USBC-HS-MPSSE

USB 2.0 Type C Hi-Speed to MPSSE

Datasheet

Document Reference No.: CP_000060

Version 1.2

Connective Peripherals Pte Ltd
178 Paya Lebar Road, #07-03 Singapore 409030
Tel.: +65 67430980   Fax: +65 68416071

E-Mail (Support): support@connectiveperipherals.com Web: www.connectiveperipherals.com/products

Copyright © Connective Peripherals Pte Ltd

1 Introduction

1.1 Functional Description

The **USBC-HS-MPSSE** cable provides a fast, simple way to connect devices with 3.3 Volt digital interfaces to USBC.

The USBC-HS-MPSSE contains a small internal electronic circuit board, utilising the FTDI FT232H, which is encapsulated into the USB Type C connector end of the cable. The FT232H handles the USB signalling and protocols. The FT232H is a single channel USB 2.0 Hi-Speed (480Mb/s) to UART/FIFO IC. For full details, features and enhancement descriptions please refer to FT232H datasheet.

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^{2}C) in an efficient manner. Full details are available in the application note – AN_108-Command Processor for MPSSE and MCU Host Bus Emulation Modes.

It can be configured in a variety of industry standard serial or parallel interfaces, such as MPSSE - JTAG, SPI, and I2C. The USBC-HS-MPSSE is easily configured into each interface e.g., JTAG, SPI, I^{2}C via the application software.

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 cable is powered from a USB Type C 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 USBC-HS-MPSSE requires USB device drivers, available free from Windows Update or from https://connectiveperipherals.com. The MPSSE requires the D2XX driver which is used with application software to directly access the FT232H in the cable though a DLL. This is illustrated in the Figure 1-1. Note that the VCP driver does not support MPSSE.
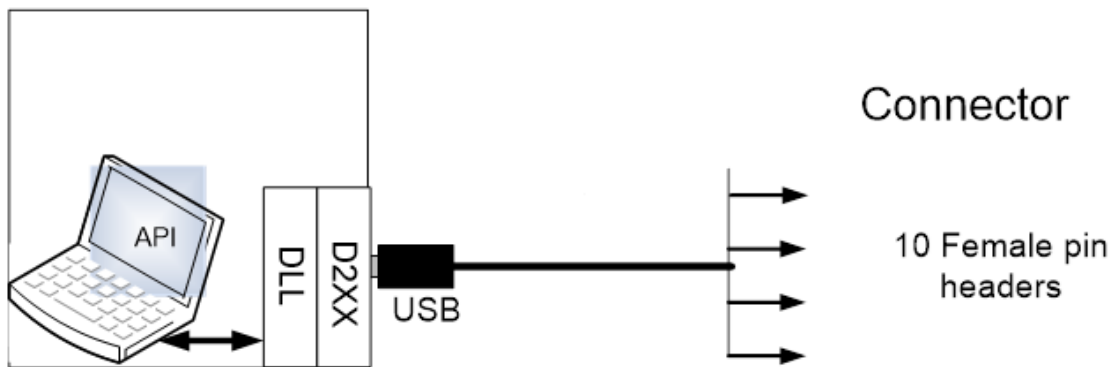
Figure 1-1 Using the USBC-HS-MPSSE

1.2 Part Numbers

The following Table 1.1 gives details of the USBC-HS-MPSSE part numbers.

Part Number	Description	End Connector	Cable details
USBC-HS-MPSSE-3.3V-3.3V-500-SPR	USB Type C to MPSSE cable with +3.3V digital level signals. Maximum output of 250mA @ 3.3VDC on VCC (see **Note 1**)	Single pole, receptacle x 10	10 core, UL2464 26 AWG, diam=6.0mm, Black
USBC-HS-MPSSE-5V-3.3V-500-SPR	USB Type C to MPSSE cable with +3.3V digital level signals. Maximum output of 450mA @ 5.0VDC on VCC (see **Note 2**)	Single pole, receptacle x 10	10 core, UL2464 26 AWG, diam=6.0mm, Black

Table 1.1 USBC-HS-MPSSE Descriptions and Part Numbers

Note 1: The VCC power output signal (RED wire) is 3.3V. The source of 3.3V is the on-board 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.

CP supports customised end connector designs. For more information, please contact your local CP Sales office (see section **5** for contact details).

1.3 Certifications

The USBC-HS-MPSSE are fully RoHS compliant as well as CE, FCC and UKCA certified.

1.4 USB Compliant

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

Table of Contents

2 Typical Applications

- USB to JTAG interfaces
- USB to SPI interfaces
- USB to I^{2}C interfaces
- Interfacing MCU / PLD / FPGA based designs to USB

- 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...

- Windows 11, 10, 8.x, 7
- Windows XP (legacy)
- Windows CE 4.2, 5.0 and 6.0 (Legacy)
- macOS 10.9 and above
- Linux 2.4 and greater

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

- Windows 11, 10, 8.x, 7
- Windows XP (legacy)
- Windows CE 4.2, 5.0 and 6.0 (Legacy)
- macOS 10.9 and above
- Linux 2.4 and greater

The drivers listed above are all available to download for free from https://connectiveperipherals.com Various 3rd Party Drivers are also available for other operating systems. Refer to https://connectiveperipherals.com and www.ftdichip.com for details.

2.2 Driver Installation

For driver installation and troubleshooting, please refer to the **Connective Peripherals USB to Serial Converters Driver Installation Guide (CP_000084)** which is available from www.connectiveperipherals.com.

2.3 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 C connector for direct connection to a host or hub

- USB bus powered

- Synchronous Serial (MPSSE) data rates of up to 30Mbps on JTAG, SPI and I2C

- 1kByte receive and transmit buffers for high data throughput

- 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))

- Royalty-free D2XX drivers eliminate the requirement for USB driver development in most cases

3 USBC-HS-MPSSE connection & Mechanical Details

The following Figure 3-1 shows the cable signals and the wire colours for these signals on the USBC-HS-MPSSE.
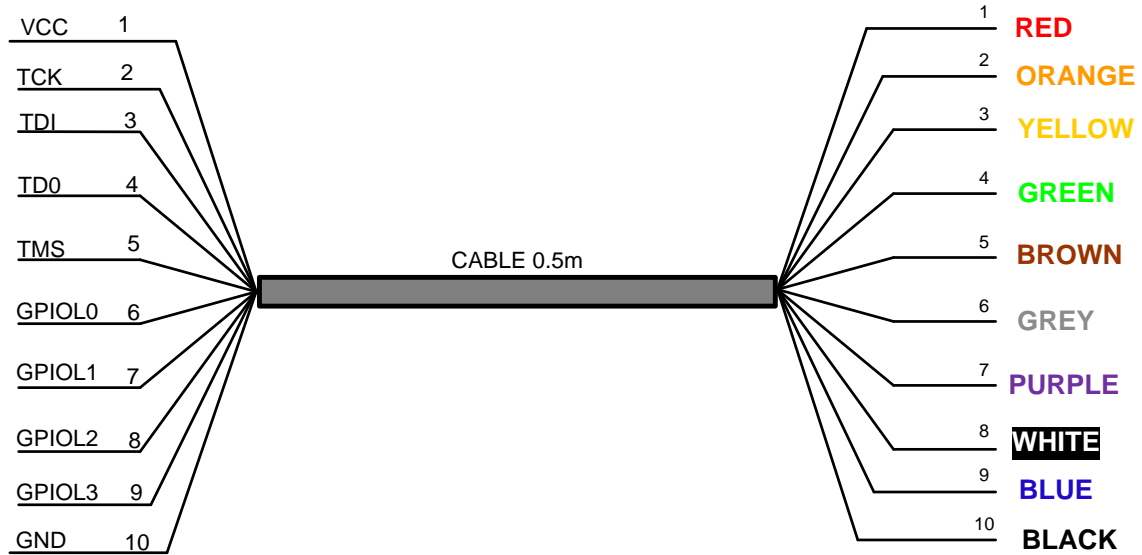
Figure 3-1 USBC-HS-MPSSE Connections (numbers refer to pad numbers on the PCB)

3.1 USBC-HS-MPSSE Cable Signal Descriptions

Figure 3-2 USBC-HS-MPSSE Mechanical Details (dimensions in mm)

3.2 USBC-HS-MPSSE Signal Descriptions

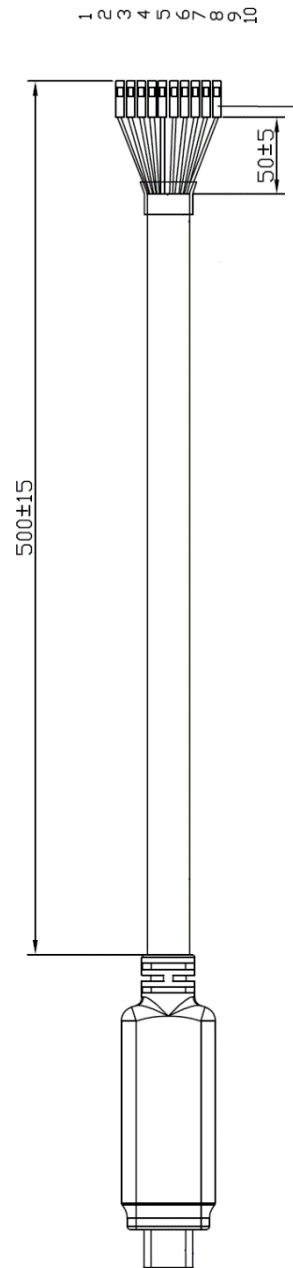| Colour	Pin Number	Name	Type	Description
Red	1	VCC	Output	Power Supply Output to target board.
Grey	6	GPIOL0	Input/Output	General Purpose input/output.
Purple	7	GPIOL1	Input/Output	General Purpose input/output.
White	8	GPIOL2	Input/Output	General Purpose input/output.
Blue	9	GPIOL3	Input/Output	General 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	Output	Test Data In (Output from C232HM)
Green	4	TDO	Input	Test Data Out (Input to C232HM)
Brown	5	TMS	Output	Test Mode Select

Table 3.2 MPSSE Option JTAG - Signal Descriptions

Note that TDI and TDO are named with respect to the JTAG device, and so TDI is an Output from the C232HM and TDO is an Input to the C232HM

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			Serial data signal shorted together to create bidirectional data(both yellow and green wires need to be shorted together)
Green	4	SDA	Input/Output	

Table 3.4 MPSSE Option I2C - Signal Descriptions

3.3 USBC-HS-MPSSE Electrical Parameters

3.3.1 USBC-HS-MPSSE-3.3V-3.3V-500-SPR Electrical Parameters

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
VCC	Output Power Voltage	3.2	3.3	3.6	V	
I_O	Output Power Current	-	-	250	mA	
T	Operating Temperature Range	-40		+85	ºC	

Table 3.5 USBC-HS-MPSSE-3.3V-3.3V-500-SPR Operating Parameters

3.3.2 USBC-HS-MPSSE-5V-3.3V-500-SPR Electrical Parameters

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
VCC	Output Power Voltage	4.75	5	5.25	V	
I_O	Supply Current	-	-	450	mA	Must be less than 2.5mA during suspend.
T	Operating Temperature Range	-40		+85	ºC	

Table 3.6 USBC-HS-MPSSE-5V-3.3V-500-SPR Power Supply Output Parameters

3.3.3 USBC-HS-MPSSE-3.3V-3.3V-500-SPR & USBC-HS-MPSSE-5V-3.3V-500-SPR 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	LVTTL
Vih	Input High Switching Threshold	2.00	-		V	LVTTL
Vt	Switching Threshold		1.50		V	LVTTL
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 USBC-HS-MPSSE-3.3V-3.3V-500-SPR and USBC-HS-MPSSE-5V-3.3V-500-SPR 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 FT232H, which is encapsulated into the USBC connector end of the cable, are shown in Figure 4-1 and Figure 4-2.

Customised versions of these cables are also available. Users interested in customised versions of these cables should contact CP Sales (sales@connectiveperipherals.com).

Figure 4-1 Circuit Schematic of USBC-HS-MPSSE-3.3V-3.3V-500-SPR

Figure 4-2 Circuit Schematic of PCB - USBC-HS-MPSSE-5V-3.3V-500-SPR

5 Contact Information

Global Headquarters – Singapore

Connective Peripherals Pte Ltd
178 Paya Lebar Road
#07-03
Singapore 409030

Tel: +65 67430980
Fax: +65 68416071

E-Mail (Sales)	sales@connectiveperipherals.com
E-Mail (Support)	support@connectiveperipherals.com
Web Site URL	http://www.connectiveperipherals.com
Web Shop URL	http://www.connectiveperipherals.com

Appendix A - Cable EEPROM Configuration

Each USBC-HS-MPSSE 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 UD (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 the Product descriptions for each different cable. USBC-HS-MPSSE-3.3V-3.3V-500SPR USBC-HS-MPSSE-5V-3.3V-500-SPR
Max Bus Power Current	500mA	Includes power to operate the FT232H plus the cable output current.
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	
High Current I/Os	Enabled	The device supports 4mA, 8mA, 12mA and 16mA drive strength settings. Default is 4mA.
Load VCP Driver	Enabled	Makes the device load the VCP driver interface for the device.

The internal EEPROM in the cable can be re-programmed over USB using the utility program FT_PROG. Both can be downloaded from https://www.ftdichip.com/

Note that the EEPROM is supplied programmed ready to use for most applications. Changing the EEPROM settings is for advanced users only. Changing the settings can cause incorrect operation of the device. Before editing the VID or PID, note that this requires the user to have a driver with matching VID/PID in order to install the device before it can be used again. It is recommended to contact technical support if in doubt before making any changes.

Appendix B – References

Document References

FT232H datasheet

AN_108-Command Processor for MPSSE and MCU Host Bus Emulation Modes

FTDI MPSSE Examples

Acronyms & Abbreviations

Terms	Description
DLL	Dynamic Link Library
EHCI	Enhanced Host Controller Interface
EEPROM	Electrically Erasable Programmable Read Only Memory
FPGA	Field Programmable Gate Array
IC	Integrated Circuit
MCU	Microcontroller Unit
RoHS	Restriction of Hazardous Substance
SIL	Single In Line
OHCI	Open Host Controller Interface
PLD	Programmable Logic Device
TTL	Transistor-Transistor Logic
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver/Transmitter
UHCI	Universal Host Controller Interface

Appendix C – List of Figures and Tables

List of Figures

List of Tables

Appendix D – Revision History

Revision	Changes	Date
Version 1.0	Initial Release	29-07-2020
Version 1.1	Update Fig 4.1 & Fig 4.2 to new schematics Updated the Part Number & Device Description Updated Default Internal EEPROM Configuration table	07-10-2020
Version 1.2	Added driver install section and other minor updates. Corrected directions of TDI and TDO JTAG signals in Table 3.2	30-01-2023