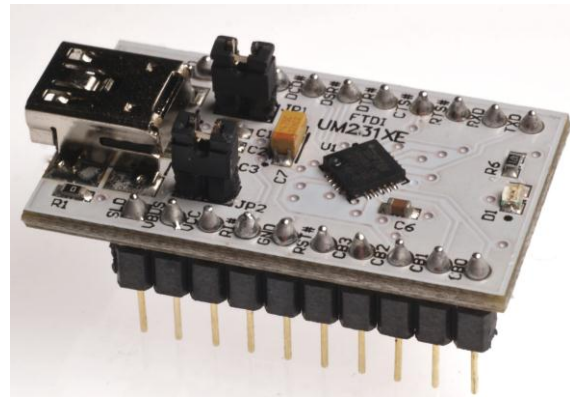# Future Technology Devices International Ltd

Datasheet

UMFT231XE USB to Full-Handshake UART Development Module

UMFT231XE is a USB to serial Full-Handshake UART DIP module with a 0.6" row pitch.

1 Introduction

The UMFT231XE is a development module for FTDI's FT231XQ, one of the devices from FTDI's range of USB interface bridging integrated circuit devices. FT231X is a USB to UART interface with a battery charger detection feature, which can allow batteries to be charged with a higher current from a dedicated charger port (without the FT231X being enumerated). In addition, asynchronous and synchronous bit bang interface modes are available. The internally generated clock (6MHz, 12MHz and 24MHz) can be brought out of the on one of the CBUS pin to be used to drive a microprocessor or external logic.

The UMFT231XE is a module which is designed to plug into a standard 0.6" wide 20 pin DIP socket. All components used, including the FT231XQ are Pb-free (RoHS compliant).

1.1 Features

The UMFT231XE is fitted with a FT231XQ, all the features of the FT231X can be utilized with the UMFT231XE. For a full list of the FT231X's features please see the FT231X datasheet which can be found by clicking here.
In addition to the features listed in the FT231X datasheet, the UMFT231XE has the following features:

- Small PCB assembly module designed to fit a standard 15.24mm (0.6") wide 20 pin DIP socket. Pins are on a 2.54mm (0.1") pitch.

- On board USB 'mini-B' socket allows module to be connected to a PC via a standard A to mini-B USB cable.

- Functionally configurable using jumpers. The default jumper setup enables the module to function without peripheral wires or application board. Other configurations enable external power supply options and variation of logic reference levels.

Table of Contents

2 Driver Support

Royalty-Free VIRTUAL COM PORT (VCP) DRIVERS for:

- Windows 7 32,64-bit
- Windows Vista
- Windows XP 32,64-bit
- Windows XP Embedded
- Windows CE.NET 4.2 , 5.0 and 6.0
- MAC OS OS-X
- Linux 3.0 and greater
- Android

Royalty-Free D2XX Direct Drivers (USB Drivers + DLL S/W Interface):

- Windows 7 32,64-bit
- Windows Vista
- Windows XP 32,64-bit
- Windows XP Embedded
- Windows CE.NET 4.2, 5.0 and 6.0
- MAC OS OS-X
- Linux 3.0 and greater
- Android

The drivers listed above are all available to download for free from www.ftdichip.com. Various 3rd Party Drivers are also available for various other operating systems - visit www.ftdichip.com for details.

3 Ordering Information

Module Code	Utilised IC Code	Description
UMFT201XE-01	FT201XQ	USB to I^{2}C evaluation module. 0.6" row pitch, standard DIP headers.
UMFT221XE-01	FT221XQ	USB to 8-bit SPI/FT1248 evaluation module. 0.6" row pitch, standard DIP headers.
UMFT231XE-01	FT231XQ	USB to Full-Handshake UART evaluation module. 0.6" row pitch, standard DIP headers.
UMFT240XE-01	FT240XQ	USB to 8-bit 245 FIFO evaluation module. 0.6" row pitch, standard DIP headers.

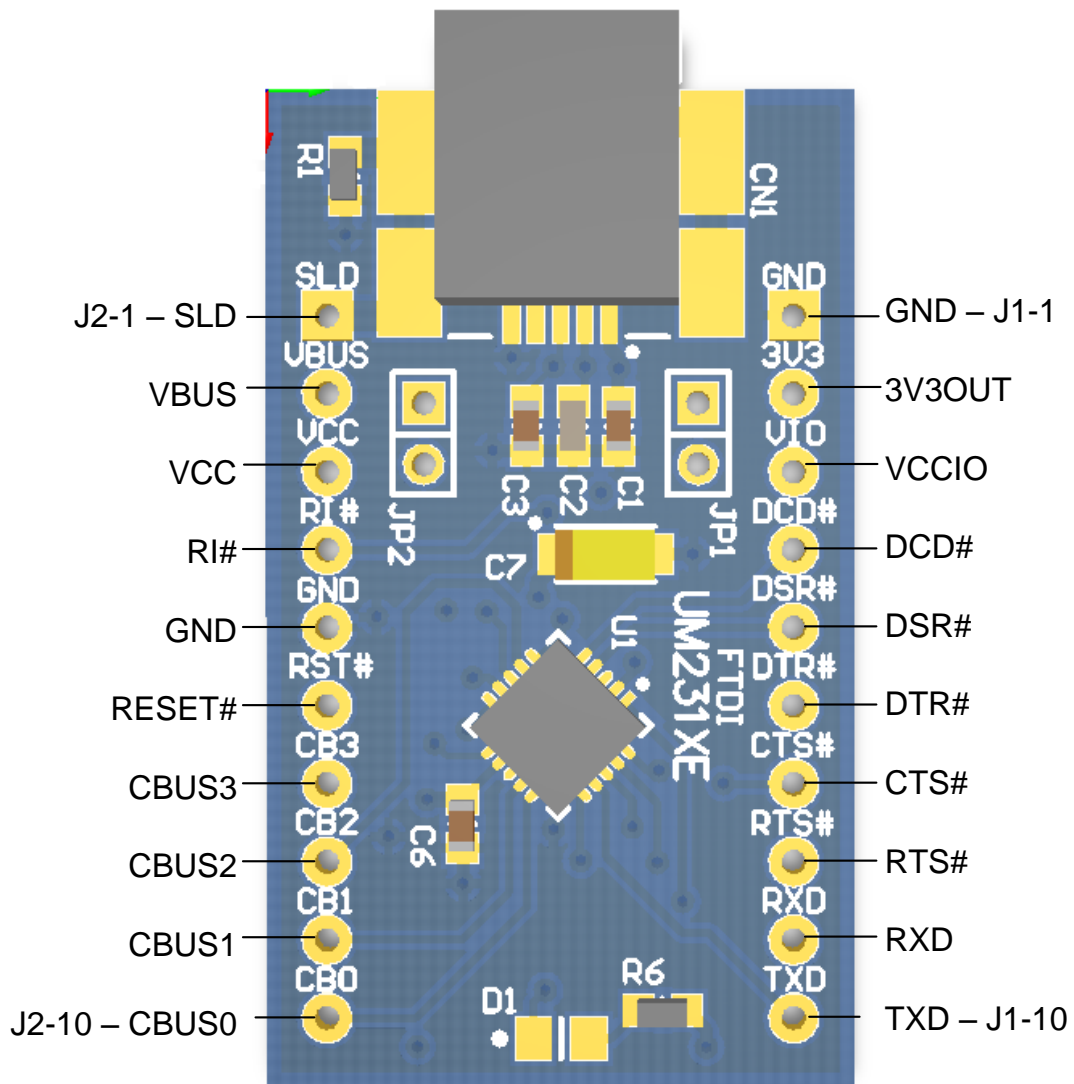# 4   UMFT231XE Signals and Configurations

4.1 UMFT231XE Pin Out

Figure 4.1 – Module Pin Out

Figure 4.1 illustrates the signals available on the DIP pins.

4.2 Signal Descriptions

Pin No.	Name	Type	Description
J1-1, J2-5	GND	PWR	Module Ground Supply Pins
J1-2	3V3OUT	Power Input/Output	3.3V output from integrated L.D.O. regulator. This pin is decoupled with a 100nF capacitor to ground on the PCB module. The prime purpose of this pin is to provide the 3.3V supply that can be used internally. For power supply configuration details see Section 5.
J1-3	VCCIO	Power Input	+1.8V to +3.3V supply to the UART Interface and CBUS I/O pins. For power supply configuration details see Section 5.
J1-4	DCD#	Input	Data Carrier Detect Control Input.
J1-5	DSR#	Input	Data Set Ready Control Input / Handshake Signal.
J1-6	DTR#	Output	Data Terminal Ready Control Output / Handshake Signal.
J1-7	CTS#	Input	Clear To Send Control Input / Handshake Signal.
J1-8	RTS#	Output	Request to Send Control Output / Handshake Signal.
J1-9	RXD	Input	Receiving Asynchronous Data Input.
J1-10	TXD	Output	Transmit Asynchronous Data Output.
J2-1	SLD	GND	USB Cable Shield. Connected to GND via a 0ohm resistor.
J2-2	VBUS	Power Output	5V Power output from the USB bus. For a low power USB bus powered design, up to 100mA can be sourced from the 5V supply and applied to the USB bus. A maximum of 500mA can be sourced from the USB bus in a high power USB bus powered design. Currents up to 1A can be sourced from a dedicated charger and applied to the USB bus.
J2-3	VCC	Power Input	5V power input for FT231X. For power supply configuration details see Section 5.
J2-4	RI#	Input	Ring Indicator Control Input. When remote wake up is enabled in the internal MTP ROM taking RI# low >20ms can be used to resume the PC USB host controller from suspend.
J2-6	RESET#	Input	FT231X active low reset line. Configured with an on board pull-up and recommended filter capacitor. When no power is applied to the USB bus reset, will be held low, this prevents current from flowing to the host or hub when in self-powered mode.
J2-7	CBUS3	I/O	Configurable CBUS I/O Pin. Function of this pin is configured in the device internal MTP ROM. See CBUS Signal Options, Table 4.2.
J2-8	CBUS2	I/O	Configurable CBUS I/O Pin. Function of this pin is configured in the device internal MTP ROM. See CBUS Signal Options,Table 4.2.
J2-9	CBUS1	I/O	Configurable CBUS I/O Pin. Function of this pin is configured in the device internal MTP ROM. See CBUS Signal Options, Table 4.2.
J2-10	CBUS0	I/O	Configurable CBUS I/O Pin. Function of this pin is configured in the device internal MTP ROM. See CBUS Signal Options,Table 4.2.

Table 4.1 – Module Pin Out Description

4.3 CBUS Signal Options

The following options can be configured on the CBUS I/O pins. These options are all configured in the internal MTP ROM using the utility software FT_PROG, which can be downloaded from the www.ftdichip.com. The default configuration is described in Section 9.

CBUS Signal Option	Available On CBUS Pin	Description
Tristate	CBUS0-CBUS3	IO Pad is tri-stated
DRIVE_1	CBUS0-CBUS3	Output a constant 1
DRIVE_0	CBUS0-CBUS3	Output a constant 0
TXDEN	CBUS0-CBUS3	Enable transmit data for RS485
PWREN#	CBUS0-CBUS3	Output is low after the device has been configured by USB, then high during USB suspend mode. This output can be used to control power to external logic P-Channel logic level MOSFET switch. **NOTE:** This function is driven by an open-drain to ground with no internal pull-up, this is specially designed to aid battery charging applications. UMFT231XE connects all CBUS and DBUS signals an on-board 47K pull-up.
TXLED#	CBUS0-CBUS3	Transmit data LED drive – open drain pulses low when transmitting data via USB.
RXLED#	CBUS0-CBUS3	Receive data LED drive – open drain pulses low when receiving data via USB.
TX&RXLED#	CBUS0-CBUS3	LED drive – open drain pulses low when transmitting or receiving data via USB.
SLEEP#	CBUS0-CBUS3	Goes low during USB suspend mode. Typically used to power down an external logic to RS232 level converter IC in USB to RS232 converter designs. Cancel SLEEP# option for when connected to a dedicated charger port, this can be selected when configuring the MTP ROM. When this option is enabled SLEEP# is driven high when FT231X is connected to a Dedicated Charger Port.
CLK24MHz	CBUS0-CBUS3	24 MHz Clock output.**
CLK12MHz	CBUS0-CBUS3	12 MHz Clock output.**
CLK6MHz	CBUS0-CBUS3	6 MHz Clock output.**
GPIO	CBUS0-CBUS3	CBUS bit bang mode option. Allows up to 4 of the CBUS pins to be used as general purpose I/O. Configured individually for CBUS0, CBUS1, CBUS2 and CBUS3 in the internal MTP ROM. A separate application note, AN232R-01, available from FTDI website (www.ftdichip.com) describes in more detail how to use CBUS bit bang mode.
BCD_Charger	CBUS0-CBUS3	Battery Charge Detect indicates when the device is connected to a dedicated battery charger host. Active high output. NOTE: Requires a 10K pull-down to remove power up toggling.
BCD_Charger#	CBUS0-CBUS3	Active low BCD Charger, driven by an open drain to ground with no internal pull-up (4.7K on board pull-up present).
BitBang_WR#	CBUS0-CBUS3	Synchronous and asynchronous bit bang mode WR# strobe output.
BitBang_RD#	CBUS0-CBUS3	Synchronous and asynchronous bit bang mode RD# strobe output.
VBUS_Sense	CBUS0-CBUS3	Input to detect when VBUS is present.
Time_Stamp	CBUS0-CBUS3	Toggle signal which changes state each time a USB SOF is received
Keep_Awake#	CBUS0-CBUS3	Active Low input, prevents the chip from going into suspend.

Table 4.2 – CBUS Signal Options

**When in USB suspend mode the outputs clocks are also suspended.

5 Module Configurations

5.1 Jumper Configuration Options

Jumper No.	Setting	Status	Description
JP1	Shorted	Default	Connects internal 3.3V regulator to VCCIO. This restricts signal drive to only 3.3V level signals.
JP1	Opened	Non-Default	Disconnects internal 3.3V regulator connection to VCCIO. This mode allows for the supply of 1.8V-3.3V power from an external power supply, thus allows the processing of signals with logic levels between 1.8V and 3.3V. VCCIO can be adjusted to match the interface requirements of external circuitry.

Table 5.1 – Jumper JP1 Pin Description

Jumper No.	Setting	Status	Description
JP2	Shorted	Default	Connects VBUS to VCC. This mode is known as "USB-Powered" mode.
JP2	Opened	Non-Default	Disconnects VBUS to VCC. This allows the supply of power from an external power supply. This mode is known as "Self-Powered" mode.

Table 5.2 – Jumper JP2 Pin Description

Note: There should never be more than one power output supplied to the same net. If JP2 is fitted when an external power supply is applied a direct short between two power supplies will be formed, this can result in damage to the UMFT231XE module and the target circuit.
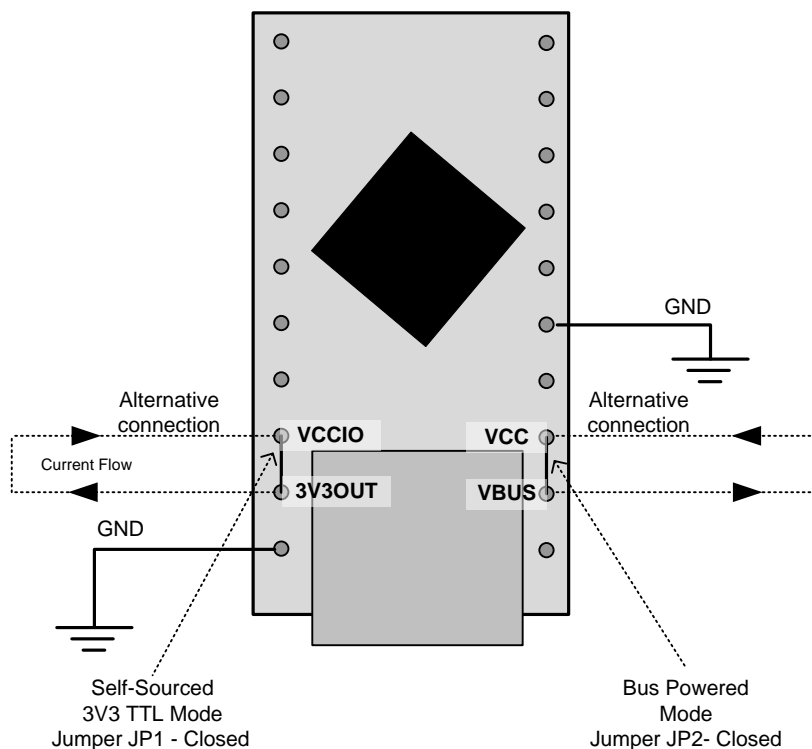
5.2 Bus Powered Configuration

Figure 5.1 – Bus Powered Configuration

A bus powered configuration draws its power from the USB host/hub. The UMFT231XE is configured by default to be in bus powered mode.

Figure 5.1 illustrates the UMFT231XE module in a typical USB bus powered design configuration. By default VCCIO is connected to 3V3OUT, and VCC is connected to VBUS.

For a bus power configuration power is supplied from the USB VBUS:

+5V VBUS power is sourced from the USB bus and is connected to the FT231X power input (VCC)

+3.3V power is sourced from the FT231X's voltage regulator output and is connected to the FT231X IO port's power input (VCCIO).

Interfacing the UMFT231XE module to a microcontroller (MCU), or other logic devices for bus powered configuration is done the same way as a self-powered configuration (see Section 3), except it is possible for the MCU or external device to take its power supply from the USB bus (either the 5V from the USB pin, or 3.3V from the 3V3OUT pin).
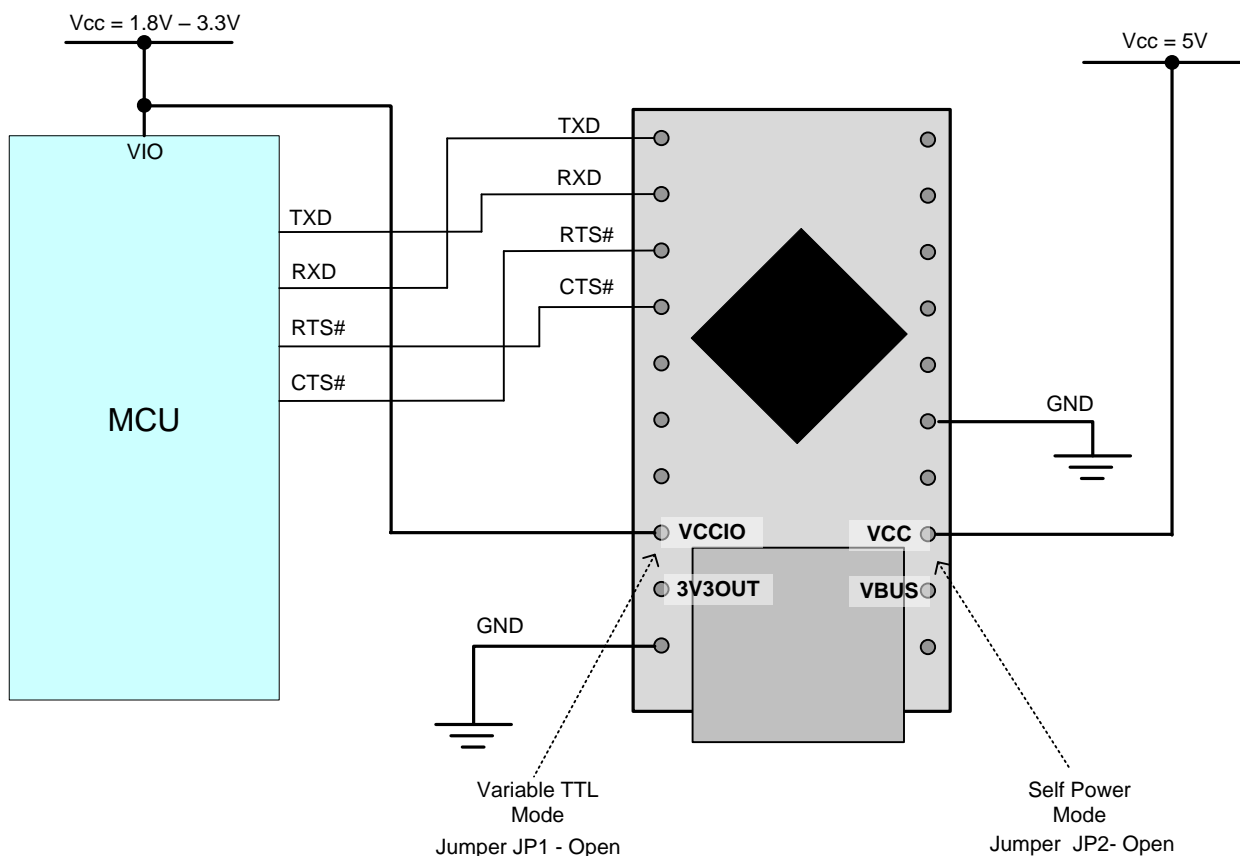
5.3 Self Powered Configuration

Figure 5.2 – Self-Powered Configuration

A self-powered configuration operates on the principle of drawing power from an external power supply, as oppose to drawing power from the USB host. In this configuration no current is drawn from the USB bus.

Figure 5.2 illustrates the UMFT231XE in a typical USB self-powered configuration. In this case the jumper connection of JP1 is removed, which allows 5V power to be supplied to the module VCC pins from an external source. VCCIO can to be powered from 3V3OUT or the VCC of an external source.

For a self-powered configuration, it is necessary to prevent current from flowing back to the USB data lines when the connected USB host or hub has powered down. To carry out this function the UMFT231XE uses an on-board voltage divider network connected to the USB bus and RESET# pin. This operates on the principle that when no power is supplied to the VBUS line, the FT231X will automatically be held in reset by a weak pull-down, when power is applied the voltage divider will apply a weak 3.3V pull-up. Driving a level to the RESET# pin of the UMFT231XE will override the effect of this voltage divider. When the FT231X is in reset the USB DP signal pull-up resistor connected to the data lines is disconnected and no current can flow down the USB lines.

An example of interfacing the FT231X with a Microcontroller's UART interface is also illustrated in Figure 5.2. This example shows the wire configuration of the transfer and handshake lines. This example also illustrates that a voltage other than 3.3V can be supplied to the FT231X's IO port, this feature is described further and for bus powered mode in Section 5.5.

Alternatively, both the FT231X's IO port and MCU can be powered from the 3V3OUT pin; this approach is described in Section 5.4.

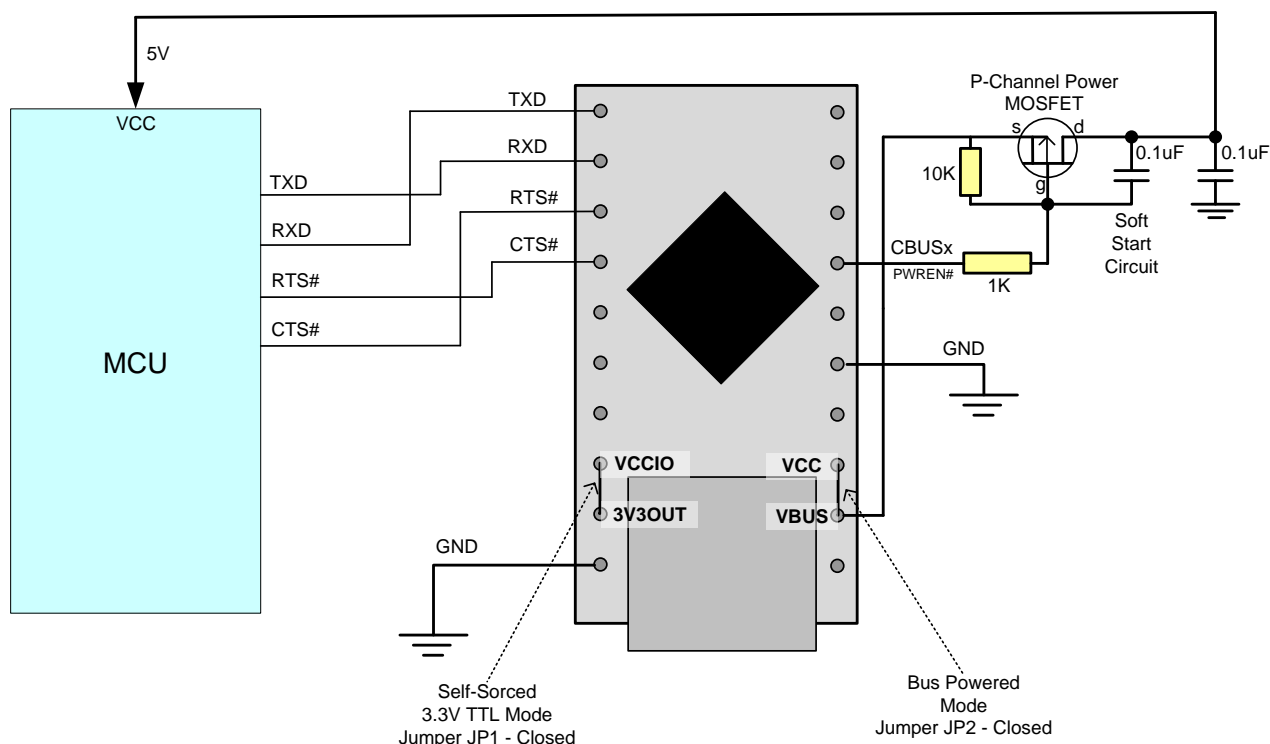## 5.4 USB Bus Powered with Power Switching Configuration

Figure 5.3 – Bus Powered with Power Switching Configuration

USB bus powered mode is introduced in Section 5.2. This section describes how to use bus-powered mode with a power switch.

USB bus powered circuits are required by USB compliance standards to consume less than 2.5mA (and less than 100mA when not enumerated and not suspended) when connected to a host or hub when in USB suspend mode. The PWREN# CBUS function can be used to remove power from external circuitry whenever the FT231X is not enumerated.

To implement a power switch using PWREN#, configure a P-Channel Power MOSFET to have a soft start by fitting a 10K pull-up, a 1K series resistor and a 100nF cap as shown in Figure 5.3.

Connecting the source of the P-Channel MOSFET to 3V3OUT instead of VBUS can allow external logic to source 3.3V power from the FT231X without breaking USB compliancy. In this setup it is important that the VCCIO is not sourced from the drain of this MOSFET, this is because the power used to drive the gate of this transistor is sourced from VCCIO. VCCIO should be connected directly to 3V3OUT for this setup to function effectively. It is also important that the external logic must and IO core of the FT231X must not draw more that 50mA, this is because the current limit of the internal 3.3V regulator is 50mA.
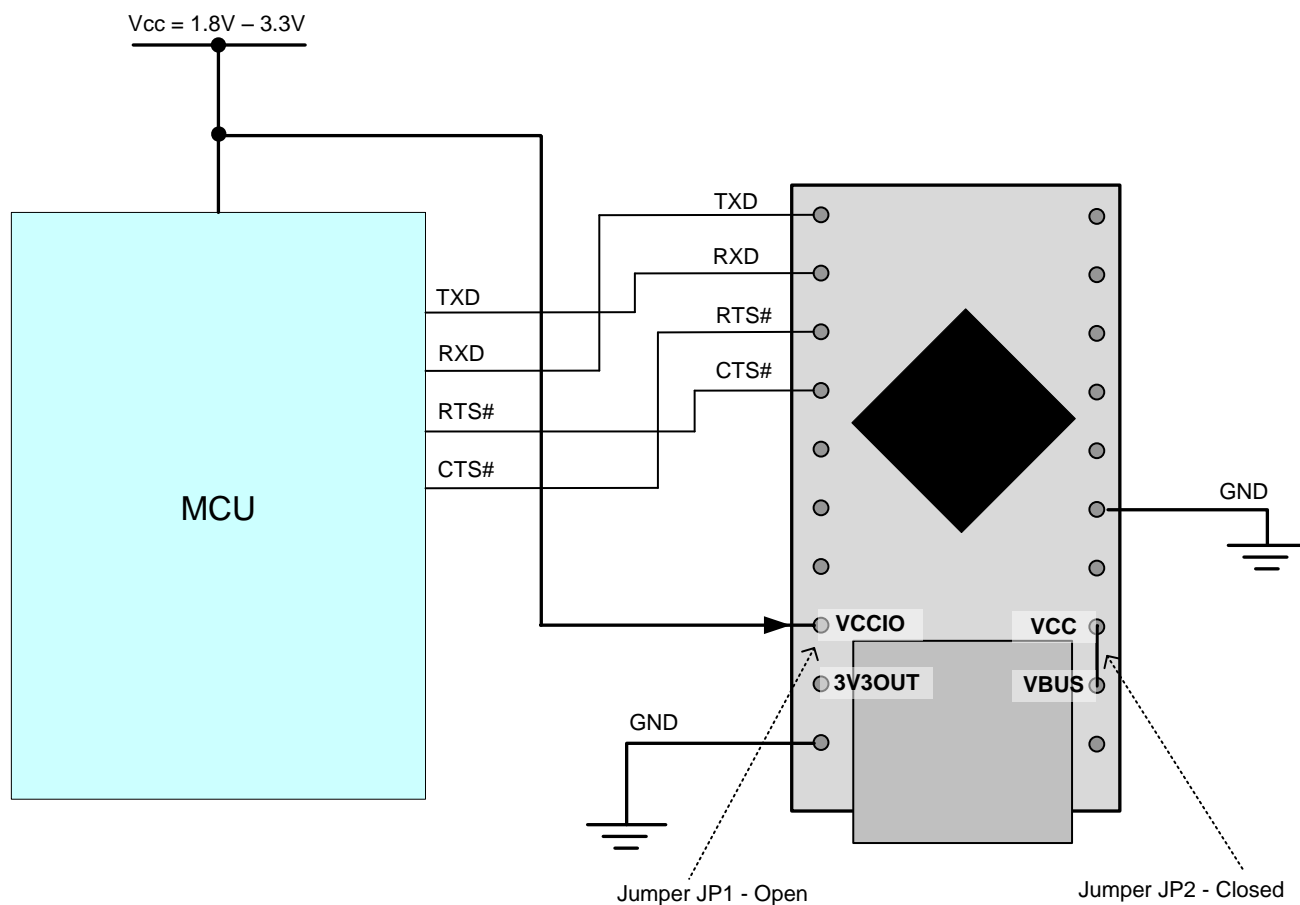
5.5 Variable IO Voltage Supply

Figure 5.4 – USB Bus Powered 3.3V Logic Drive

The FT231X can process signals at CMOS/TTL logic levels in the range of 1.8V to 3.3V. This section describes how to utilise this feature.

Figure 5.4 shows a configuration where the FT231X is interfaced to a device with IOs operating in the range of 1.8V - 3.3V. The IO ports of this module need to be powered with a voltage level that is equal to the level of the signals it is processing. Since the FT231X's embedded voltage regulator only outputs 3V3 the IO ports will need to be powered from another power source when operating at voltage levels other than 3.3V.

By default, a short is present between 3V3OUT (embedded voltage regulator) and VCCIO (IO port's power input with the connection made by JP1. If an external power supply is used to power the IO ports this jumper needs to be open.

The configuration described in this section can be implemented in either bus-powered mode or self-powered mode.

Note 1: The CBUS and DBUS pins are 5V tolerant; however these signals cannot drive signals at 5V TTL/CMOS. VCCIO is not 5V tolerant; applying 5V to VCCIO will damage the chip.

Note 2: If power is applied to VCCIO and no power is applied to VCC all IOs will be at an unknown state, this however will not damage the chip. The FT231X also has protective circuitry to prevent the chip being damaged by a voltage discrepancy between VCCIO and the level of the signal being processed.

Note 3: When using VCCIO less than 3V3 on a chip from FTDI's X-chip range, it is recommended to use pull up resistors (47K) to VCCIO on the data lines, all of the UMFT2xxXE devices include an on-board pull-up for these lines.
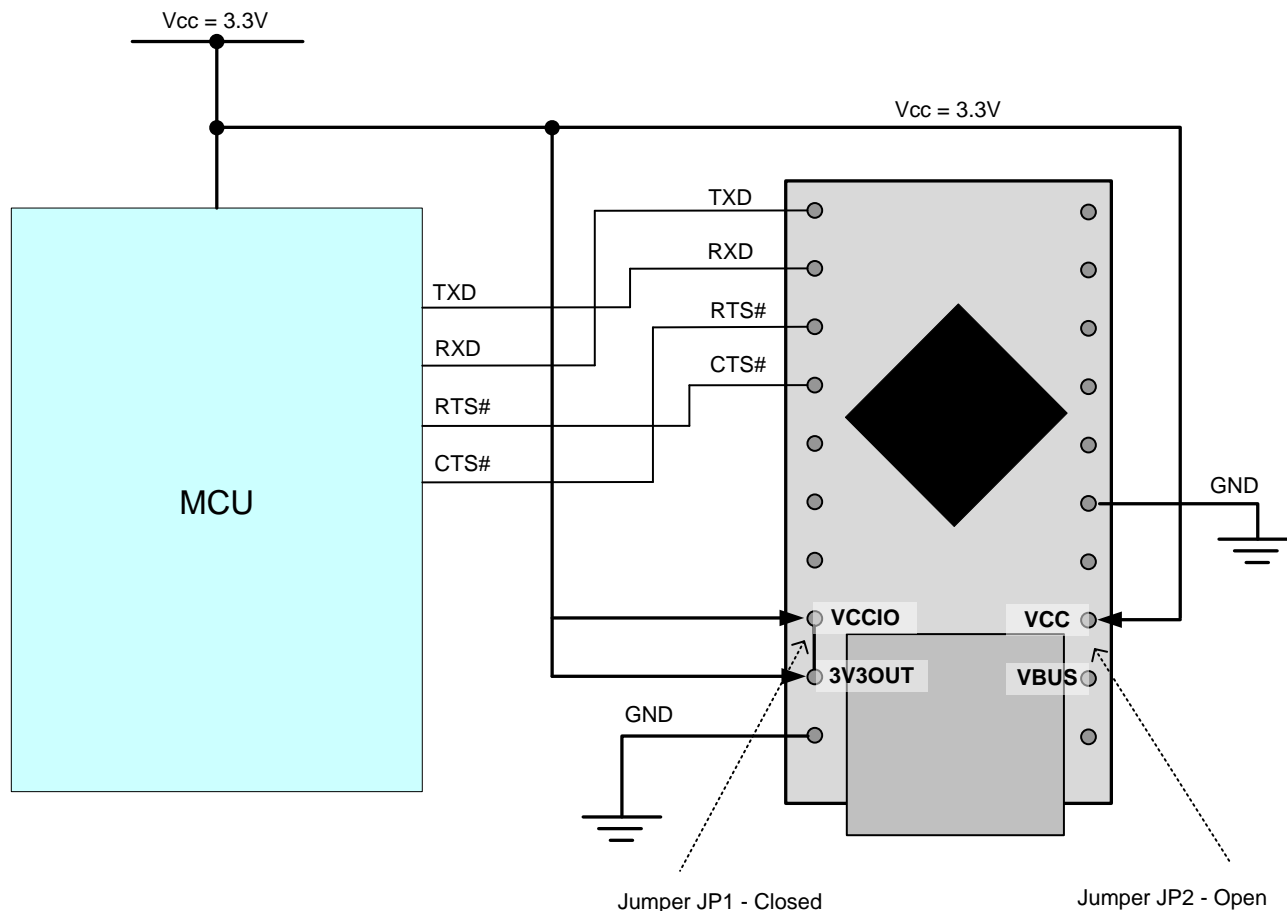
5.6 3.3V Voltage Supply

Figure 5.5 – USB Self Powered 3.3V Logic Drive

The FT231X can be powered from a single 3.3V supply. This feature is an alternative to having the FT231X powered at 5V in standard self-powered configuration.

The 3.3V Self Powered configuration is illustrated in Figure 5.5. Note that the 3.3V input is connected to VCC, VCCIO and 3V3OUT.

5.7 Configuring the MTP ROM

The FT231X contains an embedded MTP ROM. This can be used to configure the functions of each CBUS pin, the current drive on each signal pin, current limit for the USB bus and the other descriptors of the device. For details on using the MTP ROM/EEPROM programming utility FT_PROG, please see the FT_PROG User Guide.

When programming the MTP ROM please note:

i) One of the CBUS Pins can be configured as PWREN# in the internal MTP ROM. This can be used to switch the power supply to the external circuitry.

ii) The Max Bus Power setting of the MTP ROM should specify the maximum current to be drawn from the USB host/hub when enumerated. For high-powered USB devices the current limit when enumerated is between 100mA and 500mA, for low-powered USB devices the current limit is 100mA.

6 Module Dimensions
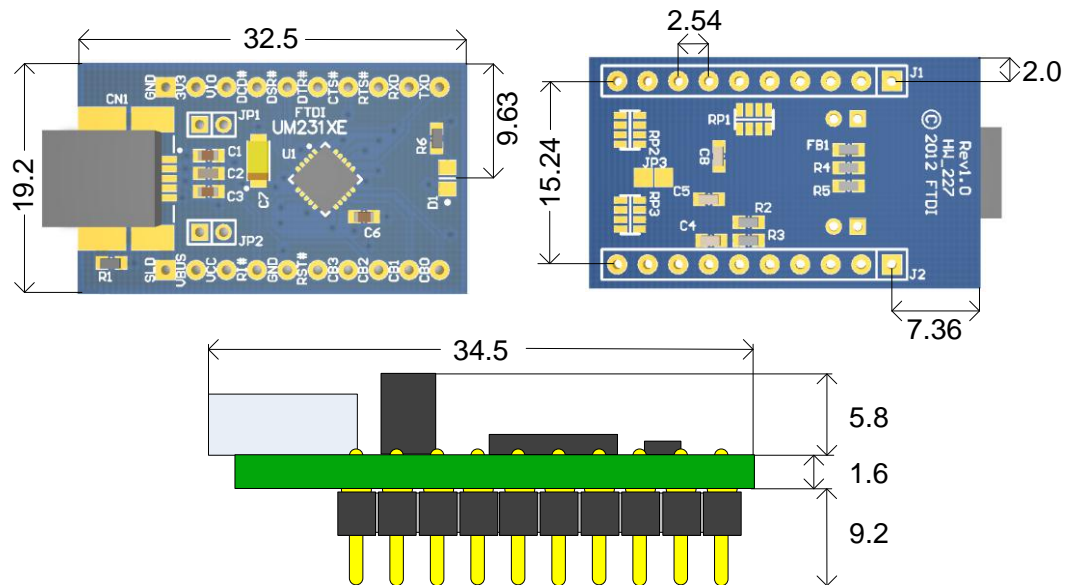
Figure 6.1 – UMFT231XE Module Dimensions

All dimensions are given in millimetres.

The UMFT231XE module exclusively uses lead free components, and is fully compliant with European Union directive 2002/95/EC.
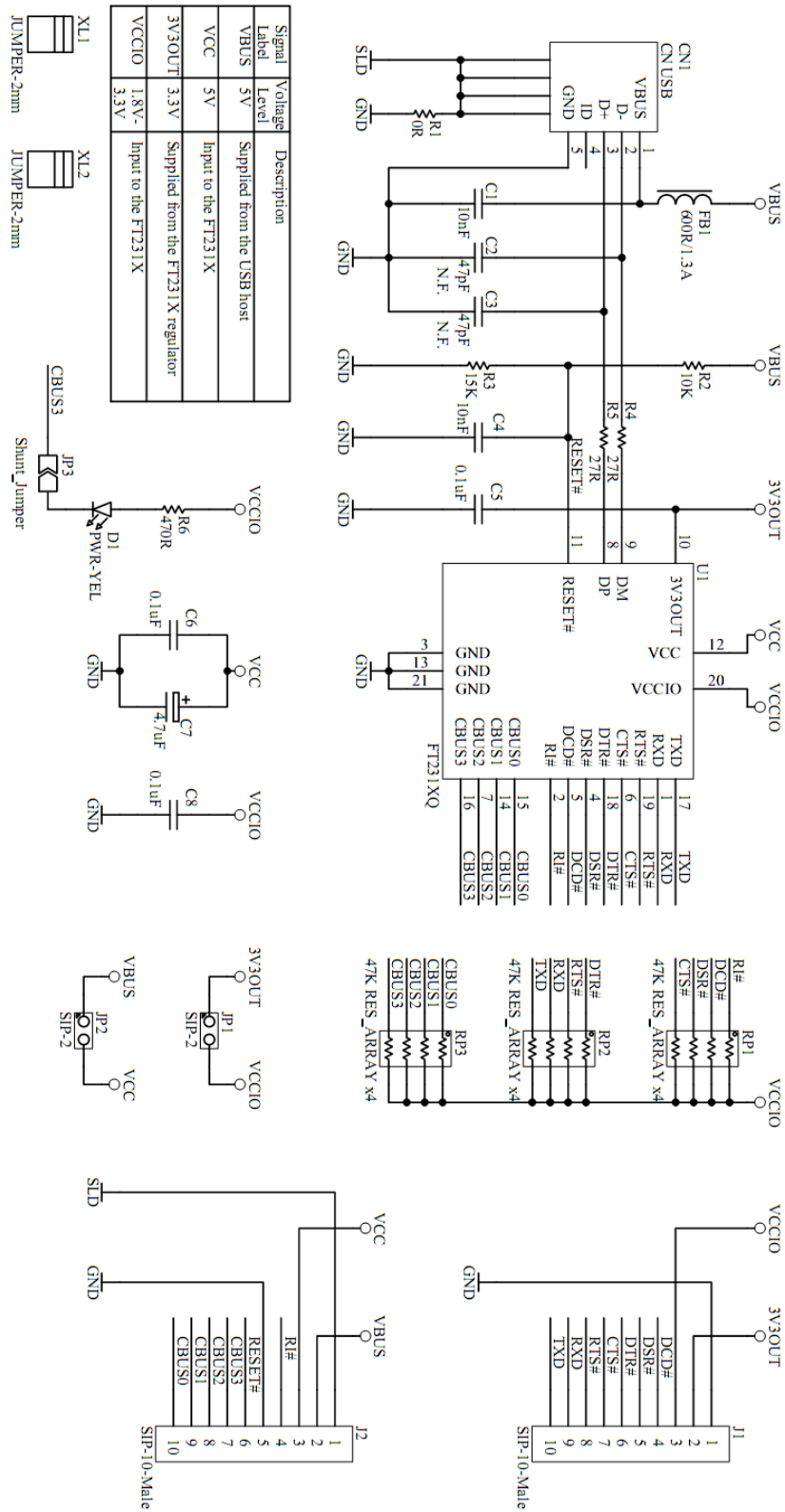
7 UMFT231XE Module Circuit Schematic

Figure 7.1 – Module Circuit Schematic

8 Internal MTP ROM Configuration

Following a power-on reset or a USB reset the FT231X will scan its internal MTP ROM and read the USB configuration descriptors stored there. The default values programmed into the internal MTP ROM in the FT231XQ used on the UMFT231XE are shown in Table 8.1.

Parameter	Value	Notes
USB Vendor ID (VID)	0403h	FTDI default VID (hex)
USB Product UD (PID)	6015h	FTDI default PID (hex)
Serial Number Enabled?	Yes	
Serial Number	See Note	A unique serial number is generated and programmed into the MTP ROM during final test of the UM232R module.
Pull down I/O Pins in USB Suspend	Disabled	Enabling this option will make the device pull down on the UART interface lines when the power is shut off (PWREN# is high).
Manufacturer Name	FTDI	
Product Description	UMFT231XE	
Max Bus Power Current	90mA	
Power Source	Bus Powered	
Device Type	FT231X	
USB Version	0200	Returns USB 2.0 device description to the host. Note: The device is a USB 2.0 Full Speed device (12Mb/s) as opposed to a USB 2.0 High Speed device (480Mb/s).
Remote Wake Up	Enabled	Taking RI# low will wake up the USB host controller from suspend.
High Current I/Os	Disabled	Enables the high drive level on the UART and CBUS I/O pins.
Load VCP Driver	Enabled	Makes the device load the CVP driver interface for the device.
CBUS0	GPIO	
CBUS1	GPIO	
CBUS2	GPIO	
CBUS3	GPIO	
Invert UART	Disabled	Signal on this pin becomes TXD# if enable.

Table 8.1 – Default Internal MTP ROM Configuration

The internal MTP ROM in the FT231X can be programmed over USB using the utility program FT_PROG. FT_PROG can be downloaded from the www.ftdichip.com. Users who do not have their own USB vendor ID but who would like to use a unique Product ID in their design can apply to FTDI for a free block of unique PIDs. Contact FTDI Support (support1@ftdichip.com) for this service, also see TN_100 and TN_101.

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Distributor and Sales Representatives

Please visit the Sales Network page of the FTDI Web site for the contact details of our distributor(s) and sales representative(s) in your country.

Appendix A - List of Figures and Tables