

**Future Technology Devices International Ltd**

**C232HM**

**USB 2.0 Hi-Speed to MPSSE Cable**

**Datasheet**

**Document Reference No.: FT\_000401**

**Version 1.2.1**

**Issue Date: 2016-05-05**

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## 1 Description

The **USB 2.0 Hi-Speed to MPSSE cable** contains a small internal electronic circuit board, utilising the FTDI FT232H, which is encapsulated into the USB connector end of the cable, this handles all the USB signalling and protocols. The cable provides a fast, simple way to connect devices with 3.3 Volt digital interfaces to USB. For full details of the IC, consult the FT232H datasheet, this is available from [DS\\_FT232H](#).

The integrated FT232H device incorporates a command processor called the Multi-Protocol Synchronous Serial Engine (MPSSE). The purpose of the MPSSE command processor is to communicate with devices which use synchronous protocols (such as JTAG, SPI or I<sup>2</sup>C) in an efficient manner. Full details are available in the [MPSSE application note - AN\\_108](#).

The cable is terminated by ten individual wires with single pole connectors which can be interfaced to a male header. Cable signals are compliant with CMOS logic at 3.3 volts.

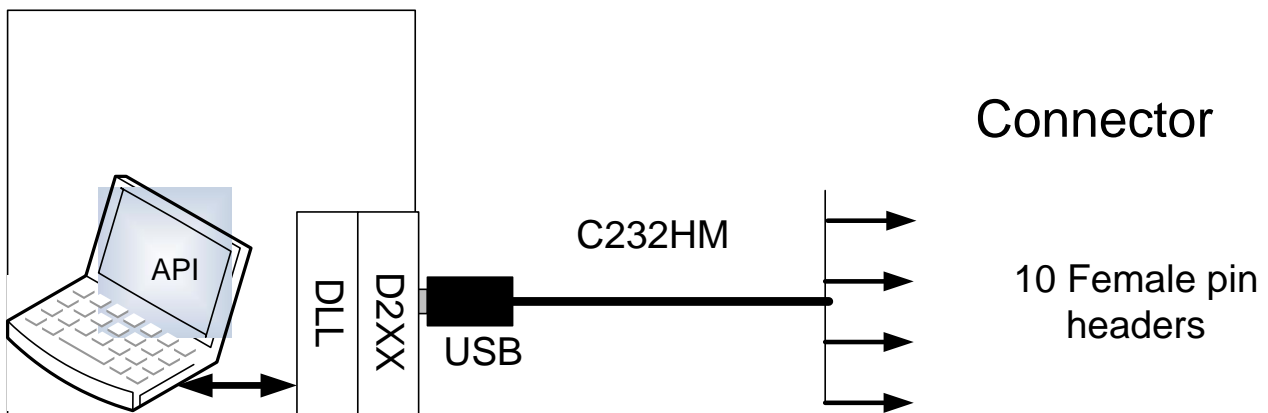
The FT232H is a single channel USB 2.0 Hi-Speed (480Mb/s) to UART/FIFO IC. It can be configured in a variety of industry standard serial or parallel interfaces, such as MPSSE - JTAG, SPI, I<sup>2</sup>C.

The C232HM MPSSE cable is easily configured into each interface e.g. JTAG, SPI, I<sup>2</sup>C via the application software.

The cable is powered from a USB host port and is USB 2.0 Hi-Speed compatible. The cable is 0.5m long and supports a data transfer up to 30Mbps in MPSSE mode.

The C232HM MPSSE cable requires USB device drivers, available free from <http://www.ftdichip.com>. The D2XX driver is used with application software to directly access the FT232H in the cable through a DLL. This is illustrated in the Figure 1-1

The C232HM MPSSE cable uses the FTDI's FT232H USB to serial IC device.



## Software application access to USB via D2XX

Figure 1-1 Using the C232HM MPSSE Cable

## 1.1 Available Cables and Part Numbers

The following Table 1.1 gives details of the available C232HM MPSSE cables.

Part Number	Description	End Connector	Cable details
C232HM-DDHSL-0	USB to MPSSE cable with +3.3V digital level signals. Maximum output of 250mA @ 3.3VDC on VCC  (see <b>Note 1</b> )	Single pole, receptacle x 10	10 core, UL2464 24 AWG, diam=6.5mm
C232HM-EDHSL-0	USB to MPSSE cable with +3.3V digital level signals. Maximum output of 450mA @ 5.0VDC on VCC  (see <b>Note 2</b> )	Single pole, receptacle x 10	10 core, UL2464 24 AWG, diam=6.5mm

**Table 1.1 C232HM MPSSE Cable Descriptions and Part Numbers**

**Note 1:** The VCC power output signal (RED wire) is 3.3V. The source of 3.3V is the onboard regulator output, which is switched onto the power output signal.

**Note 2:** The VCC power output signal (RED wire) is 5.0V. The source of 5.0V is the USB VBUS input, which is switched onto the power output signal.

FTDI supports customised end connector designs. For more information, please contact your local FTDI sales office (see end of datasheet for contact details).

## 1.2 Certifications

The FTDI C232HM MPSSE cables are fully RoHS compliant. At the time of writing this datasheet the cables were being CE and FCC tested.

## 1.3 USB Compliant

The FTDI C232HM MPSSE cables are fully compliant with the USB 2.0 specification and have been given the USB-IF Test-ID (TID) 10820025.



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## 2 Typical Applications

- USB to JTAG interfaces
- USB to SPI interfaces
- USB to I<sup>2</sup>C interfaces
- Interfacing MCU / PLD / FPGA based designs to USB
- USB Audio and Low Bandwidth Video data transfer
- Rapid USB integration into existing electronic systems
- Prototyping platform for USB interface on new systems
- USB Instrumentation

### 2.1 Driver Support

#### **Royalty free VIRTUAL COM PORT (VCP) DRIVERS for...**

- Microsoft Windows 10 32,64-bit
- Microsoft Windows 8/8.1 32,64-bit
- Microsoft Windows 7 32,64-bit
- Microsoft Windows 2000, Server 2003, XP and Server 2008
- Microsoft Windows XP and XP 64-bit
- Microsoft Windows Vista and Vista 64-bit
- Microsoft Windows CE 4.2, 5.0 and 6.0
- Apple Mac OS-X
- Linux 2.6.39 or later

#### **Royalty free D2XX Direct Drivers (USB Drivers + DLL S/W Interface)**

- Microsoft Windows 10 32,64-bit
- Microsoft Windows 8/8.1 32,64-bit
- Microsoft Windows 7 32,64-bit
- Microsoft Windows 2000, Server 2003, XP and Server 2008
- Microsoft Windows XP and XP 64-bit
- Microsoft Windows Vista and Vista 64-bit
- Microsoft Windows CE 4.2, 5.0 and 6.0
- Linux 2.6.32 or later

The drivers listed above are all available to download for free from <http://www.ftdichip.com>. Various Third-Party Drivers are also available for various other operating systems - see <http://www.ftdichip.com/Support/Links.htm> for details.

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## 2.2 Features

- Based on the Single chip USB Hi-Speed FT232H device
- USB 2.0 Hi-Speed (480Mbits/Second) and Full Speed (12Mbits/Second) compatible
- Entire USB protocol handled on the chip – No USB-specific firmware programming required
- USB Type A connector for direct connection to a host or hub
- USB bus powered
- Fully assisted hardware or X-On / X-Off software handshaking
- Synchronous Serial (MPSSE) data rates of up to 30Mbps on JTAG, SPI and I2C
- 1kByte receive and transmit buffers for high data throughput
- Transmit and receive LED drive signals
- Adjustable receive buffer timeout
- Support for USB suspend and resume
- Low operating and USB suspend current
- Low USB bandwidth consumption
- UHCI / OHCI / EHCI host controller compatible
- -40°C to +85°C operating temperature range
- Cable length is 0.5m (19.7 inch)
- Custom versions also available (subject to Minimum Order Quantity (MOQ))
- FTDI's royalty-free D2XX drivers eliminate the requirement for USB driver development in most cases

### 3 C232HM MPSSE Cable connection and Mechanical Details

The following Figure 3-1 shows the cable signals and the wire colours for these signals on the C232HM MPSSE cable.

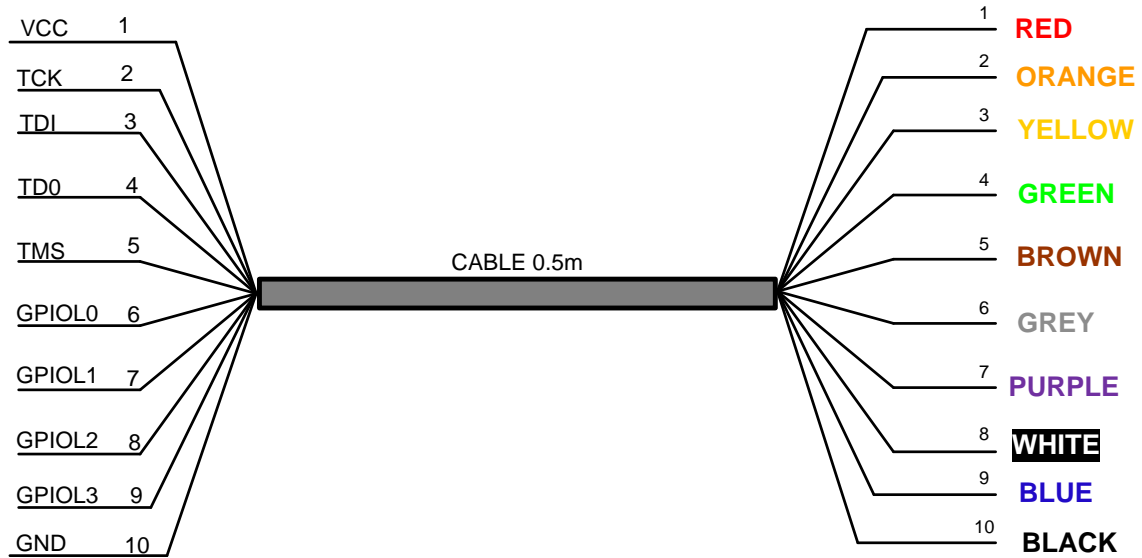


Figure 3-1 C232HM MPSSE Cable Connections (numbers refer to pad numbers on the PCB)

### 3.1 C232HM MPSSE Cable Signal Descriptions

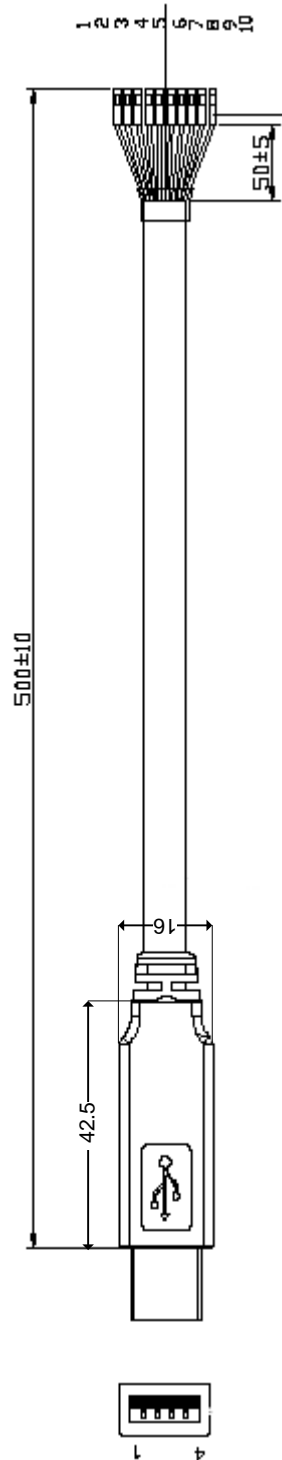


Figure 3-2 C232HM MPSSE Cable Mechanical Details (dimensions in mm)



### 3.2 C232HM MPSSE Cable Signal Descriptions

Colour	Pin Number	Name	Type	Description
Red	1	VCC	Output	Power Supply Output to target board.
Gray	6	GPIOL0	Input/Output	General Purpose input/output.
Purple	7	GPIOL1	Input/Output	General Purpose input/output.
White	8	GPIOL2	Input/Output	General Purpose input/output.
Blue	9	GPIOL3	Input/Output	General Purpose input/output.
Black	10	GND	GND	Device ground supply pin.

**Table 3.1 Common Cable Signal Descriptions**

Colour	Pin Number	Name	Type	Description
Orange	2	TCK	Output	Test Interface Clock
Yellow	3	TDI	Input	Test Data Input
Green	4	TDO	Output	Test Data Output
Brown	5	TMS	Output	Test Mode Select

**Table 3.2 MPSSE Option JTAG - Signal Descriptions**

Colour	Pin Number	Name	Type	Description
Orange	2	SK	Output	Serial Clock
Yellow	3	DO	Output	Serial data output
Green	4	DI	Input	Serial Data Input
Brown	5	CS	Output	Serial Chip Select

**Table 3.3 MPSSE Option SPI - Signal Descriptions**

Colour	Pin Number	Name	Type	Description
Orange	2	SCL	Output	Serial Clock
Yellow	3	SDA	Input/Output	Serial data signal shorted together to create bidirectional data(both yellow and green wires need to be shorted together)
Green	4			

**Table 3.4 MPSSE Option I2C - Signal Descriptions**

### 3.3 C232HM MPSSE Cable Electrical Parameters

#### 3.3.1 C232HM-DDHSL-0 Electrical Parameters

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
VCC	Output Power Voltage	3.2	3.3	3.6	V	
I <sub>o</sub>	Output Power Current	-	-	250	mA	
T	Operating Temperature Range	-40		+85	°C	

Table 3.5 C232HM-DDHSL-0 Operating Parameters

#### 3.3.2 C232HM-EDHSL-0 Electrical Parameters

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
VCC	Output Power Voltage	4.75	5	5.25	V	
I <sub>o</sub>	Supply Current	-	-	450	mA	Must be less than 2.5mA during suspend.
T	Operating Temperature Range	-40		+85	°C	

Table 3.6 C232HM-EDHSL-0 Power Supply Output Parameters

### 3.3.1 C232HM-DDHSL-0 and C232HM-EDHSL-0 I/O Characteristics

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
Voh	Output Voltage High	2.40	3.14		V	Ioh = +/-2mA I/O Drive strength* = 4mA
			3.20		V	I/O Drive strength* = 8mA
			3.22		V	I/O Drive strength* = 12mA
			3.22		V	I/O Drive strength* = 16mA
Vol	Output Voltage Low		0.18	0.40	V	Iol = +/-2mA I/O Drive strength* = 4mA
			0.12		V	I/O Drive strength* = 8mA
			0.08		V	I/O Drive strength* = 12mA
			0.07		V	I/O Drive strength* = 16mA
Vil	Input low Switching Threshold		-	0.80	V	LVTTTL
Vih	Input High Switching Threshold	2.00	-		V	LVTTTL
Vt	Switching Threshold		1.50		V	LVTTTL
Vt-	Schmitt trigger negative going threshold voltage	0.80	1.10	-	V	
Vt+	Schmitt trigger positive going threshold voltage		1.60	2.00	V	
Rpu	Input pull-up resistance	40	75	190	KΩ	Vin = 0
Rpd	Input pull-down resistance	40	75	190	KΩ	Vin = VCCIO
Iin	Input Leakage Current	15	45	85	μA	Vin = 0
Ioz	Tri-state output leakage current		±10		μA	Vin = 5.5V or 0

**Table 3.7 C232HM-DDHSL-0 and C232HM-EDHSL-0 I/O Pin Characteristics**

\* The I/O drive strength and slow slew-rate are configurable in the EEPROM.

The I/O pins are +3.3v cells, which are +5V tolerant

## 4 Cable PCB Circuit Schematic

The circuit schematics for the small internal electronic circuit board, utilising the FTDI FT232H, which is encapsulated into the USB connector end of the cable, are shown in Figure 4.1 Circuit Schematic of C232HM-DDHSL-0 and Figure 4.2 - Circuit Schematic of PCB - C232HM-EDHSL-0.

Customised versions of these cables are also available. Users interested in customised versions of these cables should contact FTDI sales ([sales1@ftdichip.com](mailto:sales1@ftdichip.com)).

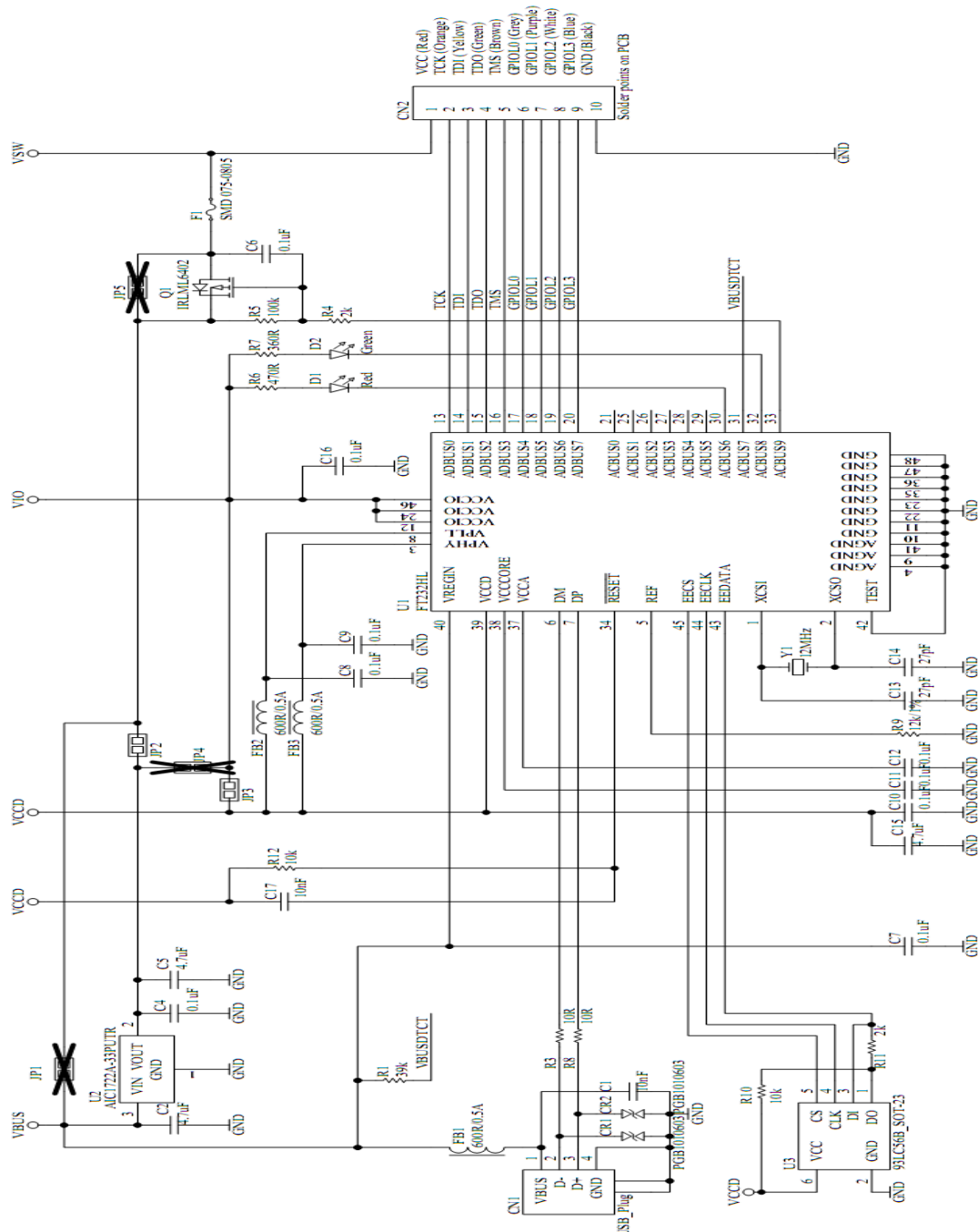


Figure 4.1 Circuit Schematic of C232HM-DDHSL-0



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## Appendix A - Cable EEPROM Configuration

Each C232HM MPSSE cable is controlled by the FTDI FT232H IC. This FT232H device contains an EEPROM which contains the USB configuration descriptors for that device. When the cable is plugged into a PC or a USB reset is performed, the PC will read these descriptors. The default values stored into the internal EEPROM are defined in the following table

Parameter	Value	Notes
USB Vendor ID (VID)	0403h	FTDI default VID (hex)
USB Product ID (PID)	6014h	FTDI default PID (hex)
Serial Number Enabled?	Yes	
Serial Number	See Note	A unique serial number is generated and programmed into the EEPROM during device final test.
Manufacturer Name	FTDI	
Product Description	See note	Product description depends on the cable. The following lists a the Product descriptions for each different cable. C232HM-VSW3V3 C232HM-VSW5V0
Max Bus Power Current	500mA	Includes power available from the cable plus power required for the FT232H
Power Source	Bus Powered	
Device Type	FT232H	
USB Version	0200	Returns USB 2.0 device description to the host. Note: The device is a USB 2.0 Hi-Speed device (480Mb/s).
Remote Wake Up	Disabled	500uA suspend limit when in this state
High Current I/Os	Enabled	Enables the high drive level on the CBUS I/O pins.
Invert TXD	Disabled	Signal on this pin becomes TXD# if enable.
Invert RXD	Disabled	Signal on this pin becomes RXD# if enable.
Invert RTS#	Disabled	Signal on this pin becomes RTS if enable.
Invert CTS#	Disabled	Signal on this pin becomes CTS if enable.

### Default Internal EEPROM Configuration

The internal EEPROM in the cable can be re-programmed over USB using the utility program FT\_PROG. Both can be downloaded from [www.ftdichip.com](http://www.ftdichip.com).

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## Appendix C – Revision History

Document Title: C232HM  
Document Reference No.: FT\_000401  
Clearance No.: FTDI# 214  
Product Page: <http://www.ftdichip.com/Products/Cables/USBMPSSE.htm>  
Document Feedback: [Send Feedback](#)

Version 1.0	First Release	21 <sup>st</sup> July 2011
Version 1.1	Updated schematic to give correct the correct part number for the fuse, and correct current limits in Table1.1. Updated section 1.1, Linux Version	14 <sup>th</sup> March 2012
Version 1.2	Added section 1.2 and 1.3 (CE&FCC test and USB Compliant – TID number)	06 <sup>th</sup> June 2012
Version 1.2.1	Corrected the typo data in table 3.5 and table3.6	14 <sup>th</sup> May 2016

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