INTRODUCTION

Microchip’s SCSI USB to I²C™ bridge devices provide a USB to I²C bridge. The I²C bridge utilizes SCSI pass-through commands using the Mass Storage Class driver. The internal hub can have e.g., three ports enabled with two exposed externally. This document includes the following topics:

• Example of a USB to I²C Bridge Environment on page 1
• SCSI Pass-through Commands on page 3

EXAMPLE OF A USB TO I²C BRIDGE ENVIRONMENT

Figure 1 provides an example how the USB to I²C bridge can be integrated in an environment.

FIGURE 1: USB TO I²C BRIDGE ENVIRONMENT (EXAMPLE)
Figure 2 depicts which function blocks are involved in such an example environment.

**FIGURE 2: USB TO I²C BRIDGE AS FBLOCK IN THE EXAMPLE ENVIRONMENT**

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<th>Head Unit Application</th>
<th>Operating System</th>
<th>Application Protocol</th>
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<td>Other USB Device Class</td>
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<td>USB EHCI Driver or Equivalent</td>
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</table>
SCSI PASS-THROUGH COMMANDS

General Description of the Write_I²C_Stream Command

A Write I²C Stream command sends any length of data over the I²C interface. The sequence shall follow the I²C protocol for writing data. Such a command can look as the sequence below:

\[
S \text{ write_addr c0 c1 .. cn d0 d1 d2 d3 d4 .. dn P}
\]

where:

- **S** - Start
- **P** - Stop
- **addr** - Slave address
- **cx** - Command bytes
- **dx** - data bytes

It is expected that all bytes are ACK’d by the slave. A failure of the slave to ACK any byte will terminate the transfer and an error will be reported.

All clock L->H are checked for clock stretching.

This routine allows up to 512 data bytes to be transferred in a single operation. Only one Start and one Stop command will be issued. If the number of bytes to write is 1 to 9, then all data can be sent as immediate write data. In this case, set the Write Data Length to 0 and the Write Immediate Length to the number of bytes. The bytes should be loaded into the Write Data (0-8) as required. In this case there will be no data phase.

**TABLE 1: SCSI Vendor Command Data Block (CDB) - Write_I²C_Stream**

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</table>

SCSI Operation Code (0xCF)

SCSI Vendor Action (0x23) - Write I²C Stream

I²C Slave Address (Write)

I²C Slave Address (Read) - UNUSED

I²C Write Data Length (0-512)

Length in DATA phase

I²C Write Immediate Length (0-9)

Can be used if number of bytes to write is less than 10

I²C Write Data 0

I²C Write Data 1

I²C Write Data 2

I²C Write Data 3

I²C Write Data 4

I²C Write Data 5

I²C Write Data 6

I²C Write Data 7

I²C Write Data 8
General Description of the WriteRead_I²C_Stream Command

A WriteRead I²C Stream command reads any length of data over the I²C interface. The sequence shall follow the I²C protocol for reading data. Such a command can look as the sequence below:

\[ S \text{ write_addr} \; c_0 \; c_1 \; \ldots \; c_n \; S \; \text{read_addr} \; d_0 \; d_1 \; d_2 \; d_3 \; d_4 \; \ldots \; d_n \; P \]

where:
- \( S \) - Start
- \( P \) - Stop
- \( addr \) - Slave address
- \( cx \) - command bytes
- \( dx \) - data bytes

It is expected that all bytes are ACK'd by the slave. A failure of the slave to ACK any byte will terminate the transfer and an error will be reported.

The command bytes (up to 9 as applicable) will be transferred first using the write slave address. A restart will occur and then up to 512 bytes will be read using the read slave address.

This routine allows up to 512 data bytes to be transferred in a single operation. Only one Start, one Re-Start, and one Stop command will be issued.

### TABLE 2: SCSI VENDOR COMMAND DATA BLOCK (CDB) - WRITEREAD_I²C_STREAM

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</table>

- SCSI Operation Code (0xCF)
- SCSI Vendor Action (0x22) - WriteRead I²C Stream
- I²C Slave Address (Write) - used if Write command length > 0
- I²C Slave Address (Read)
- I²C Read Data Length (0-512)
- Length in DATA phase
- I²C Write Command Length (0-9)
- I²C Write Data 0
- I²C Write Data 1
- I²C Write Data 2
- I²C Write Data 3
- I²C Write Data 4
- I²C Write Data 5
- I²C Write Data 6
- I²C Write Data 7
- I²C Write Data 8
General Description of the GPIO_1_SET_OUTPUT Command

This command must be used for a USB ROM version 2.04. It allows an application to control the GPIO_1. The command utilizes a Command Block Wrapper (CBW), a data packet and a Command Status Wrapper (CSW).

TABLE 3: SCSI VENDOR COMMAND DATA BLOCK (CDB) - GPIO_1_SET_OUTPUT

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<tr>
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<td>SCSI Vendor Action (0x20) - I²C BRIDGE COMMAND</td>
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</table>

The DATA block uses the following data structures:

typedef struct {
    uint8 GPIO_1_FLAG; // if zero, GPIO_1 is output LOW, if 0xFF, high
} U2C_GPIO_MODE;

typedef struct usb_i2c_cmd_struct {
    unsigned char mCommandType; // 0x0F for GPIO_1_SET_OUTPUT
    union usb_i2c_cmd {
        U2C_WRITE_ONLY_DATA mWriteDataParams;
        U2C_READ_ONLY_DATA mReadDataParams;
        U2C_CMD_RESPONSE mCmdResponseParams;
        U2C_READ_DATA_RESPONSE mReadDataResponseParams;
        U2C_GPIO_MODE mSwitchModeParams;
        U2C_CLK mClkDelayParams;
    }mCommandParams;
} USB_I2C_CMD, *pUSB_I2C_CMD;

mCommandType must be set to 0x0F. A standard CSW will also be returned.
General Description of the SET_CLOCK_DELAY Command

The command allows an application to change the I²C clock. It utilizes a CBW, a data packet and a CSW.

TABLE 4: SCSI VENDOR COMMAND DATA BLOCK (CDB) - SET_CLOCK_DELAY

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The DATA block uses the data structures described below. For operation at 50 kHz, a value of roughly 25 should be used.

```c
typedef struct {
    unsigned char mClkDelay;  // adds delay to the SCL if required. 1-127
}U2C_CLK, *pU2C_CLK;

typedef struct usb_i2c_cmd_struct {
    unsigned char mCommandType; // 0x14 for SET_CLOCK_DELAY
    union usb_i2c_cmd {
        U2C_WRITE_ONLY_DATA mWriteDataParams;
        U2C_READ_ONLY_DATA mReadDataParams;
        U2C_CMD_RESPONSE mCmdResponseParams;
        U2C_READ_DATA_RESPONSE mReadDataResponseParams;
        U2C_GPIO_MODE mSwitchModeParams;
        U2C_CLK mClkDelayParams;
    }mCommandParams;
}USB_I2C_CMD, *pUSB_I2C_CMD;
```

mCommandType must be set to 0x14. A standard CSW will also be returned.
# APPENDIX A: TERMS AND ACRONYMS

## TABLE A-1: TERMS AND ACRONYMS

<table>
<thead>
<tr>
<th>Acronym / Term</th>
<th>Description</th>
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<td>ACK</td>
<td>Acknowledge</td>
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<tr>
<td>CBW</td>
<td>Command Block Wrapper</td>
</tr>
<tr>
<td>CDB</td>
<td>Command Data Block</td>
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<tr>
<td>CSW</td>
<td>Command Status Wrapper</td>
</tr>
<tr>
<td>GPIO</td>
<td>General Purpose Input / Output</td>
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<tr>
<td>HID</td>
<td>Human Interface Device</td>
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<tr>
<td>HS</td>
<td>High-speed</td>
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<td>FC</td>
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<td>MultiMediaCard</td>
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<td>MSC</td>
<td>Mass Storage Class</td>
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<td>Small Computer System Interface</td>
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<td>Serial Peripheral Interface Bus</td>
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<td>Universal Serial Bus</td>
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## APPENDIX B: APPLICATION NOTE REVISION HISTORY

### TABLE B-1: REVISION HISTORY

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<th>Date</th>
<th>Section</th>
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<td>2014-01-08</td>
<td>All</td>
<td>AN1630, Revision A replaces the previous SMSC version AN 25.19</td>
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<td>Previous versions</td>
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<td>For former changes refer to the previous version.</td>
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