

October 19, 2001



**ISD-300A1**

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# **ISD-300A1**

## **High Speed USB to ATA ASIC**

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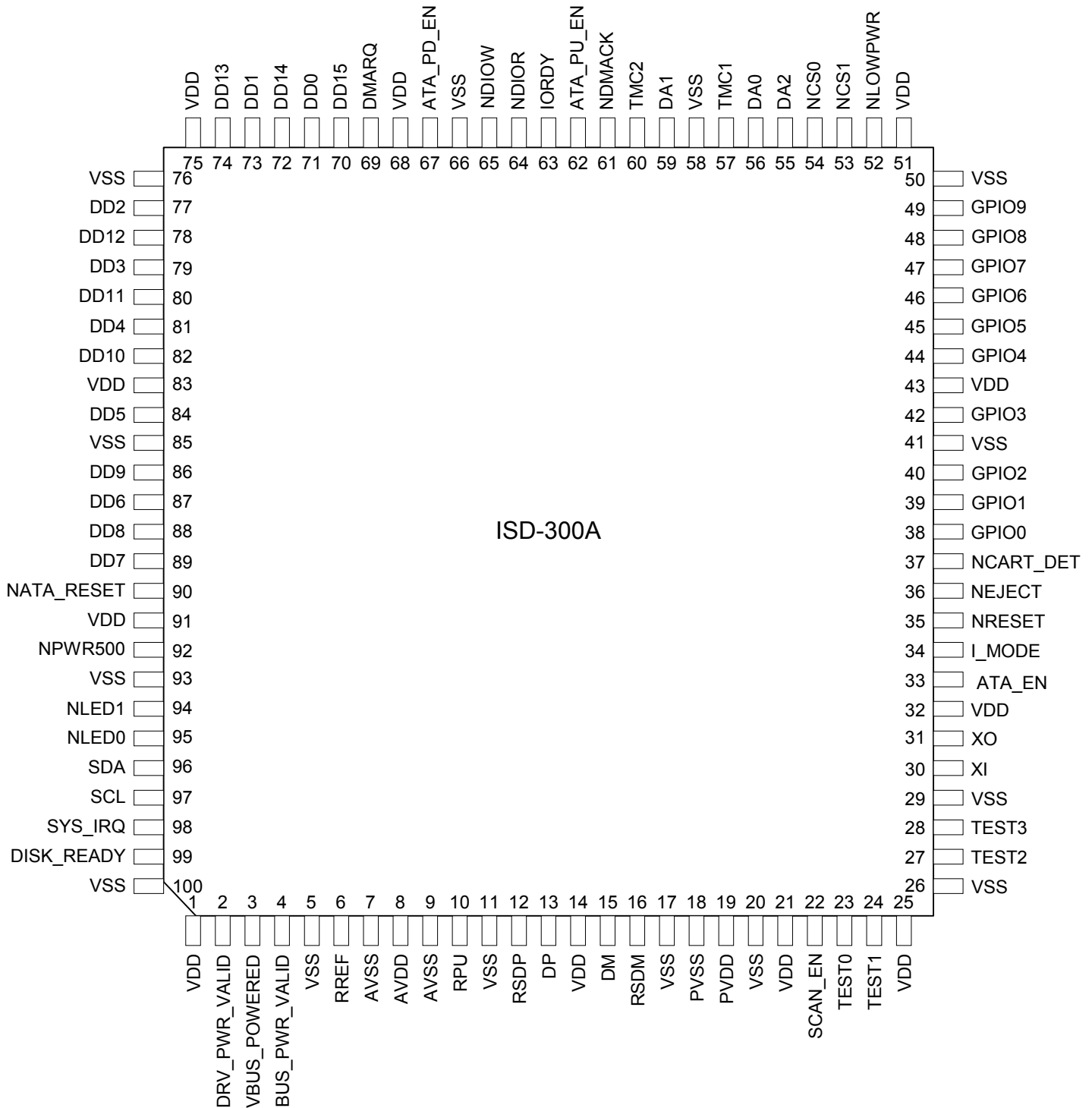
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## Document Revision History

|                    |                          |
|--------------------|--------------------------|
| Title              | ISD-300A1 ASIC Datasheet |
| Company            | Cypress Semiconductor    |
| Initial Revision # | 0.8                      |
| Creation Date/Time | January 16, 2001         |

| Revision | Date             | Comments                                                                           |
|----------|------------------|------------------------------------------------------------------------------------|
| 0.8      | January 16, 2001 | Initial revision                                                                   |
| 0.82     | March 28, 2001   | Grammar edits.                                                                     |
| 0.83     | April 18, 2001   | Identified I <sup>2</sup> C limitations                                            |
| 0.9      | June 19, 2001    | Rolled version to release draft                                                    |
| 1.0      | July 10, 2001    | Minor corrections, rolled to final release draft.                                  |
| 1.01     | Aug 1, 2001      | Added text to Figure 5 noting 45Ω impedance on D+ and D- for High-speed operation. |
| 1.02     | October 19, 2001 | Initial conversion to Cypress document                                             |

**Table 1 –Document Revision History**

**Pin Information****Figure 1 – Pin Layout**

| Pin Name       | TQFP<br>Pin #                          | Dir | Type                                                        | Description                                                                                                                                                                                                                                                                                                                     |
|----------------|----------------------------------------|-----|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NRESET         | 35                                     | I   | LVTTL, 5V tolerant, hysteresis                              | Active low. Asynchronous chip reset. To evoke reset, NRESET must be held asserted for a minimum of 1 ms after power is stable.                                                                                                                                                                                                  |
| XI             | 30                                     | I   | OSC input                                                   | 30 MHz crystal connection. 3.3V tolerant input.                                                                                                                                                                                                                                                                                 |
| XO             | 31                                     | O   | OSC output                                                  | 30 MHz crystal connection.                                                                                                                                                                                                                                                                                                      |
| TEST0 – TEST3  | 23, 24, 27, 28                         | I   | LVTTL, 5V tolerant, internal pull-down resistor             | Active high. ASIC fabrication and mfg. test mode select. The TEST pins must be a no-connect or set to 0x0 during normal operation.                                                                                                                                                                                              |
| SCAN_EN        | 22                                     | I   | LVTTL, 5V tolerant, internal pull-down resistor             | Active high. ASIC test – scan chain enable. SCAN_EN must be a no-connect or set to 0 during normal operation.                                                                                                                                                                                                                   |
| ATA_EN         | 33                                     | I   | LVTTL, 5V tolerant, hysteresis                              | Active high. ATA interface enable. Allows ATA bus sharing with other host devices.<br>Setting ATA_EN=1 enables the ATA interface for normal operation. Disabling ATA_EN 3-states (high-Z) the ATA interface and halts the ATA interface state machine logic.                                                                    |
| SYS_IRQ        | 98                                     | I   | LVTTL, 5V tolerant, internal pull down resistor, hysteresis | Active high. USB interrupt. SYS_IRQ controls ISD-300A1 responses to USB interrupt pipe requests. Setting SYS_IRQ = 1 enables the return of interrupt data to the host.                                                                                                                                                          |
| DISK_READY     | 99                                     | I   | LVTTL, 5V tolerant, hysteresis                              | Active high. Indicates device is powered and ready to begin accepting ATA / ATAPI commands.                                                                                                                                                                                                                                     |
| NLOWPWR        | 52                                     | O   | 12 mA LVTTL, 5V tolerant                                    | Active low. Indicates when the ISD-300A1 is in a low power state of operation. Open drain during normal operation.                                                                                                                                                                                                              |
| NPWR500        | 92                                     | O   | 12 mA LVTTL, 5V tolerant                                    | Active low. Indicates the USB host has enabled use of VBUS power (USB configuration set to 1) up to the requested amount in the USB descriptor <i>bMaxPower</i> entry. VBUS powered devices must condition power circuitry with the state of the VBUS_POWERED signal for correct operation. Open drain during normal operation. |
| VBUS_POWERED   | 3                                      | I   | LVTTL, 5V tolerant, hysteresis                              | Active high. Indicates the amount of VBUS current the system is capable of consuming (typically <= 100 mA OR <= 500 mA)                                                                                                                                                                                                         |
| VBUS_PWR_VALID | 4                                      | I   | LVTTL, 5V tolerant, hysteresis                              | Active high. Indicates that VBUS power is present.                                                                                                                                                                                                                                                                              |
| DRV_PWR_VALID  | 2                                      | I   | LVTTL, 5V tolerant, hysteresis                              | Power / connection indication in hybrid power systems (VBUS ISD-300A1, brick device). Functionality and active polarity is controlled with configuration data. Set DRV_PWR_VALID = 0 if the functionality is not utilized.                                                                                                      |
| GPIO0 – GPIO9  | 38, 39, 40, 42, 44, 45, 46, 47, 48, 49 | IO  | 12 mA LVTTL, 5V tolerant, internal pull-down resistor       | General purpose IO pins. Configuration data provides independent 3-state control for each GPIO pin. The GPIO pins may be left as no-connect if functionality is not utilized.                                                                                                                                                   |
| NCART_DET      | 37                                     | I   | LVTTL, 5V tolerant, hysteresis                              | Active low. Media present indication. If remote wakeup is enabled by the USB host, a state change on this pin will cause the ISD-300A1 to perform a USB remote wakeup event. Filtered internally by ISD-300A1. Set NCART_DET = 1 if the functionality is not utilized.                                                          |

| Pin Name   | TQFP<br>Pin #                                                  | Dir | Type                           | Description                                                                                                                                                                                                                                                                                                                         |
|------------|----------------------------------------------------------------|-----|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NEJECT     | 36                                                             | I   | LVTTL, 5V tolerant, hysteresis | Active low. Media eject requested. If remote wakeup is enabled by the USB host, a state change on this pin will cause the ISD-300A1 to perform a USB remote wakeup event. Filtered internally by ISD-300A1. Set NEJECT = 1 if the functionality is not utilized.                                                                    |
| SCL        | 97                                                             | O   | 6 mA LVTTL, 5V tolerant        | I <sup>2</sup> C clock. Open drain during normal operation. This pin may be left as a no-connect pin if the I <sup>2</sup> C interface is not utilized.                                                                                                                                                                             |
| SDA        | 96                                                             | IO  | 6 mA LVTTL, 5V tolerant        | I <sup>2</sup> C address/data. Open drain during normal operation. An external pull-up resistor is required for correct operation in all ISD-300A1 modes of operation.                                                                                                                                                              |
| DMARQ      | 69                                                             | I   | LVTTL, 5V Fail Safe            | ATA control.                                                                                                                                                                                                                                                                                                                        |
| NDMACK     | 61                                                             | O   | 6 mA LVTTL, 5V Fail Safe       | ATA control.                                                                                                                                                                                                                                                                                                                        |
| DA0 – DA2  | 56, 59, 55                                                     | O   | 6 mA LVTTL, 5V Fail Safe       | ATA Address.                                                                                                                                                                                                                                                                                                                        |
| DD0 – DD15 | 71, 73, 77, 79, 81, 84, 87, 89, 88, 86, 82, 80, 78, 74, 72, 70 | IO  | 6 mA LVTTL, 5V Fail Safe       | ATA Data.                                                                                                                                                                                                                                                                                                                           |
| NDIOR      | 64                                                             | O   | 6 mA LVTTL, 5V Fail Safe       | ATA control.                                                                                                                                                                                                                                                                                                                        |
| NDIOW      | 65                                                             | O   | 6 mA LVTTL, 5V Fail Safe       | ATA control.                                                                                                                                                                                                                                                                                                                        |
| NCS0, NCS1 | 54, 53                                                         | O   | 6 mA LVTTL, 5V Fail Safe       | ATA Chip Selects.                                                                                                                                                                                                                                                                                                                   |
| IORDY      | 63                                                             | I   | LVTTL, 5V Fail Safe            | ATA control.                                                                                                                                                                                                                                                                                                                        |
| ATA_PU_EN  | 62                                                             | O   | 6 mA LVTTL, 5V Fail Safe       | Active high. ATA IORDY pull-up connection. Driven low during USB suspend, 3-stated (hi-Z) when ATA_EN=0.                                                                                                                                                                                                                            |
| ATA_PD_EN  | 67                                                             | O   | 6 mA LVTTL, 5V Fail Safe       | Active low. ATA DMARQ pull-down connection. 3-state (hi-Z) when ATA_EN=0.                                                                                                                                                                                                                                                           |
| NATA_RESET | 90                                                             | O   | 6 mA LVTTL, 5V Fail Safe       | Active low. ATA reset.                                                                                                                                                                                                                                                                                                              |
| NLED0      | 95                                                             | O   | 12 mA LVTTL                    | Active low. LED drive to indicate USB bus speed. Active when utilizing HS, inactive during FS or USB suspend or other low power modes of operation. Open drain during normal operation. Leave as a no-connect pin if functionality is not utilized.                                                                                 |
| NLED1      | 94                                                             | O   | 12 mA LVTTL                    | Active low. LED drive to indicate status of device initialization. Flashing when initializing is in progress, solid when the device is initialized, and inactive during USB suspend or other low power modes of operation. Open drain during normal modes of operation. Leave as a no-connect pin if functionality is not utilized. |
| I_MODE     | 34                                                             | I   | LVTTL, 5V Tolerant             | Active high. Indicates ISD-300A1 configuration / USB descriptor information is obtained using the ATA vendor specific Identify command (FBh)                                                                                                                                                                                        |
| RSDM       | 16                                                             | O   | USB IO                         | USB full speed output buffer (D–). RSDM also functions as a current sink for termination during HS operation.                                                                                                                                                                                                                       |



| Pin Name | TQFP<br>Pin #                                          | Dir | Type       | Description                                                                                                   |
|----------|--------------------------------------------------------|-----|------------|---------------------------------------------------------------------------------------------------------------|
| DM       | 15                                                     | IO  | USB IO     | USB high speed IO buffer (D-).                                                                                |
| DP       | 13                                                     | IO  | USB IO     | USB high speed IO buffer (D+).                                                                                |
| RSDP     | 12                                                     | O   | USB IO     | USB full speed output buffer (D+). RSDP also functions as a current sink for termination during HS operation. |
| RPU      | 10                                                     | O   | USB output | RPU sources power for the 1.5K ohm resistor attached to D+ during full speed operation.                       |
| RREF     | 6                                                      |     | Analog     | PLL voltage reference. Current source for 9.1K ohm resistor (1%) connected to AVSS.                           |
| TMC1     | 57                                                     | I   | ASIC test  | Fabrication only. Connect to VSS.                                                                             |
| TMC2     | 60                                                     | I   | ASIC test  | Fabrication only. Connect to VSS.                                                                             |
| PVDD     | 19                                                     |     |            | Analog 3.3V supply (PLL)                                                                                      |
| PVSS     | 18                                                     |     |            | Analog 3.3V ground (PLL)                                                                                      |
| AVDD     | 8                                                      |     |            | Analog 3.3V supply                                                                                            |
| AVSS     | 7, 9                                                   |     |            | Analog ground                                                                                                 |
| VDD      | 1, 14, 21, 25, 32, 43, 51, 68, 75, 83, 91              |     |            | 3.3V digital supply                                                                                           |
| VSS      | 5, 11, 17, 20, 26, 29, 41, 50, 58, 66, 76, 85, 93, 100 |     |            | Digital ground                                                                                                |

Table 2 – Pin Descriptions

## Overview

- **Compact 100 pin TQFP package – No Requirement For Additional External ROM Or RAM**
- **USB Mass Storage Class Bulk-Only Specification Compliant (Version 1.0)**
- **5V Tolerant Inputs, 3.3V Output Drive, Single 3.3V Supply Voltage Requirement Simplifies System Integration**
- **Command Queuing Hooks In Hardware Allow Near Theoretical USB Data Transfer Rates**
- **USB Version 2.0 Compliant**
  - ◆ **Integrated USB Transceiver**
  - ◆ **High Speed (480 Mbit) And Full Speed (12 Mbit) Support**
  - ◆ **USB Suspend / Resume, Remote Wakeup Support**
- **Two Power Modes Of Operation**
  - ◆ **USB Bus Powered**
  - ◆ **Self Powered**
- **Flexible USB Descriptor And Configuration Retrieval Source**
  - ◆ **I<sup>2</sup>C Serial ROM Interface**
  - ◆ **ATA Interface Using Vendor Specific ATA Command (FBh) Implemented On ATAPI Or ATA Device**
  - ◆ **Default On-Chip ROM Contents For Manufacturing / Development**
- **Large 8 Kbyte Data Buffer Maximizes ATA / ATAPI Data Transfer Rate**
- **ATA Interface Supports ATA PIO Modes 0-4, UDMA Modes 0-4 Of Operation (Multi-word DMA Not Supported). ATA Interface Operation Mode Is Automatically Selected During Device Initialization Or Manually Programmed With Configuration Data**
- **Automatic Detection Of Either Master or Slave ATA/ATAPI Devices**
- **Event Notification Via Vendor Specific ATA Command**
  - ◆ **Configurable ATA Command**
  - ◆ **Input Pins For Media Cartridge Detection And Ejection Request**
  - ◆ **USB Bus State Indications (Reset, FS/HS Mode Of Operation, Suspend/Resume)**
- **Multiple LUN support**
- **ATA Translation Provides Seamless ATA Support with Standard MSC Drivers**
  - ◆ **Additional ATA Command Support Provided By Vendor Specific ATACBs (ATA Command Blocks Utilizing the MSC Command Block Wrapper)**
- **Provisions To Share ATA Bus With Other Hosts**
- **Manufacturing Interconnect Test Support Provided With Vendor Specific USB Commands**
  - ◆ **Read / Write Access To Relevant ASIC Pins**
- **Utilizes Inexpensive 30Mhz Crystal For Clock Source**

## Introduction

The ISD-300A1 implements a 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. Hardware design allows CBW command queuing, which with vendor specific drivers allows data transfer rates of up to the USB theoretical maximum.

The USB port of the ISD-300A1 is connected to a host computer directly or via the downstream port of a USB hub. Host software issues commands and data to the ISD-300A1 and receives status and data from the ISD-300A1 using standard USB protocol.

The ATA/ATAPI port of the ISD-300A1 is connected to a mass storage device. A large 8 Kbyte buffer maximizes ATA/ATAPI data transfer rates by minimizing losses due to device seek times. The ATA interface supports ATA PIO modes 0-4, and Ultra Mode DMA modes 0-4.

The device initialization process is configurable, enabling the ISD-300A1 to initialize most ATA/ATAPI devices without software intervention. The ISD-300A1 can also be configured to allow software initialization of a device if initialization requirements are not supported by ISD-300A1 algorithms.

## ISD-300A1 Configuration

Certain timing parameters and operational modes are configurable by external configuration data. USB descriptor information is also retrieved externally. ISD-300A1 configuration data should not be confused with the USB Configuration Descriptor data.

### ISD-300A1 Configuration and USB Descriptor Sources

ISD-300A1 configuration and USB descriptor data can be retrieved from three sources. **Table 3** indicates the method of determining which data source is used.

ISD-300A1 configuration and USB descriptor data can be supplied from an I<sup>2</sup>C serial memory device. The ISD-300A1 can address 2 Kbytes of I<sup>2</sup>C data, but ISD-300A1 configuration and USB descriptor information are limited to 512 bytes maximum. Unused register space in the I<sup>2</sup>C serial memory device may be used for product specific data storage. Note that no descriptor is allowed to span multiple pages within the I<sup>2</sup>C serial memory device. The ISD-300A1 provides support for the 24LC01-16 EEPROM family.

Alternatively, configuration and descriptor data can be supplied by an attached mass storage device through a vendor-specific Identify (FBh) ATA command. The ISD-300A1 provides 256 bytes of internal RAM for FBh data storage.

The ISD-300A1 also contains an internal set of ISD-300A1 configuration and USB descriptors. Retrieval of internal ROM data will occur under the specific circumstances outlined in **Table 3**. The internal descriptors may only be used during manufacturing, as the internal ROM values disable some features required for normal operation to aid use in a manufacturing environment. *NOTE: The internal descriptors do not provide a unique serial number (required for USB Mass Storage Class compliance), and therefore cannot be used for shipping products. An external I<sup>2</sup>C memory device or utilization of the vendor specific FBh identify command is required to correctly configure the ISD-300A1 for operation and provide a unique serial number for MSC compliance.*

**Table 3** describes how the ISD-300A1 determines USB descriptor / configuration sources.

| <b>I<sup>2</sup>C MODE<br/>Pin Active</b> | <b>I<sup>2</sup>C<br/>Memory<br/>Device<br/>present</b> | <b>Signature<br/>Check<br/>Passes</b> | <b>ISD-300A1 Configuration and USB Descriptor Retrieval</b>                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------|---------------------------------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No                                        | No                                                      | X                                     | In this mode, the ISD-300A1 uses internal ROM contents for USB descriptor information and configuration register values. <i>This mode is for debug / manufacturing operation only. Not for shipping products.</i>                                                                                                                                                                                          |
| Yes                                       | X                                                       | No                                    | In this mode, the ISD-300A1 uses internal ROM contents for USB descriptor information. Configuration register values are loaded from internal ROM. <i>This is not a valid mode of operation.</i>                                                                                                                                                                                                           |
| Yes                                       | X                                                       | Yes                                   | The ISD-300A1 retrieves all Descriptor and Configuration values from the vendor-specific Identify (FBh) data. The ISD-300A1 is configured using internal ROM values until FBh data becomes available.                                                                                                                                                                                                      |
| No                                        | Yes                                                     | No                                    | The ISD-300A1 uses internal ROM contents for USB descriptor information. Configuration register values are loaded from internal ROM. In this mode of operation, any ISD-300A1 vendor specific configuration access causes the ISD-300A1 to recheck the signature field. Once the signature check passes, SROM data is returned for USB descriptors requests. <i>This is not a valid mode of operation.</i> |
| No                                        | Yes                                                     | Yes                                   | The ISD-300A1 retrieves all Descriptor and Configuration values from the I <sup>2</sup> C memory device. The ISD-300A1 is configured using values present in the I <sup>2</sup> C memory device data.                                                                                                                                                                                                      |

**Table 3 – ISD-300A1 Configuration and Descriptor Sources**

### Internal ROM Contents

Internal on-board ROM addresses and the contents of those locations are shown in the **ISD-300A1 Configuration/USB Descriptor Data Formatting** section on page 9 of this document.

Internal ROM is necessary for manufacturing activities. Internal ROM contents allow the host to enumerate the ISD-300A1 when an un-programmed I<sup>2</sup>C memory device is connected.

### I<sup>2</sup>C Memory Device Interface

The ISD-300A1 supports a subset of the “slow mode” specification (100 KHz) required for 24LC01-16 EEPROM family device support. Features such as “Multi-Master”, “Clock Synchronization” (the SCL pin is output only), “10-bit addressing”, and “CBUS device support”, are NOT supported. Vendor specific USB commands allow the ISD-300A1 to address up to 2 K bytes of data (although configuration / descriptor information is limited to 512 bytes of register space).

Following release of NRESET, the ISD-300A1 waits 50ms, then checks for I<sup>2</sup>C device presence. If an I<sup>2</sup>C device is present but does not pass signature check (first two data bytes must equal 0x4D54), the ISD-300A1 re-tests the signature with each vendor specific USB load or read access of configuration bytes 0 and 1. Once the signature check passes, I<sup>2</sup>C data is returned for USB descriptor requests. If an I<sup>2</sup>C device is detected initially, it is always assumed present until the next reset cycle (NRESET). If an I<sup>2</sup>C device is present, a lack of an ACK response when required causes the ISD-300A1 to stall that USB request. The ISD-300A1 will attempt the access again with the next USB request.

Programming of the I<sup>2</sup>C memory device can be accomplished using an external device programmer, ISD-300A1 supported vendor specific USB commands, or using a “bed of nails”. An example of I<sup>2</sup>C memory device data formatting is shown in **Appendix A – Example EEPROM or FBh Identify Data Contents**.

**Vendor-Specific Identify Data (FBh)**

If an I<sup>2</sup>C memory device is not utilized, the ISD-300A1 must be configured to accept descriptor and configuration data from an attached device using a vendor-specific identify command. (See **I\_MODE Pin** on page 41)

For vendor specific identify data (FBh) to be deemed valid, it must pass the signature check (first two data bytes must equal 0x4D54). In the event of a failed signature check, the ISD-300A1 will respond to all USB GET\_DESCRIPTOR or GET\_CONFIGURATION commands by returning defaults contained in internal ROM.

An example of vendor specific identify data (FBh) formatting is shown in **Appendix A – Example EEPROM or FBh Identify Data Contents** on page 51.

**ISD-300A1 Configuration/USB Descriptor Data Formatting**

Data formatting for all ISD-300A1 configuration data and USB descriptor data is identical for internal ROM, I<sup>2</sup>C memory device data, and vendor specific identify data (FBh). The following sections show how the ISD-300A1 configuration data is mapped into address space. The **USB Interface** section on page 14 explains formatting of USB descriptor data.

**ISD-300A1 Configuration Data**

The ISD-300A1 Configuration Data is located at addresses 0x0 to 0xF of the Descriptor/Configuration data contents. Configuration Data determine certain parameters and operational modes used by the ISD-300A1. Any vendor specific USB command write operation to I<sup>2</sup>C memory device configuration space will simultaneously update internal configuration register values as well. If the I<sup>2</sup>C memory device is programmed without vendor specific USB commands, the ISD-300A1 must be asynchronously reset (NRESET) before configuration data is reloaded.

Formatting is identical for the internal ROM, the I<sup>2</sup>C memory device, and FBh data. ISD-300A1 configuration data is loaded into internal registers, regardless of the original data source.

| Address | Field Name                                     | Description                                                                                                                                                                                                                                                                                                                                                                               | On-board ROM Defaults |
|---------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 0x0     | I <sup>2</sup> C memory device Signature (LSB) | LSB I <sup>2</sup> C memory device signature byte.<br><b>Register does not exist in HW</b>                                                                                                                                                                                                                                                                                                | 0x54                  |
| 0x1     | I <sup>2</sup> C memory device Signature (MSB) | MSB I <sup>2</sup> C memory device signature byte.<br><b>Register does not exist in HW</b>                                                                                                                                                                                                                                                                                                | 0x4D                  |
| 0x2     | Event Notification                             | ATAPI event notification command. Setting this field to 0x00 disables this feature.                                                                                                                                                                                                                                                                                                       | 0x00                  |
| 0x3     | APM Value                                      | ATA Device Automatic Power Management Value. If an attached ATA device supports APM and this field contains other than 0x00, the Initialization state machines will issue a SET FEATURES command to Enable APM with the register value during the drive initialization process. Setting APM Value to 0x00 disables this functionality. This register value is ignored with ATAPI devices. | 0x00                  |
| 0x4     | ATA Initialization Timeout                     | Time in 128 millisecond granularity before the ISD-300A1 stops polling the ALT STAT register for reset complete and restarts the reset process (0x80 = 16.4 seconds).                                                                                                                                                                                                                     | 0x80                  |



| Address | Field Name                                                                                                                                                                                | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | On-board ROM Defaults |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 0x5     | USB Bus Mode<br><br>ATAPI Command Block Size<br><br>Master/Slave Selection<br><br>ATAPI Reset<br><br>ATA_NATAPI<br><br>Force USB FS<br><br>VS / MSC SOFT_RESET<br><br>DISK_READY Polarity | Bit (7) – read only.<br>USB bus mode of operation<br>0 USB bus is operating in full speed mode (12 Mbit/sec).<br>1 USB bus is operating in high speed mode (480 Mbit/sec).<br><br>Bit (6)<br>CBW Command Block Size.<br>0 12 byte ATAPI CB<br>1 16 byte ATAPI CB<br><br>Bit (5)<br>Device number selection. This bit is valid only when “Skip ATA/ATAPI Device Initialization” is active. Under ISD-300A1 control (“Skip ATA/ATAPI Device Initialization = ‘0’”), the value is ignored.<br>0 Drive 0 (master)<br>1 Drive 1 (slave)<br><br>Bit (4)<br>ATAPI reset during drive initialization.<br>Setting this bit enables the ATAPI reset algorithm in the drive initialization state machines<br><br>Bit (3) – read only.<br>Indicates if an ATA or ATAPI device is detected<br>0 ATAPI device<br>1 ATA device or possible device initialization failure.<br><br>Bit(2)<br>Force USB full speed only operation.<br>Setting this bit prevents the ISD-300A1 from negotiating HS operation during USB reset events<br>0 Normal operation – allow HS negotiation during USB reset<br>1 USB FS only – do not allow HS negotiation during USB reset<br><br>Bit(1)<br>Vendor Specific / MSC SOFT_RESET control.<br>0 Vendor Specific USB command utilized for SOFT_RESET<br>1 Mass Storage Class USB command utilized for SOFT_RESET<br><br>Bit (0)<br>DISK_READY active polarity. DISK_READY Polarity is ignored if I_MODE is set to 1. During I_MODE operation DISK_READY polarity is active high.<br>0 Active high polarity<br>1 Active low polarity | 0x00                  |
| 0x6     | ATA Command Designator (Byte 0, LSB)                                                                                                                                                      | Value in CBW CB field that designates if the CB is decoded as vendor specific ATA commands instead of the ATAPI command block.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0x24                  |
| 0x7     | ATA Command Designator (Byte 1, MSB)                                                                                                                                                      | Value in CBW CB field that designates if the CB is decoded as vendor specific ATA commands instead of the ATAPI command block.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0x24                  |



| Address | Field Name                             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | On-board ROM Defaults |
|---------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 0x8     | Initialization Status                  | Bit (7) – read only<br>Drive Initialization Status<br>If set, indicates the drive initialization sequence state machine is active                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0x00                  |
|         | Force ATA Device                       | Bit (6)<br>Allows software to manually enable ATA Translation with devices that do not support ISD-300A1 device initialization algorithms. <i>Note: Force ATA Device must be set '1' in conjunction with Skip ATA/ATAPI Device Initialization and ATA Translation Enable.</i> Software must issue an INQUIRY command followed with a MSC reset to allow the ISD-300A1 to parse drive information and optimize system performance and operation. Force ATA Device should be set '0' for devices that support ISD-300A1 device initialization algorithms.                                                                          |                       |
|         | Skip ATA / ATAPI Device Initialization | Bit (5)<br>Skip_Init – This bit should be cleared for I_MODE operation. The host driver must initialize the attached device (if required) when this bit is set. <i>Note: For ATAPI devices, if Skip_Init is set the host driver must issue an IDENTIFY command utilizing ATACBs to allow the ISD-300A1 to parse drive information and optimize system performance and operation. Refer to bmATACBActionSelect in the ATA Command Block - Field Descriptions section on page 30 for further information.</i><br>0 normal operation<br>1 only reset the device and write the device control register prior to processing commands. |                       |
|         | Obsolete                               | Bit (4:3) – Shall be set to '0'                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |
|         | Last LUN Identifier                    | Bits (2:0)<br>Maximum number of LUNs device supports.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                       |
| 0x9     | ATA_EN                                 | Bits (7) – read only.<br>Current logic state of the ATA_EN pin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0x01                  |
|         | Obsolete                               | Bit (6:1) – Shall be set to 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                       |
|         | SRST Enable                            | Bit (0)<br>SRST reset during drive initialization. Setting this bit enables the SRST reset algorithm in the drive initialization state machines.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                       |
| 0xA     | ATA Data Assert                        | Bits (7:4)<br>Standard values for ATA compliant devices and a 30.0 MHz system clock (in binary). <i>Note: These values are only valid when the Override PIO Timing configuration bit is set.</i><br>mode 0 0101 (5+1)*33.33 = 200 ns<br>mode 1 0011 (3+1)*33.33 = 133 ns<br>mode 2 0011 (3+1)*33.33 = 133 ns<br>mode 3 0010 (2+1)*33.33 = 100 ns<br>mode 4 0010 (2+1)*33.33 = 100 ns                                                                                                                                                                                                                                             | 0x5C                  |
|         | ATA Data Recover                       | Bits (3:0)<br>ATA cycle times are calculated using Data Assert and Data Recover values. Standard recover values and cycle times for ATA compliant devices and a 30.0 MHz system clock (in binary). <i>Note: These values are only valid when the Override PIO Timing configuration bit is set.</i><br>mode 0 1100 (4+1)+(12+1)*33.33 = 600 ns<br>mode 1 0111 (3+1)+(7+1)*33.33 = 400 ns<br>mode 2 0011 (2+1)+(3+1)*33.33 = 233 ns<br>mode 3 0010 (2+1)+(2+1)*33.33 = 200 ns<br>mode 4 0000 (2+1)+(0+1)*33.33 = 133 ns                                                                                                            |                       |



| Address | Field Name                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | On-board ROM Defaults |
|---------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 0xB     | ATA Data Setup             | Bits (7:5)<br>Setup time is only incurred on the first data cycle of a burst. Standard values for ATA compliant devices and a 30.0 MHz system clock are (in binary):<br><i>Note: These values are only valid when the Override PIO Timing configuration bit is set.</i><br>mode 0    010 $(2+1)*33.33 = 133 \text{ ns}$<br>mode 1    001 $(1+1)*33.33 = 66 \text{ ns}$<br>mode 2    001 $(1+1)*33.33 = 66 \text{ ns}$<br>mode 3    001 $(1+1)*33.33 = 66 \text{ ns}$<br>mode 4    000 $(0+1)*33.33 = 33 \text{ ns}$ | 0x40                  |
|         | Drive Power Valid Polarity | Bit (4)<br>Controls the polarity of DRV_PWR_VALID pin<br>0    Active low ("connector ground" indication)<br>1    Active high (power indication from device)                                                                                                                                                                                                                                                                                                                                                         |                       |
|         | Override PIO Timing        | Bit (3)<br>This field is used in conjunction with ATA Data Setup, ATA Data Assertion, ATA Data Recover, and PIO Mode Selection fields.<br>0    Use timing information acquired from the Drive<br>1    Override device timing information with configuration values                                                                                                                                                                                                                                                  |                       |
|         | Drive Power Valid Enable   | Bit (2)<br>Enable for the DRV_PWR_VALID pin. Drive Power Valid should only be enabled in cable applications where the ISD-300A1 is VBUS powered.<br>0    pin disabled (most systems)<br>1    pin enabled                                                                                                                                                                                                                                                                                                            |                       |
|         | ATA Read Kludge            | Bit(1)<br>PIO data read 3-state control. Enabling this will 3-state (hi-Z) the ATA data bus during PIO read operations while addressing the data register. In most applications this bit is set to '0'. This functionality is provided as a solution for devices that erroneously drive the ATA data bus continuously during PIO data register reads.<br>0    Normal operation as per ATA/ATAPI interface specification.<br>1    3-state (hi-Z) DD[15:0] during PIO data register reads.                            |                       |
|         | I_MODE                     | Bit (0) – read only<br>This bit reflects the current state of the I_MODE input pin.                                                                                                                                                                                                                                                                                                                                                                                                                                 |                       |



| Address | Field Name             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | On-board ROM Defaults |
|---------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 0xC     | SYS_IRQ                | Bits(7) – read only<br>This bit reflects the current logic state of the SYS_IRQ input.                                                                                                                                                                                                                                                                                                                                                                                                         | 0x00                  |
|         | DISK_READY             | Bit(6) – read only<br>This bit reflects the current logic state of the DISK_READY input.                                                                                                                                                                                                                                                                                                                                                                                                       |                       |
|         | ATA Translation Enable | Bit(5)<br>Enable ATAPI to ATA protocol translation enable. If enabled, AND if an ATA device is detected, ATA translation is enabled. <i>Note: If Skip ATA/ATAPI Device Initialization is set '1', Force ATA Device must also be set '1' in order to utilize ATA translation. Software must further issue an INQUIRY command followed with an MSC reset to enable ATA translation operation.</i><br>0 ATA Translation Disabled<br>1 ATA Translation Enable                                      |                       |
|         | ATA UDMA Enable        | Bit(4)<br>Enable Ultra Mode data transfer support for ATA devices. If enabled, AND the ATA device reports UDMA support, the ISD-300A1 will utilize UDMA data transfers.<br>0 Disable ATA device UDMA support<br>1 Enable ATA device UDMA support                                                                                                                                                                                                                                               |                       |
|         | ATAPI UDMA Enable      | Bit(3)<br>Enable Ultra Mode data transfer support for ATAPI devices. If enabled, AND the ATAPI device reports UDMA support, the ISD-300A1 will utilize UDMA data transfers.<br>0 Disable ATAPI device UDMA support<br>1 Enable ATAPI device UDMA support                                                                                                                                                                                                                                       |                       |
|         | ROM UDMA Mode          | Bits(2:0)<br>ROM UDMA Mode indicates the highest UDMA mode supported by the product. The ISD-300A1 will utilize the lesser of ROM UDMA Mode or the highest mode supported by the device. <i>Note: UDMA read operation mode timing is controlled by the device.</i><br>mode 0 000 133.3 ns per 16-bit word write<br>mode 1 001 100 ns per 16-bit word write<br>mode 2 010 66.7 ns per 16-bit word write<br>mode 3 011 66.7 ns per 16-bit word write<br>mode 4 100 33.3 ns per 16-bit word write |                       |

| Address | Field Name                         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                     | On-board ROM Defaults |
|---------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 0xD     | PIO Mode Selection                 | Bits (7:5)<br>PIO Mode Selection. The PIO mode reported back to the device if the Override PIO Timing configuration bit is set. This field represents the PIO mode of operation configured by the ATA Data Setup, ATA Data Assertion, ATA Data Recover, and Override PIO Timing fields.<br>mode 0    000<br>mode 1    001<br>mode 2    010<br>mode 3    011<br>mode 4    100                                                                    | 0x03                  |
|         | Skip Pin Reset                     | Bit (4)<br>Skip ATA_NRESET assertion. <i>Note: SRST Enable must be set in conjunction with Skip Pin Reset.</i> Setting this bit causes the Initialize algorithm to bypass ATA_NRESET assertion unless a DISK_READY 0=>1 event occurred. All other reset events utilize SRST as the drive reset mechanism.<br>0        Allow ATA_NRESET assertion for all resets<br>1        Disable ATA_NRESET assertion except for drive power-on reset cycles |                       |
|         | General Purpose IO                 | Bits (3:2)<br>GPIO[9:8] input / output control<br>Writing this register controls the output state of the GPIO pin (if the 3-state control is enabled)<br>Reading this register returns the logic value from the GPIO pin                                                                                                                                                                                                                        |                       |
|         | General Purpose IO 3-state control | Bits (1:0)<br>GPIO[9:8] 3-state control<br>0    Output enabled (GPIO pin is an output)<br>1    3-state(hi-Z) (GPIO pin is an input)                                                                                                                                                                                                                                                                                                             |                       |
| 0xE     | General Purpose IO                 | Bits(7:0)<br>GPIO[7:0] input / output control<br>Writing this register controls the output state of the GPIO pin (if the 3-state control is enabled)<br>Reading this register returns the logic value from the GPIO pin                                                                                                                                                                                                                         | 0x00                  |
| 0xF     | General Purpose IO 3-state control | Bits(7:0)<br>GPIO[7:0] 3-state control<br>0    Output enabled (GPIO pin is an output)<br>1    3-state (hi-Z) (GPIO pin is an input)                                                                                                                                                                                                                                                                                                             | 0xFF                  |

**Table 4 – ISD-300A1 Configuration Bytes**

## USB Interface

The ISD-300A1 is electrically and logically compliant with the *Universal Serial Bus Specification Revision 2.0*.

## Descriptors

### Supported Descriptors

- *Device*
- *USB Device Qualifier*

The ISD-300A1 requires only one Device Qualifier descriptor. The information returned is identical for full and high speed modes of operation.

- *Standard Configuration*

The ISD-300A1 supports two configurations, depending on the mode of operation. See the **VBUS\_POWERED** section on page 38 for more information.

Configuration bus-powered. This configuration descriptor is reported if the VBUS\_POWERED signal is set active, typically indicating more than 100 mA of current is sourced from VBUS.

Configuration non-bus-powered. This configuration descriptor is reported if the VBUS\_POWERED input is set inactive, indicating the system is sourcing 100 mA or less of current from VBUS (self powered system).

- *Other Speed Configuration*

The ISD-300A1 supports two configurations, depending on the mode of operation. See the **VBUS\_POWERED** section on page 38 for more information.

Other Speed Configuration bus-powered. This configuration descriptor is reported if the VBUS\_POWERED signal is active.

Other Speed Configuration non-bus-powered. This configuration descriptor is reported if the VBUS\_POWERED input is inactive.

- *Interface*

The ISD-300A1 supports two interface descriptors, both FS (full speed) and HS (high speed), each with four possible endpoints.

- *Endpoint*

The ISD-300A1 supports the following endpoints:

Default Control endpoint. Accessible as endpoint 0.

Bulk Out endpoint. Accessible as endpoint 1.

Bulk In endpoint. Accessible as endpoint 2.

Interrupt endpoint. Accessible as endpoint 3.

- *String*

The ISD-300A1 supports a set of class and vendor-specific string descriptors. For more information on strings, refer to the **String Descriptors** section on page 19 of this document.

## Descriptor Data Format

### *Device Descriptor*

There is only one device descriptor for each USB device. This descriptor gives USB information about the ISD-300A1 device such as device class and device subclass, etc.

| Address | Field Name       | Description                                               | On-board Defaults |
|---------|------------------|-----------------------------------------------------------|-------------------|
| 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.                                             | 0xFF              |
| 0x15    | bDeviceSubClass  | Device subclass.                                          | 0x00              |
| 0x16    | bDeviceProtocol  | Device protocol.                                          | 0xFF              |
| 0x17    | bMaxPacketSize0  | USB packet size supported for default pipe.               | 0x40              |
| 0x18    | idVendor (LSB)   | Vendor ID.                                                | 0xAB              |
| 0x19    | idVendor (MSB)   |                                                           | 0x05              |
| 0x1A    | idProduct (LSB)  | Product ID.                                               | 0x6A              |
| 0x1B    | idProduct (MSB)  |                                                           | 0x00              |
| 0x1C    | bcdDevice (LSB)  | Device release number in BCD LSB (product release number) | 0x00              |

| Address | Field Name         | Description                                                                                                                                                                                                                                    | On-board Defaults           |
|---------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 0x1D    | bcdDevice (MSB)    | Device release number in BCD MSB (silicon release number). <i>NOTE: This field entry is always returned from internal ROM contents, regardless of the descriptor source.</i>                                                                   | 0x10 (300A)<br>0x11 (300A1) |
| 0x1E    | iManufacturer      | Index to manufacturer string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                                                       | 0x49                        |
| 0x1F    | iProduct           | Index to product string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                                                            | 0x5A                        |
| 0x20    | iSerialNumber      | Index to serial number string. This entry must equal half of the address value where the string starts or 0 if the string does not exist. <i>The USB Mass Storage Class Bulk Only Transport Specification requires a unique serial number.</i> | 0x00                        |
| 0x21    | bNumConfigurations | Number of configurations supported.                                                                                                                                                                                                            | 0x01                        |

Table 5 – Device Descriptor

*Device Qualifier Descriptor*

The device qualifier descriptor describes information about a high-speed capable device that would change if the device were operating at the other speed. For the ISD-300A1, none of the descriptor information requires modification, thus only one Device Qualifier Descriptor is required. The ISD-300A1 returns the same descriptor while operating in either full speed or high speed mode.

| Address | Field Name         | Description                                 | On-board Defaults |
|---------|--------------------|---------------------------------------------|-------------------|
| 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)       |                                             | 0x02              |
| 0x26    | bDeviceClass       | Device class.                               | 0xFF              |
| 0x27    | bDeviceSubClass    | Device subclass.                            | 0x00              |
| 0x28    | bDeviceProtocol    | Device protocol.                            | 0xFF              |
| 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 zero       | 0x00              |

Table 6 – Device Qualifier Descriptor

*Standard Configuration Descriptor*

The ISD-300A1 requires two configuration descriptors. The first configuration is returned when the VBUS\_POWERED signal is active, the second configuration when the VBUS\_POWERED signal is inactive (brick powered). The configuration descriptor contains information about the ISD-300A1 device configuration. Each configuration has one interface that supports four endpoints. See the **VBUS\_POWERED** section on page 38 for more information.

| Address<br>(Config.<br>Number) | Field Name      | Description                                  | On-board Defaults |
|--------------------------------|-----------------|----------------------------------------------|-------------------|
| 0x2C(1)<br>0x80(2)             | bLength         | Length of configuration descriptor in bytes. | 0x09              |
| 0x2D(1)<br>0x81(2)             | bDescriptorType | Descriptor type.                             | 0x02              |

| Address<br>(Config.<br>Number) | Field Name           | Description                                                                                                                                                                                                                                                           | On-board<br>Defaults |
|--------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 0x2E(1)<br>0x82(2)             | bTotalLength (LSB)   | Number of bytes returned in this configuration. This includes the configuration descriptor plus all the interface and endpoint descriptors.                                                                                                                           | 0x27                 |
| 0x2F(1)<br>0x83(2)             | bTotalLength (MSB)   |                                                                                                                                                                                                                                                                       | 0x00                 |
| 0x30(1)<br>0x84(2)             | bNumInterfaces       | Number of interfaces supported. The ISD-300A1 only supports one interface.                                                                                                                                                                                            | 0x01                 |
| 0x31(1)<br>0x85(2)             | bConfiguration Value | The value to use as an argument to Set Configuration to select the configuration. This value must be set to 0x02                                                                                                                                                      | 0x02                 |
| 0x32(1)<br>0x86(2)             | iConfiguration       | Index to the configuration string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                                                                         | 0x00                 |
| 0x33(1)<br>0x87(2)             | bmAttributes         | Device attributes for this configuration. Configuration characteristics:<br>Bit Description On-board default<br>7 Reserved, set to 1. '1'<br>6 Self-powered. '0' for configuration 1, '1' for configuration 2<br>5 Remote wake-up. '0'<br>4-0 Reserved, set to 0. '0' | 0x80 (1)<br>0xC0 (2) |
| 0x34(1)<br>0x88(2)             | bMaxPower            | Maximum power consumption for this configuration. Units used are mA*2 (i.e. 0x31 = 98 mA, 0xF9 = 498 mA).                                                                                                                                                             | 0xF9 (1)<br>0x31 (2) |

Table 7 – Standard Configuration Descriptor(s)

*Other Speed Configuration Descriptor*

This descriptor describes a configuration of a high-speed capable device if it were operating at its other possible speed. Although two descriptors are not required to distinguish differences between full speed and high speed operation, the ISD-300A1 supports two other speed configuration descriptors to enumerate differences between VBUS powered and self powered operation. The first configuration is returned when the VBUS\_POWERED signal is active, the second configuration when the VBUS\_POWERED signal is inactive. Each configuration has one interface that supports four endpoints. See the **VBUS\_POWERED** section on page 38 for more information.

| Address<br>(Config.<br>Number) | Field Name           | Description                                                                                                                                                                                                                                                           | On-board<br>Defaults |
|--------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 0x35(1)<br>0x89(2)             | bLength              | Length of configuration descriptor in bytes.                                                                                                                                                                                                                          | 0x09                 |
| 0x36(1)<br>0x8A(2)             | bDescriptorType      | Descriptor type.                                                                                                                                                                                                                                                      | 0x07                 |
| 0x37(1)<br>0x8B(2)             | bTotalLength (LSB)   | Number of bytes returned in this configuration. This includes the configuration descriptor plus all the interface and endpoint descriptors.                                                                                                                           | 0x27                 |
| 0x38(1)<br>0x8C(2)             | bTotalLength (MSB)   |                                                                                                                                                                                                                                                                       | 0x00                 |
| 0x39(1)<br>0x8D(2)             | bNumInterfaces       | Number of interfaces supported. The ISD-300A1 only supports one interface.                                                                                                                                                                                            | 0x01                 |
| 0x3A(1)<br>0x8E(2)             | bConfiguration Value | The value to use as an argument to Set Configuration to select the configuration. This value must be set to 0x02                                                                                                                                                      | 0x02                 |
| 0x3B(1)<br>0x8F(2)             | iConfiguration       | Index to configuration string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                                                                             | 0x00                 |
| 0x3C(1)<br>0x90(2)             | bmAttributes         | Device attributes for this configuration. Configuration characteristics:<br>Bit Description On-board default<br>7 Reserved, set to 1. '1'<br>6 Self-powered. '0' for configuration 1, '1' for configuration 2<br>5 Remote wake-up. '0'<br>4-0 Reserved, set to 0. '0' | 0x80 (1)<br>0xC0 (2) |
| 0x3D(1)<br>0x91(2)             | bMaxPower            | Maximum power consumption for the second configuration. Units used are mA*2 (i.e. 0x31 = 98 mA, 0xF9 = 498 mA).                                                                                                                                                       | 0xF9 (1)<br>0x31 (2) |

**Table 8 – Other Speed Configuration Descriptor(s)***Interface Descriptor*

This descriptor specifies the interface within a configuration. There are two interface descriptors in the ISD-300A1, one for high speed, and one for full speed. Each interface contains four endpoint descriptors: Default Control (no descriptor), Bulk out, Bulk in, and Interrupt.

Interface and endpoint descriptors cannot be directly accessed using the Get\_Descriptor USB command. However, interface and endpoint descriptors are always returned as part of the configuration and other speed configuration descriptor. When the other speed configuration descriptor is requested, the interface descriptor returned is dependent upon the USB bus speed mode of operation. When operating in high speed, the full speed interface descriptor is returned with the other speed configuration descriptor. When operating in full speed, the high speed interface descriptor is returned with the other speed configuration descriptor.

Endpoint descriptors and addresses must be in the fixed order of the ISD-300A1 internal defaults: Bulk-out first, then Bulk-in, followed by Interrupt.

| Address<br>(HS or FS)        | Field Name           | Description                                                                                                                                 | On-board Defaults      |
|------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Interface Descriptor</b>  |                      |                                                                                                                                             |                        |
| 0x3E(HS)<br>0x5D(FS)         | bLength              | Length of interface descriptor in bytes.                                                                                                    | 0x09                   |
| 0x3F(HS)<br>0x5E(FS)         | bDescriptorType      | Descriptor type.                                                                                                                            | 0x04                   |
| 0x40(HS)<br>0x5F(FS)         | bInterfaceNumber     | Interface number.                                                                                                                           | 0x00                   |
| 0x41(HS)<br>0x60(FS)         | bAlternateSettings   | Alternate settings                                                                                                                          | 0x00                   |
| 0x42(HS)<br>0x61(FS)         | bNumEndpoints        | Number of endpoints                                                                                                                         | 0x03                   |
| 0x43(HS)<br>0x62(FS)         | bInterfaceClass      | Interface class.                                                                                                                            | 0xFF                   |
| 0x44(HS)<br>0x63(FS)         | bInterfaceSubClass   | Interface subclass.                                                                                                                         | 0x00                   |
| 0x45(HS)<br>0x64(FS)         | bInterfaceProtocol   | Interface protocol.                                                                                                                         | 0xFF                   |
| 0x46(HS)<br>0x65(FS)         | iInterface           | Index to first interface string. This entry must equal half of the address value where the string starts or 0 if the string does not exist. | 0x00                   |
| <b>USB Bulk Out Endpoint</b> |                      |                                                                                                                                             |                        |
| 0x47(HS)<br>0x66(FS)         | bLength              | Length of this descriptor in bytes.                                                                                                         | 0x07                   |
| 0x48(HS)<br>0x67(FS)         | bDescriptorType      | Endpoint descriptor type.                                                                                                                   | 0x05                   |
| 0x49(HS)<br>0x68(FS)         | bEndpointAddress     | This is an Out endpoint, endpoint number 1.                                                                                                 | 0x01                   |
| 0x4A(HS)<br>0x69(FS)         | bmAttributes         | This is a bulk endpoint.                                                                                                                    | 0x02                   |
| 0x4B(HS)<br>0x6A(FS)         | wMaxPacketSize (LSB) | Max data transfer size.                                                                                                                     | 0x00 (HS)<br>0x40 (FS) |
| 0x4C(HS)<br>0x6B(FS)         | wMaxPacketSize (MSB) |                                                                                                                                             | 0x02 (HS)<br>0x00 (FS) |
| 0x4D(HS)<br>0x6C(FS)         | bInterval            | HS interval for polling (max NAK rate). Does not apply to FS bulk endpoints.                                                                | 0x01 (HS)<br>0x00 (FS) |
| <b>USB Bulk In Endpoint</b>  |                      |                                                                                                                                             |                        |
| 0x4E(HS)<br>0x6D(FS)         | bLength              | Length of this descriptor in bytes.                                                                                                         | 0x07                   |

| Address<br>(HS or FS)         | Field Name           | Description                                                                  | On-board Defaults      |
|-------------------------------|----------------------|------------------------------------------------------------------------------|------------------------|
| 0x4F(HS)<br>0x6E(FS)          | bDescriptorType      | Endpoint descriptor type.                                                    | 0x05                   |
| 0x50(HS)<br>0x6F(FS)          | bEndpointAddress     | This is an In endpoint, endpoint number 2.                                   | 0x82                   |
| 0x51(HS)<br>0x70(FS)          | bmAttributes         | This is a bulk endpoint.                                                     | 0x02                   |
| 0x52(HS)<br>0x71(FS)          | wMaxPacketSize (LSB) | Max data transfer size.                                                      | 0x00 (HS)<br>0x40 (FS) |
| 0x53(HS)<br>0x72(FS)          | wMaxPacketSize (MSB) |                                                                              | 0x02 (HS)<br>0x00 (FS) |
| 0x54(HS)<br>0x73(FS)          | bInterval            | HS interval for polling (max NAK rate). Does not apply to FS bulk endpoints. | 0x01 (HS)<br>0x00 (FS) |
| <b>USB Interrupt Endpoint</b> |                      |                                                                              |                        |
| 0x55(HS)<br>0x74(FS)          | bLength              | Length of this descriptor in bytes.                                          | 0x07                   |
| 0x56(HS)<br>0x75(FS)          | bDescriptorType      | Endpoint descriptor type.                                                    | 0x05                   |
| 0x57(HS)<br>0x76(FS)          | bEndpointAddress     | This is an Interrupt endpoint, endpoint number 3.                            | 0x83                   |
| 0x58(HS)<br>0x77(FS)          | BmAttributes         | This is an interrupt endpoint.                                               | 0x03                   |
| 0x59(HS)<br>0x78(FS)          | wMaxPacketSize (LSB) | Max data transfer size.                                                      | 0x02                   |
| 0x5A(HS)<br>0x79(FS)          | wMaxPacketSize (MSB) |                                                                              | 0x00                   |
| 0x5B(HS)<br>0x7A(FS)          | bInterval            | This is the polling interval.                                                | 0x05 (HS)<br>0x20 (FS) |

**Table 9 – HS and FS Interface Descriptor(s)***String Descriptors*

The ISD-300A1 supports multiple string descriptors, such as a manufacturer name string indexed by the iManufacturer field in the Device Descriptor. The descriptor index is specified as the starting address values divided by 2 (i.e. Manufacturer string begins at address 0x92, but is specified in the iManufacturer field as 0x49).

String index 0 must contain the LANGID of exactly one language, as the ISD-300A1 supports only a single language. Microsoft defines the LANGID codes for Windows, as described in *Developing International Software for Windows 95 and Windows NT*, Nadine Kano, Microsoft Press, Redmond, Washington. Note the LANGID code for English is 0x0409.

The following table shows how the LANGID, manufacturer, and product strings are formatted in the on-board ROM contents, and this can be considered an example of how to format strings in the I<sup>2</sup>C memory device or FBh Identify data. Each string character is comprised of an ASCII character appended to a NULL byte to meet the UNICODE encoding requirements as specified in *The Unicode Standard, Worldwide Character Encoding, Version 1.0, Volumes 1 and 2*.

| Address                                  | Field Name      | Description                                                                        | On-board Defaults |
|------------------------------------------|-----------------|------------------------------------------------------------------------------------|-------------------|
| USB String Descriptor - Index 0 (LANGID) |                 |                                                                                    |                   |
| 0x7C                                     | bLength         | LANGID string descriptor length in bytes.                                          | 0x04              |
| 0x7D                                     | bDescriptorType | Descriptor type.                                                                   | 0x03              |
| 0x7E                                     | LANGID (LSB)    | Language supported.                                                                | 0x09              |
| 0x7F                                     | LANGID (MSB)    | Note: See LANGID table in Microsoft documentation (the code for English is 0x0409) | 0x04              |
| USB String Descriptor - Manufacturer     |                 |                                                                                    |                   |

| Address                                | Field Name      | Description                       | On-board Defaults |
|----------------------------------------|-----------------|-----------------------------------|-------------------|
| 0x92                                   | bLength         | String descriptor length in bytes | 0x22              |
| 0x93                                   | bDescriptorType | Descriptor type.                  | 0x03              |
| 0x94                                   | bString         | ASCII character.                  | 0x49 ("I")        |
| 0x95                                   | bString         | ("NUL")                           | 0x00              |
| 0x96                                   | bString         | ASCII character.                  | 0x6E ("n")        |
| 0x97                                   | bString         | ("NUL")                           | 0x00              |
| 0x98                                   | bString         | ASCII character.                  | 0x2D ("-")        |
| 0x99                                   | bString         | ("NUL")                           | 0x00              |
| 0x9A                                   | bString         | ASCII character.                  | 0x53 ("S")        |
| 0x9B                                   | bString         | ("NUL")                           | 0x00              |
| 0x9C                                   | bString         | ASCII character.                  | 0x79 ("y")        |
| 0x9D                                   | bString         | ("NUL")                           | 0x00              |
| 0x9E                                   | bString         | ASCII character.                  | 0x73 ("s")        |
| 0x9F                                   | bString         | ("NUL")                           | 0x00              |
| 0xA0                                   | bString         | ASCII character.                  | 0x74 ("t")        |
| 0xA1                                   | bString         | ("NUL")                           | 0x00              |
| 0xA2                                   | bString         | ASCII character.                  | 0x65 ("e")        |
| 0xA3                                   | bString         | ("NUL")                           | 0x00              |
| 0xA4                                   | bString         | ASCII character.                  | 0x6D ("m")        |
| 0xA5                                   | bString         | ("NUL")                           | 0x00              |
| 0xA6                                   | bString         | ASCII character.                  | 0x20 (" ")        |
| 0xA7                                   | bString         | ("NUL")                           | 0x00              |
| 0xA8                                   | bString         | ASCII character.                  | 0x44 ("D")        |
| 0xA9                                   | bString         | ("NUL")                           | 0x00              |
| 0xAA                                   | bString         | ASCII character.                  | 0x65 ("e")        |
| 0xAB                                   | bString         | ("NUL")                           | 0x00              |
| 0xAC                                   | bString         | ASCII character.                  | 0x73 ("s")        |
| 0xAD                                   | bString         | ("NUL")                           | 0x00              |
| 0xAE                                   | bString         | ASCII character.                  | 0x69 ("i")        |
| 0xAF                                   | bString         | ("NUL")                           | 0x00              |
| 0xB0                                   | bString         | ASCII character.                  | 0x67 ("g")        |
| 0xB1                                   | bString         | ("NUL")                           | 0x00              |
| 0xB2                                   | bString         | ASCII character.                  | 0x6E ("n")        |
| 0xB3                                   | bString         | ("NUL")                           | 0x00              |
| <b>USB String Descriptor – Product</b> |                 |                                   |                   |
| 0xB4                                   | bLength         | String descriptor length in bytes | 0x28              |
| 0xB5                                   | bDescriptorType | Descriptor type                   | 0x03              |
| 0xB6                                   | bString         | ASCII character.                  | 0x55 ("U")        |
| 0xB7                                   | bString         | ("NUL")                           | 0x00              |
| 0xB8                                   | bString         | ASCII character.                  | 0x53 ("S")        |
| 0xB9                                   | bString         | ("NUL")                           | 0x00              |
| 0xBA                                   | bString         | ASCII character.                  | 0x42 ("B")        |
| 0xBB                                   | bString         | ("NUL")                           | 0x00              |
| 0xBC                                   | bString         | ASCII character.                  | 0x20 (" ")        |
| 0xBD                                   | bString         | ("NUL")                           | 0x00              |
| 0xBE                                   | bString         | ASCII character.                  | 0x53 ("S")        |
| 0xBF                                   | bString         | ("NUL")                           | 0x00              |
| 0xC0                                   | bString         | ASCII character.                  | 0x74 ("t")        |
| 0xC1                                   | bString         | ("NUL")                           | 0x00              |

| Address      | Field Name       | Description      | On-board Defaults |
|--------------|------------------|------------------|-------------------|
| 0xC2         | bString          | ASCII character. | 0x6F ("o")        |
| 0xC3         | bString          | ("NUL")          | 0x00              |
| 0xC4         | bString          | ASCII character. | 0x72 ("r")        |
| 0xC5         | bString          | ("NUL")          | 0x00              |
| 0xC6         | bString          | ASCII character. | 0x61 ("a")        |
| 0xC7         | bString          | ("NUL")          | 0x00              |
| 0xC8         | bString          | ASCII character. | 0x67 ("g")        |
| 0xC9         | bString          | ("NUL")          | 0x00              |
| 0xCA         | bString          | ASCII character. | 0x65 ("e")        |
| 0xCB         | bString          | ("NUL")          | 0x00              |
| 0xCC         | bString          | ASCII character. | 0x20 (" ")        |
| 0xCD         | bString          | ("NUL")          | 0x00              |
| 0xCE         | bString          | ASCII character. | 0x41 ("A")        |
| 0xCF         | bString          | ("NUL")          | 0x00              |
| 0xD0         | bString          | ASCII character. | 0x64 ("d")        |
| 0xD1         | bString          | ("NUL")          | 0x00              |
| 0xD2         | bString          | ASCII character. | 0x61 ("a")        |
| 0xD3         | bString          | ("NUL")          | 0x00              |
| 0xD4         | bString          | ASCII character. | 0x70 ("p")        |
| 0xD5         | bString          | ("NUL")          | 0x00              |
| 0xD6         | bString          | ASCII character. | 0x74 ("t")        |
| 0xD7         | bString          | ("NUL")          | 0x00              |
| 0xD8         | bString          | ASCII character. | 0x65 ("e")        |
| 0xD9         | bString          | ("NUL")          | 0x00              |
| 0xDA         | bString          | ASCII character. | 0x72 ("r")        |
| 0xDB         | bString          | ("NUL")          | 0x00              |
| 0xDC<br>0xFF | Unused ROM space |                  | 0x00              |

**Table 10 – String Descriptors**

## Descriptor Requirements

Descriptors programmed into an I<sup>2</sup>C memory device must observe the following constraints.

### String Descriptor Indexes

An index of 0x00 indicates the string is absent. If the string descriptor is present, the index value is the beginning address location divided by 2. String descriptors must not cross I<sup>2</sup>C memory device block boundaries, i.e., the starting address must be moved to the next I<sup>2</sup>C memory device boundary.

## Pipes

The ISD-300A1 provides four USB pipes: Default Control, Bulk Out, Bulk In, and Interrupt.

### Default Control Pipe

The default pipe is used to transport standard, class and vendor-specific USB requests to the ISD-300A1.

### Bulk Out Pipe



The Bulk Out pipe is used to send commands and data to an attached mass storage device. Maximum packet size is 64 bytes in FS operation, 512 bytes in HS operation.

### Bulk In Pipe

The Bulk In pipe is used to receive status and read data from an attached mass storage device. Maximum packet size is 64 bytes in FS operation, 512 bytes in HS operation.

### Interrupt Pipe

The Interrupt pipe implemented in the ISD-300A1 serves two purposes: 1) Some legacy software applications require the endpoint to exist for correct operation, and 2) to enable systems to request service by the host. For more information, see the **SYS\_IRQ Pin** section on page 41 of this document.

## Requests

The ISD-300A1 responds to three different types of request:

- Standard USB device requests
- Mass Storage Class Bulk-Only requests
- Vendor-specific requests

### Standard Requests

The ISD-300A1 supports all USB standard device requests except the optional Set Descriptor request. These requests, which are described in Chapter 9, Device Framework, of the *USB Specification*, are:

- Clear Feature
- Get Configuration
- Get Descriptor (for information on String Descriptors, see **String Descriptors** on page 19)
- Get Interface
- Get Status
- Set Address
- Set Configuration
- Set Interface
- Set Feature

### Mass Storage Class Bulk-Only Requests

Mass Storage Class Bulk-Only requests supported by the ISD-300A1 are listed in **Table 11**.

| Label       | bmRequestType | bRequest | wValue | wIndex    | wLength | Data   |
|-------------|---------------|----------|--------|-----------|---------|--------|
| RESET       | 0x21          | 0xFF     | 0x0000 | Interface | 0x0000  | [None] |
| GET_MAX_LUN | 0xA1          | 0xFE     | 0x0000 | Interface | 0x0001  | 1 byte |

**Table 11 – Mass Storage Class Bulk-Only Requests**

#### RESET

This request flushes all buffers and resets the pipes to their default states, resets all hardware registers to their default state, and basically causes the ISD-300A1 to enter a power-up reset state. Any STALL conditions or bulk data toggle bits remain unchanged.

#### GET\_MAX\_LUN

The ISD-300A1 returns one byte of data that contains the maximum LUNs supported by the device. This information is derived from the Last LUN Identifier configuration setting, bits (2:0) of configuration data located at address offset 0x8. For example, if the device supports four LUNs then the LUNs would be

numbered from 0 to 3, and the Last LUN Identifier configuration data bit field should be set to 0x3. If no LUN is associated with the device, the Last LUN Identifier shall be set to 0x0.

### Vendor-Specific Requests

Vendor specific requests supported by the ISD-300A1 are listed in **Table 12**. The ISD-300A1 will STALL any vendor specific request if not configured by the USB host (USB configuration is 0).

| Label                | bmRequestType | bRequest | wValue           | WIndex                    | WLength     | Data               |
|----------------------|---------------|----------|------------------|---------------------------|-------------|--------------------|
| LOAD_CONFIG_DATA     | 0x40          | 0x01     | Data Source      | Starting Address          | Data Length | Configuration Data |
| READ_CONFIG_DATA     | 0xC0          | 0x02     | Data Source      | Starting Address          | Data Length | Configuration Data |
| SOFT_RESET           | 0x40          | 0x03     | 0x0000           | 0x0000                    | 0x0000      | [None]             |
| CMD_QUEUEING_CONTROL | 0x40          | 0x04     | Queueing Control | 0x0000                    | 0x0000      | [None]             |
| BOGUS_READ           | 0xC0          | 0x01     | 0XXXXX           | 0XXXXX                    | 0XXXXX      | Null byte data     |
| LOAD_MFG_DATA        | 0x40          | 0x05     | Disable / Enable | 0x0000 (starting address) | Data Length | Mfg. test data     |
| READ_MFG_DATA        | 0xC0          | 0x06     | 0x0000           | 0x0000                    | Data Length | Mfg. test data     |

**Table 12 – Vendor-Specific Requests**

### LOAD\_CONFIG\_DATA

This request enables configuration data writes to the data source specified by the wValue field. The WIndex field specifies the starting address and the wLength field denotes the data length in bytes.

Legal values for wValue are as follows:

|        |                                              |
|--------|----------------------------------------------|
| 0x0000 | Configuration bytes, address range 0x2 – 0xF |
| 0x0002 | External I <sup>2</sup> C memory device      |

Configuration byte writes must be constrained to addresses 0x2 through 0xF, as shown in **Table 4 – ISD-300A1 Configuration Bytes** on page 14. Attempts to write outside this address space will result in a STALL condition. Configuration byte writes only overwrite ISD-300A1 Configuration Byte registers, the original data source remains unchanged (I<sup>2</sup>C memory device, FBh identify data, or internal ROM).

Writes to I<sup>2</sup>C memory devices shall only start on eight-byte boundaries, meaning that the address value must be evenly divisible by eight.

Writes to I<sup>2</sup>C memory devices must not cross 256 byte page boundaries, i.e. start and finish write addresses must have equal modulo 256 values. Write operations with beginning and end addresses that do not fall in the same 256 byte page will result in a STALL condition.

Illegal values for wValue as well as attempts to write to an I<sup>2</sup>C memory device when none is connected will result in a STALL condition.

### READ\_CONFIG\_DATA

This USB request allows data retrieval from the data source specified by the wValue field. Data is retrieved beginning at the address specified by the wIndex field. The wLength field denotes the length in bytes of data requested from the data source.

Legal values for wValue are as follows:



|        |                                               |
|--------|-----------------------------------------------|
| 0x0000 | Configuration bytes, addresses 0x0 – 0xF only |
| 0x0001 | Internal ROM                                  |
| 0x0002 | External I <sup>2</sup> C memory device       |
| 0x0003 | Vendor-specific identify (FBh) data           |

Illegal values for wValue will result in a STALL condition on the USB port. Attempted reads from an I<sup>2</sup>C memory device when none is connected or attempted reads from FBh data when not in I\_MODE will result in a STALL condition. Attempts to read configuration bytes with starting addresses greater than 0xF will also result in a STALL condition.

### **SOFT\_RESET**

This request resets the ISD-300A1's data path control state machines, buffer RAM and command queue. The attached device is not reset. This USB request is required for error recovery while complex command queuing is enabled.

Issuing a SOFT\_RESET when complex command queuing is not enabled will result in a STALL condition.

### **CMD\_QUEUEING\_CONTROL**

This request sets the type of command queuing used by the ISD-300A1. Command queuing is a vendor specific feature of the ISD-300A1 that allows the CBW (refer to the USB Mass Storage Class Bulk Only Transport Specification) and possibly data for a new command to be transferred before the CSW for the previous command has been sent. Queuing commands can hide delays between the CBW, data, and CSW of a command and between commands, and thus improve overall system performance. The ISD-300A1 supports two types of command queuing: simple and complex.

#### **Simple Command Queuing**

In simple command queuing the ISD-300A1 stops when there is a phase error and does not process a queued CBW. But when there is a device error the ISD-300A1 continues and processes the queued command. It is up to the host to notice the "command failed" status in the CSW for the first command and recover from the error even though the subsequent queued command might have changed the state of the attached device after the error occurred.

### Complex Command Queuing

In complex command queuing the ISD-300A1 stops processing commands in the event of a device error just as it does for a phase error. This preserves the state of the attached device. The SOFT\_RESET command is available when complex command queuing is enabled to allow the host to reset the ISD-300A1 and discard any queued commands or data without resetting the attached device. After the SOFT\_RESET the host can send another CBW to query the device for more information about the error or re-issue the failed command.

Legal values for wValue are as follows:

|        |                                                          |
|--------|----------------------------------------------------------|
| 0x0000 | Simple Command Queuing ( <b>Power-on reset default</b> ) |
| 0x0001 | Complex Command Queuing                                  |

### BOGUS\_READ

This USB request is present for legacy software reasons – some USB drivers require this command to exist for proper operation. The ISD-300A1 will return the requested amount of zero filled data packets.

### LOAD\_MFG\_DATA

This USB request is used to enable and control Manufacturing Test Mode operation. Manufacturing Test Mode is provided as a means to implement board/system level interconnect tests. During Manufacturing Test Mode operation, all outputs not associated directly with USB operation are controllable. Normal state machine and register control of output pins are disabled. Control of the select ISD-300A1 IO pins and their 3-state controls are mapped to the USB data packet associated with this request. (See **Table 13 – LOAD\_MFG\_DATA Data Block Bit Map** for explanation of the required LOAD\_MFG\_DATA data packet format.)

The wValue field enables/disables Manufacturing Test Mode operation. All Manufacturing Test Mode operation requests must contain a complete data packet (wLength field set to 0x0007) and start from the beginning of the register chain (wIndex field set to 0x0000).

Legal values for wValue are as follows:

|        |                                                                                                                                                                        |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x0000 | Normal operation mode – writing this wValue returns the ISD-300A1 to normal operation regardless of previous command data sets (power-on reset default).               |
| 0x0001 | Manufacturing Test Mode – manufacturing test registers control specific outputs cells of the ISD-300A1 to enable board level testing in the manufacturing environment. |

Legal values for wLength are as follows:

|        |                                                                                                                                                                                    |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x0000 | Valid only when wValue = 0x0000; when disabling Manufacturing Test Mode of operation.                                                                                              |
| 0x0007 | Valid only when wValue = 0x0001. For proper Manufacturing Test Mode operation, wLength must equal 0x0007. Any data packet lengths greater than 7 will result in a STALL condition. |

**Table 13** shows the bit-wise test control register mapping of the data packet associated with the LOAD\_MFG\_DATA vendor specific USB command.

| Byte | Bit(s) | Test / 3-State Control Register Name                                       |
|------|--------|----------------------------------------------------------------------------|
| 0    | 1:0    | NLED[1:0]                                                                  |
| 0    | 2      | NPWR500                                                                    |
| 0    | 3      | NATA_RESET                                                                 |
| 0    | 4      | NDIOW                                                                      |
| 0    | 5      | NDIOR                                                                      |
| 0    | 6      | NDMACK                                                                     |
| 0    | 7      | ATA_PU_EN                                                                  |
| 1    | 0      | ATA_PD_EN                                                                  |
| 1    | 2:1    | NCS[1:0]                                                                   |
| 1    | 5:3    | DA[2:0]                                                                    |
| 1    | 6      | NLOWPWR                                                                    |
| 1    | 7      | DD[15:0] 3-State Active hi 3-state buffer enable for ATA data bus.         |
| 2    | 7:0    | DD[7:0]                                                                    |
| 3    | 7:0    | DD[15:8]                                                                   |
| 4    | 7:0    | GPIO[7:0]                                                                  |
| 5    | 1:0    | GPIO[9:8]                                                                  |
| 5    | 7:2    | GPIO[5:0] 3-State Enable Active hi 3-state buffer enable for each GPIO pin |
| 6    | 3:0    | GPIO[9:6] 3-State Enable Active hi 3-state buffer enable for each GPIO pin |
| 6    | 7:4    | Reserved, software must write 0000b                                        |

**Table 13 – LOAD\_MFG\_DATA Data Block Bit Map**

**READ\_MFG\_DATA**

This USB request returns a “snapshot in time” of select ISD-300A1 input pins. The input pin states are bit-wise mapped to the USB data packet associated with this request. ISD-300A1 input pins not associated directly with USB operation can be sampled at any time during normal or Manufacturing Test Mode operation. This request is independent of normal ISD-300A1 state machine control or Manufacturing Test Mode write operations. See **Table 14 – READ\_MFG\_DATA Data Block Bit Map** for an explanation of the READ\_MFG\_DATA data packet format.

Legal values for wValue are as follows:

0x0000                      wValue must be set to 0x0000.

Legal values for wLength are as follows:

0x0001 –

0x0008                      Any data packet lengths greater than 0x0008 will result in a STALL condition.

**Table 14** shows the bit-wise input pin mapping of the data packet associated with the READ\_MFG\_DATA vendor specific USB command. All input and bi-directional pin values are taken from the pin.

| Byte | Bit(s) | Pin Name                                      |
|------|--------|-----------------------------------------------|
| 0    | 0      | DRV_PWR_VALID                                 |
| 0    | 1      | VBUS_PWR_VALID                                |
| 0    | 2      | VBUS_POWERED                                  |
| 0    | 3      | DISK_READY                                    |
| 0    | 3      | SYS_IRQ                                       |
| 0    | 5      | IORDY                                         |
| 0    | 6      | DMARQ                                         |
| 0    | 7      | I_MODE                                        |
| 1    | 0      | NCART_DET                                     |
| 1    | 1      | N_EJECT                                       |
| 1    | 3:2    | NLED[1:0]                                     |
| 1    | 4      | NPRW500 (output register value only)          |
| 1    | 5      | NATA_RESET (output register value only)       |
| 1    | 6      | NDIOW (output register value only)            |
| 1    | 7      | NDIOR (output register value only)            |
| 2    | 0      | NDMACK (output register value only)           |
| 2    | 1      | ATA_PU_EN (output register value only)        |
| 2    | 2      | ATA_PD_EN (output register value only)        |
| 2    | 4:3    | NCS[1:0] (output register value only)         |
| 2    | 7:5    | DA[2:0] (output register value only)          |
| 3    | 7:0    | DD[7:0]                                       |
| 4    | 7:0    | DD[15:8]                                      |
| 5    | 7:0    | GPIO[7:0]                                     |
| 6    | 1:0    | GPIO[9:8]                                     |
| 6    | 2      | DD[15:0] 3-State Control (internal register)  |
| 6    | 7:3    | GPIO[4:0] 3-State Control (internal register) |
| 7    | 4:0    | GPIO[9:5] 3-State Control (internal register) |
| 7    | 5      | MFG_SEL (manufacturing test mode enable)      |
| 7    | 6      | NLOWPWR (output register value only)          |
| 7    | 7      | ATA_EN                                        |

**Table 14 – READ\_MFG\_DATA Data Block Bit Map**

## ATA/ATAPI Interface

The ATA/ATAPI port on the ISD-300A1 is compliant with the *Information Technology – AT Attachment with Packet Interface – 5 (ATA/ATAPI-5) Specification, T13/1321D Rev 3*. The ISD-300A1 supports both ATAPI packet commands as well as ATA commands (by use of ATA Command Blocks). Additionally, the ISD-300A1 translates ATAPI SFF-8070i commands to ATA commands for seamless integration of ATA devices with generic Mass Storage Class BOT drivers. The ISD-300A1 also provides a vendor-specific “event notify” ATA command to automatically communicate certain USB and system events to the attached device.

## Protocol

The ISD-300A1 supports command protocol flows as defined in the *ATA/ATAPI-5 Specification*. Commands are grouped into different classes, based on the protocol followed for command execution.

The ATA/ATAPI interface supports the following clarifications:

- Immediately after the reset recovery period, the ISD-300A1 will write 0x00 to the Device Control register.
- Arbitrary byte count transfers are supported.
- 16-bit data reads and writes are supported.
- 8-bit data transfers are not supported.

## Reset Mapping

The ATA/ATAPI interface responds to several resets: Power-on, USB, MSC, and Vendor-specific Soft reset.

In the case of a power-on reset, a full device initialization is performed. FBh data is retrieved and stored if the I\_MODE pin is set active.

In the cases of USB reset and MSC reset, a partial initialization is performed which excludes all attempts to perform Identify Device commands.

In the case of a Vendor-specific Soft reset, only the internal ISD-300A1 state machines are reset.

## Device Requirements

Attached mass storage devices must support the following:

### ATA Reset, A1h, FBh

After deassertion of ATA\_NRESET, BSY and DRQ must be cleared by the device within the ATA Initialization Timeout configuration setting value.

### ATA Polling Device

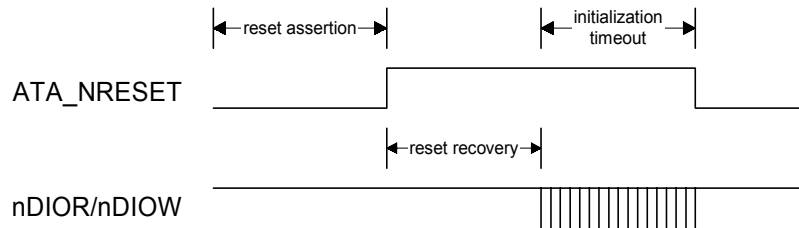
The device shall be capable of being a polling only device. The ATA signal **INTRQ** is not used by the ISD-300A1.

### ATA Initialization Timeout

ISD-300A1 internal ROM has a default configuration value of 8.2 seconds for ATA Initialization Timeout. When I\_MODE operation is utilized, the default ATA Initialization Timeout value is used to retrieve FBh data. Once the vendor specific Identify (FBh) command completes, the default value is overridden with the FBh data value.

If an I<sup>2</sup>C memory device is utilized for ISD-300A1 configuration and USB descriptor data, the ATA Initialization Timeout value is loaded from the I<sup>2</sup>C memory device prior to any ATA interface activity.

Reset Recovery is 3 ms. **Figure 2** graphically defines “Initialization Timeout” and “Reset Recovery”.



**Figure 2 – ATA Reset Protocol**

## ATA Command Block

ATA commands for the ISD-300A1 are supported by command encoding in the command block portion of the *MSC Command Block Wrapper (CBW)*. Refer to the *USB Mass Storage Class (MSC) Bulk Only Transport Specification* for information on CBW formatting.

The ATA Command Block (*ATACB*) provides a means of passing ATA commands and ATA register accesses for execution. The *ATACB* resides in the *CBWCB* portion of the *CBW*. The *ATACB* is distinguished from other command blocks by the first two bytes of the command block matching the *wATACBSignature*. Only command blocks that have a valid *wATACBSignature* are interpreted as ATA Command Blocks. All other fields of the *CBW* and restrictions on the *CBWCB* shall remain as defined in the *USB Mass Storage Class Bulk Only Transport Specification*. The *ATACB* shall be 16 bytes in length. The following table and text defines the fields of the *ATACB*.

| Byte  | 7                               | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------|---------------------------------|---|---|---|---|---|---|---|
| 0-1   | <i>wATACBSignature</i>          |   |   |   |   |   |   |   |
| 2     | <i>bmATACBActionSelect</i>      |   |   |   |   |   |   |   |
| 3     | <i>bmATACBRegisterSelect</i>    |   |   |   |   |   |   |   |
| 4     | <i>bATACBTransferBlockCount</i> |   |   |   |   |   |   |   |
| 5-12  | <i>bATACBTaskFileWriteData</i>  |   |   |   |   |   |   |   |
| 13-15 | Reserved (0)                    |   |   |   |   |   |   |   |

**Table 15 – ATA Command Block Formatting**

### Field Descriptions

#### *wATACBSignature* –

This signature indicates that the *CBWCB* contains an *ATACB*. The signature field shall contain the ATA Command Designator value obtained from ISD-300A1 configuration space to indicate an *ATACB* (the default value is 0x2424). Devices capable of accepting only ATA Command Blocks shall return a command failed status if the *wATACBSignature* is not correct.

#### *bmATACBActionSelect* –

The bit fields of this register shall control the execution of the *ATACB*. Refer to **Figure 3– ATA Command Block Flow Diagram** for further clarification. The bitmap of the *bmATACBActionSelect* shall be defined as follows:

- Bit 7      *IdentifyPacketDevice* – ATA/ATAPI Identify Packet Device Command. Setting *IdentifyPacketDevice* indicates the data phase will contain ATAPI (A1h) or ATA (Ech) IDENTIFY device data. Setting *IdentifyPacketDevice* when the data phase is not IDENTIFY data will cause undetermined device behavior.  
0 = Normal operation.  
1 = Data phase of command will contain ATAPI or ATA IDENTIFY data, allowing the device to parse data for required device information.
- Bit 6      *UDMACommand* - Ultra DMA Data Transfer Enable (Multi-word DMA not supported). Setting *UDMACommand* with non-UDMA capable devices or using it with non-UDMA commands will cause undetermined behavior.  
0 = Do not use DMA data transfers (PIO transfers only).  
1 = Utilize Ultra DMA for data transfers (device must be capable).

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit 5    | <p><i>DEVOverride</i> – Use the DEV value specified in the <i>ATACB</i>.</p> <p>0 = The DEV bit value will be determined from ISD-300A1 Configuration data (0x5 bit 5).</p> <p>1 = The DEV bit value will be determined from the <i>ATACB</i>(0xB bit 4).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Bits 4-3 | <p><i>DPErrOverride(1:0)</i> - Device and Phase Error Override. These bits shall not be set in conjunction with <i>bmATACBActionSelect TaskFileRead</i>. The order of precedence for error override shall be dependant on the amount of data left to transfer when the error is detected, as depicted in the <i>ATACB</i> Command Flow diagram.</p> <p>00 = Data accesses are halted if a device or phase error is detected.</p> <p>01 = Phase error conditions are not used to qualify the occurrence of data accesses.</p> <p>10 = Device error conditions are not used to qualify the occurrence of data accesses.</p> <p>11 = Neither device error or phase error conditions are used to qualify the occurrence of data accesses.</p> |
| Bit 2    | <p><i>PollAltStatOverride</i> - Poll ALTSTAT Override.</p> <p>0 = The Alternate Status register shall be polled until BSY=0 before proceeding with the <i>ATACB</i> operation.</p> <p>1 = Execution of the <i>ATACB</i> shall proceed with the data transfer without polling the Alternate Status register until BSY=0.</p>                                                                                                                                                                                                                                                                                                                                                                                                               |
| Bit 1    | <p><i>DeviceSelectionOverride</i> - Device Selection Override. This bit shall not be set in conjunction with <i>bmATACBActionSelect TaskFileRead</i>.</p> <p>0 = Device selection shall be performed prior to command register write accesses.</p> <p>1 = Device selection shall not be performed prior to command register write accesses.</p>                                                                                                                                                                                                                                                                                                                                                                                           |
| Bit 0    | <p><i>TaskFileRead</i> - Read and return the task file register data selected in <i>bmATACBRegisterSelect</i>. If <i>TaskFileRead</i> is set, the <i>dCBWDataTransferLength</i> field must be set to 8.</p> <p>0 = Execute <i>ATACB</i> command and data transfer (if any).</p> <p>1 = Only task file registers selected in <i>bmATACBRegisterSelect</i> shall be read. Task file registers not selected in <i>bmATACBRegisterSelect</i> shall not be accessed and 00h shall be returned for the unselected register data.</p>                                                                                                                                                                                                            |

#### bmATACBRegisterSelect –

Setting the appropriate bit fields shall cause the taskfile read or write register access to occur. Taskfile read data shall always be 8 bytes in length. Unselected taskfile register data shall be returned as 00h. Taskfile register accesses shall occur in sequential order as shown (Bit 0 first, Bit 7 last). The *bmATACBRegisterSelect* bitmap shall be as defined below.

|       |        |                                   |
|-------|--------|-----------------------------------|
| Bit 0 | (3F6h) | Device Control / Alternate Status |
| Bit 1 | (1F1h) | Features / Error                  |
| Bit 2 | (1F2h) | Sector Count                      |
| Bit 3 | (1F3h) | Sector Number                     |
| Bit 4 | (1F4h) | Cylinder Low                      |
| Bit 5 | (1F5h) | Cylinder High                     |
| Bit 6 | (1F6h) | Device / Head                     |
| Bit 7 | (1F7h) | Command / Status                  |

#### bATACBTransferBlockCount –

This value shall denote the maximum requested block size in 512 byte blocks. This variable shall be set to the value last used for “Sectors per block” in the SET\_MULTIPLE\_MODE command. Valid values are 0, 1, 2, 4, 8, 16, 32, 64, and 128 (0 indicates 256 sectors per block). Command failed status shall be returned if an invalid value is detected in the *ATACB*. Non-multiple commands shall set this value to 1 (block size of 512 bytes).

**bATACBTaskFileWriteData –**

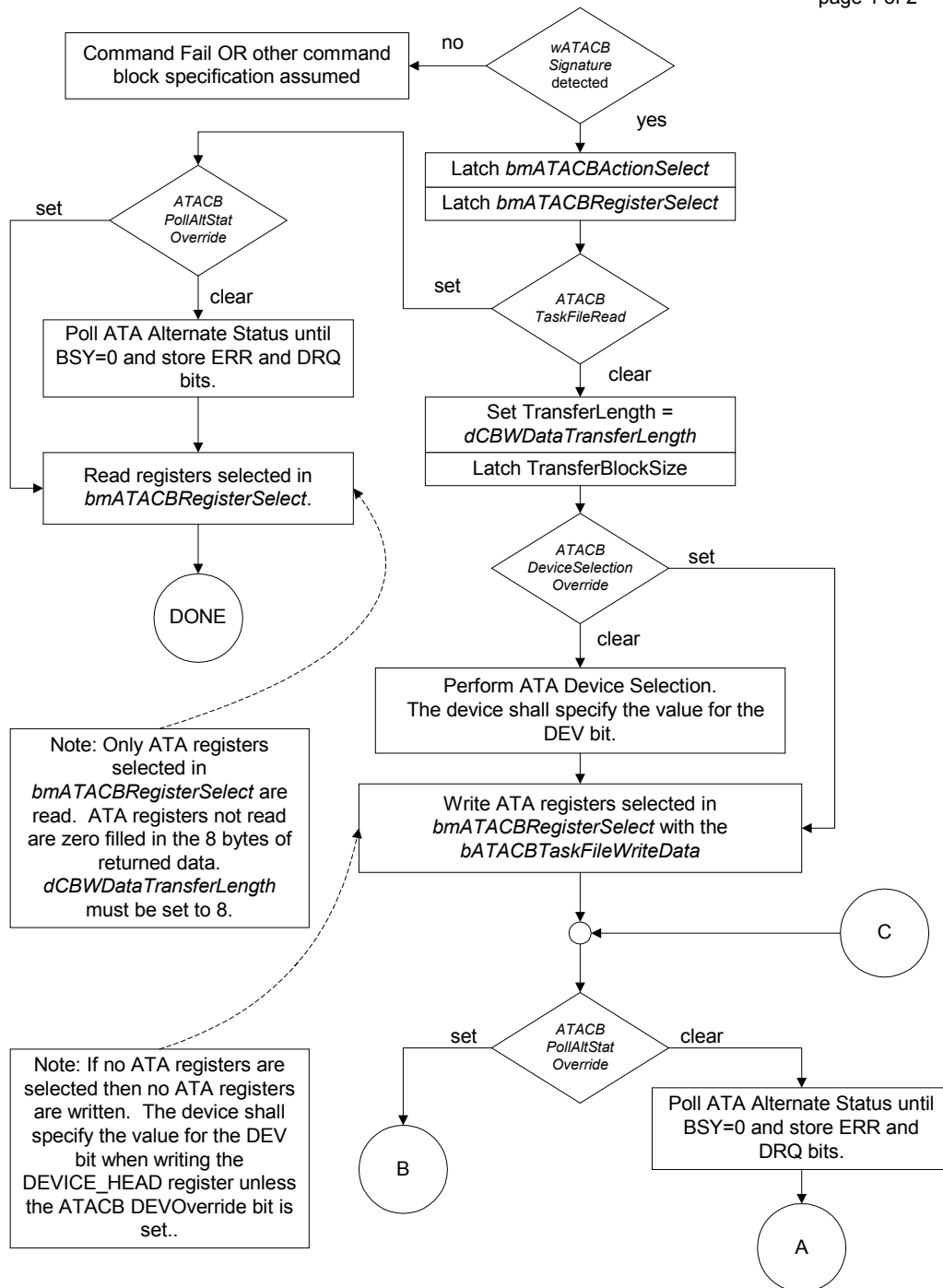
ATA register data used on ATA command or PIO write operations. Only data entries that have the associated *bmATACBRegisterSelect* bit set shall be required to have valid data.

|                         |        |                |
|-------------------------|--------|----------------|
| ATACB Address offset 5h | (3F6h) | Device Control |
| ATACB Address offset 6h | (1F1h) | Features       |
| ATACB Address offset 7h | (1F2h) | Sector Count   |
| ATACB Address offset 8h | (1F3h) | Sector Number  |
| ATACB Address offset 9h | (1F4h) | Cylinder Low   |
| ATACB Address offset Ah | (1F5h) | Cylinder High  |
| ATACB Address offset Bh | (1F6h) | Device         |
| ATACB Address offset Ch | (1F7h) | Command        |

## ATA Command Flow

**Figure 3** shows the flow of ATA commands, specifically the actions taken by the ISD-300A1 based upon how the ATA Command Block is configured.

page 1 of 2



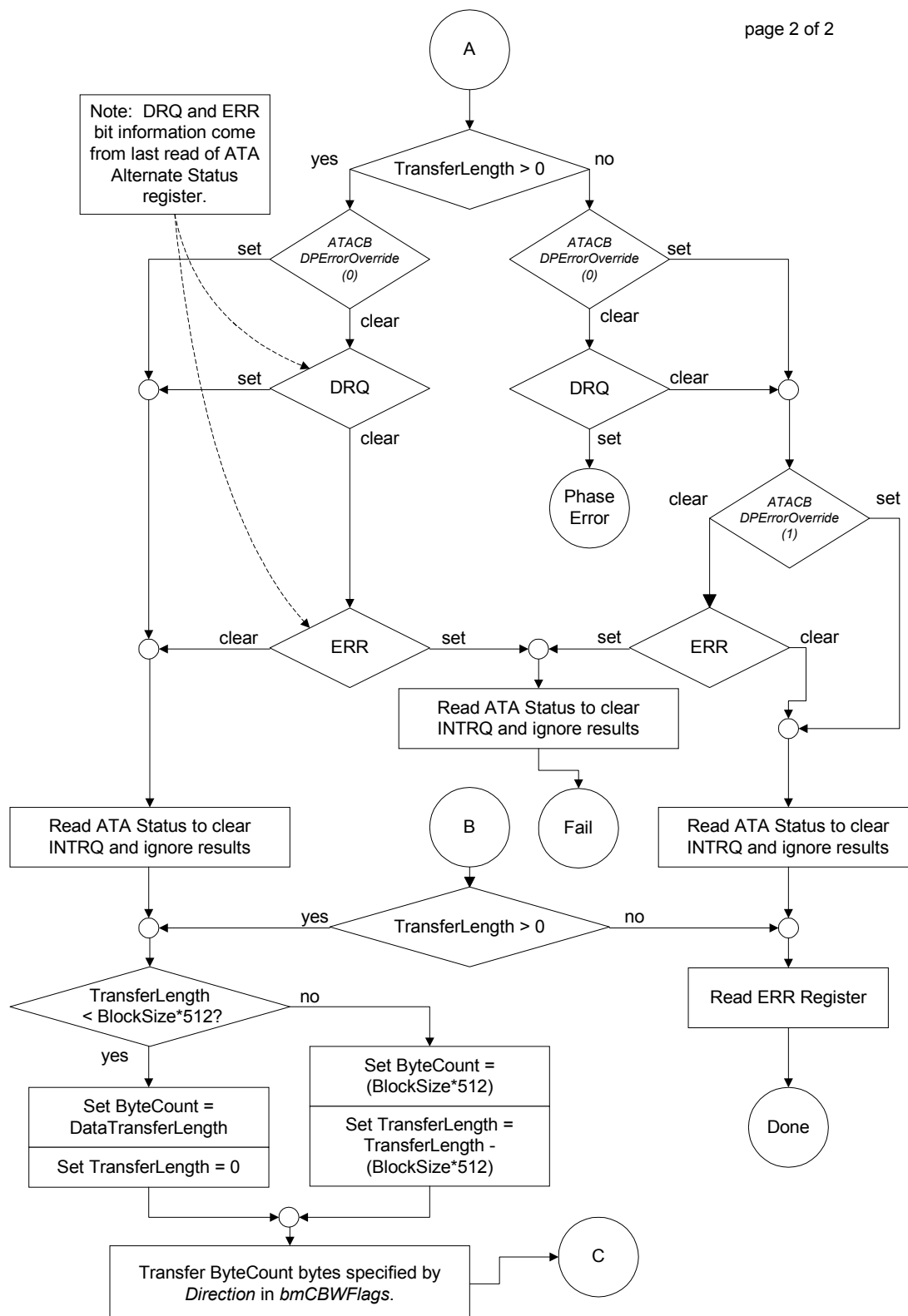


Figure 3– ATA Command Block Flow Diagram

## Vendor-Specific ATA Commands

There are two vendor-specific ATA commands implemented in the ISD-300A1. These commands are shown in **Table 16**.

| Label        | Command Code                    | Description                                                                                                             |
|--------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| IDENTIFY     | FBh                             | This command is used to read ISD-300A1 configuration data and USB descriptor data from an attached mass storage device. |
| EVENT_NOTIFY | Specified in Configuration Data | This command communicates certain events to the device and is executed as the events occur.                             |

**Table 16 – Vendor-Specific ATA Commands**

### IDENTIFY

The vendor-specific Identify (FBh) command enables the ISD-300A1 to request configuration and USB descriptor information from an attached mass storage device.

### Command Code

FBh

### Protocol

PIO data-in (refer to *ATA/ATAPI-5 Specification*, section 9.7).

### Identification Register Writes

| Register      | 7   | 6   | 5   | 4   | 3 | 2 | 1 | 0 |
|---------------|-----|-----|-----|-----|---|---|---|---|
| Features      | N/A |     |     |     |   |   |   |   |
| Sector Count  | N/A |     |     |     |   |   |   |   |
| Sector Number | N/A |     |     |     |   |   |   |   |
| Cylinder Low  | N/A |     |     |     |   |   |   |   |
| Cylinder High | N/A |     |     |     |   |   |   |   |
| Device/Head   | obs | N/A | obs | DEV | 0 | 0 | 0 | 1 |
| Command       | FBh |     |     |     |   |   |   |   |

**Table 17 - Identification Register Writes**

Device/Head register –

The DEV bit indicates the selected device.

### Identification Register Reads

| Register      | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Error         | N/A |     |     |     |     |     |     |     |
| Sector Count  | N/A |     |     |     |     |     |     |     |
| Sector Number | N/A |     |     |     |     |     |     |     |
| Cylinder Low  | N/A |     |     |     |     |     |     |     |
| Cylinder High | N/A |     |     |     |     |     |     |     |
| Device/Head   | obs | N/A | obs | DEV | N/A | N/A | N/A | N/A |
| Status        | BSY | N/A | N/A | N/A | DRQ | N/A | N/A | ERR |

**Table 18 - Identification Register Reads**



Device/Head register –

The DEV bit indicates the selected device.

Status register –

BSY shall be cleared to zero upon command completion.

DRDY shall be set to one.

DF (Device Fault) shall be cleared to zero.

DRQ shall be cleared to zero.

ERR shall be cleared to zero.

### Device Error Indication

If the device does not support this command, the device shall return command aborted. Otherwise, the device shall not report an error.

### Description

When the command is issued, the device sets the BSY bit to one, and prepares to transfer 512 bytes of configuration/descriptor data to the ISD-300A1. *Note: Configuration and descriptor information is limited to 256 bytes in length. Data beyond 256 bytes (bytes 256-511) is read by the ISD-300A1 but ignored.* The device then sets DRQ to one and clears BSY to zero.

The arrangement and meaning of the FBh data bytes are specified in **Table 3, Table 7, Table 8, Table 9, Table 10, and Table 11**. An example of FBh programming is shown in **Appendix A**.

### EVENT\_NOTIFY

The vendor-specific Event-notify command enables the ISD-300A1 to communicate the occurrence of certain USB and system events to the attached device.

### Command Code

Specified in the ISD-300A1 Configuration Bytes, address 0x2. Programming the command code to 0x00 disables the event-notify feature.

### Protocol

Non-data (refer to *ATA/ATAPI-5 Specification*, section 9.9).

### Notification Register Writes

| Register      | 7                                              | 6                    | 5           | 4          | 3                | 2                 | 1                  | 0                    |
|---------------|------------------------------------------------|----------------------|-------------|------------|------------------|-------------------|--------------------|----------------------|
| Features      | USB Reset                                      | Class Specific Reset | USB Suspend | USB Resume | Cartridge Insert | Cartridge Release | Eject Button Press | Eject Button Release |
| Sector Count  | Reserved                                       | Reserved             | Reserved    | Reserved   | Reserved         | Reserved          | USB High Speed     | USB Full Speed       |
| Sector Number | N/A                                            |                      |             |            |                  |                   |                    |                      |
| Cylinder Low  | STATE0                                         |                      |             |            |                  |                   |                    |                      |
| Cylinder High | STATE1                                         |                      |             |            |                  |                   |                    |                      |
| Device/Head   | N/A                                            |                      |             |            |                  |                   |                    |                      |
| Command       | Specified in the ISD-300A1 Configuration Bytes |                      |             |            |                  |                   |                    |                      |

**Table 19 – Event Notify ATA Command**

Features register –

The USB Reset bit indicates that a USB Reset event has occurred.

The Class Specific Reset bit indicates that an *MSC* Reset was issued by the host.

The USB Suspend bit indicates that the USB bus has gone into suspend.

The USB Resume bit denotes that the USB bus is no longer in suspend.  
 The Cartridge Insert bit is set when the device media is inserted.  
 The Cartridge Release bit is set when the device media is ejected.  
 The Eject Button Press bit is set when the eject button on the device is pressed.  
 The Eject Button Release bit is set when the eject button on the device is released.

#### Sector Count –

The USB Full Speed bit indicates the USB bus is now operating in full speed mode (12 Mbit).  
 The USB High Speed bit indicates the USB bus is now operating in high speed mode (480 Mbit).

#### Cylinder Low – STATE0

STATE0 is written with the value of NSTATE0 obtained from the previously completed event notification command. Assertion of NRESET resets STATE0 to 0x00.

#### Cylinder High – STATE1

STATE1 is written with the value of NSTATE1 obtained from the previously completed event notification command. Assertion of NRESET resets STATE1 to 0x00.

### Notification Register Reads

| Register      | 7       | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------------|---------|-----|-----|-----|-----|-----|-----|-----|
| Error         | N/A     |     |     |     |     |     |     |     |
| Sector Count  | N/A     |     |     |     |     |     |     |     |
| Sector Number | N/A     |     |     |     |     |     |     |     |
| Cylinder Low  | NSTATE0 |     |     |     |     |     |     |     |
| Cylinder High | NSTATE1 |     |     |     |     |     |     |     |
| Device/Head   | N/A     |     |     |     |     |     |     |     |
| Status        | BSY     | N/A | N/A | N/A | DRQ | N/A | N/A | N/A |

**Table 20 - Event Notify Drive Status**

#### Cylinder Low – NSTATE0

NSTATE0 is read from the device and stored for use as STATE0 during the next execution of the event notification command. NSTATE0 provides temporary non-volatile storage for devices whose power is controlled by NPWR500 (typically VBUS powered systems). This allows the device to store information prior to entering a USB suspend state for retrieval after resuming from the USB low power state.

#### Cylinder High – NSTATE1

NSTATE1 is read from the device and stored for use as STATE0 during the next execution of the event notification command. NSTATE0 provides temporary non-volatile storage for devices whose power is controlled by NPWR500 (typically VBUS powered systems). This allows the device to store information prior to entering a USB suspend state for retrieval after resuming from the USB low power state.

Note that a USB reset from the host may interrupt the collection of data. The device must accommodate the potential for this occurrence.

#### Status register –

BSY shall be cleared to zero upon command completion.  
 DRQ shall be cleared to zero.



### Error Outputs

If the device does not support this command, the device shall return command aborted. Otherwise, the device shall not report an error.

### Description

When the event notification command is issued, the ISD-300A1 waits until the device clears BSY and DRQ to zero before beginning register writes. After writing the input registers, the ISD-300A1 waits for BSY and DRQ cleared to zero and then reads the next state information (NSTATE).

The event notification command is issued following every reset of the device and following the power-on reset device initialization sequence. The event notification command is also issued after any of the events reported in the event notification data take place.

If any combination of mating events (mating events are defined as USB HS/FS, suspend/resume, cartridge insert/release, eject press/release, and USB/class reset) take place before the ISD-300A1 can issue the event notification command to the device, the following will occur:

1. Send an event notification command showing all events.
2. Send a subsequent event notification command showing only the most recent of any mated events.

If an event notification command does not complete for any reason (such as an incoming reset), the ISD-300A1 will re-issue the command (with any new event data) until it completes successfully. Success of the command does NOT depend upon the ERR bit. If the DRQ bit is set in response to an event notification, the ISD-300A1 will continue to poll (this debug feature makes device incompatibility obvious).

## Power Management

The ISD-300A1 is capable of offering two types of system power configurations.

- Self-Powered – VBUS current is limited to 100 mA or less.
- Bus-Powered – VBUS current is limited to 500 mA or less.

The ISD-300A1 dynamically operates in a self or bus powered system depending upon the state of the VBUS\_POWERED input.

### Control Pins

#### VBUS\_POWERED Pin

The VBUS\_POWERED input pin indicates the amount of system current drawn from VBUS. The VBUS powered input is used to qualify:

- The response for a GET\_STATUS USB request.
- An ISD-300A1 asynchronous reset in the following cases:
  - If VBUS\_POWERED is asserted high and the host has set the USB configuration for self powered operation.
  - If VBUS\_POWERED is detected changing state when USB configuration is set to 0.
- Which USB descriptors are presented to the host. If asserted, the first descriptor set is returned. If de-asserted, the second descriptor set is returned.

Setting VBUS\_POWERED inactive dictates the system is self powered, drawing up to the value of current returned in the bMaxPower field (100 mA maximum) or less from VBUS. Setting VBUS\_POWERED active indicates the system is capable of drawing up to the amount present in the bMaxPower USB descriptor field (500 mA maximum).

**DRV\_PWR\_VALID Pin**

*The DRV\_PWR\_VALID input pin is typically enabled only in Hybrid powered systems, or systems in which the ISD-300A1 receives power from VBUS, and the device receives power from another source. In VBUS or self powered systems DRV\_PWR\_VALID is typically not utilized. In Hybrid powered systems, DRV\_PWR\_VALID indicates if the device is powered or at least attached and qualifies device operation. DRV\_PWR\_VALID active polarity and enabling is controlled during ISD-300A1 configuration. It is active high in systems that can supply a power indication from the drive. It is active low in systems that utilize a “grounding scheme” to indicate when the cable is connected to the device. If enabled, and DRV\_PWR\_VALID is not determined active after the ISD-300A1 configuration data is loaded, the ISD-300A1 enters a low power mode of operation (similar to USB suspend state when in VBUS powered operation. See **Table 21 – ATA Interface Line States** on page 40 for more information). Asserting DRV\_PWR\_VALID enables resume from the low power operation state. This signal may also be used in conjunction with ATA\_EN to force the ISD-300A1 to disable the USB interface and operate in a low power state when sharing the ATA interface.*

**VBUS\_PWR\_VALID Pin**

This input pin indicates that VBUS power is present at the USB connector. VBUS\_PWR\_VALID qualifies driving the system's 1.5K ohm pull-up resistor on D+ when the system is externally powered (the USB specification only allows the device to source power to D+ when the host is powered). After the ISD-300A1 configuration data is loaded, if VBUS\_PWR\_VALID is inactive the ISD-300A1 enters a low power mode of operation. Asserting VBUS\_PWR\_VALID resumes operation from the low power state.

**DISK\_READY Pin**

This input pin indicates the attached device is powered and ready to begin communication with the ISD-300A1. DISK\_READY qualifies the start of the ISD-300A1's initialization sequence. A state change from 0 to 1 on DISK\_READY will cause the ISD-300A1 to wait for 25 ms before asserting NATA\_RESET and re-initialize the device. The ATA interface state machines remain inactive and all of the ATA interface signals are driven logic '0' if DISK\_READY is not asserted (assuming ATA\_EN = '1'). This input is not used in conjunction with DRV\_PWR\_VALID, and should be tied to logic '1' in hybrid powered systems. DISK\_READY is filtered for 25 ms on the rising edge and cleared asynchronously on the falling edge.

**NLOWPWR Pin**

When active, the NLOWPWR pin indicates the ISD-300A1 is operating in a low power state.

**NPWR500 Pin**

The NPWR500 output pin indicates the USB host has configured the ISD-300A1 USB interface for VBUS powered operation (VBUS\_POWERED pin active), granting the requested amount of power for the peripheral (the bMaxPower entry from descriptor set 1). In the case of a USB suspend condition, NPWR500 is de-asserted and the ISD-300A1 enters a low power state of operation. Upon a resume condition, the ISD-300A1 will resume normal operation and restore NPWR500 accordingly. *Note: ISD-300A1 power sources should not be controlled at any time by using the NPWR500 pin.*

## ATA Interface Line States

The following table depicts the ATA interface line state dependency with the various controlling input pins.

| Control Signals |        |                   |            | ATA Interface / Power Management                                                                                                                                                                                                                                                                                                                      |
|-----------------|--------|-------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 |        |                   |            | <b>VBUS_SUSPEND</b> DD[15:0], NCS[1:0], DA[2:0], ATA_PD_EN, ATA_PU_EN, NDIOR, NDIOW, NDMACK, NATA_RESET = '0'<br><b>OPERATIONAL</b> ATA_PD_EN = '0'<br>ATA_PU_EN = '1'<br>(NCS[1:0], DA[2:0] NDIOR, NDIOW, NDMACK, NATA_RESET = '1' when the ATA interface is idle)<br><b>ATA_HIZ</b> ATA_PD_EN, ATA_PU_EN, and all other ATA interface signals = 'Z' |
| NRESET          | ATA_EN | DRV_PWR_VALID (1) | DISK_READY |                                                                                                                                                                                                                                                                                                                                                       |
| 0               | 1      | X                 | X          | VBUS_SUSPEND state for the ATA interface.                                                                                                                                                                                                                                                                                                             |
| X               | 0      | X                 | X          | ATA_HIZ. All ATA interface signals are 3-stated (hi-Z).                                                                                                                                                                                                                                                                                               |
| 1               | 1      | 0                 | X<br>(= 1) | VBUS_SUSPEND state for ATA interface. This is a Hybrid powered application (VBUS powered ISD-300A1, brick powered ATA/ATAPI device)                                                                                                                                                                                                                   |
| 1               | 1      | 1                 | 0          | VBUS_SUSPEND state for the ATA interface.                                                                                                                                                                                                                                                                                                             |
| 1               | 1      | 1                 | 1          | OPERATIONAL. VBUS / Brick powered normal operation mode                                                                                                                                                                                                                                                                                               |

Notes: (1) DRV\_PWR\_VALID is active (polarity is correct) OR is disabled by configuration data.

**Table 21 – ATA Interface Line States**

## Operation Control

### NEJECT, NCART\_DET Pins – USB Remote Wakeup and Event Notification

These pins are used to trigger USB remote-wakeup as well as ATA Event Notification. When asserted low NEJECT indicates that a media eject request occurred. When asserted low NCART\_DET indicates that a media cartridge is present. For NEJECT, the pin value must remain static for 10 ms before any state change is detected by internal state machine logic. For NCART\_DET, any asynchronous change in state after the signal retains a static value for more than 10 ms is detected by internal state machine logic.

### GPIO Pins – General Purpose IO

The GPIO pins enable general purpose IO for miscellaneous use. Each GPIO pin has independent 3-state control, with an internal pull down resistor (50K ohm typically). The GPIO pins input, output, and 3-state control span three bytes of configuration space. The chosen implementation methodology does not allow read and write operations between GPIO[9:8] and GPIO[7:0] to occur during the same clock period.

- During read operations GPIO[9:8] are sampled one clock period (33ns) prior to GPIO[7:0] (assuming the read operation spans all GPIO register space).
- During write operations GPIO[9:8] 3-state control and output values are latched one clock period (33ns) prior to GPIO[7:0] 3-state control and output values (assuming the write operation spans all GPIO register space).

### I\_MODE Pin – Vendor Specific Identify (FBh) ATA Command (I\_MODE)

Asserting the I\_MODE pin high enables ISD-300A1 configuration and USB Descriptor data retrieval from an attached device via a vendor specific ATA command (FBh) rather than an external I<sup>2</sup>C memory device.

Unlike operation with an external I<sup>2</sup>C memory device, I\_MODE operation requires the attached device first be initialized and FBh data retrieved before the ISD-300A1 can allow USB enumeration. To meet USB specification requirements, I\_MODE operation must be limited to systems that draw 100 mA or less from VBUS prior to USB enumeration.

### SYS\_IRQ Pin – USB Interrupt

The SYS\_IRQ pin provides a way for systems to request service from host software by use of the USB Interrupt pipe. If the ISD-300A1 has no pending interrupt data to return, USB interrupt pipe data requests are NAK'd. If pending data is available, the ISD-300A1 returns 16-bits of data indicating the state of the GPIO[9:0] and DISK\_READY pins. **Table 22** and **Figure 4** depicts the bit map and latching algorithm incorporated by the ISD-300A1.

| USB Interrupt Data Byte 1 Bit Map |   |   |   |   |            |         |         | USB Interrupt Data Byte 0 Bit Map |         |         |         |         |         |         |         |
|-----------------------------------|---|---|---|---|------------|---------|---------|-----------------------------------|---------|---------|---------|---------|---------|---------|---------|
| 7                                 | 6 | 5 | 4 | 3 | 2          | 1       | 0       | 7                                 | 6       | 5       | 4       | 3       | 2       | 1       | 0       |
| 0                                 | 0 | 0 | 0 | 0 | DISK_READY | GPIO[9] | GPIO[8] | GPIO[7]                           | GPIO[6] | GPIO[5] | GPIO[4] | GPIO[3] | GPIO[2] | GPIO[1] | GPIO[0] |

**Table 22 – USB Interrupt Pipe Data**

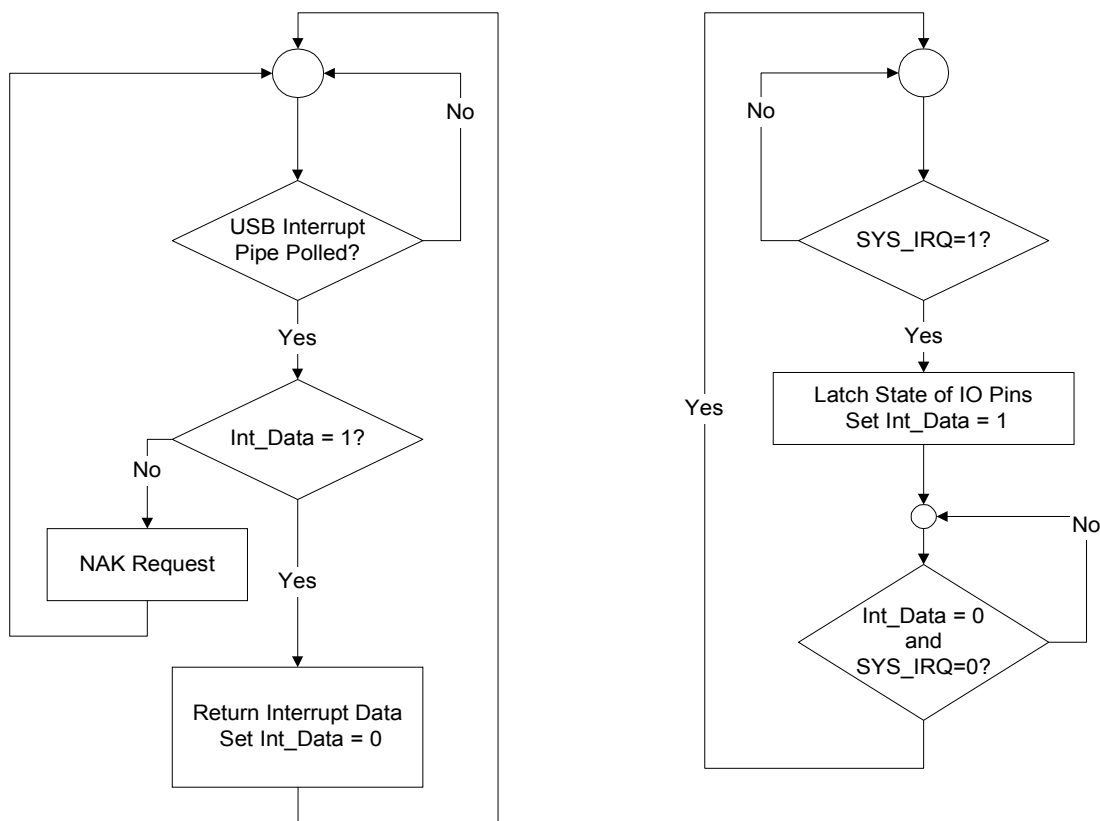


Figure 4 – SYS\_IRQ – USB Interrupt Pipe

### ATA\_EN Pin – ATA Interface Disabled

The ATA\_EN pin allows ATA bus sharing with other host devices. Asserting ATA\_EN low causes the ISD-300A1 to 3-state all ATA bus interface pins hi-Z and suspend ATA state machine activity, otherwise leaving the ISD-300A1 operational (USB operation continues). Asserting ATA\_EN high resumes normal operation.

To disable USB operation and the ATA interface, the DRIVE\_PWR\_VALID signal can be used in conjunction with ATA\_EN to force the ISD-300A1 into a low power state until normal operation is resumed.

### ATA\_PU\_EN Pin – ATA Interface Pull-up Resistor Source

This output provides control for the required host pull-up resistors on the ATA interface. ATA\_PU\_EN is 3-stated hi-Z when ATA\_EN is low.

### ATA\_PD\_EN Pin – ATA Interface Pull-down Resistor Sink

This output provides control for the required host pull-down resistors on the ATA interface. ATA\_PD\_EN is 3-stated hi-Z when ATA\_EN is low.

**TEST<3:0> Pins - Test Modes**

| <b>TEST(3:0)</b> | <b>Mode Description</b>                                                                                                                                                                               |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0000             | <b>Normal Mode</b> - This is the default mode of operation, or run time mode. Pull-downs are on.                                                                                                      |
| 0001             | <b>Normal Mode XCVR Muxout</b> – debug mode 1. See <b>XCVR Mux-out Mode</b> below.                                                                                                                    |
| 0010             | <b>Limbo</b> - Setting this mode disables most outputs. See <b>Limbo Mode</b> below.                                                                                                                  |
| 0011             | <b>Input NandTree</b> – Allows board level manufacturing tests. See <b>Input NandTree Mode</b> below.                                                                                                 |
| 0100             | <b>Bi-di NandTree</b> – Allows board level manufacturing tests. See <b>Bi-di NandTree Mode</b> below.                                                                                                 |
| 0101             | <b>SimTest</b> – HDL simulation only test mode. Specific GPIO pins are multiplexed in this mode of operation:<br>Short Timers      GPIO[2]<br>Short SRAM        GPIO[1]<br>Skip Identify      GPIO[0] |
| 0110             | <b>Scan Mode</b> – Fab only test mode                                                                                                                                                                 |
| 0111             | <b>Reserved</b>                                                                                                                                                                                       |
| 1000             | <b>Normal Mode XCVR Mux-out</b> – ASIC debug mode 2. See <b>XCVR Mux-out Mode</b> .                                                                                                                   |
| 1001             | <b>Normal Mode XCVR Mux-out</b> – ASIC debug mode 3. See <b>XCVR Mux-out Mode</b> .                                                                                                                   |
| 1010             | <b>Normal Mode XCVR Mux-out</b> – ASIC debug mode 4. See <b>XCVR Mux-out Mode</b> .                                                                                                                   |
| 1011             | <b>Test Bus</b> – SERDES Fab only test mode                                                                                                                                                           |
| 1100             | <b>Test Bus</b> – ROM Fab only test mode                                                                                                                                                              |
| 1101             | <b>Test Bus</b> – 256x8 SP SRAM. Fab only test mode                                                                                                                                                   |
| 1110             | <b>Test Bus</b> – 32x16 DP SRAM. Fab only test mode                                                                                                                                                   |
| 1111             | <b>Test Bus</b> – 4Kx16 DP SRAM. Fab only test mode                                                                                                                                                   |

**Table 23 – Test Modes****XCVR Mux-out Mode**

These modes of operation are similar to the Normal Mode of operation with various internal transceiver logic signals brought out through the GPIO and LED pins. These modes are intended only for Cypress ASIC qualification. The table below shows the mux-out scheme for each mode of operation.

| <b>Pin #</b> | <b>ISD-300A1 Pin Name</b> | <b>Mode 1 – XCVR signal</b> | <b>Mode 2 – XCVR signal</b> | <b>Mode 3 – XCVR signal</b> | <b>Mode 4 – XCVR signal</b> |
|--------------|---------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| 38           | GPIO0                     | RXERROR                     | IHS DRVON                   | TXREADY                     | PUE                         |
| 39           | GPIO1                     | RXBUSACT                    | CDRCLKEN                    | TXVALID                     | CLR XVM                     |
| 40           | GPIO2                     | RXDOUT(0)                   | CLK_30                      | TXDIN(0)                    | CLRSVP                      |
| 42           | GPIO3                     | RXDOUT(1)                   | CLK_60                      | TXDIN(1)                    | CLRXISE0                    |
| 44           | GPIO4                     | RXDOUT(2)                   | LPBACK1                     | TXDIN(2)                    | CLRS DATA                   |
| 45           | GPIO5                     | RXDOUT(3)                   | LPBACK0                     | TXDIN(3)                    | CNEN                        |
| 46           | GPIO6                     | RXDOUT(4)                   | LOCK                        | TXDIN(4)                    | CLRCVEN                     |
| 47           | GPIO7                     | RXDOUT(5)                   | IOST1                       | TXDIN(5)                    | CLTXOEN                     |
| 48           | GPIO8                     | RXDOUT(6)                   | IOST0                       | TXDIN(6)                    | CLTXOSE0                    |
| 49           | GPIO9                     | RXDOUT(7)                   | HSRCVEN                     | TXDIN(7)                    | CLTX DATA                   |
| 94           | NLED1                     | RXLSTBYT                    | 0                           | RXACTIVE                    | CONTJ                       |
| 95           | NLED0                     | RXVALID                     | PWRDOWN_XCVR                | TXBUSACT                    | CONTK                       |



### Limbo Mode

This mode of operation is provided to aid debug in manufacturing environments. The ISD-300A1 3-states (high Z) all output pins during Limbo mode operation with the exception of the XO pin. The XO pin output cell does not have 3-state control (always enabled), and thus must be disabled / disconnected by other means.

### Input NandTree Mode

This mode tests the connectivity of all inputs and outputs. While in the Input NandTree Mode of operation, all bi-directional pins are wired as chain outputs. The results of the connectivity procedure will be seen on all bi-directional pins. The list below shows the connectivity order of the Input NandTree chain (beginning to end).

#### Chain inputs:

BUS\_PWR\_VALID,  
VBUS\_POWERED,  
DRV\_PWR\_VALID,  
DISK\_READY,  
SYS\_IRQ,  
DMARQ,  
IORDY,  
NCART\_DET,  
NEJECT,  
NRESET,  
I\_MODE,  
ATA\_EN

#### Chain outputs:

GPIO{9:0}, DD[15:0], SDA

### Bi-di NandTree Mode

This mode test the connectivity of all bi-directional inputs. While in the Bi-di NandTree Mode of operation, all bi-directional pins are wired as inputs and become part of the NandTree chain. The results of the connectivity procedure will be seen on all output only pins. The list below shows the connectivity order of the Bi-di NandTree chain (beginning to end).

#### Chain inputs:

GPIO[0:9], Note: GPIO[0] first, GPIO[9] last  
DD[15], DD[0], DD[14], DD[1], DD[13], DD[2], DD[12], DD[3], DD[11], DD[4], DD[10], DD[5], DD[9], DD[6], DD[8], DD[7],

#### Chain outputs:

NLED[1:0], NPWR500, NATA\_RESET, NDIOW, NDIOR, NDMACK, ATA\_PU\_EN, ATA\_PD\_EN, NCS[1:0], DA[2:0],  
NLOWPWR, SCL

Pin connectivity in both NandTree modes can be tested with the following procedure:

1. Set all inputs on the chain to '1'. Outputs will be '1'.
2. Set first input to '0'. Outputs will toggle
3. Set first input back to '1'. Outputs will toggle.
4. Set '0' on the NandTree chain inputs from second input to the end of the chain (in order). The outputs will toggle with each input toggle, testing pad / IO cell connectivity.

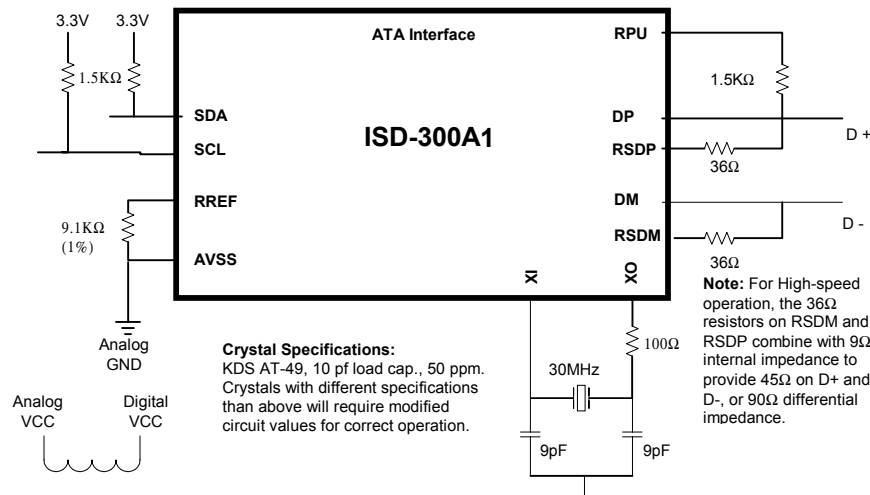
## Manufacturing Test Mode

This mode of operation is provided for interconnect test in a manufacturing environment. During Manufacturing Test Mode operation, all outputs not associated directly with USB operation are controllable. Normal state machine and register control of output pins is disabled. ISD-300A1 input pins not associated directly with USB operation can be sampled at any time during normal or Manufacturing Test Mode operation.

Vendor specific USB commands are used to enable and control Manufacturing Test Mode operation and to sample input pin states. See **Vendor-Specific Requests** for more details on the LOAD\_MFG\_DATA and READ\_MFG\_DATA USB commands.

## External Circuitry

USB, Crystal, and I<sup>2</sup>C Interface Connections



**Figure 5 – External Components connection**

## ATA Interface Considerations

### 1K Ohm Pull-down Resistor On DD<7>

For “slave” devices, a 1K ohm pull-down resistor must be utilized on DD7 for ISD-300A1 based designs. This is required for proper operation of the ISD-300A1 master/slave device auto detection algorithm. If this modification is omitted, slave devices will take an excessive amount of time to initialize (around 30 seconds). In systems with only master devices this modification may be omitted.

### ATA\_PD\_EN and ATA\_PU\_EN Usage In Self Powered Systems

These signals are controlled by ATA\_EN, DRV\_PWR\_VALID, and DISK\_READY. If these inputs are static, the ATA\_Px\_EN outputs can be left unconnected and the pull-up and pull-down resistors that normally connect to these outputs can be directly tied to the appropriate power rails.

**ATA Interface Termination**

Design practices as outlined in the *ATA/ATAPI-5 Specification* for signal integrity should be followed with systems that utilize a ribbon cable interconnect between the ISD-300A1 ATA interface and the device, especially if Ultra Mode DMA is utilized.

**3.3V Power Regulation**

In systems where the ATA/ATAPI device remains powered during ISD-300A1 low power operation (such as USB suspend state), the system design must insure the ISD-300A1 3.3V supply is not “back powered” through IO cell leakage current from the device’s 5V ATA interface, raising the supply rail above safe operating limits. Typically this may be accomplished by utilizing a 1.5K ohm resistive current sink between the 3.3V supply and ground.

**VBUS Powered System Considerations****GPIO Internal Pull Down Resistors**

All ISD-300A1 GPIO IO cells incorporate an internal pull down resistor (50K ohm typical). The system must insure the GPIO interface is at logic ‘0’ to eliminate current draw during the USB suspend state.

**Absolute Maximum Ratings**

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of this data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

| Symbol | Parameter                           | Min  | Max | Units   |
|--------|-------------------------------------|------|-----|---------|
| VDD    | 3.3 V IO Supply                     | -0.5 | 4.0 | Volts   |
| Vin    | Input Pin Voltage                   | -0.5 | 5.5 | Volts   |
| Ta     | Ambient Operating Temperature Range | -40° | 85° | Celsius |
| Tstrg  | Storage Temperature                 | -65  | 150 | Celsius |

**Table 24 – Absolute Maximum Ratings**

## Electrical Characteristics

| Voltage Parameter    | Symbol     | Test Conditions | Min | Typ | Max | Unit |
|----------------------|------------|-----------------|-----|-----|-----|------|
| Input Voltage Low    | $V_{IL}$   | —               | —   | —   | 0.8 | V    |
| Input Voltage High   | $V_{IH}$   | —               | 2.0 | —   | —   | V    |
| Output Voltage Low   | $V_{OL}$   | —               | —   | —   | 0.4 | V    |
| Output Voltage High  | $V_{OH}$   | —               | 2.4 | 3.3 | —   | V    |
| Power Supply Voltage | $V_{DD33}$ | —               | 3.0 | 3.3 | 3.6 | V    |

Note: ( $T_A = 20\text{ }^{\circ}\text{C}$ ,  $V_{DD33} = 3.3\text{ V} \pm 10\%$ ,  $V_{SS} = 0\text{ V}$ )

**Table 25 – Voltage Characteristics**

| Operation Current Parameters - Typical                   |                          |
|----------------------------------------------------------|--------------------------|
| High Speed $V_{DD}$ supply current ( $I_{DD}$ ) – Idle   | 180 mA (typ)             |
| High Speed $V_{DD}$ supply current ( $I_{DD}$ ) – Active | < 200 mA (typ)           |
| Full Speed $V_{DD}$ supply current ( $I_{DD}$ ) – Idle   | 121 mA (typ)             |
| Full Speed $V_{DD}$ supply current ( $I_{DD}$ ) – Active | < 135 mA (typ)           |
| Supply current w/ nRESET asserted                        | 90mA (typ)               |
| Low power w/ USB remote wakeup enabled                   | 2.7 mA (typ)             |
| Low power w/o USB remote wakeup enabled                  | < 20 $\mu\text{A}$ (typ) |

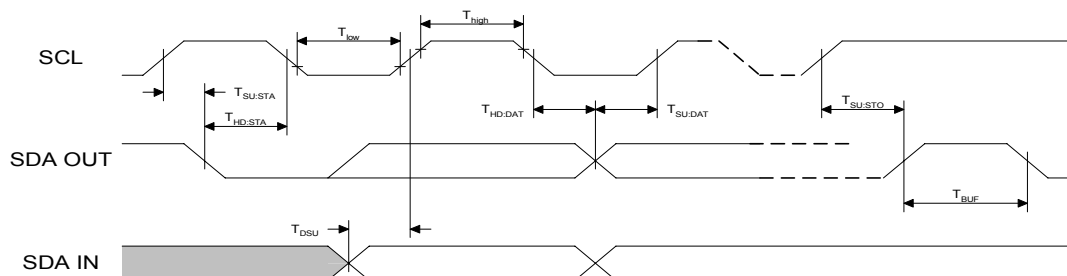
Note: ( $T_A = 20\text{ }^{\circ}\text{C}$ ,  $V_{DD} = 3.3\text{ V} \pm 10\%$ ,  $V_{SS} = 0\text{ V}$ )

**Table 26 – Power Supply Current Characteristics**

## Timing Characteristics

### I<sup>2</sup>C Memory Device Interface Timing

The I<sup>2</sup>C memory device interface supports a subset of the I<sup>2</sup>C “slow mode” specification implementation document. Timing specifics are given below.



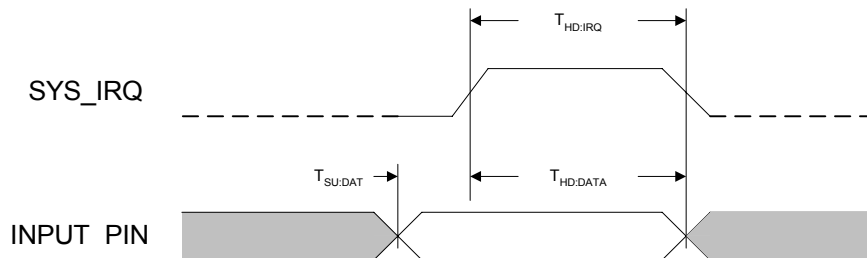
**Figure 6 – I<sup>2</sup>C Memory Device Interface Timing**

| I <sup>2</sup> C Parameter                         | Symbol       | Value   |
|----------------------------------------------------|--------------|---------|
| Clock high time                                    | $T_{high}$   | 5066 ns |
| Clock low time                                     | $T_{low}$    | 5066 ns |
| Start condition hold time                          | $T_{HD:STA}$ | 5066 ns |
| Start condition setup time                         | $T_{SU:STA}$ | 5066 ns |
| Data output hold time                              | $T_{HD:DAT}$ | 5066 ns |
| Data output setup time                             | $T_{SU:DAT}$ | 5066 ns |
| Stop condition setup time                          | $T_{SU:STO}$ | 5066 ns |
| Required data valid before clock                   | $T_{DSU}$    | 500 ns  |
| Min time bus must be free before next transmission | $T_{BUF}$    | 5066 ns |

**Table 27 – I<sup>2</sup>C Memory Device Interface Timing**

## SYS\_IRQ Interface Timing

The timing specifications for SYS\_IRQ relative to the USB interrupt pipe data are given below.



**Figure 7 – SYS\_IRQ Interface Timing**

| SYS_IRQ Parameter               | Symbol        | Value  |
|---------------------------------|---------------|--------|
| Interrupt pipe data set up time | $T_{SU:DAT}$  | 0 ns   |
| SYS_IRQ hold time               | $T_{HD:IRQ}$  | 150 ns |
| Interrupt pipe data hold time   | $T_{HD:DATA}$ | 150 ns |

**Table 28 – SYS\_IRQ Interface Timing**

## ATA/ATAPI Port Timing Characteristics

All input signals on the ATA/ATAPI port are considered asynchronous, and are synchronized to the chip's internal system clock. All output signals are clocked using the chip's internal system clock, for which there is no external reference. Thus, the output signals should be considered asynchronous. The PIO mode used for data register accesses is retrieved from the device or specified in the ISD-300A1 configuration bytes.

## Clock

| Crystal                                   | Frequency           | Duty Cycle |
|-------------------------------------------|---------------------|------------|
| KDS AT-49 crystal, 10pf load capacitance. | 30 MHz $\pm$ 0.005% | n/a        |

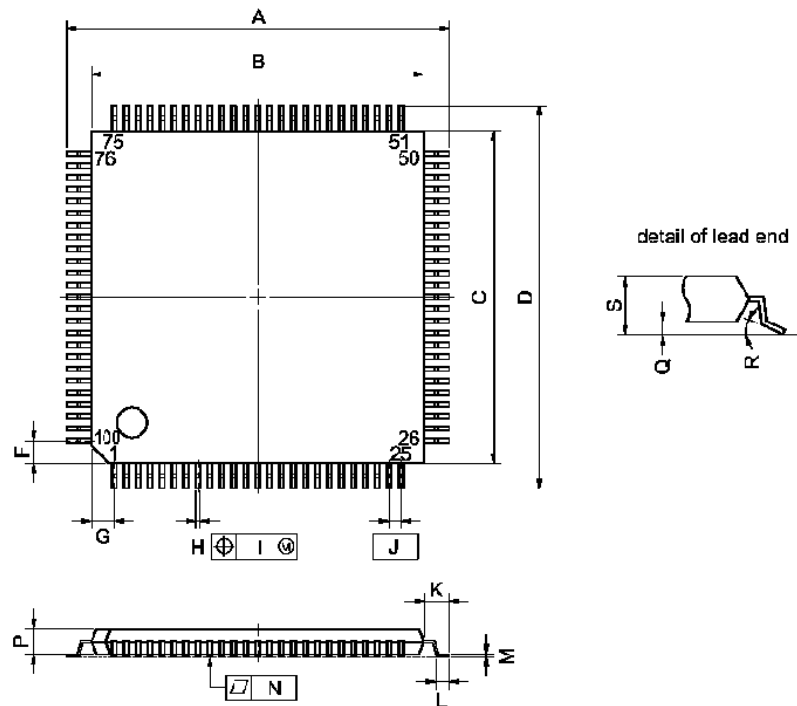
Note: Clock signal frequency is measured at  $V_{DD33}/2$  point. Rise and fall times should be 2 ns or less.

**Table 29 – Clock Requirements**

## Reset

The ISD-300A1 requires an off-chip power-on reset circuit. NRESET must be held asserted for a minimum of 1 ms after power is stable.

## Physical Diagrams

**NOTE**

Each lead centerline is located within 0.10 mm (0.004 inch) of its true position (T.P.) at maximum material condition.

| ITEM | MILLIMETERS                                | INCHES                                     |
|------|--------------------------------------------|--------------------------------------------|
| A    | 16.0±0.2                                   | 0.630±0.008                                |
| B    | 14.0±0.2                                   | 0.551 <sup>+0.009</sup> <sub>-0.008</sub>  |
| C    | 14.0±0.2                                   | 0.551 <sup>+0.009</sup> <sub>-0.008</sub>  |
| D    | 16.0±0.2                                   | 0.630±0.008                                |
| F    | 1.0                                        | 0.039                                      |
| G    | 1.0                                        | 0.039                                      |
| H    | 0.22 <sup>+0.05</sup> <sub>-0.04</sub>     | 0.009±0.002                                |
| I    | 0.10                                       | 0.004                                      |
| J    | 0.5 (T.P.)                                 | 0.020 (T.P.)                               |
| K    | 1.0±0.2                                    | 0.039 <sup>+0.009</sup> <sub>-0.008</sub>  |
| L    | 0.5±0.2                                    | 0.020 <sup>+0.008</sup> <sub>-0.009</sub>  |
| M    | 0.145 <sup>+0.055</sup> <sub>-0.045</sub>  | 0.006±0.002                                |
| N    | 0.10                                       | 0.004                                      |
| P    | 1.0±0.1                                    | 0.039 <sup>+0.005</sup> <sub>-0.004</sub>  |
| Q    | 0.1±0.05                                   | 0.004±0.002                                |
| R    | 3 <sub>1</sub> <sup>+7</sup> <sub>-3</sub> | 3 <sub>1</sub> <sup>+7</sup> <sub>-3</sub> |
| S    | 1.27 MAX.                                  | 0.050 MAX.                                 |

S100GC-50-8EU-1

Figure 8 – Package Outline Diagram

## Appendix A – Example EEPROM or FBh Identify Data Contents

| Address                             | Field Name                                        | Description                                                                                                                                                                                                                                                                                                                                                                                           | Example<br>SRAM<br>Data |
|-------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>ISD-300A1 Configuration Data</b> |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                       |                         |
| 0x0<br>(Byte 0)                     | I <sup>2</sup> C memory device<br>Signature (lsb) | lsb I <sup>2</sup> C memory device Signature byte.<br><b>Register does not exist in HW</b>                                                                                                                                                                                                                                                                                                            | 0x54                    |
| 0x1<br>(Byte 1)                     | I <sup>2</sup> C memory device<br>Signature (msb) | msb I <sup>2</sup> C memory device Signature byte.<br><b>Register does not exist in HW</b>                                                                                                                                                                                                                                                                                                            | 0x4D                    |
| 0x2<br>(Byte 0)                     | Event Notification                                | ATAPI event notification command. Setting this field to 0x00 disables this feature.                                                                                                                                                                                                                                                                                                                   | 0xFC                    |
| 0x3<br>(Byte 1)                     | APM Value                                         | Bit(7:0)<br>ATA Device Automatic Power Management Value. If an attached ATA device supports APM and this field contains other than 0x00, the Initialization state machines will issue a SET FEATURES command to Enable APM with the register value during the drive initialization process. Setting APM Value to 0x00 disables this functionality. This register value is ignored with ATAPI devices. | 0x00                    |
| 0x4                                 | ATA Initialization<br>Timeout                     | Time in 128 millisecond granularity before the ISD-300A1 stops polling the ALT STAT register for reset complete and restarts the reset process (0x80 = 16.4 seconds).                                                                                                                                                                                                                                 | 0x80                    |



| Address | Field Name                                                                                                                                                                                | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Example<br>SROM<br>Data |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 0x5     | USB Bus Mode<br><br>ATAPI Command Block Size<br><br>Master/Slave Selection<br><br>ATAPI Reset<br><br>ATA_NATAPI<br><br>Force USB FS<br><br>VS / MSC SOFT_RESET<br><br>DISK_READY Polarity | Bit (7) – read only.<br>USB bus mode of operation<br>0 USB bus is operating in full speed mode (12 Mbit/sec).<br>1 USB bus is operating in high speed mode (480 Mbit/sec).<br><br>Bit (6)<br>CBW Command Block Size.<br>0 12 byte ATAPI CB<br>1 16 byte ATAPI CB<br><br>Bit (5)<br>Device number selection. This bit is valid only when “Skip ATA/ATAPI Device Initialization” is active. Under ISD-300A1 control (“Skip ATA/ATAPI Device Initialization = ‘0’”), the value is ignored.<br>0 Drive 0 (master)<br>1 Drive 1 (slave)<br><br>Bit (4)<br>ATAPI reset during drive initialization.<br>Setting this bit enables the ATAPI reset algorithm in the drive initialization state machines<br><br>Bit (3) – read only.<br>Indicates if an ATA or ATAPI device is detected<br>0 ATAPI device<br>1 ATA device or possible device initialization failure.<br><br>Bit(2)<br>Force USB full speed only operation.<br>Setting this bit prevents the ISD-300A1 from negotiating HS operation during USB reset events<br>0 Normal operation – allow HS negotiation during USB reset<br>1 USB FS only – do not allow HS negotiation during USB reset<br><br>Bit(1)<br>Vendor Specific / MSC SOFT_RESET control.<br>0 Vendor Specific USB command utilized for SOFT_RESET<br>1 Mass Storage Class USB command utilized for SOFT_RESET<br><br>Bit (0)<br>DISK_READY active polarity. DISK_READY Polarity is ignored if I_MODE is set to 1. During I_MODE operation DISK_READY polarity is active high.<br>0 Active high polarity<br>1 Active low polarity | 0x00                    |
| 0x6     | ATA Command Designator (Byte 0, lsb)                                                                                                                                                      | Value in CBW CB field that designates if the CB is decoded as vendor specific ATA commands instead of the ATAPI command block.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0x24                    |
| 0x7     | ATA Command Designator (Byte 1, msb)                                                                                                                                                      | Value in CBW CB field that designates if the CB is decoded as vendor specific ATA commands instead of the ATAPI command block.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0x24                    |

| Address | Field Name                             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Example<br>SROM<br>Data |
|---------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 0x8     | Initialization Status                  | Bit (7) – read only<br>Drive Initialization Status<br>If set, indicates the drive initialization sequence state machine is active                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0x00                    |
|         | Force ATA Device                       | Bit (6)<br>Allows software to manually enable ATA Translation with devices that do not support ISD-300A1 device initialization algorithms. <i>Note: Force ATA Device must be set '1' in conjunction with Skip ATA/ATAPI Device Initialization and ATA Translation Enable.</i> Software must issue an INQUIRY command followed with a MSC reset to allow the ISD-300A1 to parse drive information and optimize system performance and operation. Force ATA Device should be set '0' for devices that support ISD-300A1 device initialization algorithms.                                                                         |                         |
|         | Skip ATA / ATAPI Device Initialization | Bit (5)<br>Skip_Init – This bit should be cleared for I_MODE operation. The host driver must initialize the attached device (if required) when this bit is set. <i>Note: For ATAPI devices, if Skip_Init is set the host driver must issue an IDENTIFY command utilizing ATACBs to allow the ISD-300A1 to parse drive information to optimize system performance and operation. Refer to bmATACBActionSelect in the ATA Command Block - Field Descriptions section on page 30 for further information.</i><br>0 normal operation<br>1 only reset the device and write the device control register prior to processing commands. |                         |
|         | Obsolete                               | Bit (4:3) – Shall be set to '0'                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |
|         | Last LUN Identifier                    | Bits (2:0)<br>Maximum number of LUNs device supports.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                         |
| 0x9     | ATA_EN                                 | Bits (7) – read only.<br>Current logic state of the ATA_EN pin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0x01                    |
|         | Obsolete                               | Bit (6:1) – Should be set to 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                         |
|         | SRST Enable                            | Bit (0)<br>SRST reset during drive initialization. Setting this bit enables the SRST reset algorithm in the drive initialization state machines.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |
| 0xA     | ATA Data Assert                        | Bits (7:4)<br>Standard values for ATA compliant devices and a 30.0 MHz system clock (in binary). <i>Note: These values are only valid when the Override PIO Timing configuration bit is set.</i><br>mode 0 0101 (5+1)*33.33 = 200 ns<br>mode 1 0011 (3+1)*33.33 = 133 ns<br>mode 2 0011 (3+1)*33.33 = 133 ns<br>mode 3 0010 (2+1)*33.33 = 100 ns<br>mode 4 0010 (2+1)*33.33 = 100 ns                                                                                                                                                                                                                                            | 0x20                    |
|         | ATA Data Recover                       | Bits (3:0)<br>ATA cycle times are calculated using Data Assert and Data Recover values. Standard recover values and cycle times for ATA compliant devices and a 30.0 MHz system clock (in binary). <i>Note: These values are only valid when the Override PIO Timing configuration bit is set.</i><br>mode 0 1100 (4+1)+(12+1)*33.33 = 600 ns<br>mode 1 0111 (3+1)+(7+1)*33.33 = 400 ns<br>mode 2 0011 (2+1)+(3+1)*33.33 = 233 ns<br>mode 3 0010 (2+1)+(2+1)*33.33 = 200 ns<br>mode 4 0000 (2+1)+(0+1)*33.33 = 133 ns                                                                                                           |                         |



| Address | Field Name                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Example<br>SROM<br>Data |
|---------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 0xB     | ATA Data Setup             | <p>Bits (7:5)<br/>Setup time is only incurred on the first data cycle of a burst. Standard values for ATA compliant devices and a 30.0 MHz system clock are (in binary): <i>Note: These values are only valid when the Override PIO Timing configuration bit is set.</i></p> <p>mode 0    010    <math>(2+1)*33.33 = 133 \text{ ns}</math><br/> mode 1    001    <math>(1+1)*33.33 = 66 \text{ ns}</math><br/> mode 2    001    <math>(1+1)*33.33 = 66 \text{ ns}</math><br/> mode 3    001    <math>(1+1)*33.33 = 66 \text{ ns}</math><br/> mode 4    000    <math>(0+1)*33.33 = 33 \text{ ns}</math></p> | 0x00                    |
|         | Drive Power Valid Polarity | <p>Bit (4)<br/>Controls the polarity of DRV_PWR_VALID pin</p> <p>0            Active low ("connector ground" indication)<br/> 1            Active high (power indication from device)</p>                                                                                                                                                                                                                                                                                                                                                                                                                  |                         |
|         | Override PIO Timing        | <p>Bit (3)<br/>This field is used in conjunction with ATA Data Setup, ATA Data Assertion, ATA Data Recover, and PIO Mode Selection fields.</p> <p>0            Use timing information acquired from the Drive<br/> 1            Override device timing information with configuration values</p>                                                                                                                                                                                                                                                                                                           |                         |
|         | Drive Power Valid Enable   | <p>Bit (2)<br/>Enable for the DRV_PWR_VALID pin. Drive Power Valid should only be enabled in cable applications where the ISD-300A1 is VBUS powered.</p> <p>0            pin disabled (most systems)<br/> 1            pin enabled</p>                                                                                                                                                                                                                                                                                                                                                                     |                         |
|         | ATA Read Kludge            | <p>Bit(1)<br/>PIO data read 3-state control. Enabling this will 3-state (hi-Z) the ATA data bus during PIO read operations while addressing the data register. In most applications this bit is set to '0'. This functionality is provided as a solution for devices that erroneously drive the ATA data bus continuously during PIO data register reads.</p> <p>0            Normal operation as per ATA/ATAPI interface specification.<br/> 1            3-state (hi-Z) DD[15:0] during PIO data register reads.</p>                                                                                     |                         |
|         | I_MODE                     | <p>Bit (0) – read only<br/>This bit reflects the current state of the I_MODE input pin.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |



| Address | Field Name             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Example<br>SROM<br>Data |
|---------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 0xC     | SYS_IRQ                | Bits(7) – read only<br>This bit reflects the current logic state of the SYS_IRQ input.                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0x32                    |
|         | DISK_READY             | Bit(6) – read only<br>This bit reflects the current logic state of the DISK_READY input.                                                                                                                                                                                                                                                                                                                                                                                                                                     |                         |
|         | ATA Translation Enable | Bit(5)<br>Enable ATAPI to ATA protocol translation enable. If enabled, AND if an ATA device is detected, ATA translation is enabled. <i>Note: If Skip ATA/ATAPI Device Initialization is set '1', Force ATA Device must also be set '1' in order to utilize ATA translation. Software must further issue an INQUIRY command followed with an MSC reset to enable ATA translation operation.</i><br>0      ATA Translation Disabled<br>1      ATA Translation Enable                                                          |                         |
|         | ATA UDMA Enable        | Bit(4)<br>Enable Ultra Mode data transfer support for ATA devices. If enabled, AND the ATA device reports UDMA support, the ISD-300A1 will utilize UDMA data transfers.<br>0      Disable ATA device UDMA support<br>1      Enable ATA device UDMA support                                                                                                                                                                                                                                                                   |                         |
|         | ATAPI UDMA Enable      | Bit(3)<br>Enable Ultra Mode data transfer support for ATAPI devices. If enabled, AND the ATAPI device reports UDMA support, the ISD-300A1 will utilize UDMA data transfers.<br>0      Disable ATAPI device UDMA support<br>1      Enable ATAPI device UDMA support                                                                                                                                                                                                                                                           |                         |
|         | ROM UDMA Mode          | Bits(2:0)<br>ROM UDMA Mode indicates the highest UDMA mode supported by the product. The ISD-300A1 will utilize the lesser of ROM UDMA Mode or the highest mode supported by the device. <i>Note: UDMA read operation mode timing is controlled by the device.</i><br>mode 0    000    133.3 ns per 16-bit word write<br>mode 1    001    100 ns per 16-bit word write<br>mode 2    010    66.7 ns per 16-bit word write<br>mode 3    011    66.7 ns per 16-bit word write<br>mode 4    100    33.3 ns per 16-bit word write |                         |

| Address                      | Field Name                         | Description                                                                                                                                                                                                                                                                                                                                                                                  | Example<br>SROM<br>Data |
|------------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 0xD                          | PIO Mode Selection                 | <p>Bits (7:5)<br/>PIO Mode Selection. The PIO mode reported back to the device if the Override PIO Timing configuration bit is set. This field represents the PIO mode of operation configured by the ATA Data Setup, ATA Data Assertion, ATA Data Recover, and Override PIO Timing fields.</p> <p>mode 0    000<br/>mode 1    001<br/>mode 2    010<br/>mode 3    011<br/>mode 4    100</p> | 0x23                    |
|                              | Skip Pin Reset                     | <p>Bit (4)<br/>Skip ATA_NRESET assertion. <i>Note: SRST Enable must be set in conjunction with Skip Pin Reset.</i> Setting this bit causes the Initialize algorithm to bypass ATA_NRESET assertion unless a drive Power On Reset cycle occurred, utilizing SRST as the drive reset mechanism.</p> <p>0        Allow ATA_NRESET assertion<br/>1        Disable ATA_NRESET assertion</p>       |                         |
|                              | General Purpose IO                 | <p>Bits (3:2)<br/>GPIO[9:8] input / output control<br/>Writing this register controls the output state of the GPIO pin (if the 3-state control is enabled)<br/>Reading this register returns the logic value from the GPIO pin</p>                                                                                                                                                           |                         |
|                              | General Purpose IO 3-state control | <p>Bits (1:0)<br/>GPIO[9:8] 3-state control<br/>0    Output enabled (GPIO pin is an output)<br/>1    3-state (hi-Z) (GPIO pin is an input)</p>                                                                                                                                                                                                                                               |                         |
| 0xE                          | General Purpose IO                 | <p>Bits(7:0)<br/>GPIO[7:0] input / output control<br/>Writing this register controls the output state of the GPIO pin (if the 3-state control is enabled)<br/>Reading this register returns the logic value from the GPIO pin</p>                                                                                                                                                            | 0x00                    |
| 0xF                          | General Purpose IO 3-state control | <p>Bits(7:0)<br/>GPIO[7:0] 3-state control<br/>0    Output enabled (GPIO pin is an output)<br/>1    3-state (hi-Z) (GPIO pin is an input)</p>                                                                                                                                                                                                                                                | 0xFF                    |
| <b>USB 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                    |
| 0x16                         | bDeviceProtocol                    | Device protocol.                                                                                                                                                                                                                                                                                                                                                                             | 0x00                    |
| 0x17                         | bMaxPacketSize0                    | Maximum USB packet size supported                                                                                                                                                                                                                                                                                                                                                            | 0x40                    |
| 0x18                         | idVendor (LSB)                     | Vendor ID.                                                                                                                                                                                                                                                                                                                                                                                   | 0xAB                    |
| 0x19                         | idVendor (MSB)                     |                                                                                                                                                                                                                                                                                                                                                                                              | 0x05                    |
| 0x1A                         | idProduct (LSB)                    | Product ID.                                                                                                                                                                                                                                                                                                                                                                                  | 0x60                    |
| 0x1B                         | idProduct (MSB)                    |                                                                                                                                                                                                                                                                                                                                                                                              | 0x00                    |
| 0x1C                         | bcdDevice (LSB)                    | Device release number in BCD lsb (product release number)                                                                                                                                                                                                                                                                                                                                    | 0x00                    |
| 0x1D                         | bcdDevice (MSB)                    | Device release number in BCD msb (silicon release number). <i>NOTE: This field entry is always returned from internal ROM contents, regardless of the descriptor source.</i>                                                                                                                                                                                                                 | 0x10                    |
| 0x1E                         | iManufacturer                      | Index to manufacturer string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                                                                                                                                                                                                     | 0x49                    |

| Address                                           | Field Name           | Description                                                                                                                                                                                                                                    | Example<br>SROM<br>Data |
|---------------------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 0x1F                                              | iProduct             | Index to product string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                                                            | 0x5A                    |
| 0x20                                              | iSerialNumber        | Index to serial number string. This entry must equal half of the address value where the string starts or 0 if the string does not exist. <i>The USB Mass Storage Class Bulk Only Transport Specification requires a unique serial number.</i> | 0x6E                    |
| 0x21                                              | bNumConfigurations   | Number of configurations supported.                                                                                                                                                                                                            | 0x01                    |
| <b>USB Device Qualifier Descriptor</b>            |                      |                                                                                                                                                                                                                                                |                         |
| 0x22                                              | bLength              | Length of device descriptor in bytes.                                                                                                                                                                                                          | 0x0A                    |
| 0x23                                              | bDescriptorType      | Descriptor type.                                                                                                                                                                                                                               | 0x06                    |
| 0x24                                              | bcdUSB (LSB)         | USB Specification release number in BCD.                                                                                                                                                                                                       | 0x00                    |
| 0x25                                              | bcdUSB (MSB)         |                                                                                                                                                                                                                                                | 0x02                    |
| 0x26                                              | bDeviceClass         | Device class.                                                                                                                                                                                                                                  | 0x00                    |
| 0x27                                              | bDeviceSubClass      | Device subclass.                                                                                                                                                                                                                               | 0x00                    |
| 0x28                                              | bDeviceProtocol      | Device protocol.                                                                                                                                                                                                                               | 0x00                    |
| 0x29                                              | bMaxPacketSize0      | Maximum USB packet size supported                                                                                                                                                                                                              | 0x40                    |
| 0x2A                                              | bNumConfigurations   | Number of configurations supported                                                                                                                                                                                                             | 0x01                    |
| 0x2B                                              | bReserved            | Reserved for future use, must be zero                                                                                                                                                                                                          | 0x00                    |
| <b>USB Standard Configuration Descriptor 1</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.                                                                                                    | 0x27                    |
| 0x2F                                              | bTotalLength (MSB)   |                                                                                                                                                                                                                                                | 0x00                    |
| 0x30                                              | bNumInterfaces       | Number of interfaces supported. The ISD-300A1 only supports one interface.                                                                                                                                                                     | 0x01                    |
| 0x31                                              | bConfiguration Value | The value to use as an argument to Set Configuration to select the configuration. This value must be set to 0x02                                                                                                                               | 0x02                    |
| 0x32                                              | iConfiguration       | Index to the configuration string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                                                  | 0x00                    |
| 0x33                                              | bmAttributes         | Device attributes for this configuration. Configuration characteristics:<br>Bit Description On-board default<br>7 Reserved. '1'<br>6 Self-powered. '1'<br>5 Remote wake-up. '0'<br>4-0 Reserved, set to 0. '0'                                 | 0x80                    |
| 0x34                                              | bMaxPower            | Maximum power consumption for this configuration. Units used are mA*2 (i.e. 0x31 = 98 mA, 0xF9 = 498 mA).                                                                                                                                      | 0xF9                    |
| <b>USB Other Speed Configuration Descriptor 1</b> |                      |                                                                                                                                                                                                                                                |                         |
| 0x35                                              | bLength              | Length of configuration descriptor in bytes.                                                                                                                                                                                                   | 0x09                    |
| 0x36                                              | bDescriptorType      | Descriptor type.                                                                                                                                                                                                                               | 0x07                    |
| 0x37                                              | bTotalLength (LSB)   | Number of bytes returned in this configuration. This includes the configuration descriptor plus all the interface and endpoint descriptors.                                                                                                    | 0x27                    |
| 0x38                                              | bTotalLength (MSB)   |                                                                                                                                                                                                                                                | 0x00                    |
| 0x39                                              | bNumInterfaces       | Number of interfaces supported. The ISD-300A1 only supports one interface.                                                                                                                                                                     | 0x01                    |
| 0x3A                                              | bConfiguration Value | The value to use as an argument to Set Configuration to select the configuration. This value must be set to 0x02                                                                                                                               | 0x02                    |
| 0x3B                                              | iConfiguration       | Index to configuration string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                                                      | 0x00                    |
| 0x3C                                              | bmAttributes         | Device attributes for this configuration. Configuration characteristics:<br>Bit Description On-board default<br>7 Reserved. '1'<br>6 Self-powered. '1'<br>5 Remote wake-up. '0'<br>4-0 Reserved, set to 0. '0'                                 | 0x80                    |

| Address                              | Field Name           | Description                                                                                                                                    | Example<br>SROM<br>Data |
|--------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 0x3D                                 | bMaxPower            | Maximum power consumption for the second configuration. Units used are mA*2 (i.e. 0x31 = 98 mA, 0xF9 = 498 mA).                                | 0xF9                    |
| <b>USB Interface Descriptor (HS)</b> |                      |                                                                                                                                                |                         |
| 0x3E                                 | bLength              | Length of interface descriptor in bytes.                                                                                                       | 0x09                    |
| 0x3F                                 | bDescriptorType      | Descriptor type.                                                                                                                               | 0x04                    |
| 0x40                                 | bInterfaceNumber     | Interface number.                                                                                                                              | 0x00                    |
| 0x41                                 | bAlternateSettings   | Alternate settings                                                                                                                             | 0x00                    |
| 0x42                                 | bNumEndpoints        | Number of endpoints                                                                                                                            | 0x03                    |
| 0x43                                 | bInterfaceClass      | Interface class.                                                                                                                               | 0x08                    |
| 0x44                                 | bInterfaceSubClass   | Interface subclass.                                                                                                                            | 0x06                    |
| 0x45                                 | bInterfaceProtocol   | Interface protocol.                                                                                                                            | 0x50                    |
| 0x46                                 | iInterface           | Index to first interface string. This entry must equal half of the address value where the string starts or zero if the string does not exist. | 0x00                    |
| <b>USB Bulk Out (HS)</b>             |                      |                                                                                                                                                |                         |
| 0x47                                 | bLength              | Length of this descriptor in bytes.                                                                                                            | 0x07                    |
| 0x48                                 | bDescriptorType      | Endpoint descriptor type.                                                                                                                      | 0x05                    |
| 0x49                                 | bEndpointAddress     | This is an Out endpoint, endpoint number 1.                                                                                                    | 0x01                    |
| 0x4A                                 | bmAttributes         | This is a bulk endpoint.                                                                                                                       | 0x02                    |
| 0x4B                                 | wMaxPacketSize (lsb) | Max data transfer size.                                                                                                                        | 0x00                    |
| 0x4C                                 | wMaxPacketSize (msb) |                                                                                                                                                | 0x02                    |
| 0x4D                                 | bInterval            | HS interval for polling (max NAK rate.)                                                                                                        | 0x01                    |
| <b>USB Bulk In (HS)</b>              |                      |                                                                                                                                                |                         |
| 0x4E                                 | bLength              | Length of this descriptor in bytes.                                                                                                            | 0x07                    |
| 0x4F                                 | bDescriptorType      | Endpoint descriptor type.                                                                                                                      | 0x05                    |
| 0x50                                 | bEndpointAddress     | This is an In endpoint, endpoint number 2.                                                                                                     | 0x82                    |
| 0x51                                 | bmAttributes         | This is a bulk endpoint.                                                                                                                       | 0x02                    |
| 0x52                                 | wMaxPacketSize (LSB) | Max data transfer size.                                                                                                                        | 0x00                    |
| 0x53                                 | wMaxPacketSize (MSB) |                                                                                                                                                | 0x02                    |
| 0x54                                 | bInterval            | HS interval for polling (max NAK rate). Does not apply to FS bulk endpoints.                                                                   | 0x01                    |
| <b>USB Interrupt (HS)</b>            |                      |                                                                                                                                                |                         |
| 0x55                                 | bLength              | Length of this descriptor in bytes.                                                                                                            | 0x07                    |
| 0x56                                 | bDescriptorType      | Endpoint descriptor type.                                                                                                                      | 0x05                    |
| 0x57                                 | bEndpointAddress     | This is an Interrupt endpoint, endpoint number 3.                                                                                              | 0x83                    |
| 0x58                                 | BmAttributes         | This is an interrupt endpoint.                                                                                                                 | 0x03                    |
| 0x59                                 | wMaxPacketSize (LSB) | Max data transfer size.                                                                                                                        | 0x02                    |
| 0x5A                                 | wMaxPacketSize (MSB) |                                                                                                                                                | 0x00                    |
| 0x5B                                 | bInterval            | This is the polling interval. 0x0A = 64ms.                                                                                                     | 0x0A                    |
| 0x5C                                 |                      | Unused I <sup>2</sup> C memory device / internal ROM space for address pointer alignment                                                       | 0x00                    |
| <b>USB Interface Descriptor (FS)</b> |                      |                                                                                                                                                |                         |
| 0x5D                                 | bLength              | Length of interface descriptor in bytes.                                                                                                       | 0x09                    |
| 0x5E                                 | bDescriptorType      | Descriptor type.                                                                                                                               | 0x04                    |
| 0x5F                                 | bInterfaceNumber     | Interface number.                                                                                                                              | 0x00                    |
| 0x60                                 | bAlternateSettings   | Alternate settings                                                                                                                             | 0x00                    |
| 0x61                                 | bNumEndpoints        | Number of endpoints                                                                                                                            | 0x03                    |
| 0x62                                 | bInterfaceClass      | Interface class.                                                                                                                               | 0x08                    |
| 0x63                                 | bInterfaceSubClass   | Interface subclass.                                                                                                                            | 0x06                    |
| 0x64                                 | bInterfaceProtocol   | Interface protocol.                                                                                                                            | 0x50                    |

| Address                                        | Field Name           | Description                                                                                                                                                                                                    | Example<br>SROM<br>Data |
|------------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 0x65                                           | iInterface           | Index to first interface string. This entry must equal half of the address value where the string starts or zero if the string does not exist.                                                                 | 0x00                    |
| <b>USB Bulk Out (FS)</b>                       |                      |                                                                                                                                                                                                                |                         |
| 0x66                                           | bLength              | Length of this descriptor in bytes.                                                                                                                                                                            | 0x07                    |
| 0x67                                           | bDescriptorType      | Endpoint descriptor type.                                                                                                                                                                                      | 0x05                    |
| 0x68                                           | bEndpointAddress     | This is an Out endpoint, endpoint number 1.                                                                                                                                                                    | 0x01                    |
| 0x69                                           | bmAttributes         | This is a bulk endpoint.                                                                                                                                                                                       | 0x02                    |
| 0x6A                                           | wMaxPacketSize (lsb) | Max data transfer size.                                                                                                                                                                                        | 0x40                    |
| 0x6B                                           | wMaxPacketSize (msb) |                                                                                                                                                                                                                | 0x00                    |
| 0x6C                                           | bInterval            | Interval for polling                                                                                                                                                                                           | 0x00                    |
| <b>USB Bulk In (FS)</b>                        |                      |                                                                                                                                                                                                                |                         |
| 0x6D                                           | bLength              | Bulk In descriptor length                                                                                                                                                                                      | 0x07                    |
| 0x6E                                           | bDescriptorType      | Descriptor type                                                                                                                                                                                                | 0x05                    |
| 0x6F                                           | bEndpointAddress     | Endpoint address                                                                                                                                                                                               | 0x82                    |
| 0x70                                           | bmAttributes         | Attributes                                                                                                                                                                                                     | 0x02                    |
| 0x71                                           | wMaxPacketSize (lsb) | Max packet size lsb                                                                                                                                                                                            | 0x40                    |
| 0x72                                           | wMaxPacketSize (msb) | Max packet size msb                                                                                                                                                                                            | 0x00                    |
| 0x73                                           | bInterval            | Interval for polling                                                                                                                                                                                           | 0x00                    |
| <b>USB Interrupt (FS)</b>                      |                      |                                                                                                                                                                                                                |                         |
| 0x74                                           | bLength              | Interrupt descriptor length                                                                                                                                                                                    | 0x07                    |
| 0x75                                           | bDescriptorType      | Descriptor type                                                                                                                                                                                                | 0x05                    |
| 0x76                                           | bEndpointAddress     | Endpoint address                                                                                                                                                                                               | 0x83                    |
| 0x77                                           | bmAttributes         | Attributes                                                                                                                                                                                                     | 0x03                    |
| 0x78                                           | wMaxPacketSize (lsb) | Max packet size lsb                                                                                                                                                                                            | 0x02                    |
| 0x79                                           | wMaxPacketSize (msb) | Max packet size msb                                                                                                                                                                                            | 0x00                    |
| 0x7A                                           | bInterval            | Interval for polling                                                                                                                                                                                           | 0x40                    |
| 0x7B                                           |                      | Unused I <sup>2</sup> C memory device / internal ROM space for address pointer alignment                                                                                                                       | 0x00                    |
| <b>USB String Descriptor (LANGID)</b>          |                      |                                                                                                                                                                                                                |                         |
| 0x7C                                           | bLength              | LANGID descriptor length                                                                                                                                                                                       | 0x04                    |
| 0x7D                                           | bDescriptorType      | Descriptor type                                                                                                                                                                                                | 0x03                    |
| 0x7E                                           | LANGID (lsb)         | Language supported lsb                                                                                                                                                                                         | 0x09                    |
| 0x7F                                           | LANGID (msb)         | Language supported msb                                                                                                                                                                                         | 0x04                    |
| <b>USB Standard Configuration Descriptor 2</b> |                      |                                                                                                                                                                                                                |                         |
| 0x80                                           | bLength              | Length of configuration descriptor in bytes.                                                                                                                                                                   | 0x09                    |
| 0x81                                           | bDescriptorType      | Descriptor type.                                                                                                                                                                                               | 0x02                    |
| 0x82                                           | bTotalLength (LSB)   | Number of bytes returned in this configuration. This includes the configuration descriptor plus all the interface and endpoint descriptors.                                                                    | 0x27                    |
| 0x83                                           | bTotalLength (MSB)   |                                                                                                                                                                                                                | 0x00                    |
| 0x84                                           | bNumInterfaces       | Number of interfaces supported. The ISD-300A1 only supports one interface.                                                                                                                                     | 0x01                    |
| 0x85                                           | bConfiguration Value | The value to use as an argument to Set Configuration to select the configuration. This value must be set to 0x02                                                                                               | 0x02                    |
| 0x86                                           | iConfiguration       | Index to the configuration string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                  | 0x00                    |
| 0x87                                           | bmAttributes         | Device attributes for this configuration. Configuration characteristics:<br>Bit Description On-board default<br>7 Reserved. '1'<br>6 Self-powered. '1'<br>5 Remote wake-up. '0'<br>4-0 Reserved, set to 0. '0' | 0xC0                    |
| 0x88                                           | bMaxPower            | Maximum power consumption for this configuration. Units used are mA*2 (i.e. 0x31 = 98 mA, 0xF9 = 498 mA).                                                                                                      | 0x0x31                  |

| Address                                           | Field Name           | Description                                                                                                                                                                                                    | Example<br>SROM<br>Data |
|---------------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>USB Other Speed Configuration Descriptor 2</b> |                      |                                                                                                                                                                                                                |                         |
| 0x89                                              | bLength              | Length of configuration descriptor in bytes.                                                                                                                                                                   | 0x09                    |
| 0x8A                                              | bDescriptorType      | Descriptor type.                                                                                                                                                                                               | 0x07                    |
| 0x8B                                              | bTotalLength (LSB)   | Number of bytes returned in this configuration. This includes the configuration descriptor plus all the interface and endpoint descriptors.                                                                    | 0x27                    |
| 0x8C                                              | bTotalLength (MSB)   |                                                                                                                                                                                                                | 0x00                    |
| 0x8D                                              | bNumInterfaces       | Number of interfaces supported. The ISD-300A1 only supports one interface.                                                                                                                                     | 0x01                    |
| 0x8E                                              | bConfiguration Value | The value to use as an argument to Set Configuration to select the configuration. This value must be set to 0x02                                                                                               | 0x02                    |
| 0x8F                                              | iConfiguration       | Index to configuration string. This entry must equal half of the address value where the string starts or 0 if the string does not exist.                                                                      | 0x00                    |
| 0x90                                              | bmAttributes         | Device attributes for this configuration. Configuration characteristics:<br>Bit Description On-board default<br>7 Reserved. '1'<br>6 Self-powered. '1'<br>5 Remote wake-up. '0'<br>4-0 Reserved, set to 0. '0' | 0xC0                    |
| 0x91                                              | bMaxPower            | Maximum power consumption for the second configuration. Units used are mA*2 (i.e. 0x31 = 98 mA, 0xF9 = 498 mA).                                                                                                | 0x31                    |
| <b>USB String Descriptor (Manufacturer)</b>       |                      |                                                                                                                                                                                                                |                         |
| 0x92                                              | bLength              | Descriptor length                                                                                                                                                                                              | 0x22                    |
| 0x93                                              | bDescriptorType      | Descriptor type                                                                                                                                                                                                | 0x03                    |
| 0x94                                              | bString              | ("I")                                                                                                                                                                                                          | 0x49                    |
| 0x95                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0x96                                              | bString              | ("n")                                                                                                                                                                                                          | 0x6E                    |
| 0x97                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0x98                                              | bString              | (" ")                                                                                                                                                                                                          | 0x2D                    |
| 0x99                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0x9A                                              | bString              | ("S")                                                                                                                                                                                                          | 0x53                    |
| 0x9B                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0x9C                                              | bString              | ("y")                                                                                                                                                                                                          | 0x79                    |
| 0x9D                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0x9E                                              | bString              | ("s")                                                                                                                                                                                                          | 0x73                    |
| 0x9F                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0xA0                                              | bString              | ("t")                                                                                                                                                                                                          | 0x74                    |
| 0xA1                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0xA2                                              | bString              | ("e")                                                                                                                                                                                                          | 0x65                    |
| 0xA3                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0xA4                                              | bString              | ("m")                                                                                                                                                                                                          | 0x6D                    |
| 0xA5                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0xA6                                              | bString              | (" ")                                                                                                                                                                                                          | 0x20                    |
| 0xA7                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0xA8                                              | bString              | ("D")                                                                                                                                                                                                          | 0x44                    |
| 0xA9                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0xAA                                              | bString              | ("e")                                                                                                                                                                                                          | 0x65                    |
| 0xAB                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0xAC                                              | bString              | ("s")                                                                                                                                                                                                          | 0x73                    |
| 0xAD                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0xAE                                              | bString              | ("i")                                                                                                                                                                                                          | 0x69                    |
| 0xAF                                              | bString              | ("NUL")                                                                                                                                                                                                        | 0x00                    |
| 0xB0                                              | bString              | ("g")                                                                                                                                                                                                          | 0x67                    |



| Address                                      | Field Name      | Description       | Example<br>SROM<br>Data |
|----------------------------------------------|-----------------|-------------------|-------------------------|
| 0xB1                                         | bString         | ("NUL")           | 0x00                    |
| 0xB2                                         | bString         | ("n")             | 0x6E                    |
| 0xB3                                         | bString         | ("NUL")           | 0x00                    |
| <b>USB String Descriptor (Product)</b>       |                 |                   |                         |
| 0xB4                                         | bLength         | Descriptor length | 0x28                    |
| 0xB5                                         | bDescriptorType | Descriptor type   | 0x03                    |
| 0xB6                                         | bString         | ("U")             | 0x55                    |
| 0xB7                                         | bString         | ("NUL")           | 0x00                    |
| 0xB8                                         | bString         | ("S")             | 0x53                    |
| 0xB9                                         | bString         | ("NUL")           | 0x00                    |
| 0xBA                                         | bString         | ("B")             | 0x42                    |
| 0xBB                                         | bString         | ("NUL")           | 0x00                    |
| 0xBC                                         | bString         | (" ")             | 0x20                    |
| 0xBD                                         | bString         | ("NUL")           | 0x00                    |
| 0xBE                                         | bString         | ("S")             | 0x53                    |
| 0xBF                                         | bString         | ("NUL")           | 0x00                    |
| 0xC0                                         | bString         | ("t")             | 0x74                    |
| 0xC1                                         | bString         | ("NUL")           | 0x00                    |
| 0xC2                                         | bString         | ("o")             | 0x6F                    |
| 0xC3                                         | bString         | ("NUL")           | 0x00                    |
| 0xC4                                         | bString         | ("r")             | 0x72                    |
| 0xC5                                         | bString         | ("NUL")           | 0x00                    |
| 0xC6                                         | bString         | ("a")             | 0x61                    |
| 0xC7                                         | bString         | ("NUL")           | 0x00                    |
| 0xC8                                         | bString         | ("g")             | 0x67                    |
| 0xC9                                         | bString         | ("NUL")           | 0x00                    |
| 0xCA                                         | bString         | ("e")             | 0x65                    |
| 0xCB                                         | bString         | ("NUL")           | 0x00                    |
| 0xCC                                         | bString         | (" ")             | 0x20                    |
| 0xCD                                         | bString         | ("NUL")           | 0x00                    |
| 0xCE                                         | bString         | ("A")             | 0x41                    |
| 0xCF                                         | bString         | ("NUL")           | 0x00                    |
| 0xD0                                         | bString         | ("d")             | 0x64                    |
| 0xD1                                         | bString         | ("NUL")           | 0x00                    |
| 0xD2                                         | bString         | ("a")             | 0x61                    |
| 0xD3                                         | bString         | ("NUL")           | 0x00                    |
| 0xD4                                         | bString         | ("p")             | 0x70                    |
| 0xD5                                         | bString         | ("NUL")           | 0x00                    |
| 0xD6                                         | bString         | ("t")             | 0x74                    |
| 0xD7                                         | bString         | ("NUL")           | 0x00                    |
| 0xD8                                         | bString         | ("e")             | 0x65                    |
| 0xD9                                         | bString         | ("NUL")           | 0x00                    |
| 0xDA                                         | bString         | ("r")             | 0x72                    |
| 0xDB                                         | bString         | ("NUL")           | 0x00                    |
| <b>USB String Descriptor (Serial Number)</b> |                 |                   |                         |
| 0xDC                                         | bLength         | Descriptor length | 0x24                    |
| 0xDD                                         | bDescriptorType | Descriptor Type   | 0x03                    |

| Address | Field Name | Description                                 | Example<br>SROM<br>Data |
|---------|------------|---------------------------------------------|-------------------------|
| 0xDE    | bString    | ("0")                                       | 0x30                    |
| 0xDF    | bString    | ("NUL")                                     | 0x00                    |
| 0xE0    | bString    | ("1")                                       | 0x31                    |
| 0xE1    | bString    | ("NUL")                                     | 0x00                    |
| 0xE2    | bString    | ("2")                                       | 0x32                    |
| 0xE3    | bString    | ("NUL")                                     | 0x00                    |
| 0xE4    | bString    | ("3")                                       | 0x33                    |
| 0xE5    | bString    | ("NUL")                                     | 0x00                    |
| 0xE6    | bString    | ("4")                                       | 0x34                    |
| 0xE7    | bString    | ("NUL")                                     | 0x00                    |
| 0xE8    | bString    | ("5")                                       | 0x35                    |
| 0xE9    | bString    | ("NUL")                                     | 0x00                    |
| 0xEA    | bString    | ("6")                                       | 0x36                    |
| 0xEB    | bString    | ("NUL")                                     | 0x00                    |
| 0xEC    | bString    | ("7")                                       | 0x37                    |
| 0xED    | bString    | ("NUL")                                     | 0x00                    |
| 0xEE    | bString    | ("8")                                       | 0x38                    |
| 0xEF    | bString    | ("NUL")                                     | 0x00                    |
| 0xF0    | bString    | ("9")                                       | 0x39                    |
| 0xF1    | bString    | ("NUL")                                     | 0x00                    |
| 0xF2    | bString    | ("0")                                       | 0x30                    |
| 0xF3    | bString    | ("NUL")                                     | 0x00                    |
| 0xF4    | bString    | ("1")                                       | 0x31                    |
| 0xF5    | bString    | ("NUL")                                     | 0x00                    |
| 0xF6    | bString    | ("2")                                       | 0x32                    |
| 0xF7    | bString    | ("NUL")                                     | 0x00                    |
| 0xF8    | bString    | ("3")                                       | 0x33                    |
| 0xF9    | bString    | ("NUL")                                     | 0x00                    |
| 0xFA    | bString    | ("4")                                       | 0x34                    |
| 0xFB    | bString    | ("NUL")                                     | 0x00                    |
| 0xFC    | bString    | ("5")                                       | 0x35                    |
| 0xFD    | bString    | ("NUL")                                     | 0x00                    |
| 0xFE    | bString    | ("6")                                       | 0x36                    |
| 0xFF    | bString    | ("NUL")                                     | 0x00                    |
| 0x100 + |            | Unused I <sup>2</sup> C memory device space | 0xXX                    |

Table 30 – Example I<sup>2</sup>C memory device / FBh Identify Data