



Technical Note

TN_181

Type-C USB Connectors with FTDI Products

Version 1.0

Issue Date: 07-12-2021

This Technical Note shows schematic examples of using Type-C USB connectors with FTDI products.

Use of FTDI devices in life support and/or safety applications is entirely at the user's risk, and the user agrees to defend, indemnify and hold FTDI harmless from any and all damages, claims, suits or expense resulting from such use.

Future Technology Devices International Limited (FTDI)
Unit 1, 2 Seaward Place, Glasgow G41 1HH, United Kingdom
Tel.: +44 (0) 141 429 2777 Fax: + 44 (0) 141 429 2758
Web Site: <http://ftdichip.com>
Copyright © Future Technology Devices International Limited

Table of Contents

1 Introduction	2
2 USB Type-C Plug and Receptacle	3
3 Type-C with Original FTDI Products.....	4
3.1 USB Plug	4
3.2 USB Receptacle	7
4 Type-C (Receptacle) with FT23xHP/FT223xHP/ FT423xHP Power Delivery Products	8
5 Existing Hardware with Type-C Connectors	10
6 Conclusion	11
7 Contact Information	12
Appendix A – References	13
Document References	13
Acronyms and Abbreviations.....	13
Appendix B – List of Tables & Figures	14
List of Tables.....	14
List of Figures	14
Appendix C – Revision History	15

1 Introduction

Type-C USB connectors are often associated with USB power delivery specification where power negotiation may result in power being supplied from the host or the device.

Original USB 2.0 FTDI hardware is not designed to include power delivery, as our ICs always get power from the USB Host. These include the following ICs:

- [FT232R/FT245R](#)
- [FT-X](#)
- [FT232H/FT2232H/FT4232H](#)
- [FT260](#)
- [FT4222H](#)

However, it's possible to design original USB 2.0 FTDI hardware with Type-C USB connectors and this document shows how it can be implemented.

FTDI's latest power delivery products are designed with Type-C and power delivery:

- 1 Power Delivery (PD) Port
 - [FT232HP](#) Single Channel IC
 - [FT2232HP](#) Dual Channel IC
 - [FT4232HP](#) Quad Channel IC
- 2 Power Delivery (PD) Ports
 - [FT233HP](#) Single Channel IC
 - [FT2233HP](#) Dual Channel IC
 - [FT4233HP](#) Quad Channel IC

These Hi-Speed USB devices with Type-C/PD 3.0 controller fully support the latest USB Type-C and Power Delivery (PD) standards enabling support for power negotiation with the ability to sink or source current to a USB host device.

This document shows examples of implementing USB Type-C connectors with these products.

More information on USB Type-C is available through the USB organisation:

<https://www.usb.org/usbc>

Note: No guarantees can be provided in this document. This can be used as a guide only. The product designer is responsible for their own design.

2 USB Type-C Plug and Receptacle

This section shows the Type-C plug / receptacle pinout and signal names for reference.

Figure 2.1 shows the USB Type-C receptacle pinout which is usually on the USB Host side, or what a USB Type C cable connects to.

Note that there are signals required for:

- Two pairs of D+ and D- USB data signals
- CC1 and CC2 (Configuration Channel) signals

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1-	VBUS	CC1	D+	D-	SBU1	VBUS	RX2-	RX2+	GND
GND	RX1+	RX1-	VBUS	SBU2	D-	D+	CC2	VBUS	TX2-	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

Figure 2.1 USB Type-C Receptacle (Front View)

Figure 2.2 shows the USB Type-C plug pinout which is on the USB Device side. This plug would connect directly to the USB Type C receptacle on the USB Host.

Note that there are signals required for:

- One pair of D+ and D- USB data signals
- CC (Configuration Channel) which corresponds to CC1 on the receptacle

A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
GND	RX2+	RX2-	VBUS	SBU1	D-	D+	CC	VBUS	TX1-	TX1+	GND
GND	TX2+	TX2-	VBUS	VCONN			SBU2	VBUS	RX1-	RX1+	GND
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12

Figure 2.2 USB Type-C Plug Interface (Front View)

Figure 2.3 shows how the USB Type-C connectors physically look with the receptacle on the left and the plug on the right.



Figure 2.3 USB Type-C Connectors

The main signals of interest are:

- VBUS
- GND
- D+/D- (one pair)
- CC

All other signals can be disregarded as they are not required for USB 2.0 products with no power delivery support when using a USB Plug (as opposed to a USB receptacle).

There are some things to note from this schematic snippet:

- The USB Type-C connector is a plug which connects direct to the USB Type-C receptacle on the Host.
- There should only be one D+/D- connection pair (pins A6 & A7) as the host connector should have both connected as per the USB specification.
- The CC (Configuration Channel) pin (A5) is used to configure the connection and send Power Delivery messages. The CC pin is important as this is only a USB 2.0 IC with no power delivery. This must be pulled down to GND through a 5.1K resistor.
- The edge rate control resistors and capacitors on the USB data lines are shown for the FT234X IC. These are different with other FTDI products. See AN_146 [USB Hardware Design Guidelines for FTDI ICs](#) for more information.

As you can see, implementing Type-C from an existing USB2.0 design is straightforward and cheap with exception of the connector, which can be expensive in comparison to original USB Type-A connectors.

Figure 3.3 to Figure 3.6 show schematic snippets of Type-C implementation with other FTDI original products. The same principles apply.

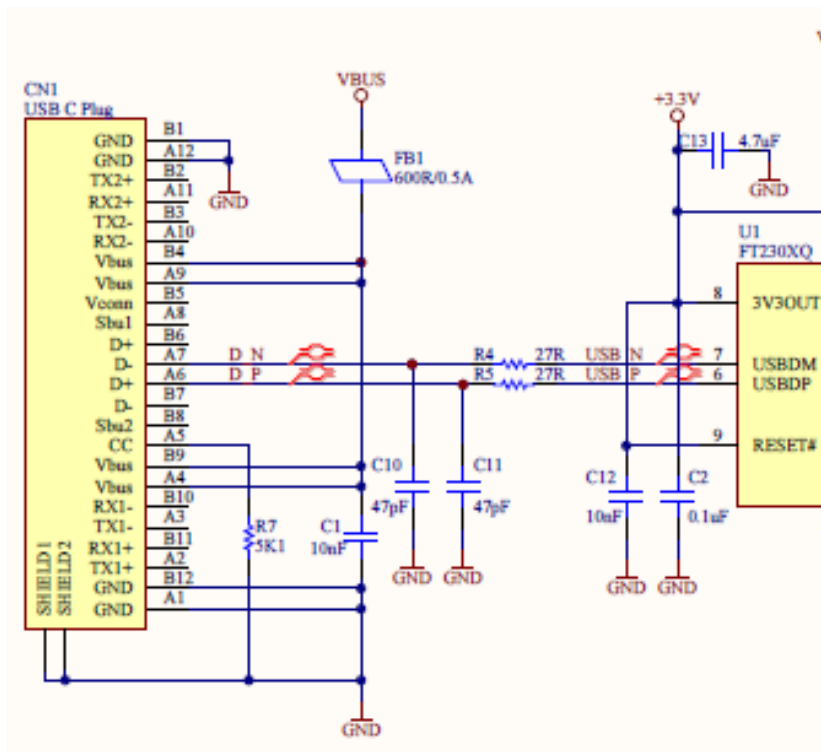


Figure 3.3 Type-C Plug with FT230X

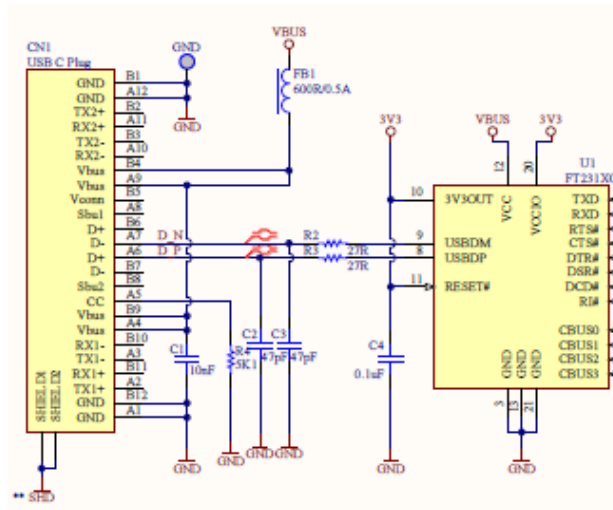


Figure 3.4 Type-C Plug with FT231X

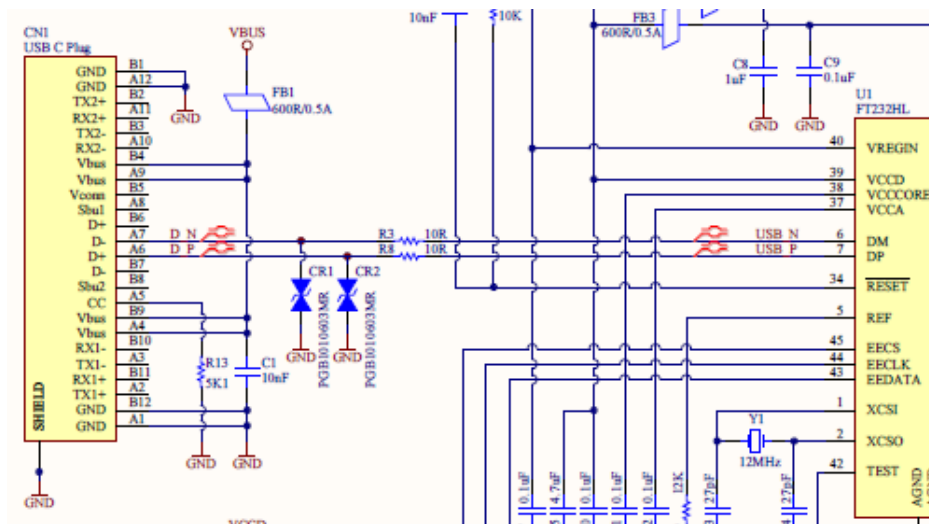


Figure 3.5 Type-C Plug with FT232HL

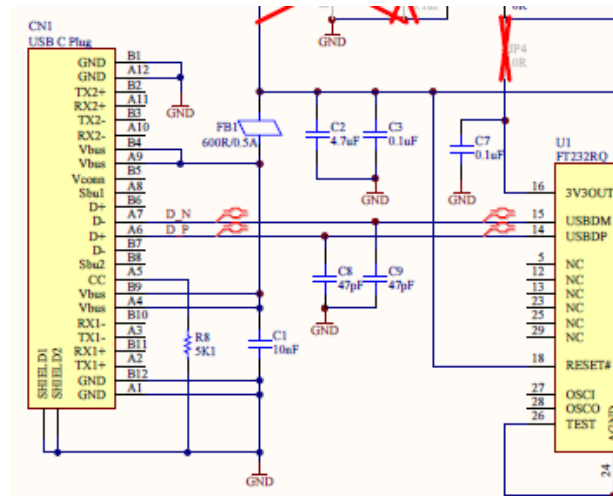


Figure 3.6 Type-C Plug with FT232R

3.2 USB Receptacle

Figure 3.7 shows a snippet of a design with FT230X and USB Type-C receptacle connector.

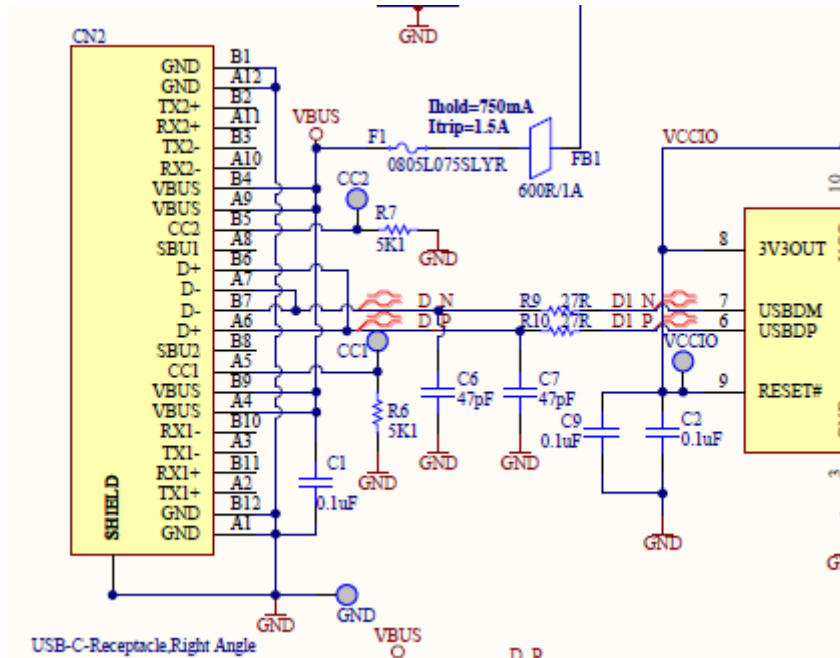


Figure 3.7 Type-C Receptacle with FT230X

The main signals of interest are:

- VBUS
- GND
- D+/D- (two pairs)
- CC1 and CC2

All other signals can be disregarded as they are not required for USB 2.0 products with no power delivery support when using a USB Plug as opposed to a USB receptacle.

There are some things to note from this schematic snippet:

- The USB Type-C connector is a receptacle. A USB Type C cable is needed to connect to the USB Host.
- There are two D+/D- pairs connected (pins A6, A7, B6 & B7).
- The CC1 and CC2 (Configuration Channel) pins (A5 & B5) are both pulled down to GND through a 5.1K resistor.
- The edge rate control resistors and capacitors on the USB data lines are shown for the FT230X IC. These are different with other FTDI products. See AN_146 [USB Hardware Design Guidelines for FTDI ICs](#) for more information.

As you can see, implementing Type-C receptacle from an existing USB2.0 design is straightforward and cheap with exception of the connector (and USB type C cable), which can be expensive in comparison to original USB Type-A connectors.

4 Type-C (Receptacle) with FT23xHP/FT223xHP/FT423xHP Power Delivery Products

The [FT23xHP/FT223xHP/FT423xHP](#) products offer the same functionality as the original [FT232H/FT2232H/FT4232H](#) products. They can be used for UART, bit bang, I2C/SPI via MPSSE, etc. The 'HP' variants offer additional power delivery functionality. This allows for control of power direction which can be either supplied from the USB Host or the USB device.

The original FT232H/FT2232H/FT4232H products only had the ability to get power from the USB Host (5V at 500mA max).

If your device requires more than 5V at 500mA to be supplied over USB, or if your device currently has its own power supply of up to 20V at 3A which you want to eliminate, you could consider the 'HP' products. The ICs support 5V at 3A, 9V at 3A, 12V at 3A, 15V at 3A and 20V at 3A as sink or source. These profiles are configurable through the external EEPROM.

These products fully support the latest USB Type-C and Power Delivery standards enabling support for power negotiation with the ability to sink or source current to a USB host device. The dual PD port controllers support 2 Type-C ports, with PD1 configurable as a power sink or dual role, and PD2 functioning as power sink, suitable in charging through applications. For Single PD port versions, the controller supports 1 Type-C port with Power Delivery sink function.

Table 4.1 shows a summary of all the HP products.

Device	Description
FT232HP	USB to Single Channel Serial UART/FIFO/JTAG/SPI/I2C with one Power Delivery (PD) Port
FT233HP	USB to Single Channel Serial UART/FIFO/JTAG/SPI/I2C with two Power Delivery (PD) Ports
FT2232HP	USB to Dual Channel Serial UART/FIFO/JTAG/SPI/I2C with one Power Delivery (PD) Port
FT2233HP	USB to Dual Channel Serial UART/FIFO/JTAG/SPI/I2C with two Power Delivery (PD) Ports
FT4232HP	USB to Quad Channel Serial UART/JTAG/SPI/I2C with one Power Delivery (PD) Port
FT4233HP	USB to Quad Channel Serial UART/JTAG/SPI/I2C with two Power Delivery (PD) Ports

Table 4.1 HP Product Summary

PD port 1 (which also carries the USB data communication) can switch between the roles of sinking power from the host to power the peripheral and sourcing power to charge the host computer.

PD port 2 is a power sink and can be used to connect an external power source or charger. This can provide power to the peripheral board as well as charging the host via PD port 1.

Figure 4.1 and Figure 4.2 show schematic snippets of the Type-C USB Connectors for PD Port 1 and PD Port 2 on the FT233HP. The same principles apply to the FT223xHP and FT423xHP ICs.

This design uses USB Type-C receptacles (not plug) so note the following points:

- There are two connection pairs for the D+ and D- signals
- The CC1 and CC2 signals are connected to the corresponding CC signals on the FT233HP IC.
- On the PD Port 2, the USB data lines are not connected as this is a power sink only.

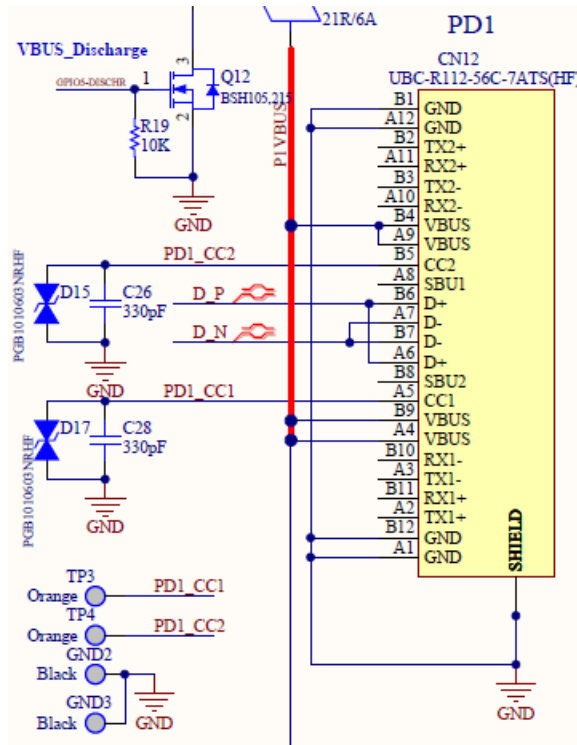


Figure 4.1 Type-C Receptacle with FT233HP PD Port 1

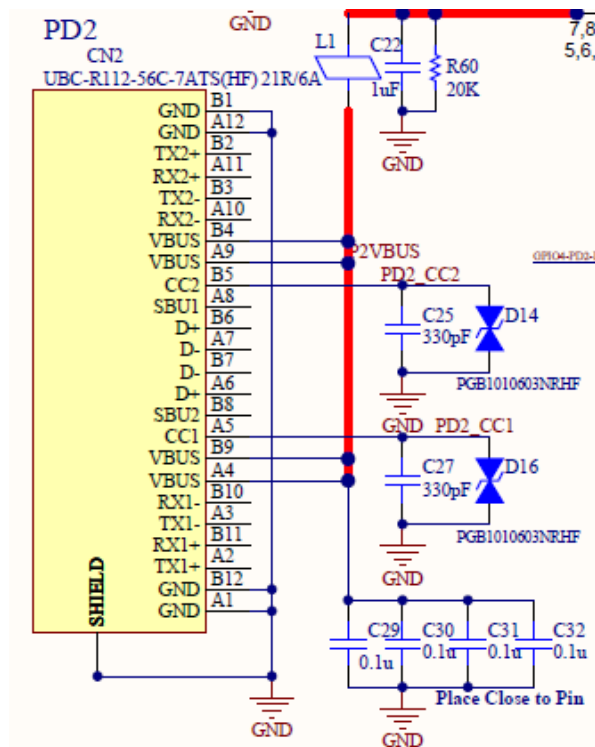


Figure 4.2 Type-C Receptacle with FT233HP PD Port 2

Reference schematics for the HP product evaluation modules can be found at the following link:
https://ftdichip.com/product-category/products/modules/?series_products=66

5 Existing Hardware with Type-C Connectors

Our sister company Connective Peripherals have some USB Type-C cables available which use original FTDI products. These include:

- USB TYPE C High Speed MPSSE
 - Implemented with FT232H
- USB TYPE C High Speed UART
 - Implemented with FT232H
- USB TYPE C Full Speed UART
 - Implemented with FT232R and FT234X
- USB TYPE C Full Speed RS232
 - Implemented with FT230X and FT231X

More information on these products can be found at the following link:

<https://connectiveperipherals.com/collections/usb-type-c-cables>

FTDI also have FT23xHP/FT223xHP/FT423xHP power delivery modules with USB Type-C connectors available for test, evaluation and reference:

https://ftdichip.com/product-category/products/modules/?series_products=66

6 Conclusion

This Technical Note has shown examples of how to implement USB Type-C connectors with original FTDI products (e.g., FT232R, FT-X and FT232H). This implementation is straightforward and provides future compatibility as more and more Host PCs have Type-C included on the hardware.

The 'HP' power delivery product implementation was also covered. The CC signals are connected to the corresponding signals on the HP ICs which are used for power delivery configuration.

7 Contact Information

Head Office – Glasgow, UK

Future Technology Devices International Limited
Unit 1, 2 Seaward Place, Centurion Business Park
Glasgow G41 1HH
United Kingdom
Tel: +44 (0) 141 429 2777
Fax: +44 (0) 141 429 2758

E-mail (Sales) sales1@ftdichip.com
E-mail (Support) support1@ftdichip.com
E-mail (General Enquiries) admin1@ftdichip.com

Branch Office – Tigard, Oregon, USA

Future Technology Devices International Limited
(USA)
7130 SW Fir Loop
Tigard, OR 97223-8160
USA
Tel: +1 (503) 547 0988
Fax: +1 (503) 547 0987

E-Mail (Sales) us.sales@ftdichip.com
E-Mail (Support) us.support@ftdichip.com
E-Mail (General Enquiries) us.admin@ftdichip.com

Branch Office – Taipei, Taiwan

Future Technology Devices International Limited
(Taiwan)
2F, No. 516, Sec. 1, NeiHu Road
Taipei 114
Taiwan, R.O.C.
Tel: +886 (0) 2 8797 1330
Fax: +886 (0) 2 8751 9737

E-mail (Sales) tw.sales1@ftdichip.com
E-mail (Support) tw.support1@ftdichip.com
E-mail (General Enquiries) tw.admin1@ftdichip.com

Branch Office – Shanghai, China

Future Technology Devices International Limited
(China)
Room 1103, No. 666 West Huaihai Road,
Shanghai, 200052
China
Tel: +86 21 62351596
Fax: +86 21 62351595

E-mail (Sales) cn.sales@ftdichip.com
E-mail (Support) cn.support@ftdichip.com
E-mail (General Enquiries) cn.admin@ftdichip.com

Web Site

<http://ftdichip.com>

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.

System and equipment manufacturers and designers are responsible to ensure that their systems, and any Future Technology Devices International Ltd (FTDI) devices incorporated in their systems, meet all applicable safety, regulatory and system-level performance requirements. All application-related information in this document (including application descriptions, suggested FTDI devices and other materials) is provided for reference only. While FTDI has taken care to assure it is accurate, this information is subject to customer confirmation, and FTDI disclaims all liability for system designs and for any applications assistance provided by FTDI. Use of FTDI devices in life support and/or safety applications is entirely at the user's risk, and the user agrees to defend, indemnify and hold harmless FTDI from any and all damages, claims, suits or expense resulting from such use. This document is subject to change without notice. No freedom to use patents or other intellectual property rights is implied by the publication of this document. Neither the whole nor any part of the information contained in, or the product described in this document, may be adapted or reproduced in any material or electronic form without the prior written consent of the copyright holder. Future Technology Devices International Ltd, Unit 1, 2 Seaward Place, Centurion Business Park, Glasgow G41 1HH, United Kingdom. Scotland Registered Company Number: SC136640

Appendix A – References

Document References

[All FTDI ICs](#)

[Full Speed USB ICs](#) (e.g., FT232R, FT-X, FT260, etc.)

[FT23xHP/FT223xHP/FT423xHP ICs](#)

[FT232H/FT2232H/FT4232H ICs](#)

[High Speed USB Evaluation Modules](#)

[Connective Peripherals USB Type-C Cables](#)

AN_146 [USB Hardware Design Guidelines for FTDI ICs](#)

<https://www.usb.org/usbc>

Acronyms and Abbreviations

Terms	Description
CC	Configuration Channel
EEPROM	Electrically Erasable Programmable Read Only Memory
FIFO	First In First Out
JTAG	Joint Test Action Group
I2C	Inter-Integrated Circuit
ICs	Integrated Circuits
MPSSE	Multi-Protocol Synchronous Serial Engine
PD	Power Delivery
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

Appendix B – List of Tables & Figures

List of Tables

Table 4.1 HP Product Summary	8
------------------------------------	---

List of Figures

Figure 2.1 USB Type-C Receptacle (Front View)	3
Figure 2.2 USB Type-C Plug Interface (Front View)	3
Figure 2.3 USB Type-C Connectors.....	3
Figure 3.1 Type-C Plug with FT234X	4
Figure 3.2 Type-C Plug Cable.....	4
Figure 3.3 Type-C Plug with FT230X	5
Figure 3.4 Type-C Plug with FT231X	6
Figure 3.5 Type-C Plug with FT232H	6
Figure 3.6 Type-C Plug with FT232R	6
Figure 3.7 Type-C Receptacle with FT230X.....	7
Figure 4.1 Type-C Receptacle with FT233HP PD Port 1	9
Figure 4.2 Type-C Receptacle with FT233HP PD Port 2.....	9

Appendix C – Revision History

Document Title: TN_181 Type-C USB Connectors with FTDI Products
Document Reference No.: FT_001512
Clearance No.: FTDI#567
Product Page: <https://ftdichip.com/product-category/products/ic/>
Document Feedback: [Send Feedback](#)

Revision	Changes	Date
1.0	Initial Release	07-12-2021