
Microchip USB57xx USB Type-C™ Applications

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INTRODUCTION

Some USB Hub applications may require a specific mix of USB 3.1 Gen 1 and USB 2.0 downstream ports. The Microchip USB57xx family of USB Hubs allows for the USB 3.1 Gen 1 PHY associated with any of the downstream facing ports to be disabled via OTP (One-Time Programmable) configuration.

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[Section 1.0, Upstream Facing Port FlexConnect Implementation \(USB5734 Only\)](#)

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REFERENCES

Consult the following documents for details on the specific parts referred to in this document.

- *Microchip USB5734 Data Sheet*
- *Microchip USB5744 Data Sheet*
- *Microchip USB5742 Data Sheet*
- *Microchip UTC2000 Data Sheet*
- *Microchip AN 1953 "Introduction to USB Type-C™"*

1.0 UPSTREAM FACING PORT FLEXCONNECT IMPLEMENTATION (USB5734 ONLY)

The Microchip FlexConnect feature on the USB5734 can be used to connect the hub to an upstream facing USB Type-C port without the need for an external 2:1 multiplexer. With this implementation, both the standard upstream port 0 of the hub and the FlexConnect enabled downstream port 1 of the hub are dedicated for use with the upstream USB Type-C connector. The upstream USB data connections will only ever connect to one port:

- When a USB Type-C cable is connected in the “unflipped” orientation, the standard upstream Port 0 is used.
- When the USB Type-C cable is connected in the “flipped” orientation, FlexConnect is activated via the **FLEXCMD** pin and Port 1 is used.

In this implementation, the FlexConnect state of the hub is controlled by an input pin. This pin is controlled by a basic USB Type-C controller, such as a Microchip UTC2000. When the pin is low, the hub operates in the default state. When the pin is high, the hub operates in the “flexed” state.

1.1 Important Design Notes

1.1.1 UTC2000 BASIC TYPE-C CONTROLLER

The Microchip UTC2000 is a basic USB Type-C controller which can be used to sense and determine the value of an R_p pull-up resistor on either of the CC lines and detect both the charging capability of the connected port and the orientation.

The **PLUG_ORIENTATION#** pin is an open drain output that is used to indicate plug orientation. When no connection is detected or a connection is detected on CC1, the pin remains in a high impedance state. When a connection is detected on the CC2 pins, the **PLUG_ORIENTATION#** output drives low. This signal may be used to directly control the **FLEXCMD** pin of the USB5734, which signals the Hub when to activate or deactivate the FlexConnect feature.

1.1.2 CONNECTIONS FROM USB TYPE-C CONNECTOR TO UTC2000 & USB HUB

There are two ways to connect the USB SuperSpeed lanes to the USB5734 Hub. It is recommended to select the option that allows for the best USB SuperSpeed signal routing on the PCB layout.

- **Option A:**
 - USB Type-C Connector Side 1 Pins (A2, A3, A6, A7, B10, B11) connected to USB Port 0 of USB5734 Hub
 - USB Type-C Connector Side 2 Pins (A10, A11, B2, B3, B6, B7) connected to USB Port 1 of USB5734 Hub
 - CC1 of Type-C Connector connected to CC2 of UTC2000
 - CC2 of Type-C Connector connected to CC1 of UTC2000
- **Option B:**
 - USB Type-C Connector Side 1 Pins (A2, A3, A6, A7, B10, B11) connected to USB Port 1 of USB5734 Hub
 - USB Type-C Connector Side 2 Pins (A10, A11, B2, B3, B6, B7) connected to USB Port 0 of USB5734 Hub
 - CC1 of Type-C Connector connected to CC1 of UTC2000
 - CC2 of Type-C Connector connected to CC2 of UTC2000

1.1.3 HUB CONFIGURATION REQUIREMENTS

Because this is a special implementation of the FlexConnect feature, a custom OTP configuration file programmed to the USB5734 hub is required. From the Microchip.com USB5734 product page, download the file named “USB5734_TypeC_Flex.cfg” and program it to the USB5734 via ProTouch2.

The USB5734 must also be configured via the **CFG_STRAP** for Mode 1 or Mode 2. These modes enable the **FLEXCMD** input which allows for FlexConnect control via the pin state.

1.2 Application Diagrams

Figure 1 shows a simplified block diagram of the “Option A” implementation, while Figure 2 shows “Option B”. More detailed schematic level views are shown in Figure 3 and Figure 4.

FIGURE 1: UPSTREAM FACING PORT FLEXCONNECT IMPLEMENTATION BLOCK DIAGRAM “OPTION A”

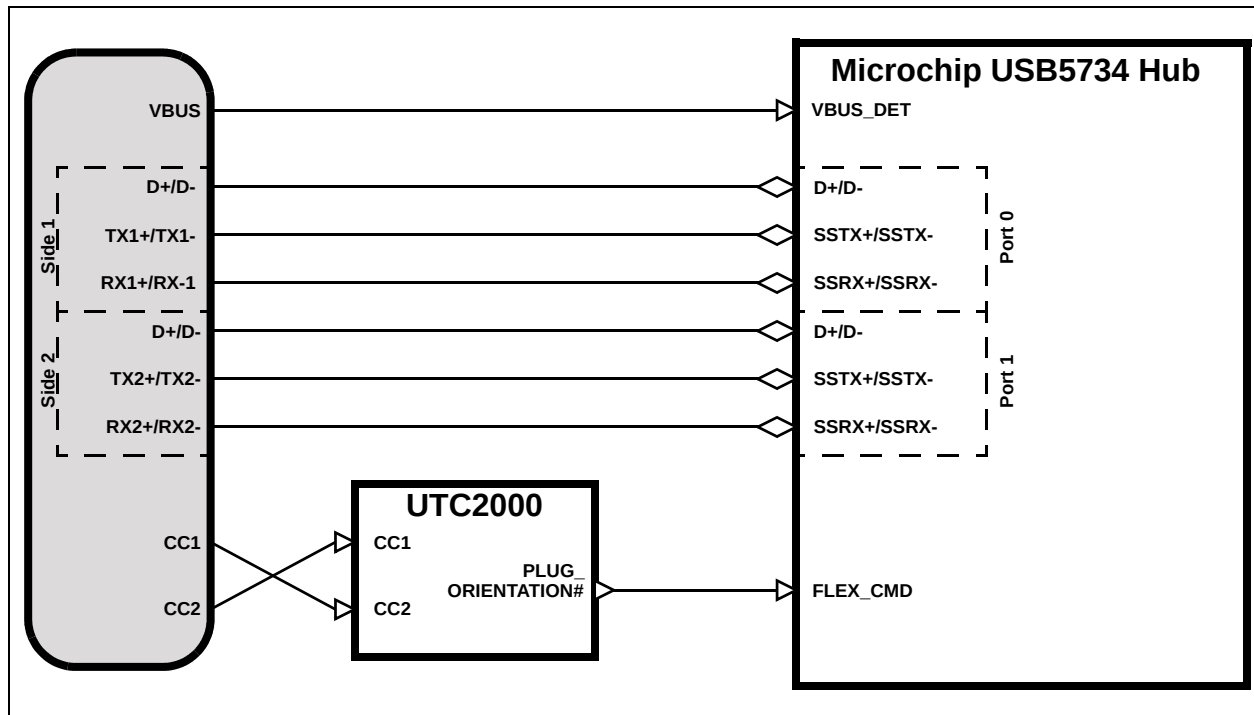


FIGURE 2: UPSTREAM FACING PORT FLEXCONNECT IMPLEMENTATION BLOCK DIAGRAM “OPTION B”

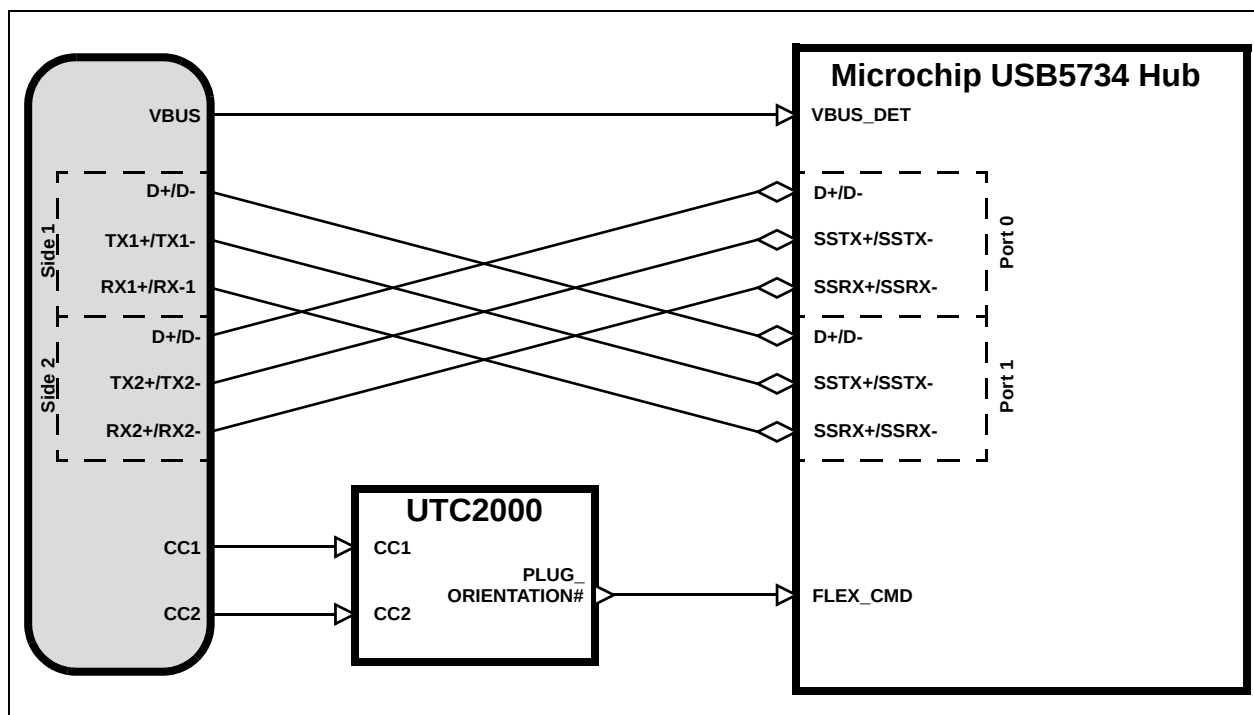


FIGURE 3: UPSTREAM FACING PORT FLEXCONNECT IMPLEMENTATION SCHEMATIC “OPTION A”

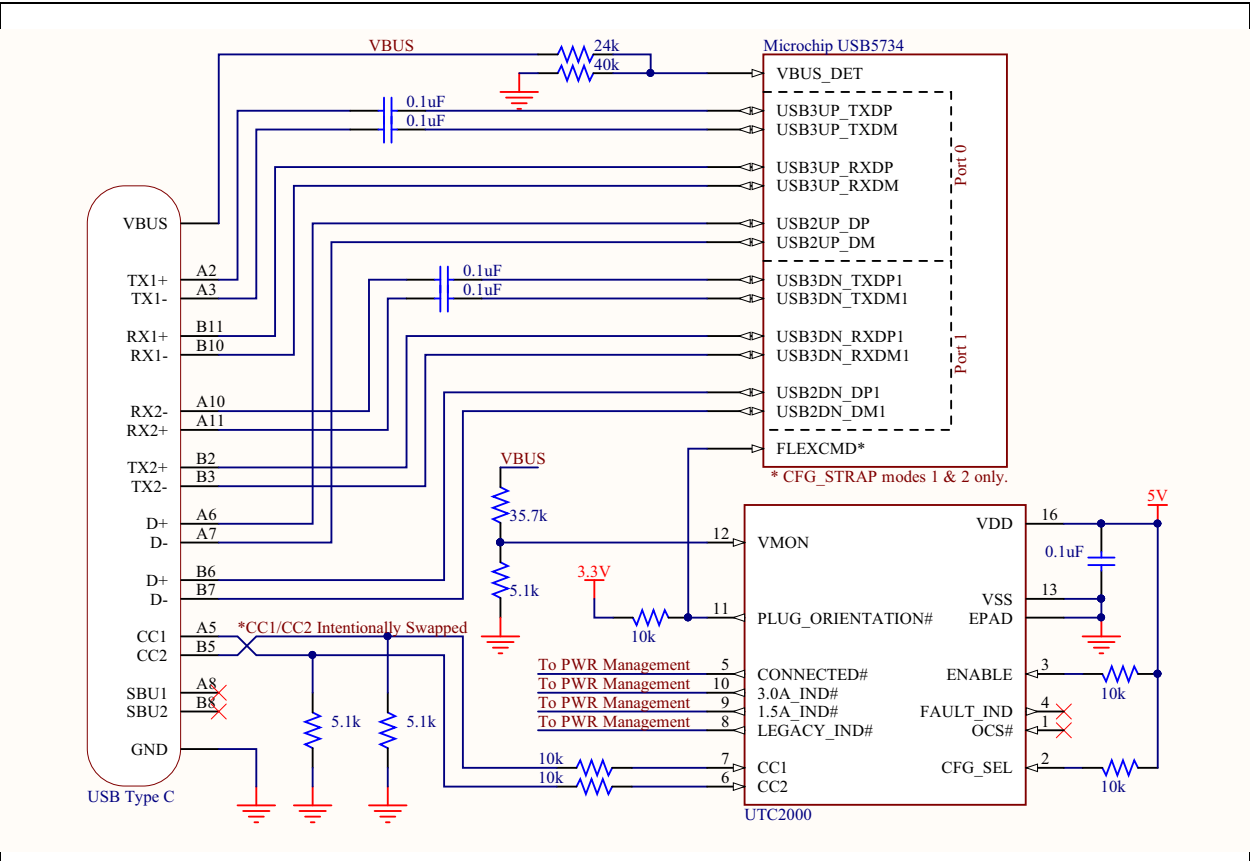
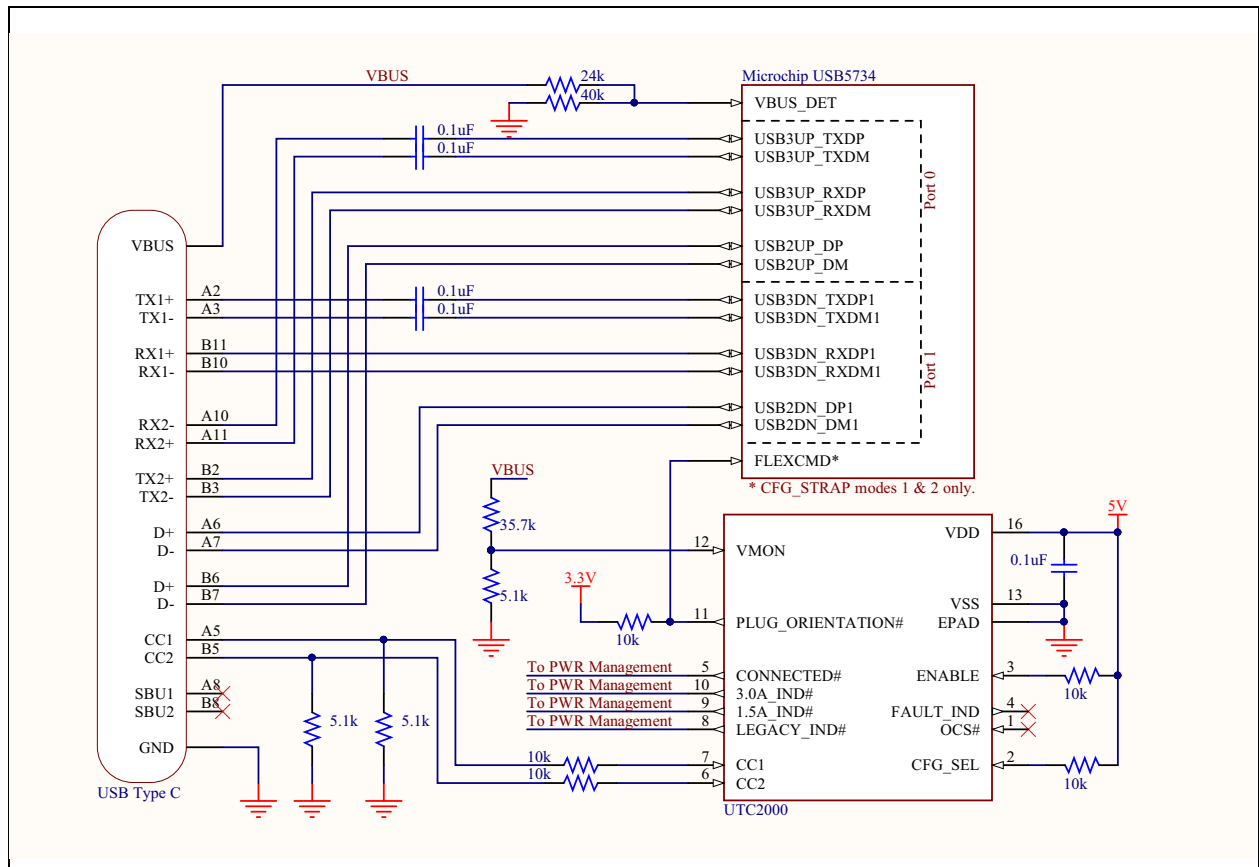


FIGURE 4: UPSTREAM FACING PORT FLEXCONNECT IMPLEMENTATION SCHEMATIC “OPTION B”



2.0 UPSTREAM FACING PORT SWITCHED IMPLEMENTATION

An external 2:1 multiplexer can be used to implement a USB Type-C connection on the upstream port of any Microchip SuperSpeed hub.

2.1 Important Design Notes

2.1.1 UTC2000 BASIC USB TYPE-C CONTROLLER

The Microchip UTC2000 is a basic USB Type-C controller which can be used to sense and determine the value of an R_p pull-up resistor on either of the CC lines and detect both the charging capability of the connected port and the orientation.

The **PLUG_ORIENTATION#** pin is an open drain output that is used to indicate plug orientation. When no connection is detected or a connection is detected on CC1, the pin remains in a high impedance state. When a connection is detected on the CC2 pins, the **PLUG_ORIENTATION#** output drives low. This signal may be used to directly control the state of the SuperSpeed switch.

2.1.2 CONNECTIONS FROM USB TYPE-C CONNECTOR TO UTC2000 & USB HUB.

Since not all SuperSpeed switches have identical functionality and connections, it is recommended to consult the data-sheet for the selected switch device in order to determine the necessary connections.

Note that all USB Side 1 connections on of the USB Type-C connector (A2, A3, A6, A7, B10, B11) can be swapped with the all USB Side 2 connections on of the USB Type-C connector (A10, A11, B2, B3, B6, B7) to facilitate better USB signal routing on the PCB if the connections from the CC1/CC2 pins on the USB Type-C connector to the UTC2000 are also swapped.

2.2 Application Diagrams

Figure 5 shows a simplified block diagram of the switching implementation. A more detailed schematic level view is shown in Figure 6.

FIGURE 5: UPSTREAM FACING PORT SWITCHED IMPLEMENTATION BLOCK DIAGRAM

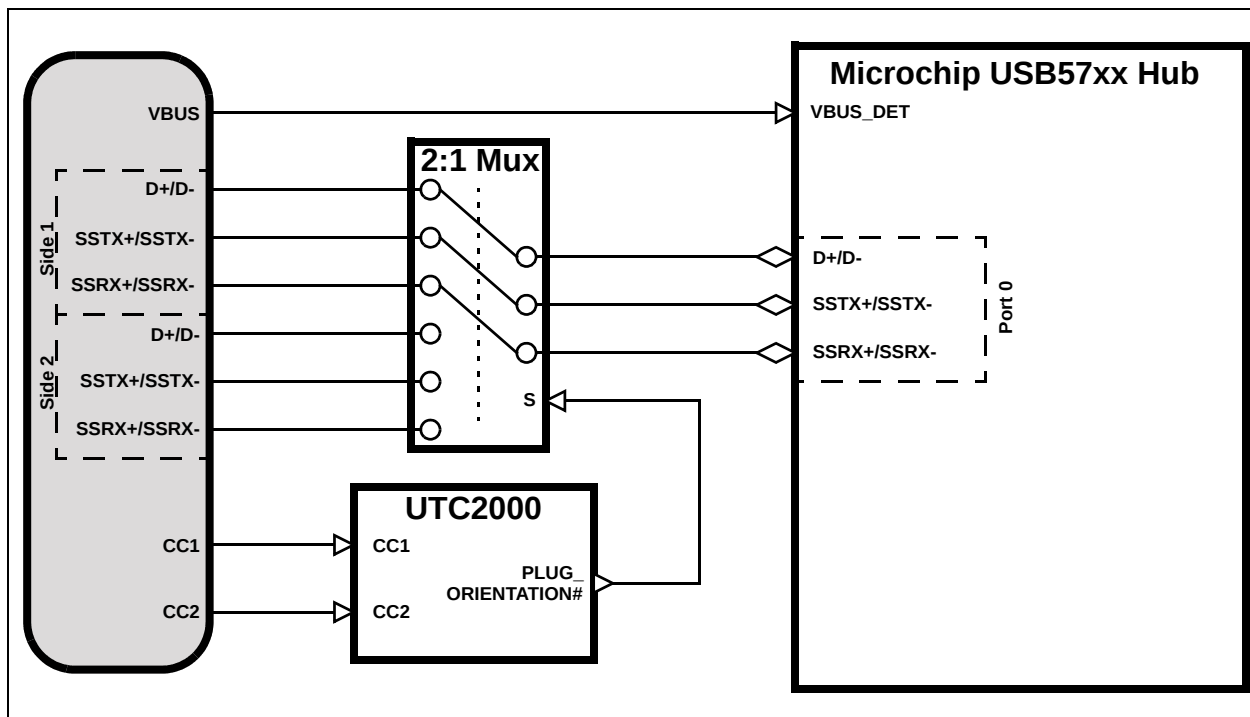
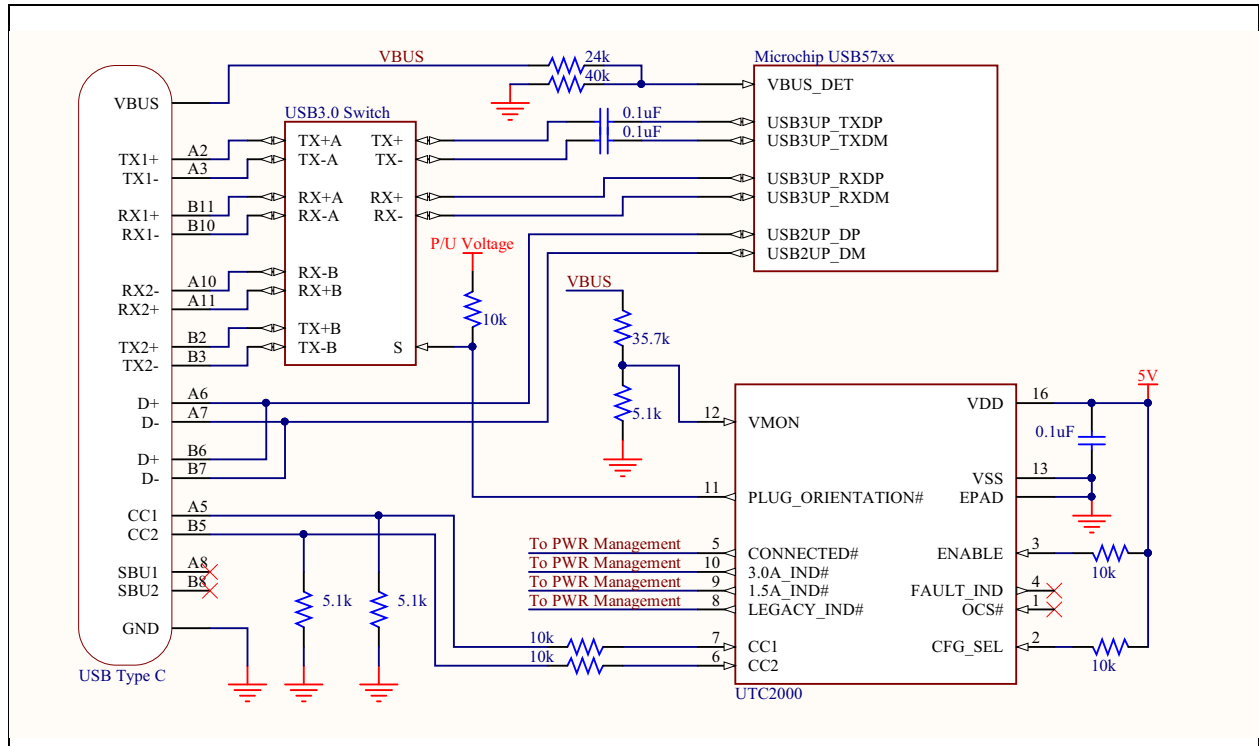


FIGURE 6: UPSTREAM FACING PORT SWITCHED IMPLEMENTATION SCHEMATIC



3.0 DOWNSTREAM FACING PORT 2-PORT IMPLEMENTATION

A basic downstream facing port can be implemented without the use of an external 2:1 switch by simply using two adjacent downstream ports of the hub. The USB data connections will only ever connect to one downstream port:

- When a USB Type-C cable is connected in the “unflipped” orientation, Port [n] is used.
- When the USB Type-C cable is connected in the “flipped” orientation, Port [n+1] is used.

3.1 Important Design Notes

3.1.1 UTC2000 BASIC TYPE-C CONTROLLER

The Microchip UTC2000 is a basic USB Type-C controller which in DFP applications can be used to sense and determine the value of an Rd pull-down resistor on either of the CC lines to detect the connection orientation. The UTC2000 also detects powered cables and controls the VCONN supply to the cable.

The **PPC_EN** pin is an active high signal which controls the 5V port power controller enable to power VBUS only when a valid USB Type-C attach is detected.

3.1.2 CONNECTIONS FROM USB TYPE-C CONNECTOR TO UTC2000 & USB HUB

There are two ways to connect the USB SuperSpeed lanes to the USB5734 Hub with the 2-Port DFP implementation. It is recommended to select the option that allows for the best USB SuperSpeed signal routing on the PCB layout.

- **Option A:**
 - USB Type-C Connector Side 1 Pins (A2, A3, A6, A7, B10, B11) connected to USB Port [n] of USB57xx Hub
 - USB Type-C Connector Side 2 Pins (A10, A11, B2, B3, B6, B7) connected to USB Port [n+1] of USB57xx Hub
- **Option B:**
 - USB Type-C Connector Side 1 Pins (A2, A3, A6, A7, B10, B11) connected to USB Port [n+1] of USB57xx Hub
 - USB Type-C Connector Side 2 Pins (A10, A11, B2, B3, B6, B7) connected to USB Port [n] of USB57xx Hub

3.2 Application Diagrams

Figure 7 below shows a simplified block diagram of the 2-port “Option A” implementation, while Figure 8 a more detailed schematic level view.

FIGURE 7: DOWNSTREAM FACING PORT 2-PORT IMPLEMENTATION BLOCK DIAGRAM

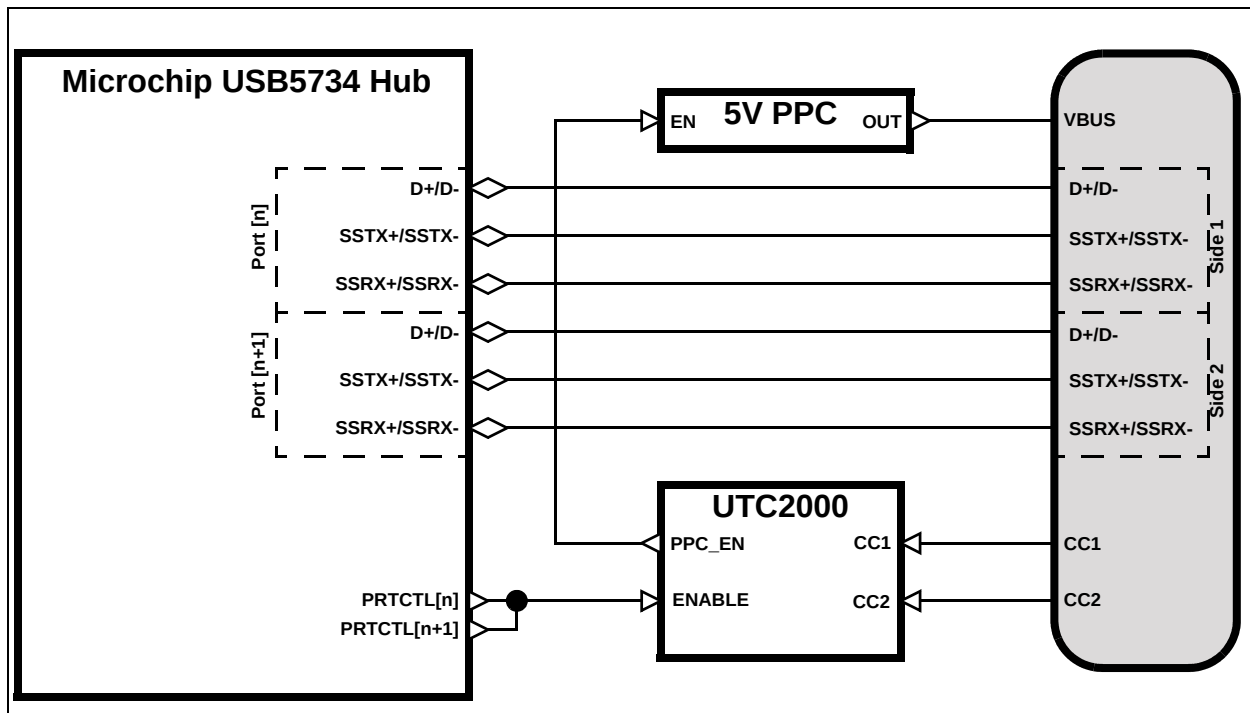
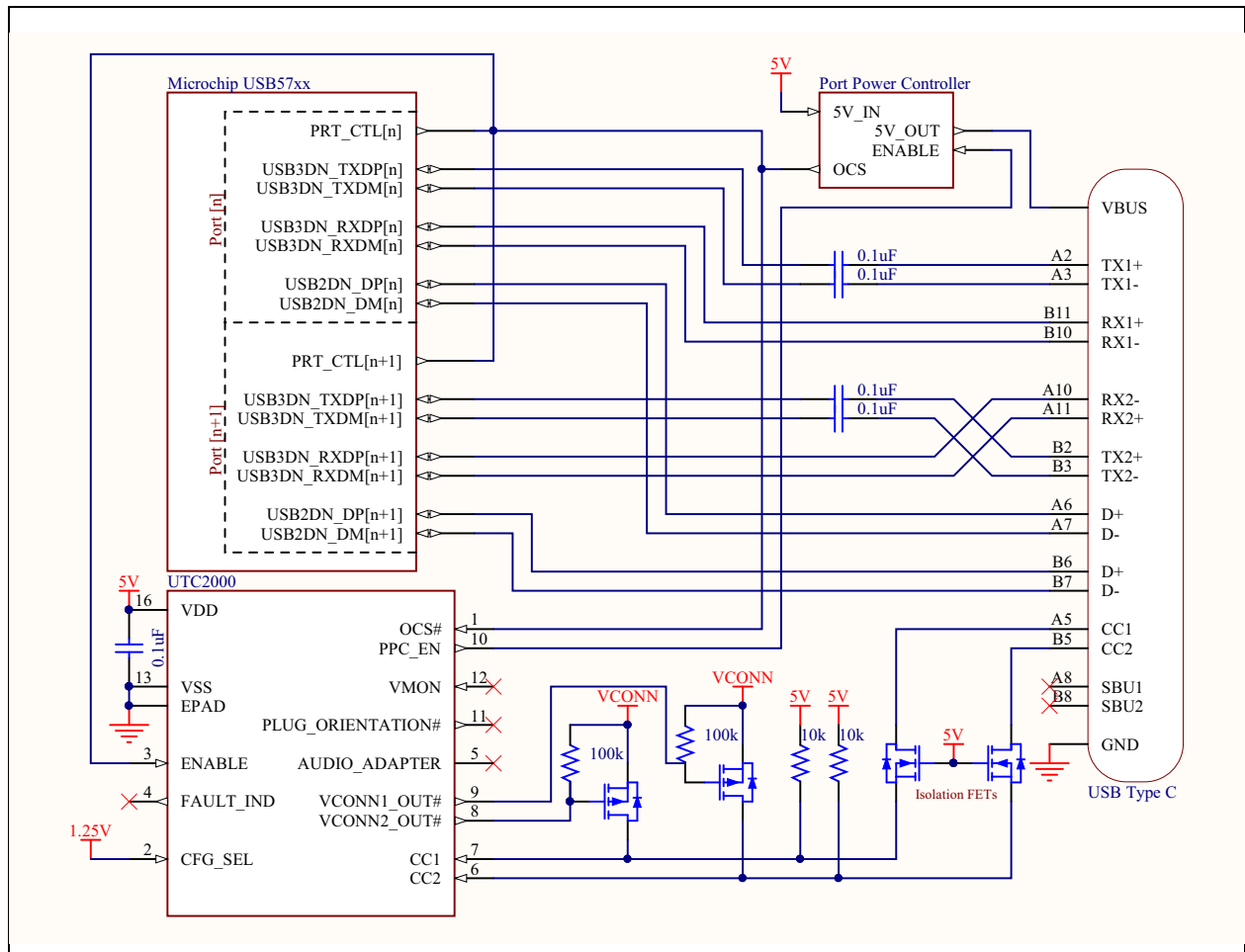


FIGURE 8: DOWNSTREAM FACING PORT 2-PORT IMPLEMENTATION SCHEMATIC



4.0 DOWNSTREAM FACING PORT SWITCHED IMPLEMENTATION

A basic downstream facing port can be implemented with the use of an external 2:1 switch and only 1 downstream port will be allocated for the USB Type-C port.

4.1 Important Design Notes

4.1.1 UTC2000 BASIC TYPE-C CONTROLLER

The Microchip UTC2000 is a basic USB Type-C controller which in DFP applications can be used to sense and determine the value of an Rd pull-down resistor on either of the CC lines to detect the connection orientation. The UTC2000 also detects powered cables and controls the VCONN supply to the cable.

The **PLUG_ORIENTATION#** pin is an open drain output that is used to indicate plug orientation. When no connection is detected or a connection is detected on CC1, the pin remains in a high impedance state. When a connection is detected on the CC2 pins, the **PLUG_ORIENTATION#** output drives low. This signal may be used to directly control the state of the USB SuperSpeed 2:1 multiplexer.

The **PPC_EN** pin is an active high signal which controls the 5V port power controller enable to power VBUS only when a valid USB Type-C attach is detected.

4.1.2 CONNECTIONS FROM USB TYPE-C CONNECTOR TO UTC2000 & USB HUB

Since not all SuperSpeed switches have identical functionality and connections, it is recommended to consult the data-sheet for the selected switch device in order to determine the necessary connections.

Note that all USB Side 1 connections on of the USB Type-C connector (A2, A3, A6, A7, B10, B11) can be swapped with all USB Side 2 connections on of the USB Type-C connector (A10, A11, B2, B3, B6, B7) to facilitate better USB signal routing on the PCB if the connections from the CC1/CC2 pins on the USB Type-C connector to the UTC2000 are also swapped.

4.2 Application Diagrams

Figure 9 shows a simplified block diagram of the switched implementation, while Figure 10 a more detailed schematic level view.

FIGURE 9: DOWNSTREAM FACING PORT SWITCHED IMPLEMENTATION BLOCK DIAGRAM

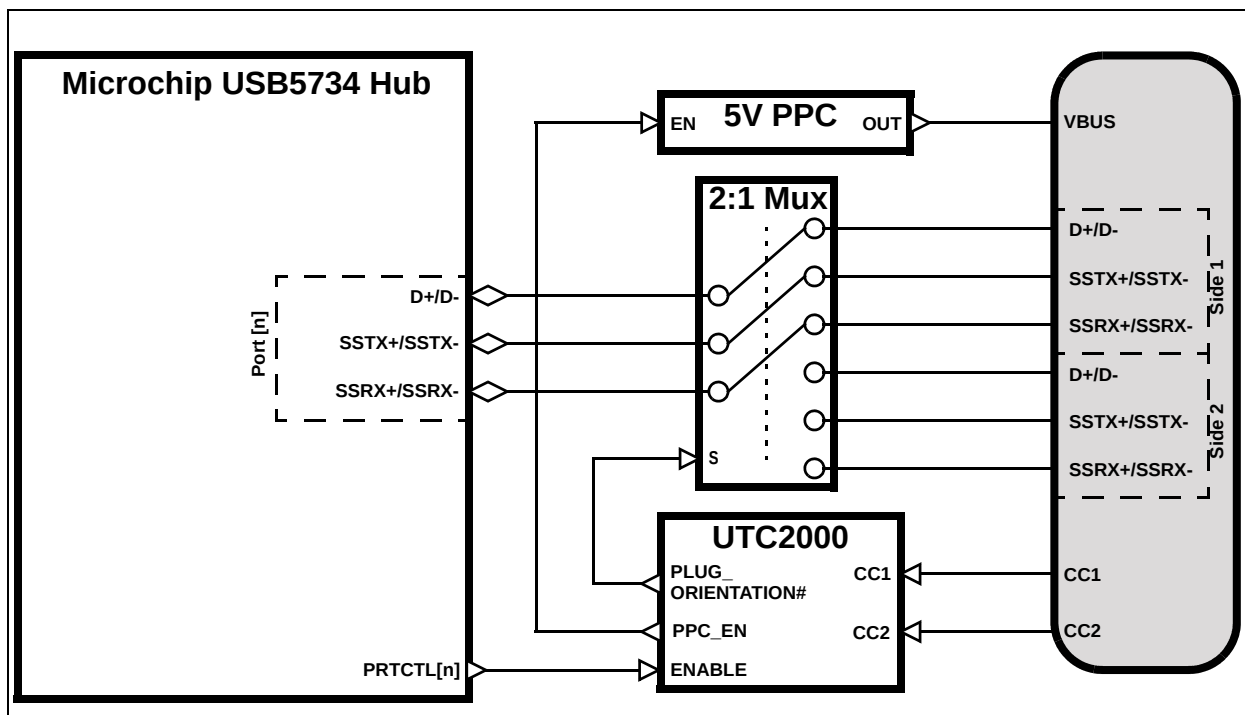
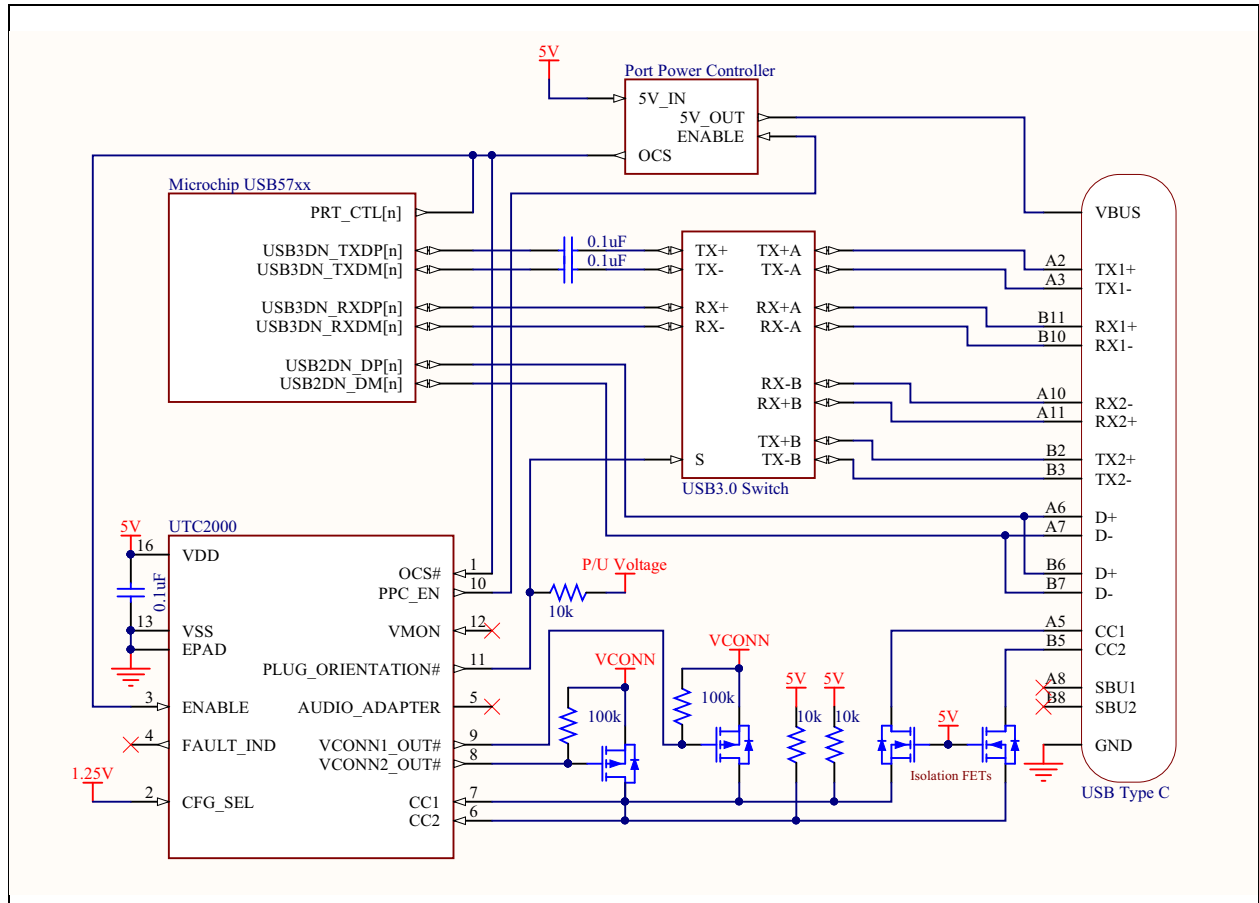


FIGURE 10: DOWNSTREAM FACING PORT SWITCHED IMPLEMENTATION SCHEMATIC



5.0 APPLICATION NOTE REVISION HISTORY

TABLE 0-1: REVISION HISTORY

Revision Level & Date	Section/Figure/Entry	Correction
DS00002051A (12-10-15)	All	Initial release.

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