AN1700

FlexConnect Applications

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INTRODUCTION TO FLEXCONNECT

The USB protocol calls for rigid system roles to maintain order. One processor acts as the host which issues commands to the device. In turn, the devices respond to the host's commands. This implementation operates well where there is one central processor controlling a wide variety of support devices. However, as technology has progressed, microprocessors have become embedded in many new and unique applications. With the proliferation of tablet PCs, laptops, ultrabooks, and smartphones, the system host may not be the same device in every application. Microchip's FlexConnect feature has been developed to allow the system to adapt to these new applications.

Description

The FlexConnect feature is unique to Microchip USB hubs and is available on these USB 2.0 hubs: USB253x, USB3613, USB3813, and USB46x4 families of devices. It is also available on the USB5734, USB58xx, and USB59xx families of USB 3.1 Gen 1 hub devices. FlexConnect allows the hub to dynamically change the physical ports that act as upstream and downstream ports. This allows a system designer to develop a product that acts as a USB host and a USB device without the requirement of two dedicated connectors. This also allows a system that had this capability on one port to now expand the devices connected to that port through the hub.

Application

PORTABLE APPLICATIONS

FlexConnect can be used on tablets and smartphones. These devices have the ability to act as a device or a host. Accessories to portable devices can also be used with FlexConnect, expanding the capabilities of the dock or device and differentiating it from the competition. For example, the downstream port of a dock can use FlexConnect to support a dual-role compatible tablet/smartphone, allowing it to receive a charge and act as a host.

AUTOMOTIVE ENTERTAINMENT

Many customers carry and use their portable devices in the car. An automotive entertainment system that includes FlexConnect provides the capability to act as a host when connecting devices like a thumb drive or card reader, and as a device when connecting to a smartphone or tablet to provide a better user experience.

SYSTEM TEST

Automated test stations can take advantage of FlexConnect to connect to existing ports on a final product. The FlexConnect feature can enable the test system to download new firmware to the SoC, communicate with all devices in the system, and execute automated routines to lower the overall test cost.

REFERENCES

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

- *Application Note AN 26.18 - Configuration Options for the USB253x/USB3x13/USB46x4*
- *Microchip USB2532 Data Sheet*
- *Microchip USB2533 Data Sheet*
- *Microchip USB2534 Data Sheet*
- *Microchip USB3613 Data Sheet*
- *Microchip USB3813 Data Sheet*
- *Microchip USB4604 Data Sheet*
- *Microchip USB4624 Data Sheet*
- *Microchip USB5734 Data Sheet*
- *Microchip USB58xx and USB59xx Data Sheets*
- *USB2530 UCH Software Development Kit*

IMPLEMENTING FLEXCONNECT

System Requirements

Some USB systems have the ability to act as a host and a device. There are multiple ways that a USB host can transfer ownership of the bus to the device. When a hub is added to the system, there are additional factors that must be considered to ensure all devices know what role they are supposed to play. The low-level signals involved in this process are as follows:

- **VBUS**: Generally, this is 5V that is supplied by the host.
- **DP**: The host has a 15k pull-down, and the device has a 1.5k pull-up to 3.3V.
- **DM**: The host has a 15k pull-down.
- **ID**: This is an option pin used in On-The-Go (OTG) applications. It is pulled up by the OTG-enabled device.
- **GND**: Common reference

For USB5734/USB58xx/USB59xx, the following signals are also included:

- **SSTX+/SSTX-**: USB3.0 Differential SuperSpeed transmit
- **SSRX+/SSRX-**: USB3.0 Differential SuperSpeed receive
- **GND_DRAIN**: Common reference

Note:	For USB5734/USB58xx/USB59xx, both the USB2 DP/DM signals and the USB3 SuperSpeed signals SSTX/SSRX are switched from Port 0 to Port 1 when the ports are flexed.

INITIAL ROLE REVERSAL

A USB port can change from a host port to a device port through two different methods.

The processor can dynamically change whether an exposed port acts as a host or device through low-level software commands. If USB host sends a special command to the device to change direction, the software also executes the low-level direction change. In the USB OTG specification, this is known as Host Negotiation Protocol (HNP). With this internal method, the initial USB host maintains the VBUS voltage supply after it has switched roles to act as a device.

The ID pin can also be used to signal the USB port whether it should act as a host or a device. The USB device enables a weak pull-up resistor on the ID pin and then monitors the state of the pin. If the ID pin is high, then the USB device checks for the presence of a host by monitoring VBUS and acts as a device. If the ID pin is low, then the USB device drives 5V on VBUS and acts as a host. Traditionally, this is done through the wiring of USB cables. A uA connector would short ID to GND and have a standard B plug at the other end of the cable. A uB connector would float ID and have a standard A plug at the other end. An intelligent USB system could change the state of the ID pin, thus changing the host and device roles of OTG ports.

RETURNING TO THE DEFAULT STATE

If the internal role reversal command is used to change directions, the control of the USB bus is passed to the new host. This means that the original system is under the control of the new host. The original system may regain control by removing VBUS. If the new host suspends the original system, it stops sending SOFs and the system enters a low power state. However, the SOFs also ceases if the new host is completely disconnected.

If the external role reversal procedure is used, then the VBUS and ID states should be monitored. To determine if the new host is disconnected, VBUS is removed. If the new host wants to pass the control back to the original system, the ID pin is connected to ground.

USB HUBS

The USB hub can be very beneficial to include in role reversal applications.

First, the hub can be used to clean up a less than ideal USB signal. The USB hub acts as a repeater of the signal, enabling a system to extend the cable length and the distance between the host and the device. For automotive and aerospace applications, the use of hubs allows multiple USB ports to be placed at the greatest convenience to the passengers, rather than as close to the host as possible. Industrial systems that have large moving components can also place the USB connectors at a safe distance from the machine.

Second, the hub enables more than one access point to the host. More ports also mean more charging points, more storage, and more features that can be added to a system.

Finally, the hub can also act as a buffer to the host. If there are any devices that drive voltage back into a port, the hub may be damaged, but the host will be shielded. This can protect the more expensive system components from errors in the external ports.

Enabling FlexConnect

There are three ways to enable the FlexConnect feature: through SMBus, by driving a digital pin high, or through a custom SETUP packet to the hub controller.

SMBUS CONTROL OF USB57XX/USB58XX/USB59XX AND USB(8)4604 WITH EXTERNAL FLEXCONNECT FW EXECUTION FROM SPI

The FlexConnect feature is controlled through the CONNECT_CFG register at address 318Eh. For the USB2 parts, there are two control bits involved: the EN_FLEX_MODE bit that enables the mode, and the FLEXCONNECT configuration bit that controls the direction of the communication. For the USB5734/USB58xx/USB59xx USB3 hub, only the FLEXCONNECT configuration bit is present.

Note 1:	For USB253x, USB38x3, and USB46xx, the only method to activate FlexConnect is via SMBus control.
2:	USB4604 can support other FlexConnect methods, but only with the FlexConnect FW executing from an external SPI ROM.

USB2 Devices

When the EN_FLEX_MODE bit is set, the FLEX port and SWAP port are enabled to change directions when the FLEXCONNECT bit is set. When FLEXCONNECT is cleared, FLEX and SWAP ports revert to their default state. The following pins also change their function when in FlexConnect mode:

- **FLEX/Port 0 (USB or HSIC)** - When FLEXCONNECT = 0, this is the upstream port; when FLEXCONNECT = 1, this is downstream port 1.
- **SWAP/Port 1 (USB or HSIC)**- When FLEXCONNECT = 0, this is downstream port 1; when FLEXCONNECT = 1, this is the upstream port.
- **VBUS_DET** - When FLEXCONNECT = 0, this pin triggers the FLEX port to enumerate; when FLEXCONNECT = 1, this pin is ignored.
- **PRTPWR1/PRTCTL1** - When FLEXCONNECT = 0, this pin enables a USB power switch through a pull-up resistor, and also detects an overcurrent fault that is driven low. When FLEXCONNECT = 1, this pin remains in the PORTCTL mode with the switch permanently enabled.

- **FLEX_VBUS (OCS1_N)** - When FLEXCONNECT = 0, this pin is ignored; when FLEXCONNECT = 1, this pin triggers the SWAP port to enumerate.
- **FLEXCTL1 (SUSPEND)** - When FLEXCONNECT = 0, this pin drives low to prevent VBUS from being driven by the FLEX port (which is the upstream port in this state). When FLEXCONNECT = 1, this pin enables a USB power switch through a pull-up resistor, and also detects an overcurrent fault that is driven low.

SMBUS CONTROL OF USB253X/USB3X13/USB(8)4604 WITH FW EXECUTING FROM INTERNAL ROM MEMORY

For USB253x, the FlexConnect feature is controlled differently. It remains true that for the USB2 there are two control buts involved: the EN_FLEX_MODE bit that enables the mode and the FLEXCONNECT configuration bit that controls the direction of communication.

The EN_FLEX_MODE bit functions the same as explained in SMBus Control of USB57xx/USB58xx/USB59xx and USB(8)4604 with External FlexConnect FW Execution from SPI on page 3. The same few pins can change their function when in the FlexConnect mode.

For USB253x, a sequence of steps must be followed to enable FlexConnect. The hub must be configured to enumerate in the Flexed state when in the SOC_CONFIG stage. Once attached, the hub can then alter the flexed state it is in with a register write.

- Enable the FlexConnect feature with/without the Flex mode pin function enabled.

  Example: Write; Slave Address - 0x2D

  `00 00 05 00 01 31 8E 83/81` (Flex mode pin function enabled/disabled)

  `99 37 00` (execute command)

- It may be required to set a bit that ensures the clocks stay on during suspend allowing SMBUS communication.

  Example: Write; Slave Address – 0x2D

  ```
  00 00 05 00 01 30 EE 80
  99 37 00
  ```

- Send the attach command to the hub.

  Example: Write; Slave Address – 0x2D

  `AA 55 00` (The hub will attempt to enumerate with port 1 as upstream.)

- In runtime, change to register Page 2 where runtime control of FlexConnect exists.

  Example: Write; Slave Address – 0x2C

  ```
  FF 40
  ```

- At this point, a register write can be done to either flex or unflex the hub. This can be done until the hub is either reset or power cycled.

  Example: Write; Slave Address – 0x2C

  `8E 82/80` (Flex mode pin function enabled/disabled. Unflex the hub. Port 0 upstream.)
  OR
  `8E 83/81` (Flex mode pin function enabled/disabled. Flex the hub. Port 1 upstream.)

DIGITAL PIN CONTROL FOR USB(8)4604 WITH FLEXCONNECT FIRMWARE

The USB(8)4604 using the FlexConnect-specific firmware has additional pin functions over the other USB4604 SKUs that expand on the FlexConnect functionality. By default, the FlexConnect feature is enabled and all pin functionality described in SMBus Control of USB57xx/USB58xx/USB59xx and USB(8)4604 with External FlexConnect FW Execution from SPI on page 3 is valid.

FLEX_IN (pin 22 of the USB5734) is used to control the direction of the upstream port. When the pin is low, the FLEX port is the upstream port. When the pin is high, the SWAP port is the upstream port. There is a weak internal pull-down resistor to prevent this pin from being sampled high when it is left disconnected. The PRTPWR, VBUS_DET, OCS1_N, and SUSPEND functionality is identical to the SMBus procedure. There are two additional outputs in this mode:

- FLEX_OUT (pin 23) is the FLEX state. It drives 0V when FLEXCONNECT is 0, or when pin 22 is low. It enables a 3.3V pull-up resistor when FLEXCONNECT is 1, or when pin 22 is driven high.
- FLEX_OUT_N (pin 34) is the inverse of the FLEX state. It enables a pull-up to 3.3V when FLEXCONNECT is 0 and drives low when FLEXCONNECT is 1.

DIGITAL PIN CONTROL FOR USB5734/USB58XX/USB59XX

The USB5734/USB58xx/USB59xx includes seven configurable I/O pins that can be set to six I/O configuration modes. I/O configuration mode 1 and I/O configuration mode 2 include additional functionality for Flex operation.

Mode1

- PROG_FUNC6 I/O (pin 49) is set as the FLEXCMD flex control input with a weak pull-down to prevent the pin from floating when left disconnected.
  - 0 = Normal operation. Set Port 0 as the upstream port; set Port 1 as the downstream port.
  - 1 = Flex operation. Set Port 0 as the downstream port; set Port 1 as the upstream port.

Mode2

- PROG_FUNC1 (pin 50) is set as the HOST_TYPE0 output and indicates the Port 0 USB host type:
  - tri-state = no USB host
  - 0 = USB3 host
  - 1 = USB2 or USB1.1 host
- PROG_FUNC2 (pin 39) is set as the HOST_TYPE1 output and indicates the Port 1 USB host type:
  - tri-state = no USB host
  - 0 = USB3 host
  - 1 = USB2 or USB1.1 host
- PROG_FUNC3 I/O (pin 40) is set as the FLEX_STATE_N output and indicates the complement of the internal flex state. This is configured as open drain with a 60k pull-up.
  - 0 = Flex operation. Port 0 is downstream, and Port 1 is upstream.
  - 1 = Normal operation. Port 0 is upstream, and Port 1 is downstream.
- PROG_FUNC6 I/O (pin 49) is set as the FLEXCMD flex control input with a weak pull-down to prevent the pin from floating when left disconnected.
  - 0 = Normal operation. Set Port 0 as the upstream port; set Port 1 as downstream port.
  - 1 = Flex operation. Set Port 0 as the downstream port; set Port 1 as upstream port.
- PROG_FUNC7 I/O (pin 16) is set as the FLEX_STATE output and indicates the internal flex state. This is configured as open drain with a 60k pull-up.
  - 0 = Normal operation. Port 0 is upstream, and Port 1 is downstream.
  - 1 = Flex operation. Port 0 is downstream, and Port 1 is upstream.

DIGITAL PIN CONTROL FOR USB58XX/USB59XX

The `FLEX_CMD` control input can be used to control the FlexConnect state. When driven or pulled low, the hub operates in its default state. When driven or pulled high, the hub operates in its “flexed” state.

The `FLEX_STATE` output displays the current state of FlexConnect. It operates in the same manner regardless of how FlexConnect is controlled (SMBus, USB Command, or Direct Pin Control). When low, the hub is currently in its default state. When high, the hub is in its “flexed” state.

USB SETUP PACKET

FlexConnect can also be enabled through a vendor-specific USB SETUP command to the hub controller.

Note:	USB253x, USB38x3, and USB46xx do not support SETUP packet.

The format of the command is as follows:

TABLE 1: USB SETUP COMMAND FORMAT

Setup Parameter	Value	Description
bmRequestType	0x41	Host-to-device, vendor class, targeted to interface.
bRequest	0x08	FlexConnect command
wValue	0xYYYY	See field definitions in Table 2, "wValue Format".
wIndex	0x0000	Always write 0 to this value.
wLength	0x00	No other data is transmitted.

The wValue field contains extra control parameters to customize the hub further.

TABLE 2: WVALUE FORMAT

Bit	Name	Description
0	RESERVED	This bit has no function.
1	DIS_P1	Disables Port 1 after switching directions.
2	DIS_P2	Disables Port 2 after switching directions.
3	DIS_P3	Disables Port 3 after switching directions.
4	DIS_P4	Disables Port 4 after switching directions.
5	DIS_P5	Disables Port 5 after switching directions.
6	FLEXCONNECT	The value of FLEXCONNECT after the hub is re-attached.
7	CHNG_PIN_FUNCT	This pin changes the digital pin controls back to the default state. For example, VBUS_DET has the same functionality regardless of the Flex state.
8-10	HD_TMR	Host Detect Timeout - The time the hub will wait for a host to enumerate before returning to the default state. 000 = No timeout 001 = 10 ms 010 = 100 ms 011 = 500 ms 100 = 1s 101 = 5s 110 = 10s 111 = 20s
11-13	RESERVED	These bits have no function.
14	DCP_EN	Enables the universal dedicated charging algorithm to be used on disabled ports. This will cause the hub to enumerate limited ports, but the VBUS and battery charging handshake will still be present on the disabled ports.
15	1	This must always be 1.

Once the SETUP command has been sent, the hub resets the internal logic and tries to enumerate in the newly configured state. All of the digital pins function similar to the SMBus and Digital Pin control modes, unless configured otherwise. The USB packet contains features that expand the hub's functionality and address some of the limitations of typical OTG applications.

- Port Disable - There are times that the original system may not want to expose all USB devices to the new host. The Port Disable bits allow the software to control which ports will be exposed when the hub changes direction.
- Host Disconnect Detection - The hub has the ability to determine if the new host has been disconnected, or if it has just placed the hub in suspend. The hub reverts to the default state if it detects that the downstream host has been disconnected.
- Host Detection Timeout - The hub can determine if it has enumerated with a host or not. This timer allows the hub to revert to the default state if no host is detected or the downstream device does not switch roles.
- Universal Dedicated Charging Ports - When a port is disabled, it can still provide VBUS and the universal DP/DM handshake that enables the connected device to charge with maximum current draw.

FLEXCONNECT APPLICATIONS

There are many different applications for the FlexConnect feature on Microchip hubs. The following sub-sections detail a few high-level examples utilizing technology that is already available on the market.

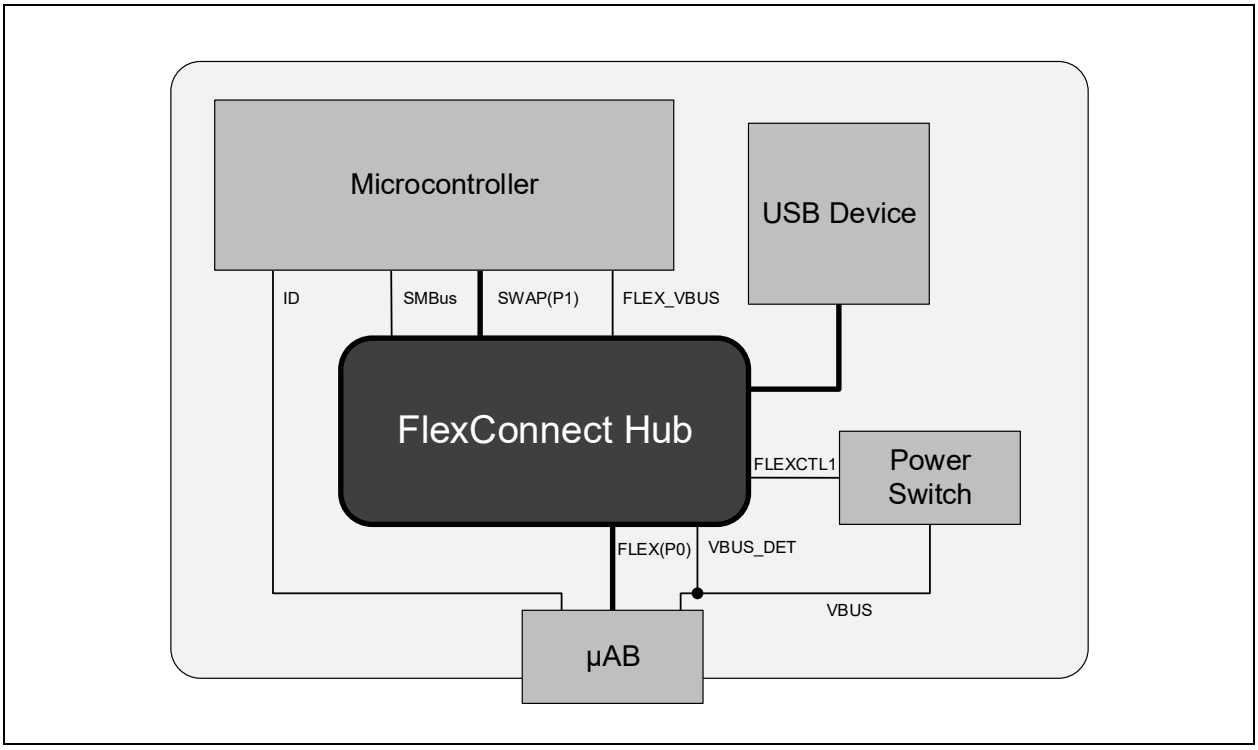
USB OTG

Although the USB hub is not fully compliant to the OTG specification, a system can take advantage of some of the OTG features to implement a dynamic change in direction. There are many processors that have OTG-capable USB ports, but only one USB device is supported per port. A hub is necessary to expand the number of devices in the system, allowing for more features that may differentiate a system in the market. The OTG application takes advantage of the ID pin to determine the direction. The following connections must be made:

- FLEX_DP/DM (Port 0) - Connected to a USB uAB connector.
- SWAP_DP/DM (Port 1) - Connected to the DP/DM pins of the OTG-capable port on a microcontroller.
- VBUS_DET - Connected through a voltage divider to the VBUS of the uAB connector.
- SUSPEND - Connected to a backdrive-tolerant power switch.
- OCS1 - Connected to a GPIO on the microcontroller.
- ID - Pulled up on the system and connected to a GPIO of the microcontroller.

When using the USB5734/USB58xx/USB59xx USB3 hub, the SSTX/SSRX should also be connected.

FIGURE 1: OTG APPLICATION CONNECTIONS

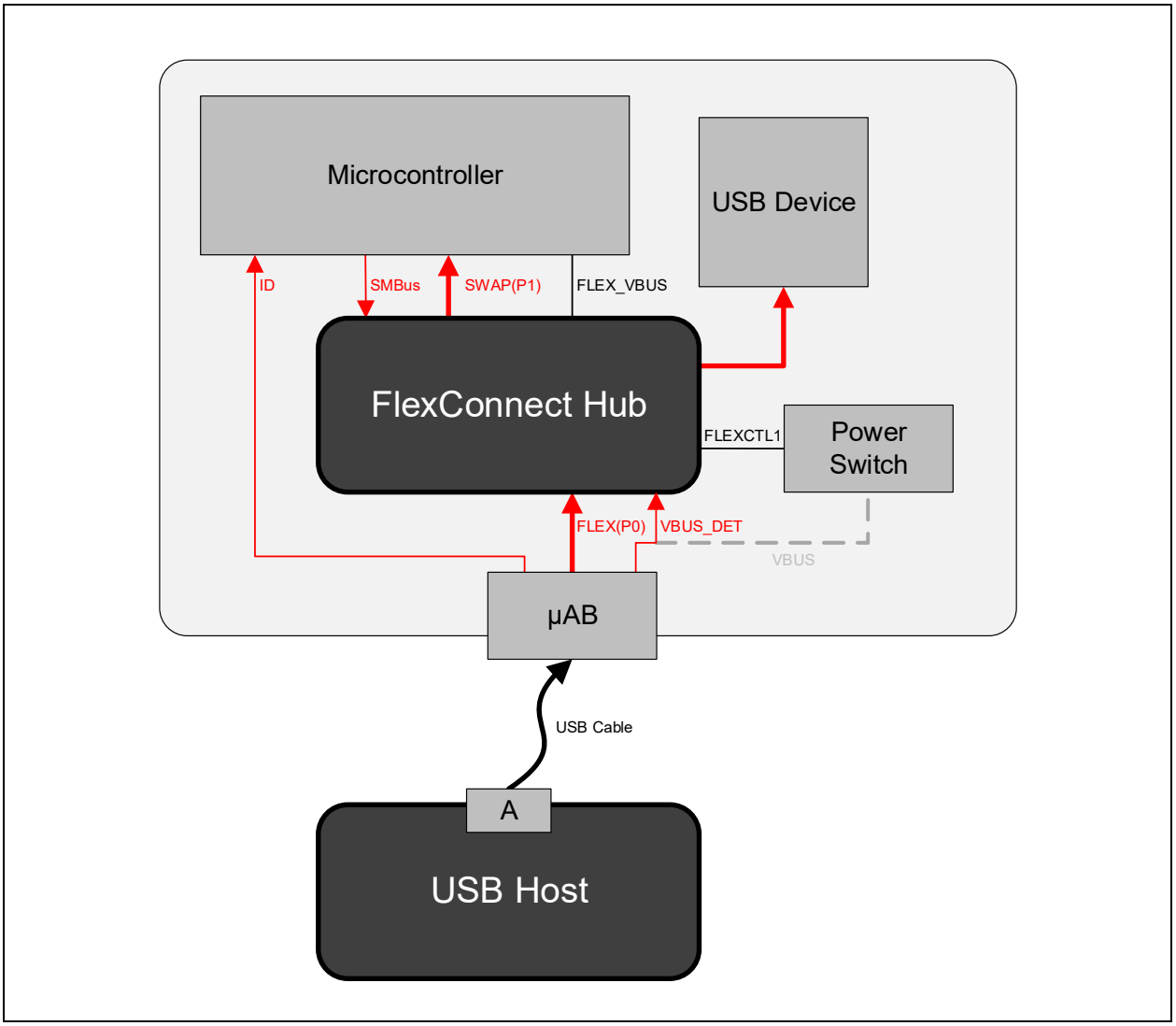


SYSTEM CONNECTED TO A USB HOST

When a Micro-B connector is inserted into the socket, the ID pin is left floating and is sampled high by the microcontroller. The microcontroller then communicates to the hub through SMBus to determine the status of the VBUS_DET pin. When ID and VBUS_DET are both high, then a USB host has been detected on the exposed connector, and the OTG port of the microcontroller must be configured as a device. The microcontroller then configures the hub with FLEXCONNECT = 0 and sends the attach command. The hub then enumerates with the host. The host sees the entire system with the downstream devices and the microcontroller configured as a device. These steps can be executed by the microcontroller as follows:

1. Read the status of the ID pin. ID is high.
2. Read register 0839h, bit `0`. This is the VBUS_DET pin. The bit becomes `1` when VBUS is present.
3. Write 82h to register 318Eh. This sets EN_FLEX_MODE to `1` and FLEXCONNECT to `0`.
4. Configure the OTG port as a device.
5. Send the special USB Attach (AA55h) command to the hub.
6. Operate in Device mode.

FIGURE 2: DATA FLOW WHEN CONNECTED TO A USB HOST

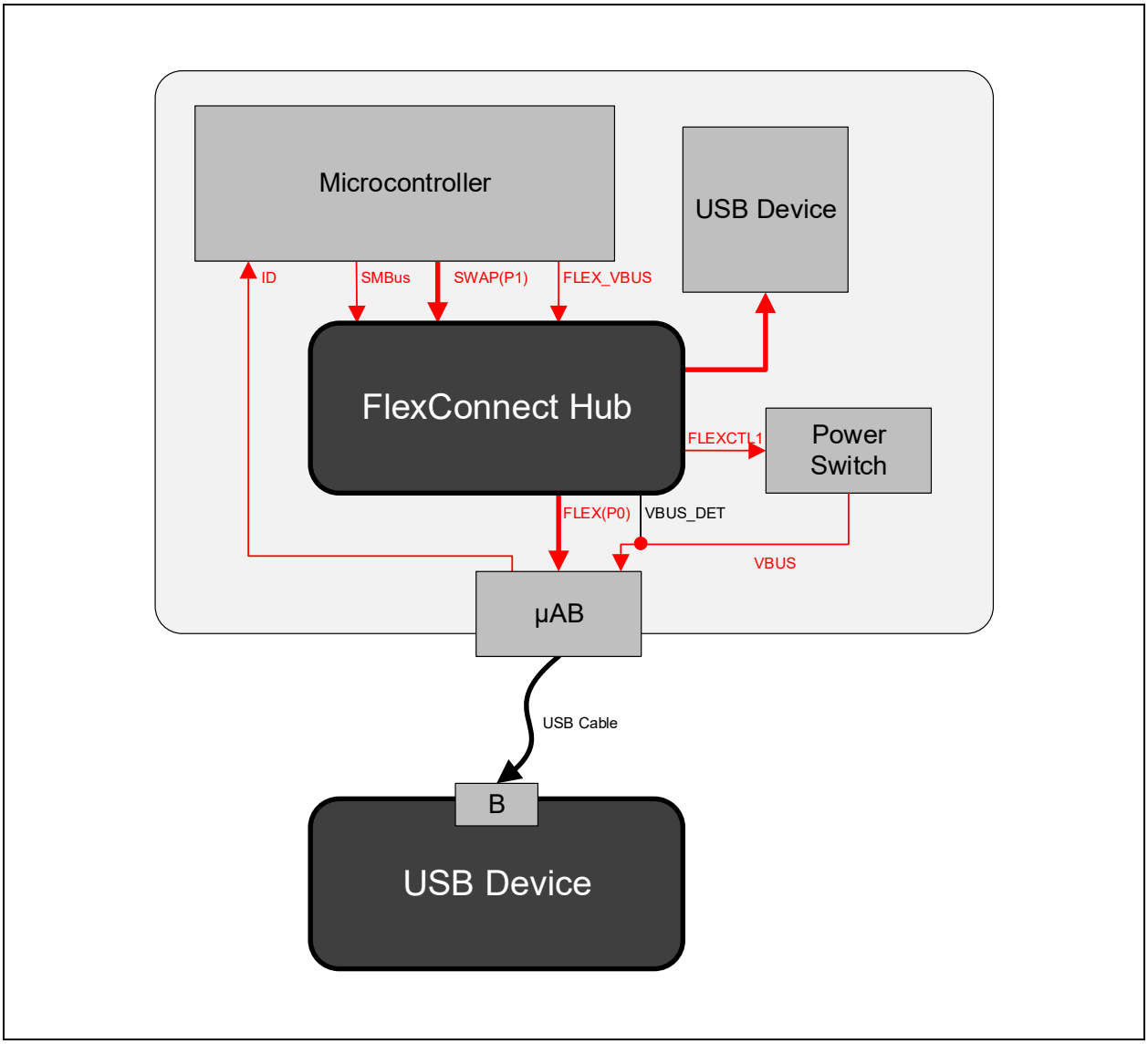


SYSTEM CONNECTED TO A USB DEVICE

When a Micro-A connector is inserted into the socket, the ID pin is shorted to GND and is sampled low by the microcontroller. A USB device is detected on the exposed connector, and the OTG port of the microcontroller must be configured as a host. The microcontroller then configures the hub with FLEXCONNECT = 1 and sends the attach command. The hub then enumerates with the microcontroller, and the host sees the entire system with the downstream devices and the microcontroller configured as a device. These steps can be executed by the microcontroller as follows:

1. Read the status of the ID pin. ID is low.
2. Write 82h to register 318Eh. This sets EN_FLEX_MODE to `1` and FLEXCONNECT to `1`.
3. Configure the OTG port as a host.
4. Send the special USB Attach (AA55h) command to the hub.
5. Operate in Host mode.

FIGURE 3: DATA FLOW WHEN CONNECTED TO A USB DEVICE

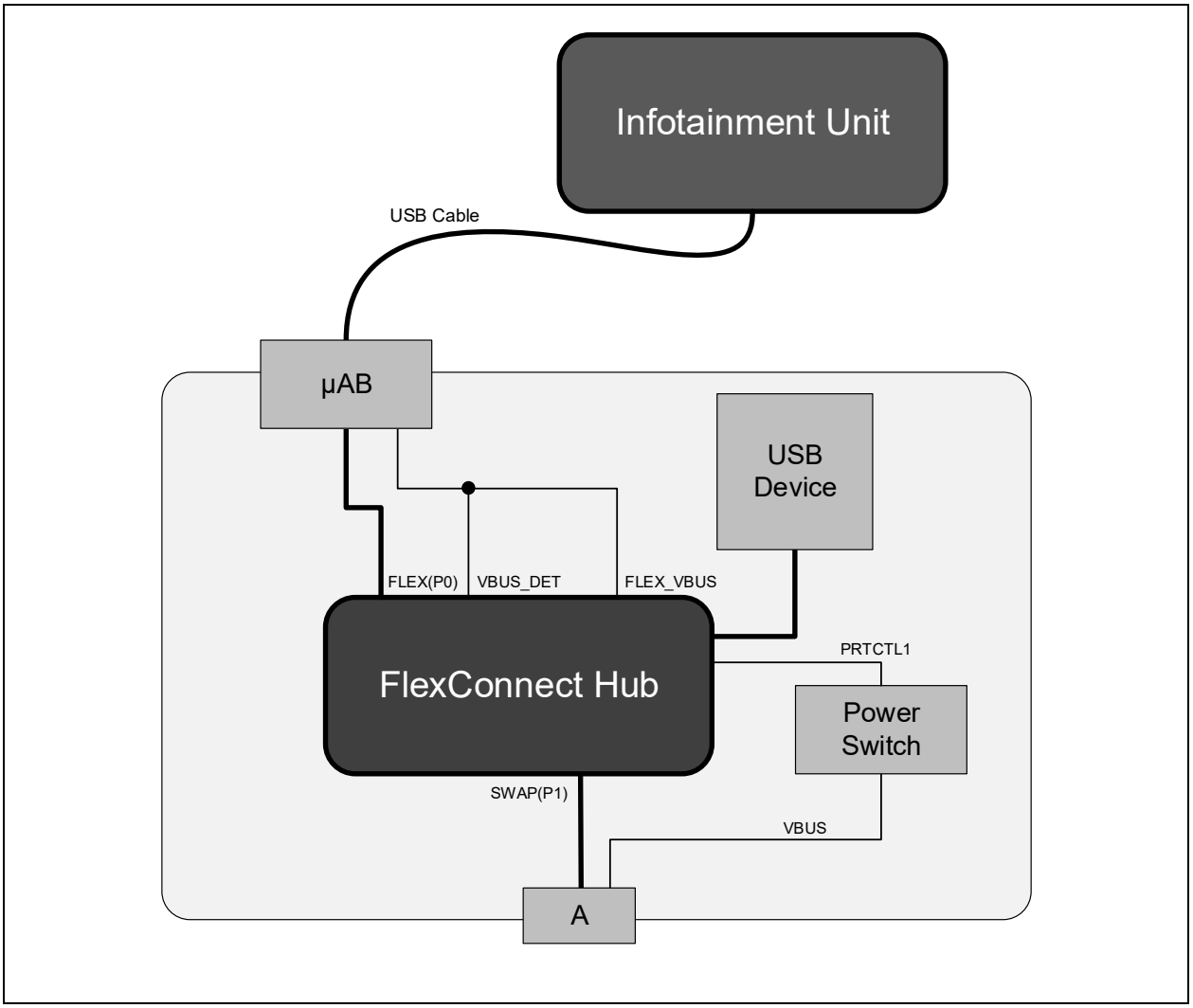


Software Direction Control

FlexConnect can also be implemented with portable devices that receive their power from an accessory, but later allow the device to control it. For example, a smartphone may plug into an automotive console to charge the battery, but the user may want to use the smartphone's interface to play the music. In this case the infotainment unit must send a USB command to the hub and the smartphone to initiate the change in control. The following connections must be made:

- FLEX DP/DM (Port 0) - Connected to the uAB connector going to the infotainment unit through a custom 5-pin cable.
- SWAP DP/DM (Port 1) - Connected to the USB A connector.
- VBUS_DET - Connected to the VBUS pin on the uAB connector.
- OCS1 - Connected to the VBUS pin on the uAB connector.
- Power Control - Controlled by the hub and always left on.

FIGURE 4: DIGITAL DIRECTION CONTROL SETUP

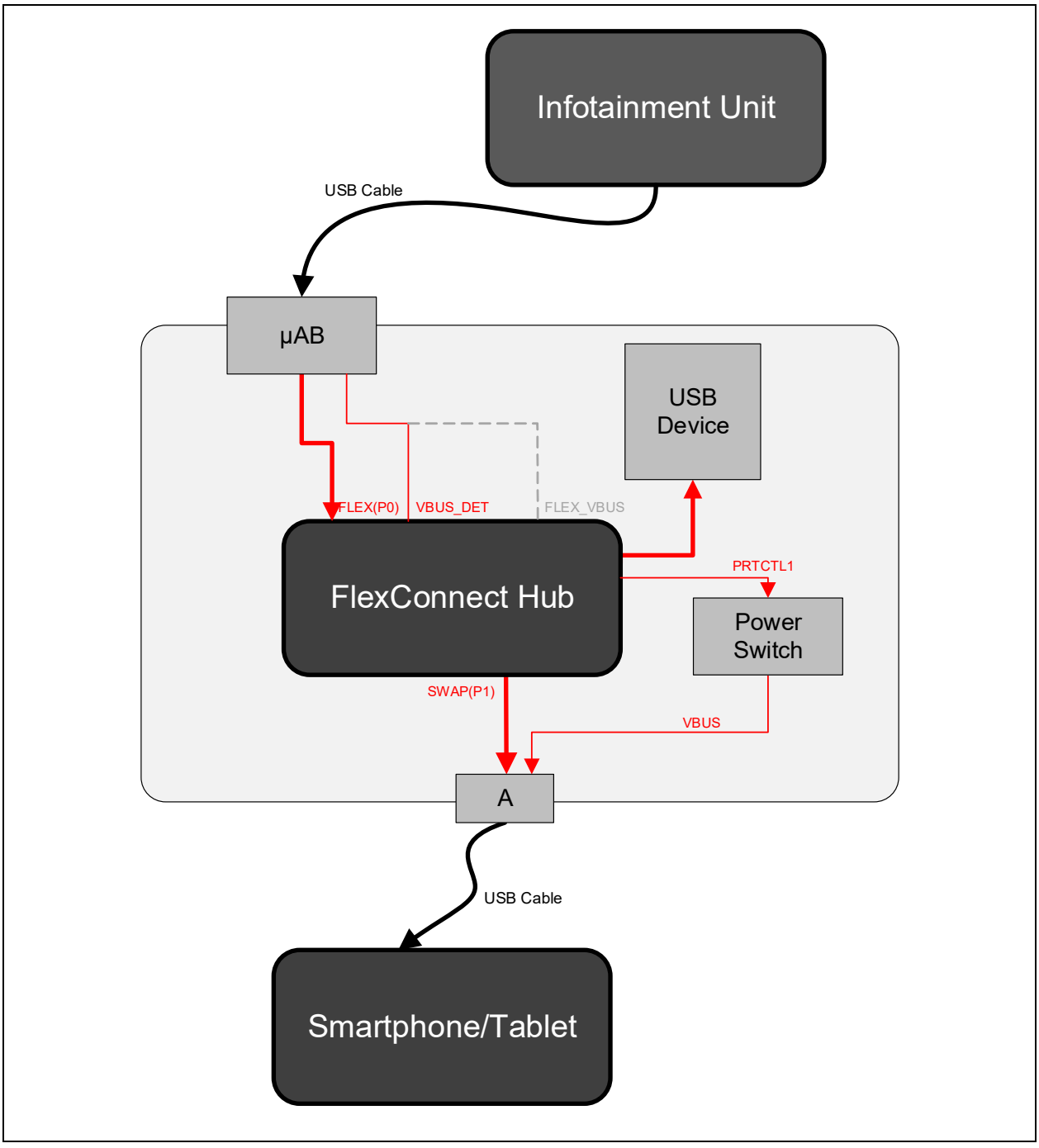


INITIAL CONNECTION

The USB system is configured and can function independently. The downstream port of the hub has battery charging enabled and has enumerated the other downstream ports. When the smartphone is connected, it detects the VBUS voltage and battery charging handshake and starts charging. The infotainment unit enumerates and controls the device. The following commands are executed by the microcontroller:

1. PRTCTL1 is pulled high to enable battery charging.
2. Infotainment unit drives VBUS_DET high to signal it is ready to enumerate.
3. The host port detects the hub and enumerates the device tree.
4. The hub detects the smartphone connected to the USB A port, and it enumerates as a device.

FIGURE 5: INITIAL DIRECTION CONTROL DATA FLOW

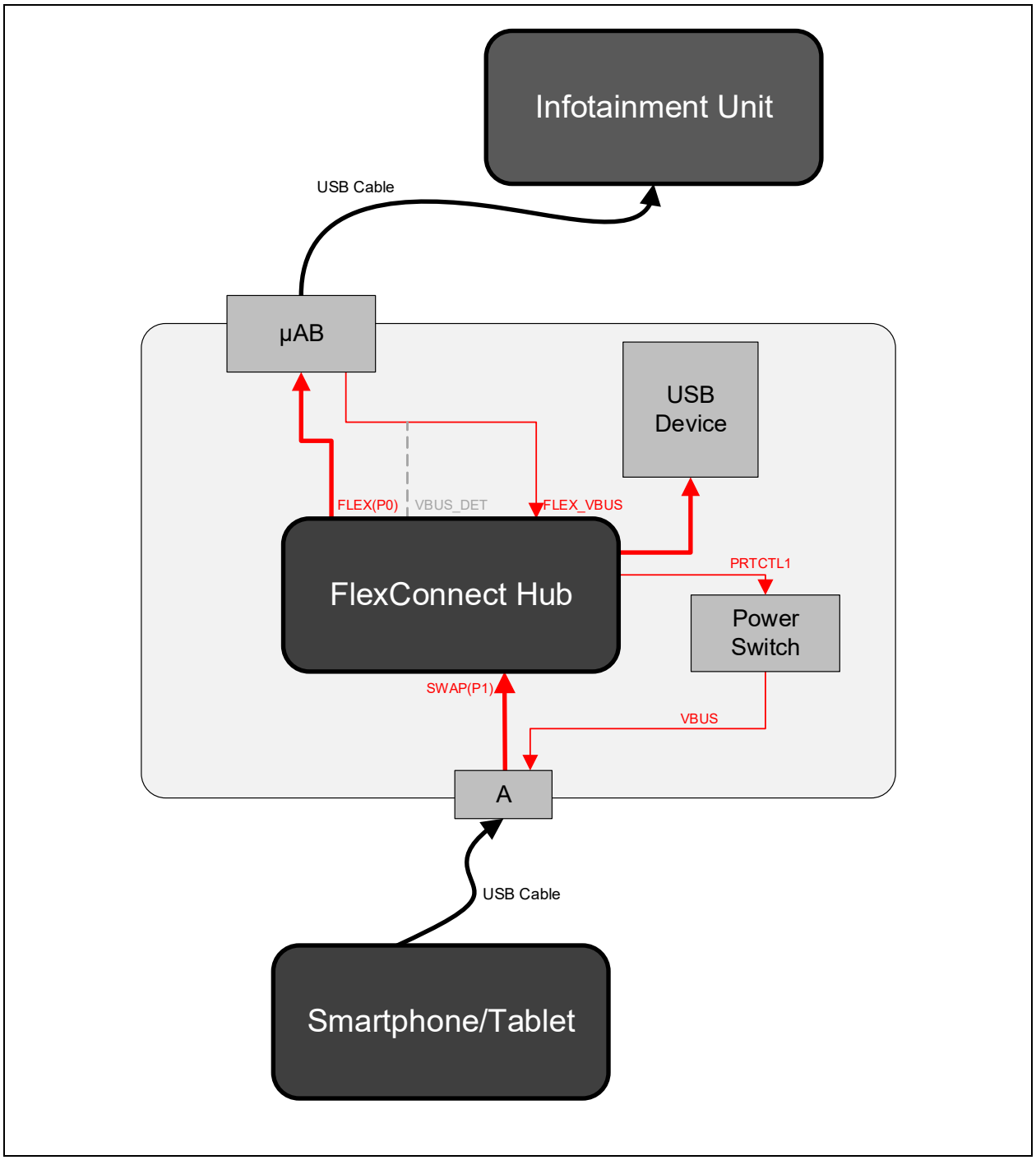


DIRECTION CHANGE

The infotainment unit can then pass control of the hub over to the smartphone if the user wants to use the interface provided with the peripheral or if the peripheral provides more capabilities than the head unit. Here is the process for changing direction:

1. Direction change is desired on the infotainment unit.
2. Infotainment unit sends out direction change command to the smartphone.
3. Infotainment unit sends out SETUP packet to the hub.
4. The hub enumerates with the peripheral, enumerating all downstream ports and the microcontroller.

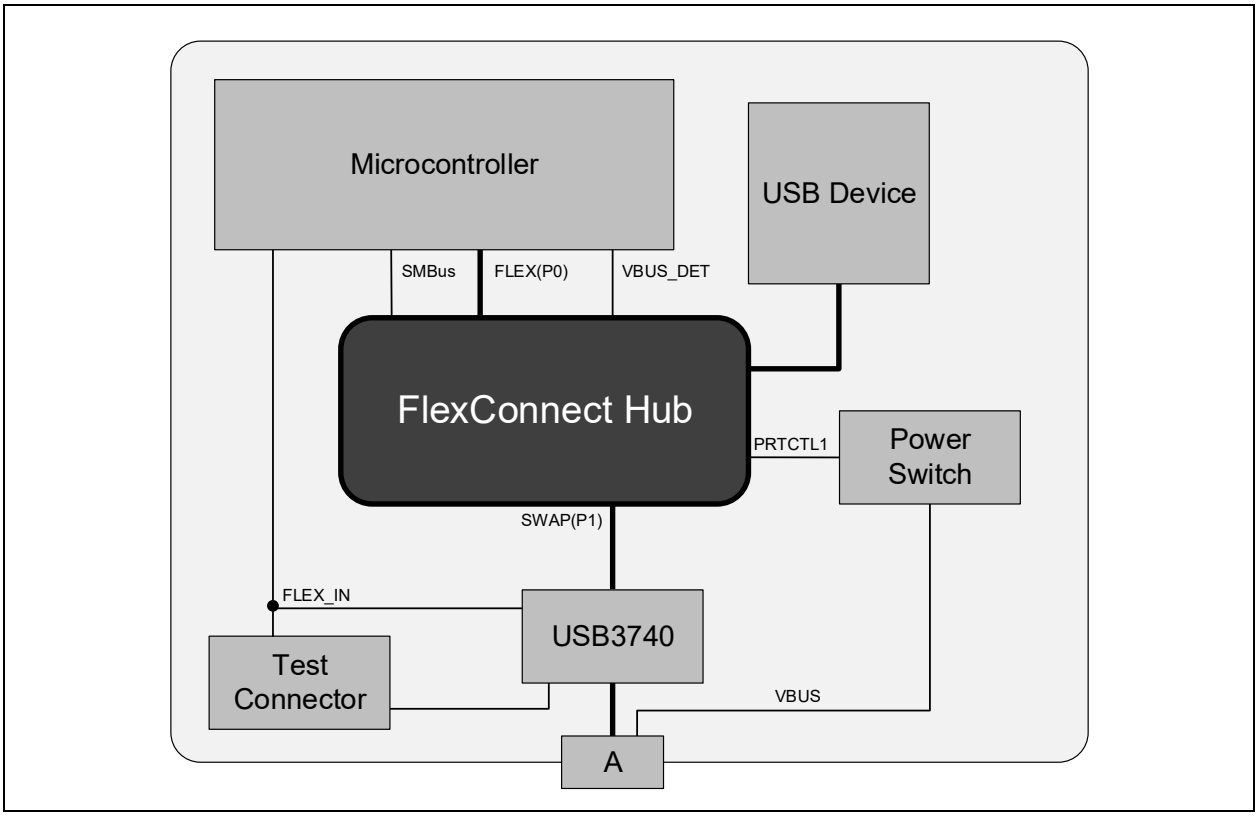
FIGURE 6: REVERSE DIRECTION CONTROL DATA FLOW



Test Mode

The software on the microcontroller may not have the ability to fully test all of the devices connected in a system. Also, an automated test system could greatly reduce the overall cost to manufacture a system. Because of this, it may be necessary to add some internal test fixtures to a system that would require the hub to change directions. The FlexConnect feature enables the tester to control the USB bus without any hardware changes to the USB system.

FIGURE 7: TEST MODE SETUP



Summary

The FlexConnect feature enables designers to develop more advanced systems that fit in today's dynamic ecosystem. Because the hub can change the direction of the data flow, the system can now differentiate itself in the highly competitive market of modern electronics. Table 3 shows the different pins and their function in each state:

TABLE 3: PIN FUNCTION SUMMARY IN EACH FLEX STATE FOR USB(8)4604 HUB

Pin	Init Port	FLEX Port
FLEX	Upstream USB	Downstream USB
SWAP	Downstream USB	Upstream USB
VBUS_DET	Connect if HIGH	Don't Care
FLEX_VBUS	Don't Care	Connect if HIGH
PRTCTL1	Port 1 Control	Pulled High
FLEXCTL1	Driven Low	Port 1 Control
FLEX_OUT	Drive Low	Pull High
FLEX_OUT_N	Pull High	Drive Low
FLEX_IN	FLEX Input	FLEX Input or Ignored

Note: FLEX_IN is ignored if the Flex state is entered through USB or SMBus. It is relevant only when it is driven high to enter the Flex state.

TABLE 4: PIN FUNCTION SUMMARY IN EACH FLEX STATE FOR USB5734/USB58XX/USB59XX

Pin	Init Port	FLEX Port
USB2UP	Upstream USB	Downstream USB
USB3UPTX	Upstream SuperSpeed transmit	Downstream SuperSpeed transmit
USB3UPRX	Upstream SuperSpeed receive	Downstream SuperSpeed receive
USB2DN1	Downstream USB	Upstream USB
USB3DN1TX	Downstream SuperSpeed transmit	Upstream SuperSpeed transmit
USB3DN1RX	Downstream SuperSpeed receive	Upstream SuperSpeed receive
VBUS_DET	Connect if HIGH	Don’t Care
FLEX_VBUS	Don’t Care	Connect if HIGH
PRTCTL1	Port 1 Control	Pulled High
FLEXCTL1	Driven Low	Port 1 Control
HOST_TYPE0	0 = USB3 host, 1 = USB2 host	Tri-state
HOST_TYPE1	Tri-state	0 = USB3 host, 1 = USB2 host
FLEX_STATE_N	Pull High	Drive Low
FLEX_STATE	Drive low	Pull High
FLEXCMD	FLEXCMD Input	FLEXCMD Input or Ignored

APPENDIX A: DOCUMENT REVISION HISTORY

TABLE A-1: REVISION HISTORY

Revision Level & Date	Section/Figure/Entry	Correction
DS00001700D (12-12-18)	All	Minor text changes throughout. Enhancement of graphics.
	SMBus Control of USB253X/ USB3x13/USB(8)4604 with FW Executing from Internal ROM Memory on page 4	Added this section.
	SMBus Control of USB57xx/ USB58xx/USB59xx and USB(8)4604 with External FlexConnect FW Execution from SPI on page 3	Updated the section title from “SMBus Control” to “SMBus Control of USB57xx/USB58xx/USB59xx and USB(8)4604 with External FlexConnect FW Execution from SPI”.
	Introduction to FlexConnect on page 1	Updated the section titles: • From “FlexConnect” to “Introduction to FlexConnect” • From “What is FlexConnect?” to “Description” • From “Where can FlexConnect be used?” to “Application”
DS00001700C (06-16-17)	All	Replaced USB5734 with USB5734/USB58xx/ USB59xx throughout document.
	What is FlexConnect?	Update to first paragraph.
	References on page 2	Added reference.
	SMBus Control of USB57xx/ USB58xx/USB59xx and USB(8)4604 with External FlexConnect FW Execution from SPI on page 3	Added notes 1 and 2.
	Digital Pin Control for USB58xx/ USB59xx on page 5	Added section.
	USB SETUP Packet on page 5	Added note.
DS00001700B (03-25-15)	All	Added USB5734 throughout document.
	Introduction to FlexConnect on page 1	Added USB5734 to list of FlexConnect devices.
	References on page 2	Added USB5734 Data Sheet to list.
	System Requirements on page 2	Added new section for USB5734-specific signals.
	SMBus Control of USB57xx/ USB58xx/USB59xx and USB(8)4604 with External FlexConnect FW Execution from SPI on page 3	Added USB5734 specific information.
	Digital Pin Control for USB5734/ USB58xx/USB59xx on page 5	Created new section specifically for the USB5734.
	USB OTG on page 7	Added USB5734-specific sentence under bullets regarding SSTX/SSRX.
	Pin Function Summary in Each Flex State for USB5734/USB58xx/ USB59xx on page 14	Added USB5734-specific pin function summary table.
DS00001700A (03-25-14)	All	Initial release

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