The FT260 is a USB device which supports I²C and UART communication through the standard USB HID interface. This application note is a guide for LibFT260, which provides high-level and convenient APIs for FT260 application development.
Table of Contents

1 Introduction .................................................................................. 5
  1.1 Overview .................................................................................. 5
  1.2 FT260 HID Interfaces and Endpoints ........................................... 6
    1.2.1 Interfaces .............................................................................. 6
    1.2.2 Endpoints ............................................................................. 6
  1.3 Scope .......................................................................................... 7

2 Wiring ............................................................................................... 8
  2.1 I²C .............................................................................................. 8
  2.2 UART .......................................................................................... 8

3 Getting Started .................................................................................. 9

4 Application Programming Interface (API) .............................. 11
  4.1 FT260 General Functions ............................................................ 11
    4.1.1 FT260_CreateDeviceList ...................................................... 11
    4.1.2 FT260_GetDevicePath ........................................................... 12
    4.1.3 FT260_Open ........................................................................... 12
    4.1.4 FT260_OpenByVidPid ............................................................. 13
    4.1.5 FT260_OpenByDevicePath .................................................... 13
    4.1.6 FT260_Close .......................................................................... 14
    4.1.7 FT260_GetChipVersion ........................................................... 14
    4.1.8 FT260_GetLibVersion .............................................................. 14
    4.1.9 FT260_SetClock ..................................................................... 15
    4.1.10 FT260_SetWakeupInterrupt .................................................. 15
    4.1.11 FT260_SetInterruptTriggerType .......................................... 16
    4.1.12 FT260_SelectGpio2Function ............................................... 17
    4.1.13 FT260_SelectGpioAFunction ............................................... 17
    4.1.14 FT260_SelectGpioGFuction ............................................... 18
    4.1.15 FT260_SetSuspendOutPolarity ............................................ 19
    4.1.16 FT260_SetUartToGPIOPin .................................................. 19
    4.1.17 FT260_EnableDcdRiPin ...................................................... 19
# 4.2 I²C Master Functions

- **4.2.1** FT260_I2CMaster_Init................................................. 21
- **4.2.2** T260_I2CMaster_Reset ............................................. 21
- **4.2.3** FT260_I2CMaster_Write ................................................ 22
- **4.2.4** FT260_I2CMaster_Read ................................................ 23
- **4.2.5** FT260_I2CMaster_GetStatus .......................................... 23

# 4.3 UART Functions

- **4.3.1** FT260_UART_Init ......................................................... 25
- **4.3.2** FT260_UART_Reset ........................................................ 25
- **4.3.3** FT260_UART_SetBaudRate ............................................ 26
- **4.3.4** FT260_UART_SetFlowControl ......................................... 26
- **4.3.5** FT260_UART_SetDataCharacteristics ................................ 27
- **4.3.6** FT260_UART_SetBreakOn ............................................... 27
- **4.3.7** FT260_UART_SetBreakOff ............................................. 28
- **4.3.8** FT260_UART_SetBreakOff ............................................. 28
- **4.3.9** FT260_UART_SetXonXoffChar .......................................... 29
- **4.3.10** FT260_UART_GetQueueStatus ........................................ 29
- **4.3.11** FT260_UART_Write ....................................................... 30
- **4.3.12** FT260_UART_Read ........................................................ 30
- **4.3.13** FT260_UART_GetDcdRiStatus ........................................ 31
- **4.3.14** FT260_UART_EnableRiWakeup ........................................ 31
- **4.3.15** FT260_GetInterruptFlag ............................................ 32
- **4.3.16** FT260_CleanInterruptFlag ........................................... 32

# 4.4 GPIO Functions

- **4.4.1** FT260_GPIO_Set .......................................................... 33
- **4.4.2** FT260_GPIO_Get .......................................................... 34
- **4.4.3** FT260_GPIO_SetDir ..................................................... 34
- **4.4.4** FT260_GPIO_Read ........................................................ 35
- **4.4.5** FT260_GPIO_Write ....................................................... 35

# 5 Contact Information

Appendix A – References
Document References ................................................................. 37
Acronyms and Abbreviations ...................................................... 37
Appendix B – List of Tables & Figures ................................. 38
  List of Tables ........................................................................ 38
  List of Figures ..................................................................... 38
Appendix C – FT260_STATUS ............................................. 39
Appendix D – Revision History .............................................. 40
1 Introduction

1.1 Overview

The FT260 is a full speed USB device which supports I²C and UART communication through standard USB HID interfaces. The USB HID class is natively supported by most operating systems. A custom driver is not required to be installed for the FT260. By default, the FT260 has two HID interfaces:

- The first HID interface sends and receives data via the I²C connection.
- The second HID interface sends and receives data via the UART connection.
- The HID interface can be configured by the DCNF0 and DCNF1 pins.

The USB HID class exchanges data between a host and a device by reports. There are three types of reports in USB HID:

1. **Feature report**: Configuration data are exchanged between the host and the HID device through a control pipe. The feature report is usually used to turn on/off a device function.
2. **Input report**: Data content that is sent from the HID device to the host.
3. **Output report**: Data content that is sent from the host to the HID device.

The FT260 device receives output reports from the HID application, decodes the requests, and passes the data to the connected I²C or UART device. Data received from the I²C or UART device is sent to the host by input reports.

![Figure 1.1 The FT260 System Block Diagram](image-url)
1.2 FT260 HID Interfaces and Endpoints

1.2.1 Interfaces

The FT260 interfaces can be configured as:

- **I²C and UART**
- **I²C only**
- **UART only**

The interfaces can be configured by mode pins: DCNF0 and DCNF1.

<table>
<thead>
<tr>
<th>DCNF1</th>
<th>DCNF0</th>
<th>HID Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>The default mode. The FT260 will create two HID interfaces: I²C and UART. This mode is the same as mode (1,1).</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>The FT260 will create a HID interface which sends and receives data via the I²C connection.</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>The FT260 will create a HID interface which sends and receives data via the UART connection.</td>
</tr>
</tbody>
</table>
| 1     | 1     | The FT260 will create two HID interfaces:  
- The first HID interface sends and receives data via the I²C connection.  
- The second HID interface sends and receives data via the UART connection. |

Table 1.1 FT260 interface configuration

1.2.2 Endpoints

An interface of the FT260 is composed of the following endpoints:

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control In</td>
<td>Input reports, Feature reports sent to the host with a GET_REPORT request</td>
</tr>
<tr>
<td>Control Out</td>
<td>Output reports, Feature reports received from the host with a SET_REPORT request</td>
</tr>
<tr>
<td>Interrupt In</td>
<td>Input reports</td>
</tr>
<tr>
<td>Interrupt Out</td>
<td>Output reports</td>
</tr>
</tbody>
</table>

Table 1.2 FT260 endpoints
1.3 Scope

The guide is intended for developers who are creating applications, extending FTDI provided applications or implementing FTDI’s applications for the FT260.

The support library, LibFT260, hides the detail of communicating by HID protocol and provides simple APIs for developers to create their own applications.

The sample source code contained in this application note is provided as an example and is neither guaranteed nor supported by FTDI.
2  Wiring

2.1  I²C
The FT260 I²C is open-drain architecture. It requires a suitable pull-high resistor on the I²C bus.

![Diagram of FT260 connecting with I²C bus](image)

Figure 2.1 The FT260 connects with I²C bus

2.2  UART
The FT260 UART supports 3 flow control modes:
- Software flow control (default)
- Hardware flow control by CTS and RTS
- Hardware flow control by DTR and DSR

Software flow control mode is the default flow control mode of the FT260 and it has the simplest wiring. It only requires connecting TXD, RXD and GND. CTS, RTS, and DTR, DSR are optional for hardware flow control.

![Diagram of FT260 connecting to an UART device](image)

Figure 2.2 The FT260 connects to an UART device
3 Getting Started

This is an example which shows how to open the device with the LibFT260 support library. After opening the device, developers need to initialize the FT260 device as either an I²C master or a UART. Different device types require different configurations. For more details refer to chapter 4.

Example

```c
#include <windows.h>
#include <stdio.h>
#include <stdlib.h>
#include "LibFT260.h"

#define MASK_1 0x0f

void ListAllDevicePaths()
{
    DWORD devNum = 0;
    WCHAR pathBuf[128];

    FT260_CreateDeviceList(&devNum);

    for(int i = 0; i < devNum; i++)
    {
        FT260_GetDevicePath(pathBuf, 128, i);
        wprintf(L"Index:%d
Path:%s\n", i, pathBuf);
    }
}

int main(int argc, char const* argv[])
{
    FT260_STATUS ftStatus = FT260_OTHER_ERROR;
    FT260_HANDLE ft260Handle = INVALID_HANDLE_VALUE;
    DWORD devNum = 0;

    // Show all HID device path
    ListAllDevicePaths();

    FT260_GetNumberOfHIDDevice(&devNum);
    if(devNum < 1) {
        return 0;
    }
```
}// Open device by index
ftStatus = FT260_Open(0, &handle);
if (FT260_OK != ftStatus) {
    printf("Open device Failed, status: %d\n", ftStatus);
    return 0;
} else {
    printf("Open device OK\n");
}

// Show version information

DWORD dwChipVersion = 0;

ftStatus = FT260_GetChipVersion(handle, &dwChipVersion);
if (FT260_OK != ftStatus) {
    printf("Get chip version Failed, status: %d\n", ftStatus);
} else {
    printf("Get chip version OK\n");
    printf("Chip version : %d.%d.%d.%d\n",
        ((dwChipVersion >> 24) & MASK_1),
        ((dwChipVersion >> 16) & MASK_1),
        ((dwChipVersion >> 8) & MASK_1),
        (dwChipVersion & MASK_1) );
}

// Initialize as an I2C master, and read/write data to an I2C slave
// FT260_I2CMaster_Init
// FT260_I2CMaster_Read
// FT260_I2CMaster_Write

// Close device
FT260_Close(handle);
return 0;
}
4 Application Programming Interface (API)

LibFT260 supports I²C, UART and GPIO communication by using high-level APIs. In addition, it provides chip configuration APIs, such as FT260_SetClock.

After opening the FT260 device, the FT260 could be initialized by one of the following initialization functions:

- FT260_I2CMaster_Init
- FT260_UART_Init

The initialization functions set up the FT260 for the subsequent operations.

Refer to "Appendix C – FT260_STATUS" for the definitions of the error code of following functions.

4.1 FT260 General Functions

The functions listed in this section are configuration functions for the FT260.

4.1.1 FT260_CreateDeviceList

FT260_STATUS FT260_CreateDeviceList (LPDWORD lpdwNumDevs)

Summary:
Create device list and get the number of HID devices.

Note: The call creates a list for all HID devices, not only FT260 devices.

Parameters:
- lpdwNumDevs: Pointer to a variable for retrieving the number of HID devices.

Return Value:
FT260_OK if successful, otherwise the return value is an error code.
4.1.2 FT260_GetDevicePath

FT260_STATUS FT260_GetDevicePath(WCHAR* pDevicePath, DWORD bufferLength, DWORD deviceIndex)

Summary:
Get device path by index.

The device path data would be of a format such as shown below:
\(?\)\hid#\vid_0403&pid_6030&mi_00#8&1d5b3f5a&0&0000#{4d1e55b2-f16f-11cf-88cb-001111000010}

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pDevicePath</td>
<td>Pointer to the buffer for getting data.</td>
</tr>
<tr>
<td>bufferLength</td>
<td>The maximum number of characters to store. Note that the device path is WCHAR.</td>
</tr>
<tr>
<td>deviceIndex</td>
<td>The index of the device, which is 0 based.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.1.3 FT260_Open

FT260_STATUS FT260_Open(int iDevice, FT260_HANDLE* pFt260Handle)

Summary:
Open device by index.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>iDevice</td>
<td>The index of the device, which is 0 based.</td>
</tr>
<tr>
<td>pFt260Handle</td>
<td>Pointer to a variable of type FT260_HANDLE where the handle will be stored. This handle must be used to access the device.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.
4.1.4 FT260_OpenByVidPid

FT260_STATUS FT260_OpenByVidPid(WORD vid, WORD pid, DWORD deviceIndex, FT260_HANDLE* pFt260Handle)

Summary:
Open device by the given VID, PID and index.

For example, call this function with VID, PID and index:0, 1 and 2 when there are three devices with the same VID and PID.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>vid</td>
<td>USB vendor ID.</td>
</tr>
<tr>
<td>pid</td>
<td>USB product ID</td>
</tr>
<tr>
<td>deviceIndex</td>
<td>The index of the device, which is 0 based. There might be several devices with the same VID/PID. Use the index to select the device.</td>
</tr>
<tr>
<td>pHandle</td>
<td>Pointer to a variable of type FT260_HANDLE where the handle will be stored. This handle must be used to access the device.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.1.5 FT260_OpenByDevicePath

FT260_STATUS FT260_OpenByDevicePath(WCHAR* pDevicePath, FT260_HANDLE* pFt260Handle)

Summary:
Open device by path.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pDevicePath</td>
<td>the device path to be opened</td>
</tr>
<tr>
<td>pFt260Handle</td>
<td>Pointer to a variable of type FT260_HANDLE where the handle will be stored. This handle must be used to access the device.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.
4.1.6 FT260_Close

FT260_STATUS FT260_Close(FT260_HANDLE ft260Handle)

Summary:
Close the device.

Parameters:
| ft260Handle | Handle of the device. |

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.1.7 FT260_GetChipVersion


Summary:
Get the chip version of the FT260 device.

Version 1.0.0.0 is shows as 16777216 in decimal.

Parameters:
| ft260Handle | Handle of the device. |
| lpdwChipVersion | Pointer to a variable for retrieving the chip version. |

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.1.8 FT260_GetLibVersion

FT260_STATUS FT260_GetLibVersion(LPDWORD lpdwLibVersion)

Summary:
Get the library version of the FT260 support library.
4.1.9 FT260_SetClock

FT260_STATUS FT260_SetClock(FT260_HANDLE ft260Handle, FT260_Clock_Rate clk)

Summary:
Set system clock rate. The default clock rate of the FT260 is 48 MHz.

A lower system clock rate will have lower power consumption, and it may also affect maximum transfer rates.

<table>
<thead>
<tr>
<th>Parameters:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>Clk</td>
<td>System clock rate:</td>
</tr>
<tr>
<td></td>
<td>• FT260_SYS_CLK_12M</td>
</tr>
<tr>
<td></td>
<td>• FT260_SYS_CLK_24M</td>
</tr>
<tr>
<td></td>
<td>• FT260_SYS_CLK_48M</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.1.10 FT260_SetWakeInterrupt

FT260_STATUS FT260_SetWakeInterrupt(FT260_HANDLE ft260Handle, BOOL enable)

Summary:
Enable/Disable wakeup interrupt.

<table>
<thead>
<tr>
<th>Parameters:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>enable</td>
<td>TRUE to enable and switch the pin mode to wakeup/interrupt</td>
</tr>
<tr>
<td></td>
<td>FALSE to disable and switch the pin mode to GPIO3</td>
</tr>
</tbody>
</table>
Return Value:
FT260_OK if successful, otherwise the return value is an error code.

### 4.1.11 FT260_SetInterruptTriggerType

FT260_STATUS FT260_SetInterruptTriggerType(FT260_HANDLE ft260Handle, FT260_Interrupt_Trigger_Type type, FT260_Interrupt_Level_Time_Delay delay)

**Summary:**
Specify edge, level and duration of signals to generate interrupt.

**Parameters:**

<table>
<thead>
<tr>
<th>ft260Handle</th>
<th>Handle of the device.</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>Trigger type:</td>
</tr>
<tr>
<td></td>
<td>• FT260_INTR_RISING_EDGE</td>
</tr>
<tr>
<td></td>
<td>• FT260_INTR_LEVEL_HIGH</td>
</tr>
<tr>
<td></td>
<td>• FT260_INTR_FALLING_EDGE</td>
</tr>
<tr>
<td></td>
<td>• FT260_INTR_LEVEL_LOW</td>
</tr>
<tr>
<td>delay</td>
<td>Specifies the minimum pulse width for level-based interrupts.</td>
</tr>
<tr>
<td></td>
<td>When the voltage at the interrupt pin exceeds the level for the specified duration, the interrupt signal will be generated. This setting only affects trigger types that are level high or level low.</td>
</tr>
<tr>
<td></td>
<td>• FT260_INTR_DELAY_1MS</td>
</tr>
<tr>
<td></td>
<td>• FT260_INTR_DELAY_5MS</td>
</tr>
<tr>
<td></td>
<td>• FT260_INTR_DELAY_30MS</td>
</tr>
</tbody>
</table>

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.
4.1.12  **FT260_SelectGpio2Function**

FT260_STATUS FT260_SelectGpio2Function(FT260_HANDLE ft260Handle, FT260_GPIO2_Pin gpio2Function)

**Summary:**
Select the function of GPIO 2.

**Parameters:**

<table>
<thead>
<tr>
<th>ft260Handle</th>
<th>Handle of the device.</th>
</tr>
</thead>
<tbody>
<tr>
<td>gpio2Function</td>
<td>Set the active function of the pin GPIO2:</td>
</tr>
<tr>
<td></td>
<td>- FT260_GPIO2_GPIO</td>
</tr>
<tr>
<td></td>
<td>GPIO 2, General Purpose I/O.</td>
</tr>
<tr>
<td></td>
<td>- FT260_GPIO2_SUSPOUT</td>
</tr>
<tr>
<td></td>
<td>SUSPOUT_N is the default functions to indicate entering the USB suspend state.</td>
</tr>
<tr>
<td></td>
<td>Active Low. It can be configured as active high.</td>
</tr>
<tr>
<td></td>
<td>- FT260_GPIO2_PWREN</td>
</tr>
<tr>
<td></td>
<td>PWREN_N is as the power enable indicator when the FT260 is USB enumerated.</td>
</tr>
<tr>
<td></td>
<td>Active Low.</td>
</tr>
<tr>
<td></td>
<td>- FT260_GPIO2_TX_LED</td>
</tr>
<tr>
<td></td>
<td>TX_LED is the LED driving source when data is transmitted on the UART TX port.</td>
</tr>
</tbody>
</table>

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.

4.1.13  **FT260_SelectGpioAFunction**

FT260_STATUS FT260_SelectGpioAFunction(FT260_HANDLE ft260Handle, FT260_GPIOA_Pin gpioAFunction)

**Summary:**
Select the function of GPIO A.

**Parameters:**

<table>
<thead>
<tr>
<th>ft260Handle</th>
<th>Handle of the device.</th>
</tr>
</thead>
<tbody>
<tr>
<td>gpioAFunction</td>
<td>Set the active function of the pin GPIOA:</td>
</tr>
<tr>
<td></td>
<td>- FT260_GPIOA_GPIO</td>
</tr>
</tbody>
</table>
GPIO A, General Purpose I/O.

- **FT260_GPIOA_TX_ACTIVE**
  TX_ACTIVE is the default function to indicate the UART transmitting is active.

- **FT260_GPIOA_TX_LED**
  TX_LED is the LED driving source when data is transmitted on the UART TX port.

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.

### 4.1.14 **FT260_SelectGpioGFunction**

FT260_STATUS **FT260_SelectGpioGFunction**(FT260_HANDLE ft260Handle, FT260_GPIO_GPIO Pin gpioGFunction)

**Summary:**
Select the function of GPIO G.

**Parameters:**

<table>
<thead>
<tr>
<th>ft260Handle</th>
<th>Handle of the device.</th>
</tr>
</thead>
</table>
| gpioGFunction | Set the active function of the pin GPIOG:  
  - **FT260_GPIOG_GPIO**  
    GPIO G, General Purpose I/O.  
  - **FT260_GPIOG_PWREN**  
    PWREN_N is the power enable indicator when the FT260 is USB enumerated. Active low.  
  - **FT260_GPIOG_RX_LED**  
    RX_LED is the LED driving source when data is received on the UART RX port.  
  - **FT260_GPIOG_BCD_DET**  
    BCD_DET is the default function. A battery charger detection indicator output when the device is connected to a dedicated battery charger port. Polarity can be defined. |

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.
4.1.15  FT260_SetSuspendOutPolarity

FT260_STATUS FT260_SetSuspendOutPolarity(FT260_HANDLE ft260Handle, FT260_Suspend_Out_Polarity polarity)

Summary:
Set suspend out polarity.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device</td>
</tr>
<tr>
<td>polarity</td>
<td>Suspend out level:</td>
</tr>
<tr>
<td></td>
<td>• FT260_SUSPEND_OUT_LEVEL_HIGH</td>
</tr>
<tr>
<td></td>
<td>• FT260_SUSPEND_OUT_LEVEL_LOW</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.1.16  FT260_SetUartToGPIOPin

FT260_STATUS FT260_SetUartToGPIOPin(FT260_HANDLE ft260Handle)

Summary:
Disable UART mode and switch pins to GPIO B, GPIO C, GPIO D, GPIO E, GPIO F and GPIO H.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.1.17  FT260_EnableDcdRiPin

FT260_STATUS FT260_EnableDcdRiPin(FT260_HANDLE ft260Handle, BOOL enable)

Summary:
Set UART DCD, RI function and switch pin function.
Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>enable</td>
<td>FALSE to disable UART DCD, UART RI, and switch the pins modes to GPIO4,</td>
</tr>
<tr>
<td></td>
<td>GPIO5</td>
</tr>
<tr>
<td></td>
<td>TRUE to enable and switch the pins modes to UART DCD, UART RI</td>
</tr>
</tbody>
</table>

Return Value:

FT260_OK if successful, otherwise the return value is an error code.

4.2 I²C Master Functions

I²C (Inter Integrated Circuit) is a multi-master serial bus invented by Philips. I²C uses two bi-directional open-drain wires called serial data (SDA) and serial clock (SCL). Common I²C bus speeds are the 100 kbit/s standard mode (SM), 400 kbit/s fast mode (FM), 1 Mbit/s Fast mode plus (FM+), and 3.4 Mbit/s High Speed mode (HS).

I²C transaction

All I²C transactions begin with a START condition, a slave address, a single bit representing write (0) or read (1), and are terminated by a STOP condition. All of them are always generated by the master.

I²C defines three basic types of message:
- Single message where a master writes data to a slave;
- Single message where a master reads data from a slave;
- Combined messages, where a master issues at least two reads and/or writes to one or more slaves

For more information on the protocol, refer to the I²C specification.

The FT260 provides flexibility to allow users to decide when to send START and STOP conditions. Here are some examples. The following scenarios are supported by the FT260.

Send data with START_AND_STOP conditions

Send the first packet with a START condition, and then send remaining data in the other packet with a STOP condition.
Start 7 bit slave address write ACK 8 bit data ACK 8 bit data ACK STOP

Separate data into three packets.

Start 7 bit slave address write ACK 8 bit data ACK 8 bit data ACK 8 bit data ACK STOP

I²C combined message
In a combined message, each read or write begins with a START and the slave address. After the first START, these are called repeated START bits; repeated START bits are not preceded by STOP bits, which is how slaves know the next transfer is part of the same message.

Start 7 bit slave address write ACK 8 bit data ACK SR 7 bit slave address read ACK 8 bit data ACK STOP

SR = repeated START condition

4.2.1 FT260_I2CMaster_Init
FT260_STATUS FT260_I2CMaster_Init(FT260_HANDLE ft260Handle, uint32 kbps)

Summary:
Initialize the FT260 as an I²C master with the requested I²C clock speed.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>kbps</td>
<td>The speed of the I²C clock, whose range is from 100K bps to 4000K bps.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.2.2 T260_I2CMaster_Reset
FT260_STATUS T260_I2CMaster_Reset(FT260_HANDLE ft260Handle)

Summary:
Reset the FT260 I²C Master controller.
4.2.3 FT260_I2CMaster_Write

**Parameters:**
- `ft260Handle`: Handle of the device.
- `deviceAddress`: Address of the target I²C slave.
- `flag`: I²C condition:
  - `FT260_I2C_NONE`
  - `FT260_I2C_START`
  - `FT260_I2C_REPEATED_START`
  - `FT260_I2C_STOP`
  - `FT260_I2C_START_AND_STOP`
- `lpBuffer`: Pointer to the buffer that contains the data to be written to the device.
- `dwBytesToWrite`: Number of bytes to write to the device.
- `lpdwBytesWritten`: Pointer to a variable of type DWORD which receives the number of bytes read and written to the device.

**Return Value:**
- `FT260_OK` if successful, otherwise the return value is an error code.
### 4.2.4 FT260_I2CMaster_Read

**FT260_STATUS FT260_I2CMaster_Read(FT260_HANDLE ft260Handle, uint8 deviceAddress, FT260_I2C_FLAG flag, LPVOID lpBuffer, DWORD dwBytesToRead, LPDWORD lpdwBytesReturned)**

**Summary:**
Read data from the specified I2C slave device with the given I2C condition.

**Parameters:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>deviceAddress</td>
<td>Address of the target I2C slave device.</td>
</tr>
<tr>
<td>Flag</td>
<td>I2C condition:</td>
</tr>
<tr>
<td></td>
<td>• FT260_I2C_NONE</td>
</tr>
<tr>
<td></td>
<td>• FT260_I2C_START</td>
</tr>
<tr>
<td></td>
<td>• FT260_I2C_REPEATED_START</td>
</tr>
<tr>
<td></td>
<td>• FT260_I2C_STOP</td>
</tr>
<tr>
<td></td>
<td>• FT260_I2C_START_AND_STOP</td>
</tr>
<tr>
<td>lpBuffer</td>
<td>Pointer to the buffer that receives the data from the device.</td>
</tr>
<tr>
<td>dwBytesToRead</td>
<td>Number of bytes to read from the device.</td>
</tr>
<tr>
<td>lpdwBytesReturned</td>
<td>Pointer to a variable of type DWORD which receives the number of bytes read from the device.</td>
</tr>
</tbody>
</table>

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.

### 4.2.5 FT260_I2CMaster_GetStatus

**FT260_STATUS FT260_I2CMaster_GetStatus(FT260_HANDLE ft260Handle, uint8* status)**

**Summary:**
Read the status of the I2C master controller.

**Parameters:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>status</td>
<td>Point to a variable of type uint8 which saves the status value.</td>
</tr>
</tbody>
</table>

**Status:**
- bit 0 = controller busy: all other status bits invalid
- bit 1 = error condition
- bit 2 = slave address was not acknowledged during last operation
bit 3 = data not acknowledged during last operation
bit 4 = arbitration lost during last operation
bit 5 = controller idle
bit 6 = bus busy

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.3 UART Functions

UART (Universal Asynchronous Receiver/Transmitter) is a commonly used interface to transfer serial data. Being asynchronous there is no clock signal but the structure of the transmitted data provides for a start and an end to a message. It is also important that both ends of the link decide to operate with the same pulse width defined as the baud rate. The UART of a micro-controller will normally operate at 3V3 or 5V TTL levels. The UART will only connect to one other device in the chain.

The FT260 device can be initialized as a UART. Here is a brief overview of FT260 UART features:

- The UART can support baud rates from 1.2K baud to 12 MBaud.
- UART data signals: TxD, RxD, RTS, CTS, DSR, DTR, DCD, RI, GND
- Serial Communication Parameters
  - Parity: None, Odd, Even, Mark, Space
  - Data bits: 7, 8
  - Flow control: RTS/CTS, DSR/DTR, X-ON/X-OFF, None
  - Stop bits 1, 2

Please refer to DS_FT260 for more information.
4.3.1 FT260_UART_Init

FT260_STATUS FT260_UART_Init(FT260_HANDLE ft260Handle);

Summary:
Initialize the FT260 as a UART device.

Parameters:
| ft260Handle | Handle of the device. |

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.3.2 FT260_UART_Reset

FT260_STATUS FT260_UART_Reset(FT260_HANDLE ft260Handle)

Summary:
Reset UART controller.

Parameters:
| ft260Handle | Handle of the device. |

Return Value:
FT260_OK if successful, otherwise the return value is an error code.
4.3.3 FT260_UART_SetBaudRate

FT260_STATUS FT260_UART_SetBaudRate(FT260_HANDLE ft260Handle, ULONG baudRate)

Summary:
Set the baud rate for the device.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>baudRate</td>
<td>The speed of UART transmission. It ranges from 1,200 to 12,000,000 bps.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.3.4 FT260_UART_SetFlowControl

FT260_STATUS FT260_UART_SetFlowControl(FT260_HANDLE ft260Handle, FT260_UART_Mode flowControl)

Summary:
Set UART flow control for the device.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>flowControl</td>
<td>Flow control:</td>
</tr>
<tr>
<td></td>
<td>• FT260_UART_OFF: Disable UART and switch UART pins to GPIO.</td>
</tr>
<tr>
<td></td>
<td>• FT260_UART_RTS_CTS_MODE</td>
</tr>
<tr>
<td></td>
<td>• FT260_UART_DTR_DSR_MODE</td>
</tr>
<tr>
<td></td>
<td>• FT260_UART_XON_XOFF_MODE</td>
</tr>
<tr>
<td></td>
<td>• FT260_UART_NO_FLOW_CTRL_MODE</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.
4.3.5 FT260_UART_SetDataCharacteristics

FT260_STATUS FT260_UART_SetDataCharacteristics(FT260_HANDLE ft260Handle,
FT260_Data_Bit dataBits, FT260_Stop_Bit stopBits, FT260_Parity parity);

**Summary:**
Set UART data characteristics for the device.

**Parameters:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>dataBits</td>
<td>Data bits:</td>
</tr>
<tr>
<td></td>
<td>• FT260_DATA_BIT_7</td>
</tr>
<tr>
<td></td>
<td>• FT260_DATA_BIT_8</td>
</tr>
<tr>
<td>stopBits</td>
<td>Stop bits:</td>
</tr>
<tr>
<td></td>
<td>• FT260_STOP_BITS_1</td>
</tr>
<tr>
<td></td>
<td>• FT260_STOP_BITS_2</td>
</tr>
<tr>
<td>parity</td>
<td>Parity:</td>
</tr>
<tr>
<td></td>
<td>• FT260_PARITY_NONE</td>
</tr>
<tr>
<td></td>
<td>• FT260_PARITY_ODD</td>
</tr>
<tr>
<td></td>
<td>• FT260_PARITY_EVEN</td>
</tr>
<tr>
<td></td>
<td>• FT260_PARITY_MARK</td>
</tr>
<tr>
<td></td>
<td>• FT260_PARITY_SPACE</td>
</tr>
</tbody>
</table>

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.

4.3.6 FT260_UART_SetBreakOn

FT260_STATUS FT260_UART_SetBreakOn(FT260_HANDLE ft260Handle)

**Summary:**
Set the BREAK condition ON for the device.

**Parameters:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
</tbody>
</table>

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.
4.3.7 FT260_UART_SetBreakOff

FT260_STATUS FT260_UART_SetBreakOff(FT260_HANDLE ft260Handle)

**Summary:**
Reset the BREAK condition OFF for the device.

**Parameters:**

| ft260Handle | Handle of the device. |

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.

4.3.8 FT260_UART_SetBreakOff

FT260_STATUS FT260_UART_GetConfig(FT260_HANDLE ft260Handle, UartConfig* pUartConfig)

**Summary:**
UART get configuration which includes baud rate, data characteristics and break condition.

**Parameters:**

| ft260Handle | Handle of the device. |
| pUartConfig | Pointer to a variable of type UartConfig where the value will be stored. Type UartConfig is defined as following:

```c
struct UartConfig
{
    u8 flow_ctrl;
    u32 baud_rate;
    u8 data_bit;
    u8 parity;
    u8 stop_bit;
    u8 breaking;
}
```

Please refer to the previous UART setting functions for a description of the fields.

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.
4.3.9 FT260_UART_SetXonXoffChar

FT260_STATUS FT260_UART_SetXonXoffChar(FT260_HANDLE ft260Handle, UCHAR Xon, UCHAR Xoff)

Summary:
Set Xon/Xoff characters for software flow control.

Software flow control (XON_XOFF)

This setting uses special characters to start and stop data flow. These are termed XON and XOFF (from "transmit on" and "transmit off", respectively). The XON character tells the downstream device to start sending data. The XOFF character tells the downstream device to stop sending data. Usually it is possible to define these characters in an application. Typical default for XON is 0x11 and for XOFF is 0x13.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>Xon</td>
<td>Setting character for transmit on.</td>
</tr>
<tr>
<td>Xoff</td>
<td>Setting character for transmit off.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.3.10 FT260_UART_GetQueueStatus

FT260_STATUS FT260_UART_GetQueueStatus(FT260_HANDLE ft260Handle, LPDWORD lpdwAmountInRxQueue)

Summary:
Gets the number of bytes in the receive queue.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>lpdwAmountInRxQueue</td>
<td>Pointer to a variable of type DWORD which save the amount of data.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.
4.3.11 FT260_UART_Write

FT260_STATUS FT260_UART_Write(FT260_HANDLE ft260Handle, LPVOID lpBuffer, DWORD dwBufferLength, DWORD dwBytesToWrite, LPDWORD lpdwBytesWritten)

Summary:
UART write data to the device.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>lpBuffer</td>
<td>Pointer to the buffer that contains the data to be written.</td>
</tr>
<tr>
<td>dwBufferLength</td>
<td>The length of the buffer.</td>
</tr>
<tr>
<td>dwBytesToWrite</td>
<td>Number of bytes to write.</td>
</tr>
<tr>
<td>lpdwBytesWritten</td>
<td>Pointer to a variable of type DWORD which receives the number of bytes written.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

4.3.12 FT260_UART_Read

FT260_STATUS FT260_UART_Read(FT260_HANDLE ft260Handle, LPVOID lpBuffer, DWORD dwBufferLength, DWORD dwBytesToRead, LPDWORD lpdwBytesReturned)

Summary:
UART read data from the device.

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>lpBuffer</td>
<td>Pointer to the buffer that contains the data to be read.</td>
</tr>
<tr>
<td>dwBufferLength</td>
<td>The length of the buffer.</td>
</tr>
<tr>
<td>dwBytesToWrite</td>
<td>Number of bytes to read.</td>
</tr>
<tr>
<td>lpdwBytesWritten</td>
<td>Pointer to a variable of type DWORD which receives the number of bytes read.</td>
</tr>
</tbody>
</table>

Return Value:
FT260_OK if successful, otherwise the return value is an error code.
4.3.13  **FT260_UART_GetDcdRiStatus**

**Parameters:**

<table>
<thead>
<tr>
<th>ft260Handle</th>
<th>Handle of the device.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>Pointer to a variable of type uint8 which saves the status value.</td>
</tr>
<tr>
<td></td>
<td>• BIT 0: DCD status</td>
</tr>
<tr>
<td></td>
<td>• BIT 1: RI status</td>
</tr>
</tbody>
</table>

**Return Value:**

FT260_OK if successful, otherwise the return value is an error code.

4.3.14  **FT260_UART_EnableRiWakeup**

**Parameters:**

<table>
<thead>
<tr>
<th>ft260Handle</th>
<th>Handle of the device.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable</td>
<td>FALSE to disable.</td>
</tr>
<tr>
<td></td>
<td>TRUE to enable.</td>
</tr>
</tbody>
</table>

**Return Value:**

FT260_OK if successful, otherwise the return value is an error code.
### 4.3.15 FT260_GetInterruptFlag

FT260_STATUS FT260_GetInterruptFlag(FT260_HANDLE ft260Handle, BOOL* pbFlag);

**Summary:**
Get interrupt flag.

**Parameters:**
- ft260Handle: Handle of the device.
- pbFlag: Pointer to a variable of type BOOL which saves the flag value.

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.

### 4.3.16 FT260_CleanInterruptFlag

FT260_STATUS FT260_CleanInterruptFlag(FT260_HANDLE ft260Handle, BOOL* pbFlag);

**Summary:**
Clean the interrupt flag.

**Parameters:**
- ft260Handle: Handle of the device.
- pbFlag: Pointer to a variable of type BOOL which saves the flag value.

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.
4.4 GPIO Functions

The FT260 contains 14 GPIO pins. Each GPIO pin is multiplexed with other functions as listed below:

- GPIO0 / SCL
- GPIO1 / SDA
- GPIO2 / SUSPEND OUT / TX_LED / PWREN
- GPIO3 / WAKEUP / INTR
- GPIO4 / UART DCD
- GPIO5 / UART RI
- GPIOA / TX_ACTIVE / TX_LED / PWREN
- GPIOB / UART_RTS_N
- GPIOC / UART_RXD
- GPIOD / UART_TXD
- GPIOE / UART_CTS_N
- GPIOF / UART_DTR_N
- GPIOG / BCD_DET / RX_LED
- GPIOH / UART_DST_N

The LibFT260 support library provides several APIs to set the function of these GPIOs and the GPIO example application shows how to use them.

Please refer to DS_FT260 for more information.

4.4.1 FT260_GPIO_Set

FT260_STATUS FT260_GPIO_Set(FT260_HANDLE ft260Handle, FT260_GPIO_Report report)

**Summary:**
Set directions and values for all GPIO pins with the FT260_GPIO_Report parameter.

**Parameters:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>report</td>
<td>The setting values which is a variable of type FT260_GPIO_Report. Type</td>
</tr>
<tr>
<td>report</td>
<td>FT260_GPIO_Report is defined as follows:</td>
</tr>
<tr>
<td>report</td>
<td>struct FT260_GPIO_Report</td>
</tr>
<tr>
<td>report</td>
<td>{</td>
</tr>
<tr>
<td>report</td>
<td>WORD value; // bit0<del>5: GPIO0</del>5 values</td>
</tr>
<tr>
<td>report</td>
<td>WORD dir; // bit0<del>5: GPIO0</del>5 directions</td>
</tr>
<tr>
<td>report</td>
<td>WORD gpioN_value; // bit0<del>7: GPIOA</del>H values</td>
</tr>
</tbody>
</table>
WORD gpioN_dir;  // bit0~7: GPIOA~H directions
}

Return Value:
FT260_OK if successful, otherwise the return value is an error code.

### 4.4.2 FT260_GPIO_Get

FT260_STATUS FT260_GPIO_Get(FT260_HANDLE ft260Handle, FT260_GPIO_Report *report)

**Summary:**
Get directions and values for all GPIO pins with the FT260_GPIO_Report parameter.

**Parameters:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>report</td>
<td>Pointer to a variable of type FT260_GPIO_Report where the value will be stored. Type FT260_GPIO_Report is defined as follows: struct FT260_GPIO_Report { WORD value; // bit0<del>5: GPIO0</del>5 values WORD dir; // bit0<del>5: GPIO0</del>5 directions WORD gpioN_value; // bit0<del>7: GPIOA</del>H values WORD gpioN_dir; // bit0<del>7: GPIOA</del>H directions</td>
</tr>
</tbody>
</table>

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.

### 4.4.3 FT260_GPIO_SetDir

FT260_STATUS FT260_GPIO_SetDir(FT260_HANDLE ft260Handle, WORD pinNum, BYTE dir)

**Summary:**
Set direction for the specified GPIO pin.

**Parameters:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>pinNum</td>
<td>Target GPIO pin number.</td>
</tr>
</tbody>
</table>
Return Value:
FT260_OK if successful, otherwise the return value is an error code.

### 4.4.4 FT260_GPIO_Read

FT260_STATUS **FT260_GPIO_Read**(FT260_HANDLE ft260Handle, WORD pinNum, BYTE* pValue)

**Summary:**
Read the value from the specified GPIO pin.

**Parameters:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>pinNum</td>
<td>Target GPIO pin number.</td>
</tr>
<tr>
<td>pValue</td>
<td>Pointer to a variable of BYTE which receives the value of the GPIO pin.</td>
</tr>
</tbody>
</table>

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.

### 4.4.5 FT260_GPIO_Write

FT260_STATUS **FT260_GPIO_Write**(FT260_HANDLE ft260Handle, WORD pinNum, BYTE value)

**Summary:**
Write value to the specified GPIO pin.

**Parameters:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft260Handle</td>
<td>Handle of the device.</td>
</tr>
<tr>
<td>pinNum</td>
<td>Target GPIO pin number.</td>
</tr>
<tr>
<td>value</td>
<td>The output value.</td>
</tr>
</tbody>
</table>

**Return Value:**
FT260_OK if successful, otherwise the return value is an error code.
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Appendix A – References

Document References

DS_FT260

Acronyms and Abbreviations

<table>
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<tr>
<th>Terms</th>
<th>Description</th>
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<tr>
<td>GPIO</td>
<td>General-purpose input/output</td>
</tr>
<tr>
<td>HID</td>
<td>Humber Interface Device</td>
</tr>
<tr>
<td>I2C</td>
<td>Inter-Integrated Circuit</td>
</tr>
<tr>
<td>UART</td>
<td>Universal Asynchronous Receiver/Transmitter</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
<tr>
<td>USB-IF</td>
<td>USB Implementers Forum</td>
</tr>
</tbody>
</table>
Appendix B – List of Tables & Figures

List of Tables
Table 1.1 FT260 interface configuration ........................................................................6
Table 1.2 FT260 endpoints ...........................................................................................6

List of Figures
Figure 1.1 The FT260 System Block Diagram .................................................................5
Figure 2.1 The FT260 connects with I²C bus .................................................................8
Figure 2.2 The FT260 connects to an UART device .......................................................8
Appendix C – FT260_STATUS

FT260_STATUS
    FT260_OK = 0
    FT260_INVALID_HANDLE = 1
    FT260_DEVICE_NOT_FOUND = 2
    FT260_DEVICE_NOT_OPENED = 3
    FT260_DEVICE_OPEN_FAIL = 4
    FT260_DEVICE_CLOSE_FAIL = 5
    FT260_INCORRECT_INTERFACE = 6
    FT260_INCORRECT_CHIP_MODE = 7
    FT260_DEVICE_MANAGER_ERROR = 8
    FT260_IO_ERROR = 9
    FT260_INVALID_PARAMETER = 10
    FT260_NULL_BUFFER_POINTER = 11
    FT260_BUFFER_SIZE_ERROR = 12
    FT260_UART_SET_FAIL = 13
    FT260_RX_NO_DATA = 14
    FT260_GPIO_WRONG_DIRECTION = 15
    FT260_INVALID_DEVICE = 16
    FT260_OTHER_ERROR = 17
### Appendix D – Revision History

Document Title: AN_395 User Guide for LibFT260  
Document Reference No.: FT_001280  
Clearance No.: FTDI# 489  
Document Feedback: [Send Feedback](http://www.ftdichip.com/FTProducts.htm)

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