54       | 47      | DD10                 | I/O <sup>[1]</sup> | Hi-Z   | <b>ATA Data bit 10.</b>  |
| 55       | 48      | DD11                 | I/O <sup>[1]</sup> | Hi-Z   | <b>ATA Data bit 11.</b>  |
| 56       | 49      | DD12                 | I/O <sup>[1]</sup> | Hi-Z   | <b>ATA Data bit 12.</b>  |

## 2.3 Additional Pin Descriptions

### 2.3.1 DPLUS, DMINUS

DPLUS and DMINUS are the USB signaling pins, and they should be tied to the D+ and D– pins of the USB connector. Because they operate at high frequencies, the USB signals require special consideration when designing the layout of the PCB.

### 2.3.2 SCL, SDA

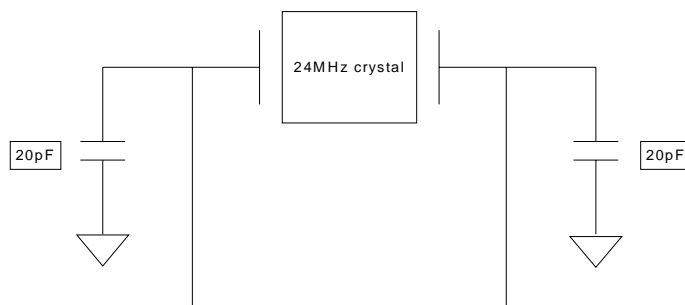
The clock and data pins for the I<sup>2</sup>C-compatible port should be connected to your configuration EEPROM and to V<sub>CC</sub> through 2.2k resistors.

### 2.3.3 XTALIN, XTALOUT

The CY7C68300A requires a 24-MHz signal to derive internal timing. Typically a 24-MHz parallel-resonant fundamental mode crystal is used, but a 24-MHz square wave from another source can also be used. If a crystal is used, connect the pins to XTALIN and XTALOUT, and also through 20-pF capacitors to GND. If an alternate clock source is used, apply it to XTALIN and leave XTALOUT open.

**Note:**

2. A # sign after the signal name indicates that it is an active LOW signal.



**Figure 2-3. XTALIN, XTALOUT Diagram**

### 2.3.4 ATA\_EN

ATA\_EN allows bus sharing with other host devices. Setting ATA\_EN = 1 enables the ATA interface for normal operation. Setting ATA\_EN = 0 disables (High-Z) the ATA interface pins and removes the CY7C68300A from the USB. Because the CY7C68300A supports a true low-power USB suspend state, new functionality was added to ensure that transitions of the ATA\_EN signal could be detected properly under all circumstances. The CY7C68300A will behave in the following manner:

- If ATA\_EN transitions to '0' during normal operation, the CY7C68300A will disconnect from the USB and drop to a low-power mode.
- If ATA\_EN transitions to '1' when in low-power mode and no other condition is causing the low-power state, the CY7C68300A will return to a post-reset state and reconnect to the USB.
- If the CY7C68300A is already in suspend and ATA\_EN transitions to '0', the CY7C68300A will resume only long enough to stop driving the ATA interface (High-Z) and drop back to low-power again.
- If the CY7C68300A is already in suspend and ATA\_EN transitions to '1', the CY7C68300A will resume only long enough to start driving the ATA interface and drop to low-power again.

The ATA\_EN pin is sampled at a rate of 50 times per second by the CY7C68300A internal logic. This pin should be set to a HIGH at start-up. Note that disabling the ATA bus with the ATA\_EN pin during the middle of a data transfer will result in data loss and can cause the operating system on the Host computer to crash.

### 2.3.5 ATA Interface Pins

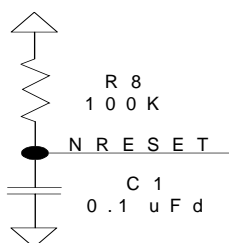
If a cable is used to connect the CY7C68300A to a UDMA device, the cable must be an 80-pin cable as shown in the ATA-6 spec, Annex A.

### 2.3.6 VBUS\_PWR\_VALID

VBUS\_PWR\_VALID indicates to the CY7C68300A that power is present on VBUS. This pin is polled by the CY7C68300A at start-up and then every 20ms thereafter. If this pin is '1', the 1.5K pull-up is attached to D+. If this pin is '0', the CY7C68300A will release the pullup on D+ as required by the USB specification.

### 2.3.7 RESET#

Asserting RESET# for 10 ms will reset the entire chip. This pin is normally tied to V<sub>CC</sub> through a 100k resistor, and to GND through a 0.1-μF capacitor.



**Figure 2-4. Typical Reset Circuit**

### 3.0 Applications

The CY7C68300A is a high-speed USB 2.0 peripheral device that connects a single ATA or ATAPI storage device to a USB host using the USB *Mass Storage Class* protocol.

#### 3.1 Additional Resources

- CY4615 EZ-USB AT2 Reference Design Kit
- USB Specification version 2.0
- ATA Specification T13/1410D Rev 3B
- USB *Mass Storage Class Bulk Only Transport Specification*, [http://www.usb.org/developers/data/devclass/usbmassbulk\\_10.pdf](http://www.usb.org/developers/data/devclass/usbmassbulk_10.pdf).

### 4.0 Functional Overview

#### 4.1 USB Signaling Speed

CY7C68300A operates at two of the three rates defined in the USB Specification Revision 2.0 dated April 27, 2000:

- Full speed, with a signaling bit rate of 12 Mb/s/sec
- High speed, with a signaling bit rate of 480 Mb/s/sec.

CY7C68300A does not support the low-speed signaling rate of 1.5 Mb/s/sec.

#### 4.2 ATA Interface

The ATA/ATAPI port on the CY7C68300A is compliant with the Information Technology AT Attachment with Packet Interface 6 (ATA/ATAPI-6) Specification, T13/1410D Rev 3B. The CY7C68300A supports ATAPI packet commands over USB. Additionally, the CY7C68300A translates ATAPI SFF-8070i commands to ATA commands for seamless integration of ATA devices with generic *Mass Storage Class Bulk Only Transport* drivers.

### 5.0 Enumeration

During the power-up sequence, internal logic checks the I<sup>2</sup>C-compatible port for an EEPROM whose first two bytes are both 0x4D. If a valid signature is found, the CY7C68300A uses the values stored in the EEPROM to configure the USB descriptors for normal operation. If an invalid EEPROM signature is read, or if no EEPROM is detected, the CY7C68300A defaults into Board Manufacturing Test Mode. The two modes of operation are described in subsections 5.1 and 5.2, below.

#### 5.1 Board Manufacturing Test Mode

In Board Manufacturing Test Mode, the chip behaves as a USB 2.0 device but the ATA/ATAPI interface is not active. The CY7C68300A allows for reading and writing an EEPROM and for board level testing through vendor specific ATAPI commands utilizing the CBW Command Block as described in the USB *Mass Storage Class Bulk-Only Transport Specification*. There is a vendor-specific ATAPI command for the EEPROM access (CfgCB) and one for the board level testing (MfgCB).

##### 5.1.1 CfgCB

The `cfg_load` and `cfg_read` vendor-specific commands are passed down through the bulk pipe in the CBWCB portion of the CBW. The format of this CfgCB is shown below. Byte 0 will be a vendor-specific command designator whose value is configurable and set in the configuration data (EEPROM address 0x04). Byte 1 must be set to 0x26 to identify CfgCB. Byte 2 is reserved and must be set to zero. Byte 3 is used to determine the memory source to write/read. For the CY7C68300A, this byte must be set to 0x02, meaning the EEPROM. Bytes 4 and 5 will be used to determine the start address. For the CY7C68300A, this must always be 0x0000. Bytes 6 through 15 are reserved and should be set to zero.

The data transferred to the EEPROM must be in the format specified in *Table 5-6* of this data sheet. Maximum data transfer size is 255 bytes.

The data transfer length is determined by the CBW Data Transfer Length specified in bytes 8 through 11 (`dCBWDataTransferLength`) of the CBW. The type/direction of the command will be determined by the direction bit specified in byte 12, bit 7 (`bmCBWFlags`) of the CBW.

**Table 5-1. Command Block Wrapper**

|                | 7                      | 6        | 5            | 4            | 3       | 2 | 1 | 0 |
|----------------|------------------------|----------|--------------|--------------|---------|---|---|---|
| 0–3            | DCBWSignature          |          |              |              |         |   |   |   |
| 4–7            | dCBWTag                |          |              |              |         |   |   |   |
| 8–11 (08h-0Bh) | dCBWDataTransferLength |          |              |              |         |   |   |   |
| 12 (0Ch)       | bwCBWFLAGS             |          |              |              |         |   |   |   |
|                | Dir                    | Obsolete | Reserved (0) |              |         |   |   |   |
| 13 (0Dh)       | Reserved (0)           |          |              |              | bCBWLUN |   |   |   |
| 14 (0Eh)       | Reserved (0)           |          |              | bCBWCBLength |         |   |   |   |
| 15–30 (0Fh1Eh) | CBWCB (CfgCB or MfgCB) |          |              |              |         |   |   |   |

**Table 5-2. Example CfgCB**

| CfgCB Byte Descriptions                       | Bits |   |   |   |   |   |   |   |
|---|------|---|---|---|---|---|---|---|
|   | 7    | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0 bVSCBSignature (set in configuration bytes) | 0    | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1 bVSCBSubCommand (must be 0x26)              | 0    | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 2 Reserved (must be set to zero)              | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 Data Source (must be set to 0x02)           | 0    | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 4 Start Address (LSB) (must be set to zero)   | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 Start Address (MSB) (must be set to zero)   | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6–15 Reserved (must be set to zero)           | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

### 5.1.2 MfgCB

The mfg\_load and mfg\_read vendor-specific commands will be passed down through the bulk pipe in the CBWCB portion of the CBW. The format of this MFGCB is shown below. Byte 0 is a vendor-specific command designator whose value is configurable and set in the configuration data. Byte 1 must be 0x27 to identify MfgCB. Byte 2–15 are reserved and must be set to zero.

The data transfer length will be determined by the CBW Data Transfer Length specified in bytes 8 through 11 (dCBWDataTransferLength) of the CBW. The type/direction of the command is determined by the direction bit specified in byte 12, bit 7 (bmCBWFlags) of the CBW.

**Table 5-3. Example MfgCB**

| MfgCB Byte Description                        | Bits |   |   |   |   |   |   |   |
|---|------|---|---|---|---|---|---|---|
|   | 7    | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0 bVSCBSignature (set in configuration bytes) | 0    | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1 bVSCBSubCommand (hardcoded 0x27)            | 0    | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| 2–15 Reserved (must be zero)                  | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

#### 5.1.2.1 Mfg\_load

During a mfg\_load, the CY7C68300A goes into Manufacturing Test Mode. Manufacturing Test Mode is provided as a means to implement board or system level interconnect tests. During Manufacturing Test Mode operation, all outputs not directly associated with USB operation are controllable. Normal control of the output pins are disabled. Control of the select CY7C68300A IO pins and their three-state controls are mapped to the ATAPI data packet associated with this request. (See the following table for explanation of the required mfg\_load data format.) This requires a write of seven bytes. To exit Manufacturing Test Mode, a hard reset (#RESET) is required.

**Table 5-4. Mfg\_load Data Format**

| Byte | Bit(s) | Test/Three-state Control Function |
|------|--------|-----------------------------------|
| 0    | 0      | Reserved                          |
| 0    | 3:1    | DA[2:0]                           |
| 0    | 5:4    | CS#[1:0]                          |
| 0    | 6      | Reserved                          |
| 0    | 7      | ARESET#                           |
| 1    | 0      | NDIOW                             |

**Table 5-4. Mfg\_load Data Format** (continued)

| Byte | Bit(s) | Test/Three-state Control Function                                   |
|------|--------|---|
| 1    | 1      | NDIOR   |
| 1    | 2      | NDMACK  |
| 1    | 3:6    | Reserved  |
| 1    | 7      | DD[15:0] Three-state (0 = three-state DD pins, 1 = enable DD pins). |
| 2    | 7:0    | DD[7:0]   |
| 3    | 7:0    | DD[15:8]  |
| 4    | 7:0    | Reserved  |
| 5    | 7:0    | Reserved  |
| 6    | 7:0    | Reserved  |

### 5.1.2.2 Mfg\_read

This USB request returns a “snapshot in time” of select CY7C68300A input pins. The input pin states are bit-wise mapped to the ATAPI data associated with this request. CY7C68300A input pins not directly associated with USB operation can be sampled at any time during Manufacturing Test Mode operation. See the following table for an explanation of the mfg\_read data format. The data length shall always be eight bytes.

**Table 5-5. Mfg\_read Data Format**

| Byte | Bit(s) | Test/Three-state Control Function      |
|------|--------|--|
| 0    | 0      | INTRQ                                  |
| 0    | 5:1    | Reserved. This data should be ignored. |
| 0    | 6      | VBUS_PWR_VALID                         |
| 0    | 7      | ARESET# (output value only)            |
| 1    | 2:0    | Reserved. This data should be ignored. |
| 1    | 3      | IORDY                                  |
| 1    | 4      | DMARQ                                  |
| 1    | 5      | ATA_EN                                 |
| 1    | 6      | Reserved. This data should be ignored. |
| 1    | 7      | DD[15:0] Three-state                   |
| 2    | 7:0    | DD[7:0]                                |
| 3    | 7:0    | DD[15:8]                               |
| 4    | 7:0    | Reserved. This data should be ignored. |
| 5    | 7:0    | Reserved. This data should be ignored. |
| 6    | 7:0    | Reserved. This data should be ignored. |
| 7    | 7:0    | Reserved. This data should be ignored. |

## 5.2 Normal Operation Mode

In Normal Operation Mode, the chip behaves as a USB 2.0 to ATA/ATAPI bridge. This includes all typical USB device states (powered, configured, etc.). The USB descriptors are returned according to the values stored in the external EEPROM. An external EEPROM is required for Mass Storage Class Bulk-Only Transport compliance, since a unique serial number is required for each device. Also, Cypress requires customers to use their own Vendor and Product IDs for final products.

## 5.3 EEPROM Organization

The contents of the 256-byte (2048-bit) two-wire serial EEPROM are arranged as follows. The column labeled “Required Contents” contains the values that must be used for proper operation of the CY7C68300A. The column labeled “Suggested Contents” contains suggested values for the bytes that are defined by the manufacturer. Some values, such as the Vendor ID and device and device serial number, must be customized to meet USB compliance. See section 5.1 for details on how to use vendor-specific ATAPI commands to read and program the EEPROM. The serial EEPROM must be hard-wired to address 0x04. This means that A0 and A1 of the serial EEPROM must be tied to ground and that A2 must be tied to 3.3V.

**Table 5-6. EEPROM Organization**

| EEPROM Address       | Field Name   | Field Description   | Required Contents | Suggested Contents |
|----------------------|--|---|-------------------|--------------------|
| <b>Configuration</b> |  |   |                   |                    |
| 0x00                 | I <sup>2</sup> C-compatible memory device signature (LSB)  | LSB I <sup>2</sup> C-compatible memory device signature byte.   | 0x4D              |                    |
| 0x01                 | I <sup>2</sup> C-compatible memory device signature (MSB)  | MSB I <sup>2</sup> C-compatible memory device signature byte.   | 0x4D              |                    |
| 0x02                 | APM Value  | ATA Device Automatic Power Management Value. If an attached ATA device supports APM and this field contains other than 0x00, the CY7C68300A will issue a SET_FEATURES command to Enable APM with this value during the drive initialization process. Setting APM Value to 0x00 disables this functionality. This value is ignored with ATAPI devices.   |                   | 0x00               |
| 0x03                 | ATA Initialization Timeout   | Time in 128-ms granularity before the CY7C68300A stops polling the ALT STAT register for reset complete and restarts the reset process (0x80 = 16.4 seconds).   |                   | 0x80               |
| 0x04                 | ATA Command Designator   | Value in the first byte of the CBW CB field that designates that the CB is to be decoded as vendor specific ATA commands instead of the ATAPI command block. See section 4.0 for more detail on how this byte is used.  |                   | 0x24               |
| 0x05                 | Reserved<br>BUSY Bit Delay<br><br>Short Packet Before Stall<br><br>SRST Enable<br><br>Skip Pin Reset | Bits(7:4) Set to 0<br><br>Bit (3)<br>Enables a delay of up to 120 ms at each read of the DRQ bit where the device data length does not match the host data length. This allows the CY7C68300A to work with most devices that incorrectly clear the BUSY bit before a valid status is present.<br><br>Bit (2)<br>Determines if a short packet is sent prior to the STALL of an IN endpoint. The <i>USB Mass Storage Class Bulk-Only Specification</i> allows a device to send a short or zero-length IN packet prior to returning a STALL handshake for certain cases. Certain host controller drivers may require a short packet prior to STALL.<br>1 = Force a short packet before STALL.<br>0 = Don't force a short packet before STALL.<br><br>Bit (1)<br>Determines if the CY7C68300A is to do a SRST reset during drive initialization. <sup>[3]</sup><br>1 = Perform SRST during initialization.<br>0 = Don't perform SRST during initialization.<br><br>Bit (0)<br>Skip ATA_NRESET assertion. <sup>[4]</sup><br>0 = Allow ARESET# assertion for all resets.<br>1 = Disable ARESET# assertion except for power-on reset cycles. |                   | 0x07               |

**Notes:**

3. At least one reset must be enabled. Do not set SRST to 0 and Skip Pin Reset to 1 at the same time.
4. SRST Enable must be set in conjunction with Skip Pin Reset. Setting this bit causes the CY7C68300A to bypass ARESET# during initialization. All reset events except a power-on reset utilize SRST as the drive mechanism.

**Table 5-6. EEPROM Organization** (continued)

| EEPROM Address           | Field Name   | Field Description  | Required Contents | Suggested Contents |
|--------------------------|--|--|-------------------|--------------------|
| 0x06                     | ATA UDMA Enable<br><br>ATAPI UDMA Enable<br><br>UDMA Modes | Bit (7)<br>Enable Ultra DMA data transfer support for ATAPI devices. If enabled, and if the ATAPI device reports UDMA support for the indicated modes, the CY7C68300A will utilize UDMA data transfers at the highest negotiated rate possible.<br>0 = Disable ATA device UDMA support.<br>1 = Enable ATA device UDMA support.<br><br>Bit (6)<br>Enable Ultra DMA data transfer support for ATAPI devices. If enabled, and if the ATAPI device reports UDMA support for the indicated modes, the CY7C68300A will utilize UDMA data transfers at the highest negotiated rate possible.<br>0 = Disable ATAPI device UDMA support.<br>1 = Enable ATAPI device UDMA support.<br><br>Bit (5:0)<br>These bits select which UDMA modes, if supported, are enabled. Setting to 1 enables. Multiple bits may be set. The CY7C68300A will operate in the highest enabled UDMA mode supported by the device. The CY7C68300A supports UDMA modes 2 and 4 only.<br>Bit Descriptions<br>5 Reserved. Must be set to 0.<br>4 Enable UDMA mode 4.<br>3 Reserved. Must be set to 0.<br>2 Enable UDMA mode 2.<br>1 Reserved. Must be set to 0.<br>0 Reserved. Must be set to 0. |                   | 0xD4               |
| 0x07                     | Reserved<br>PIO Modes                                      | Bits(7:2)<br>Bits(1:0)<br>These bits select which PIO modes, if supported, are enabled. Setting to 1 enables. Multiple bits may be set. The CY7C68300A will operate in the highest enabled PIO mode supported by the device. The CY7C68300A supports PIO modes 0, 3, and 4 only. PIO mode 0 is always enabled by internal logic.<br>Bit Descriptions<br>1 Enable PIO mode 4.<br>0 Enable PIO mode 3.   |                   | 0x03               |
| 0x08                     | Reserved   | Must be set to 0x00.   | 0x00              |                    |
| 0x09                     | Reserved   | Must be set to 0x00.   | 0x00              |                    |
| 0x0A                     | Reserved   | Must be set to 0x00.   | 0x00              |                    |
| 0x0B                     | Reserved   | Must be set to 0x00.   | 0x00              |                    |
| 0x0C                     | Reserved   | Must be set to 0x00.   | 0x00              |                    |
| 0x0D                     | Reserved   | Must be set to 0x00.   | 0x00              |                    |
| 0x0E                     | Reserved   | Must be set to 0x00.   | 0x00              |                    |
| 0x0F                     | Reserved   | Must be set to 0x00.   | 0x00              |                    |
| <b>Device Descriptor</b> |  |  |                   |                    |
| 0x10                     | bLength  | Length of device descriptor in bytes.  | 0x12              |                    |
| 0x11                     | bDescriptor Type   | Descriptor type.   | 0x01              |                    |
| 0x12                     | bcdUSB (LSB)   | USB Specification release number in BCD.   | 0x00              |                    |
| 0x13                     | bcdUSB (MSB)   |  | 0x02              |                    |
| 0x14                     | bDeviceClass   | Device class.  | 0x00              |                    |
| 0x15                     | bDeviceSubClass  | Device subclass.   | 0x00              |                    |



**Table 5-6. EEPROM Organization** (continued)

| EEPROM Address                             | Field Name           | Field Description   | Required Contents | Suggested Contents |
|--|----------------------|---|-------------------|--------------------|
| 0x16                                       | bDeviceProtocol      | Device protocol.  | 0x00              |                    |
| 0x17                                       | bMaxPacketSize0      | USB packet size supported for default pipe.   | 0x40              |                    |
| 0x18                                       | idVendor (LSB)       | Vendor ID. Cypress's Vendor ID may only be used for evaluation purposes, and not in released products.  |                   | 0xB4               |
| 0x19                                       | idVendor (MSB)       |   |                   | 0x04               |
| 0x1A                                       | idProduct (LSB)      | Product ID.   |                   | 0x30               |
| 0x1B                                       | idProduct (MSB)      |   |                   | 0x68               |
| 0x1C                                       | bcdDevice (LSB)      | Device release number in BCD LSB (product release number).  |                   | 0x01               |
| 0x1D                                       | bcdDevice (MSB)      | Device release number in BCD MSB (silicon release number).  |                   | 0x00               |
| 0x1E                                       | iManufacturer        | Index to manufacturer string. This entry must equal half of the address value where the string starts or 0x00 if the string does not exist.   |                   | 0x38               |
| 0x1F                                       | iProduct             | Index to product string. This entry must equal half of the address value where the string starts or 0x00 if the string does not exist.  |                   | 0x4E               |
| 0x20                                       | iSerialNumber        | Index to serial number string. This entry must equal half of the address value where the string starts or 0x00 if the string does not exist. The <i>USB Mass Storage Class Bulk-Only Transport Specification</i> requires a unique serial number (in upper case, hexadecimal characters) for each device. |                   | 0x64               |
| 0x21                                       | bNumConfigurations   | Number of configurations supported.   | 0x01              |                    |
| <b>Device Qualifier</b>                    |                      |   |                   |                    |
| 0x22                                       | bLength              | Length of device descriptor in bytes.   | 0x0A              |                    |
| 0x23                                       | bDescriptor          | Type Descriptor type.   | 0x06              |                    |
| 0x24                                       | bcdUSB (LSB)         | USB Specification release number in BCD.  | 0x00              |                    |
| 0x25                                       | bcdUSB (MSB)         | USB Specification release number in BCD.  | 0x02              |                    |
| 0x26                                       | bDeviceClass         | Device class.   | 0x00              |                    |
| 0x27                                       | bDeviceSubClass      | Device subclass.  | 0x00              |                    |
| 0x28                                       | bDeviceProtocol      | Device protocol.  | 0x00              |                    |
| 0x29                                       | bMaxPacketSize0      | USB packet size supported for default pipe.   | 0x40              |                    |
| 0x2A                                       | bNumConfigurations   | Number of configurations supported.   | 0x01              |                    |
| 0x2B                                       | bReserved            | Reserved for future use. Must be set to zero.   | 0x00              |                    |
| <b>High-speed Configuration Descriptor</b> |                      |   |                   |                    |
| 0x2C                                       | bLength              | Length of configuration descriptor in bytes.  | 0x09              |                    |
| 0x2D                                       | bDescriptorType      | Descriptor type.  | 0x02              |                    |
| 0x2E                                       | bTotalLength (LSB)   | Number of bytes returned in this configuration. This includes the configuration descriptor plus all the interface and endpoint descriptors.   | 0x20              |                    |
| 0x2F                                       | bTotalLength (MSB)   |   | 0x00              |                    |
| 0x30                                       | bNumInterfaces       | Number of interfaces supported.   | 0x01              |                    |
| 0x31                                       | bConfiguration Value | The value to use as an argument to Set Configuration to select the configuration. This value must be set to 0x01.   | 0x01              |                    |
| 0x32                                       | iConfiguration       | Index to the configuration string. This entry must equal half of the address value where the string starts or 0x00 if the string does not exist.  |                   | 0x00               |



**Table 5-6. EEPROM Organization** (continued)

| EEPROM Address                                       | Field Name           | Field Description   | Required Contents | Suggested Contents |
|--|----------------------|---|-------------------|--------------------|
| 0x33   | bmAttributes         | Device attributes for this configuration.<br>Bit Descriptions<br>7 Reserved. Must be set to 1.<br>6 Self-powered. Must be set to 1.<br>5 Remote wake-up. Must be set to 0.<br>4–0 Reserved. Must be set to 0. | 0xC0              |                    |
| 0x34   | bMaxPower            | Maximum power consumption for this configuration. Units used are mA*2 (i.e., 0x31 = 98 mA, 0xF9 = 498 mA). 0x00 reported for self-powered devices.  |                   | 0x00               |
| <b>High-speed Interface and Endpoint Descriptors</b> |                      |   |                   |                    |
| <i>Interface Descriptor</i>                          |                      |   |                   |                    |
| 0x35   | bLength              | Length of interface descriptor in bytes.  | 0x09              |                    |
| 0x36   | bDescriptorType      | Descriptor type.  | 0x04              |                    |
| 0x37   | bInterfaceNumber     | Interface number.   | 0x00              |                    |
| 0x38   | bAlternateSetting    | Alternate setting.  | 0x00              |                    |
| 0x39   | bNumEndpoints        | Number of endpoints.  | 0x02              |                    |
| 0x3A   | bInterfaceClass      | Interface class.  | 0x08              |                    |
| 0x3B   | bInterfaceSubClass   | Interface subclass.   |                   | 0x06               |
| 0x3C   | bInterfaceProtocol   | Interface protocol.   | 0x50              |                    |
| 0x3D   | iInterface           | Index to first interface string. This entry must equal half of the address value where the string starts or 0x00 if the string does not exist.  |                   | 0x00               |
| <i>USB Bulk In Endpoint</i>                          |                      |   |                   |                    |
| 0x3E   | bLength              | Length of this descriptor in bytes.   | 0x07              |                    |
| 0x3F   | bDescriptorType      | Endpoint descriptor type.   | 0x05              |                    |
| 0x40   | bEndpointAddress     | This is an In endpoint, endpoint number 8.  | 0x88              |                    |
| 0x41   | bmAttributes         | This is a bulk endpoint.  | 0x02              |                    |
| 0x42   | wMaxPacketSize (LSB) | Max data transfer size.   | 0x00              |                    |
| 0x43   | wMaxPacketSize (MSB) |   | 0x02              |                    |
| 0x44   | bInterval            | HS interval for polling (max. NAK rate).  | 0x00              |                    |
| <i>USB Bulk Out Endpoint</i>                         |                      |   |                   |                    |
| 0x45   | bLength              | Length of this descriptor in bytes.   | 0x07              |                    |
| 0x46   | bDescriptorType      | Endpoint descriptor type.   | 0x05              |                    |
| 0x47   | bEndpointAddress     | This is an Out endpoint, endpoint number 2.   | 0x02              |                    |
| 0x48   | bmAttributes         | This is a bulk endpoint.  | 0x02              |                    |
| 0x49   | wMaxPacketSize (LSB) | Max data transfer size.   | 0x00              |                    |
| 0x4A   | wMaxPacketSize (MSB) |   | 0x02              |                    |
| 0x4B   | bInterval            | HS interval for polling (max. NAK rate).  | 0x00              |                    |
| <b>Full-speed Configuration Descriptor</b>           |                      |   |                   |                    |
| 0x4C   | bLength              | Length of configuration descriptor in bytes.  | 0x09              |                    |
| 0x4D   | bDescriptorType      | Descriptor type.  | 0x02              |                    |
| 0x4E   | bTotalLength (LSB)   | Number of bytes returned in this configuration. This includes the configuration descriptor plus all the interface and endpoint descriptors.   | 0x20              |                    |
| 0x4F   | bTotalLength (MSB)   |   | 0x00              |                    |
| 0x50   | bNumInterfaces       | Number of interfaces supported.   | 0x01              |                    |
| 0x51   | bConfiguration Value | The value to use as an argument to Set Configuration to select the configuration.   | 0x01              |                    |

**Table 5-6. EEPROM Organization** (continued)

| EEPROM Address   | Field Name           | Field Description   | Required Contents | Suggested Contents |
|--|----------------------|---|-------------------|--------------------|
| 0x52   | iConfiguration       | Index to configuration string. This entry must equal half of the address value where the string starts or 0x00 if the string does not exist.  |                   | 0x00               |
| 0x53   | bmAttributes         | Device attributes for this configuration.<br>Bit Descriptions<br>7 Reserved. Must be set to 1.<br>6 Self-powered. Must be set to 1.<br>5 Remote wake-up. Must be set to 0.<br>4–0 Reserved. Must be set to 0. | 0xC0              |                    |
| 0x54   | bMaxPower            | Maximum power consumption for the second configuration. Units used are mA*2 (i.e., 0x31 = 98 mA, 0xF9 = 498 mA).  |                   | 0x00               |
| <b>Full-speed Interface and Endpoint Descriptors</b>   |                      |   |                   |                    |
| <i>Interface Descriptor</i>  |                      |   |                   |                    |
| 0x55   | bLength              | Length of interface descriptor in bytes.  | 0x09              |                    |
| 0x56   | bDescriptorType      | Descriptor type.  | 0x04              |                    |
| 0x57   | bInterfaceNumber     | Interface number.   | 0x00              |                    |
| 0x58   | bAlternateSettings   | Alternate settings.   | 0x00              |                    |
| 0x59   | bNumEndpoints        | Number of endpoints.  | 0x02              |                    |
| 0x5A   | bInterfaceClass      | Interface class.  | 0x08              |                    |
| 0x5B   | bInterfaceSubClass   | Interface subclass.   |                   | 0x06               |
| 0x5C   | bInterfaceProtocol   | Interface protocol.   | 0x50              |                    |
| 0x5D   | iInterface           | Index to first interface string. This entry must equal half of the address value where the string starts or 0x00 if the string does not exist.  | 0x00              |                    |
| <i>USB Bulk InEndpoint</i>   |                      |   |                   |                    |
| 0x5E   | bLength              | Length of this descriptor in bytes.   | 0x07              |                    |
| 0x5F   | bDescriptorType      | Endpoint descriptor type.   | 0x05              |                    |
| 0x60   | bEndpointAddress     | This is an In endpoint, endpoint number 8.  | 0x88              |                    |
| 0x61   | bmAttributes         | This is a bulk endpoint.  | 0x02              |                    |
| 0x62   | wMaxPacketSize (LSB) | Max data transfer size.   | 0x40              |                    |
| 0x63   | wMaxPacketSize (MSB) |   | 0x00              |                    |
| 0x64   | bInterval            | Does not apply to FS bulk endpoints. Must be set to 0.  | 0x00              |                    |
| <i>USB Bulk Out Endpoint</i>   |                      |   |                   |                    |
| 0x65   | bLength              | Length of this descriptor in bytes.   | 0x07              |                    |
| 0x66   | bDescriptorType      | Endpoint descriptor type.   | 0x05              |                    |
| 0x67   | bEndpointAddress     | This is an Out endpoint, endpoint number 2.   | 0x02              |                    |
| 0x68   | bmAttributes         | This is a bulk endpoint.  | 0x02              |                    |
| 0x69   | wMaxPacketSize (LSB) | Max data transfer size.   | 0x40              |                    |
| 0x6A   | wMaxPacketSize (MSB) |   | 0x00              |                    |
| 0x6B   | bInterval            | Does not apply to FS bulk endpoints. Must be set to 0.  | 0x00              |                    |
| <b>String Descriptor Examples</b> (Note: The values in these strings are given as examples only and should not be used in final products. Designers are encouraged to modify the string values to reflect the final product, since they are what users will see with their operating systems.) |                      |   |                   |                    |
| USB String Descriptor–Index 0 (LANGID)   |                      |   |                   |                    |
| 0x6C   | bLength              | LANGID string descriptor length in bytes.   | 0x04              |                    |
| 0x6D   | bDescriptorType      | Descriptor type.  | 0x03              |                    |

**Table 5-6. EEPROM Organization** (continued)

| EEPROM Address                     | Field Name      | Field Description                                      | Required Contents | Suggested Contents |
|------------------------------------|-----------------|--|-------------------|--------------------|
| 0x6E                               | LANGID (LSB)    | Language supported. <sup>[5]</sup>                     |                   | 0x09               |
| 0x6F                               | LANGID (MSB)    |  |                   | 0x04               |
| USB String Descriptor–Manufacturer |                 |  |                   |                    |
| 0x70                               | bLength         | String descriptor length in bytes (including bLength). |                   | 0x2C               |
| 0x71                               | bDescriptorType | Descriptor type.                                       | 0x03              |                    |
| 0x72                               | bString         | Unicode character.                                     |                   | “C” 0x43           |
| 0x73                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x74                               | bString         | Unicode character.                                     |                   | “y” 0x79           |
| 0x75                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x76                               | bString         | Unicode character.                                     |                   | “p” 0x70           |
| 0x77                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x78                               | bString         | Unicode character.                                     |                   | “r” 0x72           |
| 0x79                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x7A                               | bString         | Unicode character.                                     |                   | “e” 0x65           |
| 0x7B                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x7C                               | bString         | Unicode character.                                     |                   | “s” 0x73           |
| 0x7D                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x7E                               | bString         | Unicode character.                                     |                   | “s” 0x73           |
| 0x7F                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x80                               | bString         | Unicode character.                                     |                   | “ ” 0x20           |
| 0x81                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x82                               | bString         | Unicode character.                                     |                   | “S” 0x53           |
| 0x83                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x84                               | bString         | Unicode character.                                     |                   | “e” 0x65           |
| 0x85                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x86                               | bString         | Unicode character.                                     |                   | “m” 0x6D           |
| 0x87                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x88                               | bString         | Unicode character.                                     |                   | “i” 0x69           |
| 0x89                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x8A                               | bString         | Unicode character.                                     |                   | “c” 0x63           |
| 0x8B                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x8C                               | bString         | Unicode character.                                     |                   | “o” 0x6F           |
| 0x8D                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x8E                               | bString         | Unicode character.                                     |                   | “n” 0x6E           |
| 0x8F                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x90                               | bString         | Unicode character.                                     |                   | “d” 0x64           |
| 0x91                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x92                               | bString         | Unicode character.                                     |                   | “u” 0x75           |
| 0x93                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x94                               | bString         | Unicode character.                                     |                   | “c” 0x63           |
| 0x95                               | bString         | (“NUL”)  |                   | 0x00               |
| 0x96                               | bString         | Unicode character.                                     |                   | “t” 0x74           |
| 0x97                               | bString         | (“NUL”)  |                   | 0x00               |

**Note:**

5. See <http://www.usb.org> for LANGID documentation (the code for English is 0x0409).

**Table 5-6. EEPROM Organization** (continued)

| EEPROM Address                       | Field Name      | Field Description                                      | Required Contents | Suggested Contents |
|--------------------------------------|-----------------|--|-------------------|--------------------|
| 0x98                                 | bString         | Unicode character.                                     |                   | "o" 0x6F           |
| 0x99                                 | bString         | ("NUL")  |                   | 0x00               |
| 0x9A                                 | bString         | Unicode character.                                     |                   | "r" 0x72           |
| 0x9B                                 | bString         | ("NUL")  |                   | 0x00               |
| <b>USB String Descriptor-Product</b> |                 |  |                   |                    |
| 0x9C                                 | bLength         | String descriptor length in bytes (including bLength). |                   | 0x2C               |
| 0x9D                                 | bDescriptorType | Descriptor type.                                       | 0x03              |                    |
| 0x9E                                 | bString         | Unicode character.                                     |                   | "U" 0x55           |
| 0x9F                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xA0                                 | bString         | Unicode character.                                     |                   | "S" 0x53           |
| 0xA1                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xA2                                 | bString         | Unicode character.                                     |                   | "B" 0x42           |
| 0xA3                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xA4                                 | bString         | Unicode character.                                     |                   | "2" 0x32           |
| 0xA5                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xA6                                 | bString         | Unicode character.                                     |                   | "." 0x2E           |
| 0xA7                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xA8                                 | bString         | Unicode character.                                     |                   | "0" 0x30           |
| 0xA9                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xAA                                 | bString         | Unicode character.                                     |                   | " " 0x20           |
| 0xAB                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xAC                                 | bString         | Unicode character.                                     |                   | "S" 0x53           |
| 0xAD                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xAE                                 | bString         | Unicode character.                                     |                   | "t" 0x74           |
| 0xAF                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xB0                                 | bString         | Unicode character.                                     |                   | "o" 0x6F           |
| 0xB1                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xB2                                 | bString         | Unicode character.                                     |                   | "r" 0x72           |
| 0xB3                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xB4                                 | bString         | Unicode character.                                     |                   | "a" 0x61           |
| 0xB5                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xB6                                 | bString         | Unicode character.                                     |                   | "g" 0x67           |
| 0xB7                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xB8                                 | bString         | Unicode character.                                     |                   | "e" 0x65           |
| 0xB9                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xBA                                 | bString         | Unicode character.                                     |                   | " " 0x20           |
| 0xBB                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xBC                                 | bString         | Unicode character.                                     |                   | "D" 0x44           |
| 0xBD                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xBE                                 | bString         | Unicode character.                                     |                   | "e" 0x65           |
| 0xBF                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xC0                                 | bString         | Unicode character.                                     |                   | "v" 0x76           |
| 0xC1                                 | bString         | ("NUL")  |                   | 0x00               |
| 0xC2                                 | bString         | Unicode character.                                     |                   | "i" 0x69           |

**Table 5-6. EEPROM Organization** (continued)

| EEPROM Address  | Field Name       | Field Description  | Required Contents | Suggested Contents |
|---|------------------|--|-------------------|--------------------|
| 0xC3  | bString          | ("NUL")  |                   | 0x00               |
| 0xC4  | bString          | Unicode character.   |                   | "c" 0x63           |
| 0xC5  | bString          | ("NUL")  |                   | 0x00               |
| 0xC6  | bString          | Unicode character.   |                   | "e" 0x65           |
| 0xC7  | bString          | ("NUL")  |                   | 0x00               |
| <b>USB String Descriptor–Serial Number</b> (Note: The USB Mass Storage Class requires a unique serial number in each device. Not providing a unique serial number will crash the operating system. The serial number must be at least a minimum size of 12 characters. Some hosts will only treat the last 12 characters of the serial number as unique.) |                  |  |                   |                    |
| 0xC8  | bLength          | String descriptor length in bytes (including bLength).     |                   | 0x22               |
| 0xC9  | bDescriptor Type | Descriptor type.   | 0x03              |                    |
| 0xCA  | bString          | Unicode character.   |                   | "1" 0x31           |
| 0xCB  | bString          | ("NUL")  |                   | 0x00               |
| 0xCC  | bString          | Unicode character.   |                   | "2" 0x32           |
| 0xCD  | bString          | ("NUL")  |                   | 0x00               |
| 0xCE  | bString          | Unicode character.   |                   | "3" 0x33           |
| 0xCF  | bString          | ("NUL")  |                   | 0x00               |
| 0xD0  | bString          | Unicode character.   |                   | "4" 0x34           |
| 0xD1  | bString          | ("NUL")  |                   | 0x00               |
| 0xD2  | bString          | Unicode character.   |                   | "5" 0x35           |
| 0xD3  | bString          | ("NUL")  |                   | 0x00               |
| 0xD4  | bString          | Unicode character.   |                   | "6" 0x36           |
| 0xD5  | bString          | ("NUL")  |                   | 0x00               |
| 0xD6  | bString          | Unicode character.   |                   | "7" 0x37           |
| 0xD7  | bString          | ("NUL")  |                   | 0x00               |
| 0xD8  | bString          | Unicode character.   |                   | "8" 0x38           |
| 0xD9  | bString          | ("NUL")  |                   | 0x00               |
| 0xDA  | bString          | Unicode character.   |                   | "9" 0x39           |
| 0xDB  | bString          | ("NUL")  |                   | 0x00               |
| 0xDC  | bString          | Unicode character.   |                   | "0" 0x30           |
| 0xDD  | bString          | ("NUL")  |                   | 0x00               |
| 0xDE  | bString          | Unicode character.   |                   | "A" 0x41           |
| 0xDF  | bString          | ("NUL")  |                   | 0x00               |
| 0xE0  | bString          | Unicode character.   |                   | "B" 0x42           |
| 0xE1  | bString          | ("NUL")  |                   | 0x00               |
| 0xE2  | bString          | Unicode character.   |                   | "C" 0x43           |
| 0xE3  | bString          | ("NUL")  |                   | 0x00               |
| 0xE4  | bString          | Unicode character.   |                   | "D" 0x44           |
| 0xE5  | bString          | ("NUL")  |                   | 0x00               |
| 0xE6  | bString          | Unicode character.   |                   | "E" 0x45           |
| 0xE7  | bString          | ("NUL")  |                   | 0x00               |
| 0xE8  | bString          | Unicode character.   |                   | "F" 0x46           |
| 0xE9  | bString          | ("NUL")  |                   | 0x00               |
| 0xEA to 0xFF  | Unused ROM Space | Amount of unused ROM space will vary depending on strings. |                   | 0xFF               |

## 6.0 Absolute Maximum Ratings

|   |                          |
|---|--------------------------|
| Storage Temperature .....                           | -65°C to +150°C          |
| Ambient Temperature with power supplied .....       | 0°C to +70°C             |
| Supply Voltage to Ground Potential .....            | -0.5V to +4.0V           |
| DC Input Voltage to Any Input Pin .....             | 5.25V                    |
| DC Voltage Applied to Outputs in High-Z State ..... | -0.5V to $V_{CC} + 0.5V$ |
| Power Dissipation .....                             | 936 mW                   |
| Static Discharge Voltage .....                      | > 2000V                  |
| Max Output Current per IO port .....                | 10 mA                    |

## 7.0 Operating Conditions<sup>[6]</sup>

|   |                      |
|---|----------------------|
| $T_A$ (Ambient Temperature Under Bias) .....      | 0°C to +70°C         |
| Supply Voltage .....                              | +3.0V to +3.6V       |
| Ground Voltage .....                              | 0V                   |
| $F_{osc}$ (Oscillator or Crystal Frequency) ..... | 24 MHz $\pm$ 100 ppm |
| .....   | Parallel Resonant    |

## 8.0 DC Characteristics

| Parameter   | Description                  | Conditions                  | Min. | Typ. | Max. | Unit    |
|-------------|------------------------------|-----------------------------|------|------|------|---------|
| $V_{CC}$    | Supply Voltage               |                             | 3.0  | 3.3  | 3.6  | V       |
| $V_{IH}$    | Input High Voltage           |                             | 2    |      | 5.25 | V       |
| $V_{IL}$    | Input Low Voltage            |                             | -0.5 |      | 0.8  | V       |
| $I_I$       | Input Leakage Current        | $0 < V_{IN} < V_{CC}$       |      |      | + 10 | $\mu A$ |
| $V_{OH}$    | Output Voltage High          | $I_{OUT} = 4 \text{ mA}$    | 2.4  |      |      | V       |
| $V_{OL}$    | Output Voltage Low           | $I_{OUT} = -4 \text{ mA}$   |      |      | 0.4  | V       |
| $I_{OH}$    | Output Current High          |                             |      |      | 4    | mA      |
| $I_{OL}$    | Output Current Low           |                             |      |      | 4    | mA      |
| $C_{IN}$    | Input Pin Capacitance        | All but D+/D-               |      |      | 10   | pF      |
|             |                              | Only D+/D-                  |      |      | 15   | pF      |
| $I_{CC}$    | Supply Current               | USB High Speed              |      | 235  | 260  | mA      |
| $I_{CC}$    | Supply Current               | USB Full Speed              |      | 90   | 150  | mA      |
| $I_{SUSP}$  | Suspend Current              | Connected                   |      | 250  | 400  | $\mu A$ |
|             |                              | Disconnected                |      | 30   | 180  | $\mu A$ |
| $T_{RESET}$ | Reset Time After Valid Power | $V_{CC} \text{ min} = 3.0V$ | 1.91 |      |      | ms      |

## 9.0 AC Electrical Characteristics

### 9.1 USB Transceiver

Complies with the USB 2.0 specification.

### 9.2 ATA Timing

The ATA interface supports ATA PIO modes 0, 3, and 4, and Ultra DMA modes 2 and 4 per the ATA Specification T13/1410D Rev. 3B.

**Note:**

6. If an alternate clock source is input on XTALIN it must be supplied with standard 3.3V signaling characteristics and XTALOUT must be left floating.

## 10.0 Ordering Information

| Part Number    | Package Type                    |
|----------------|---------------------------------|
| CY7C68300A-PVC | 56 SSOP                         |
| CY7C68300A-LFC | 56 QFN                          |
| CY4615A        | EZ-USB AT2 Reference Design Kit |

## 11.0 Package Diagrams

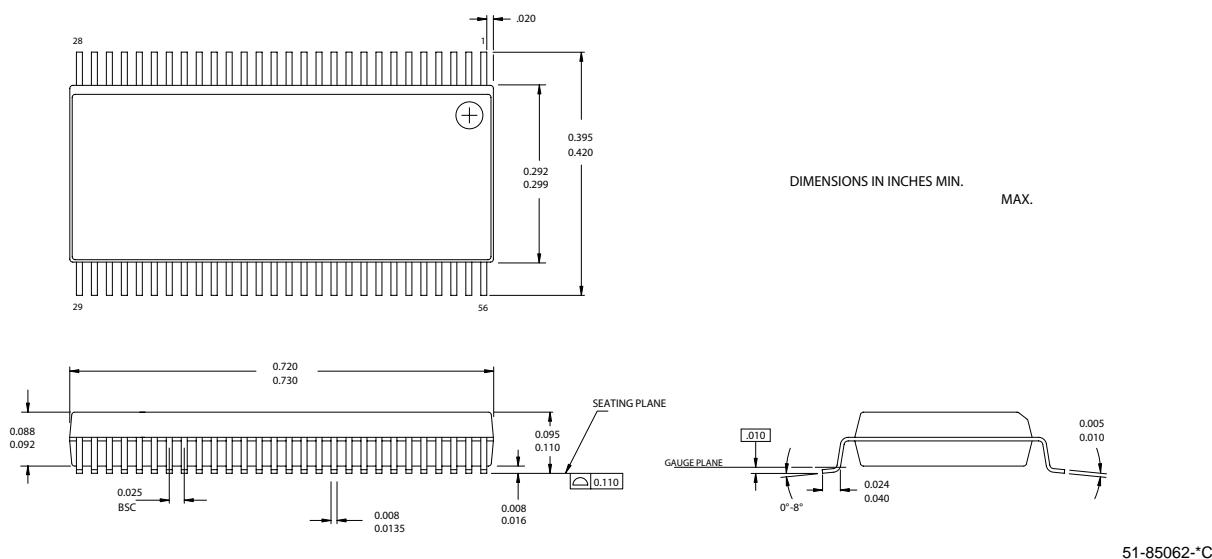


Figure 11-1. 56-lead Shrunk Small Outline Package 056

### 56-Lead QFN 8 x 8 MM LF56A

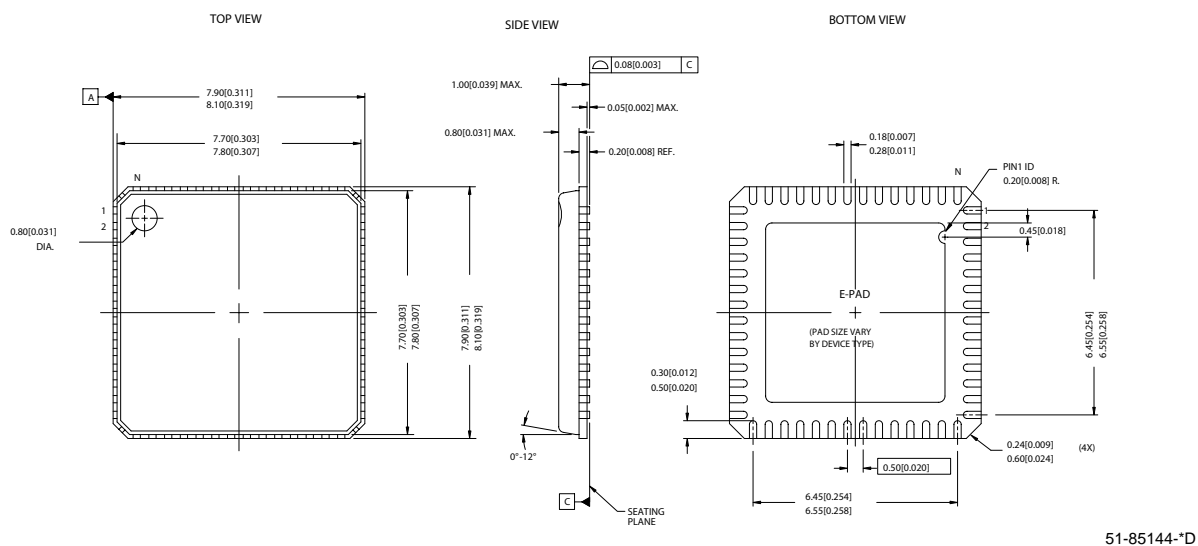


Figure 11-2. 56-lead Quad Flatpack No Lead (8 x 8 mm) LF56A

## 12.0 PCB Layout Recommendations

The following recommendations should be followed to ensure reliable high-performance operation.

- At least a four-layer impedance controlled boards are required to maintain signal quality.
- Specify impedance targets (ask your board vendor what they can achieve).
- To control impedance, maintain trace widths and trace spacing.
- Minimize stubs to minimize reflected signals.
- Connections between the USB connector shell and signal ground must be done near the USB connector.
- Bypass/flyback caps on VBus, near connector, are recommended.
- DPLUS and DMINUS trace lengths should be kept to within 2 mm of each other in length, with preferred length of 20-30mm.
- Maintain a solid ground plane under the DPLUS and DMINUS traces. Do not allow the plane to be split under these traces.
- It is preferred to have no vias placed on the DPLUS or DMINUS trace routing.
- Isolate the DPLUS and DMINUS traces from all other signal traces by no less than 10 mm.

Source for recommendations:

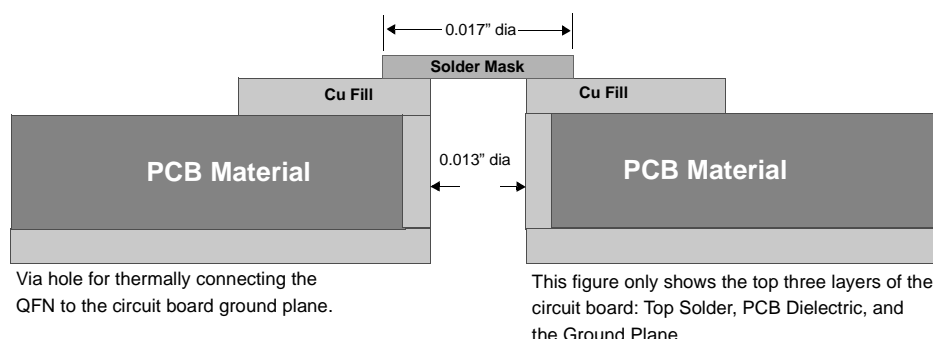
- EZ-USB FX2 PCB Design Recommendations, [http://www.cypress.com/cfuploads/support/app\\_notes/FX2\\_PCB.pdf](http://www.cypress.com/cfuploads/support/app_notes/FX2_PCB.pdf).
- High-speed USB Platform Design Guidelines, [http://www.usb.org/developers/data/hs\\_usb\\_pdg\\_r1\\_0.pdf](http://www.usb.org/developers/data/hs_usb_pdg_r1_0.pdf).

## 13.0 Quad Flat Package No Leads (QFN) Package Design Notes

Electrical contact of the part to the Printed Circuit Board (PCB) is made by soldering the leads on the bottom surface of the package to the PCB. Hence, special attention is required to the heat transfer area below the package to provide a good thermal bond to the circuit board. A Copper (Cu) fill is to be designed into the PCB as a thermal pad under the package. Heat is transferred from the CY7C68300A through the device's metal paddle on the bottom side of the package. Heat from here is conducted to the PCB at the thermal pad. It is then conducted from the thermal pad to the PCB inner ground plane by a 5 x 5 array of Via. A Via is a plated through-hole in the PCB with a finished diameter of 13 mil. The QFN's metal die paddle must be soldered to the PCB's thermal pad. Solder mask is placed on the board top side over each Via to resist solder flow into the Via. The mask on the top side also minimizes outgassing during the solder reflow process.

For further information on this package design please refer to the application note "Surface Mount Assembly of AMKOR's MicroLeadFrame (MLF) Technology." This application note can be downloaded from AMKOR's website from the following URL [http://www.amkor.com/products/notes\\_papers/MLF\\_AppNote\\_0301.pdf](http://www.amkor.com/products/notes_papers/MLF_AppNote_0301.pdf). The application note provides detailed information on board mounting guidelines, soldering flow, rework process, etc.

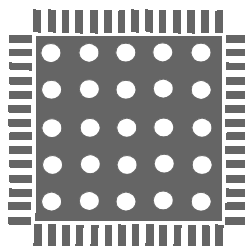
Figure 13-1 below display a cross-sectional area underneath the package. The cross section is of only one via. The solder paste template needs to be designed to allow at least 50% solder coverage. The thickness of the solder paste template should be 5 mil. It is recommended that "No Clean," type 3 solder paste is used for mounting the part. Nitrogen purge is recommended during reflow.



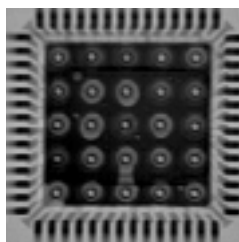
**Figure 13-1. Cross-Section of the Area Underneath the QFN Package**

Figure 13-2 is a plot of the solder mask pattern and Figure 13-3 displays an X-Ray image of the assembly (darker areas indicate solder.)





**Figure 13-2. Plot of the Solder Mask (White Area)**



**Figure 13-3. X-ray Image of the Assembly**

## 14.0 Other Design Considerations

Certain design considerations must be followed to ensure proper operation of the CY7C68300A. The following items should be taken into account when designing a USB device with the CY7C68300A.

### 14.1 Proper Power-up Sequence

Power must be applied to the CY7C68300A before, or at the same time as the ATA/ATAPI device. If power is supplied to the drive first, the CY7C68300A will start up in an undefined state. Designs that utilize separate power supplies for the CY7C68300A and the ATA/ATAPI device are not recommended.

### 14.2 IDE Removable Media Devices

The CY7C68300A does not fully support IDE removable media devices. Changes in media state are not reported to the operating system so users will be unable to eject/reinsert media properly. This may result in lost or corrupted data.

### 14.3 Devices With Small Buffers

The size of the ATA/ATAPI device's buffer can greatly affect the overall data transfer performance. Care should be taken to ensure that devices have large enough buffers to handle the flow of data to/from the drive. The exact buffer size needed depends on a number of variables, but a good rule of thumb is:

$$(\text{aprox min buffer size}) = (\text{data rate}) * (\text{seek time} + \text{rotation time} + \text{other})$$

where (other) may include things like time to switch heads, power-up a laser, etc. Devices with buffers that are too small to handle the extra data may perform considerably slower than expected.

## 15.0 Disclaimers, Trademarks, and Copyrights

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**Document History Page**

| Description Title: CY7C68300A EZ-USB AT2™ USB 2.0 to ATA/ATAPI Bridge<br>Document Number: 38-08031 |         |            |                 |   |
|--|---------|------------|-----------------|---|
| REV.   | ECN NO. | Issue Date | Orig. of Change | Description of Change   |
| **   | 124022  | 02/13/03   | GIR             | New Data Sheet  |
| *A   | 124857  | 06/06/03   | GIR             | Updated overall language/layout for "Final" status<br>Revised description of DPLUS pin in section 2.2<br>Revised text in sections 2.3.4, 2.3.5, and 2.3.6<br>Updated I <sub>SUSP</sub> and T <sub>RESET</sub> values in section 8.0<br>Updated <i>Figure 11-2</i> to include new QFN package drawing number<br>Swapped In and Out bulk endpoints in section 5.3 |
| *B   | 129094  | 08/18/03   | GIR             | Minor Change - Rework existing package drawing to improve clarity.  |