

# Ambiq FS USB Dongle User Guide

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**Revision 1.0**  
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#### 4. Document Revision History

Revision Number	Date	Description
1.0	June 2020	Document initial release
		-
		-
		-
		-
		-

*Table 1. Revision History*

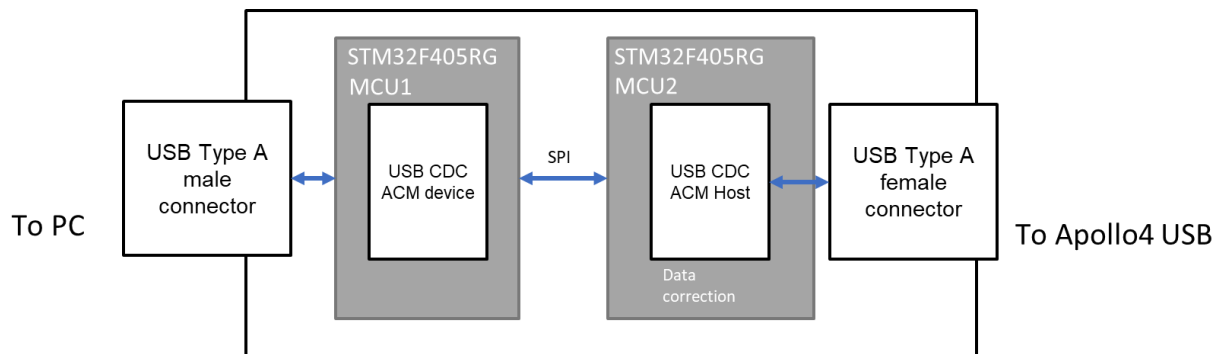
## 5. Overview

This document describes the operation and test procedure of the FS USB dongles for Apollo4 Rev. A1 silicon.

The FS USB dongles are designed and provided by Ambiq Micro together with Apollo4 Rev. A1 silicon to overcome the known 4-byte issue on the USB module of the silicon. (Please refer to silicon errata for more details)

## 6. Supported functions

The FS USB dongle is supported by two MCUs (e.g. STM32F405RG) for the data bridging. One for USB device and another for USB host, host collects data from Apollo4. The FS USB dongle implemented the mechanism to correct data sent from Apollo4 Rev. A1 silicon from USB and bridge the data to the USB host. The FS USB dongle uses a SPI interface at 24MHz for internal communication between the two MCUs.

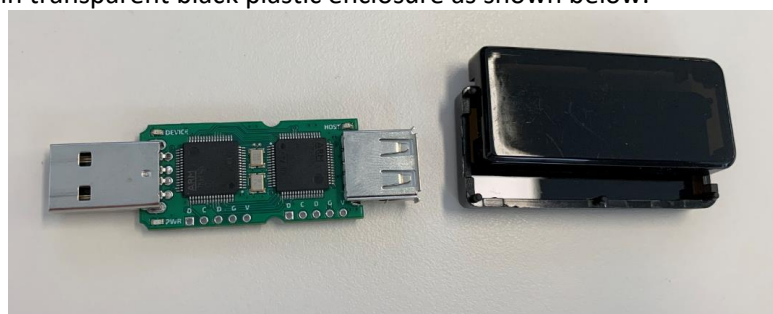


It is designed to support:

- CDC-ACM VCP channel
- Firmware/file downstream over VCP from USB host to Apollo4
- Data and log up stream over VCP from Apollo4 to USB host
- Interactive communication between USB host and Apollo4

## 7. How to use

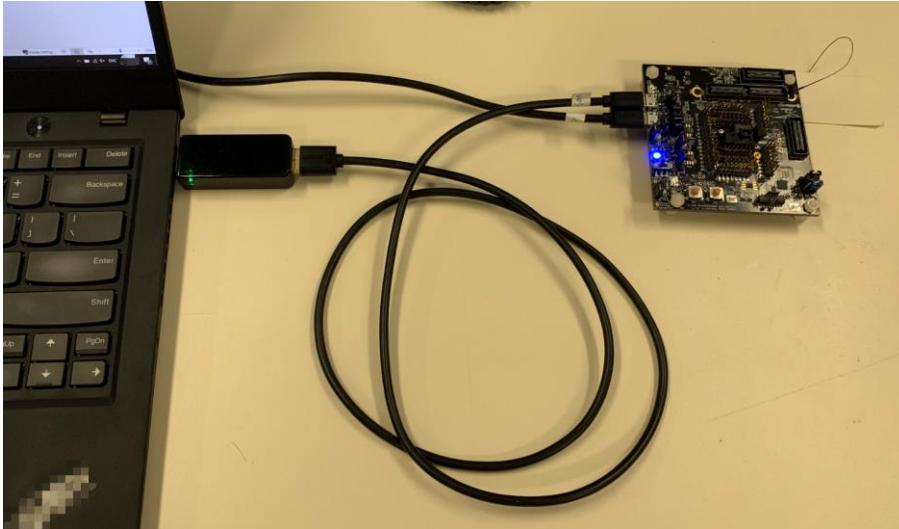
The dongle is provided with firmware preloaded. It has male and female Type A USB connectors. Dongle is enclosed in transparent black plastic enclosure as shown below:



*Figure 1. Dongle and enclosure in box*

In general, user can connect the Apollo4 Rev.A1 USB device to the female USB port of the dongle and connect the male USB port of the dongle to the USB host, e.g. A PC.

For example, using the USB dongle together with Apollo4 SIP EB board:



*Figure 2. Connection between EB and PC*

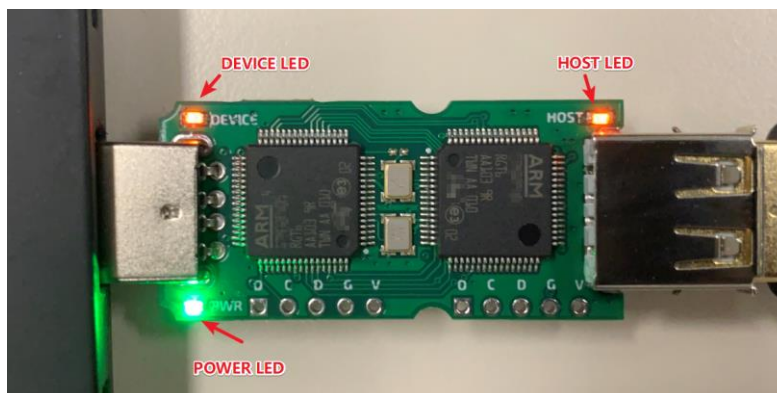
LED indicators on the dongle:

There 3 LEDs on the dongle:

*The PWR LED (Green)* is the on board 3.3V power indicator.

*The DEVICE LED (Amber)* is the USB device communication indicator, it flashes when there is USB communication between the PC host and the USB device MCU (MCU1) on the dongle.

*The HOST LED (Amber)* is the USB host communication indicator, it flashes when there is USB communication between the USB host MCU (MCU2) on the dongle and the USB device connected to it (the Apollo4 Rev. A1).



*Figure 3. LEDs on dongle*

There are 2 USB ports on the Apollo4 SIP EB as shown below:

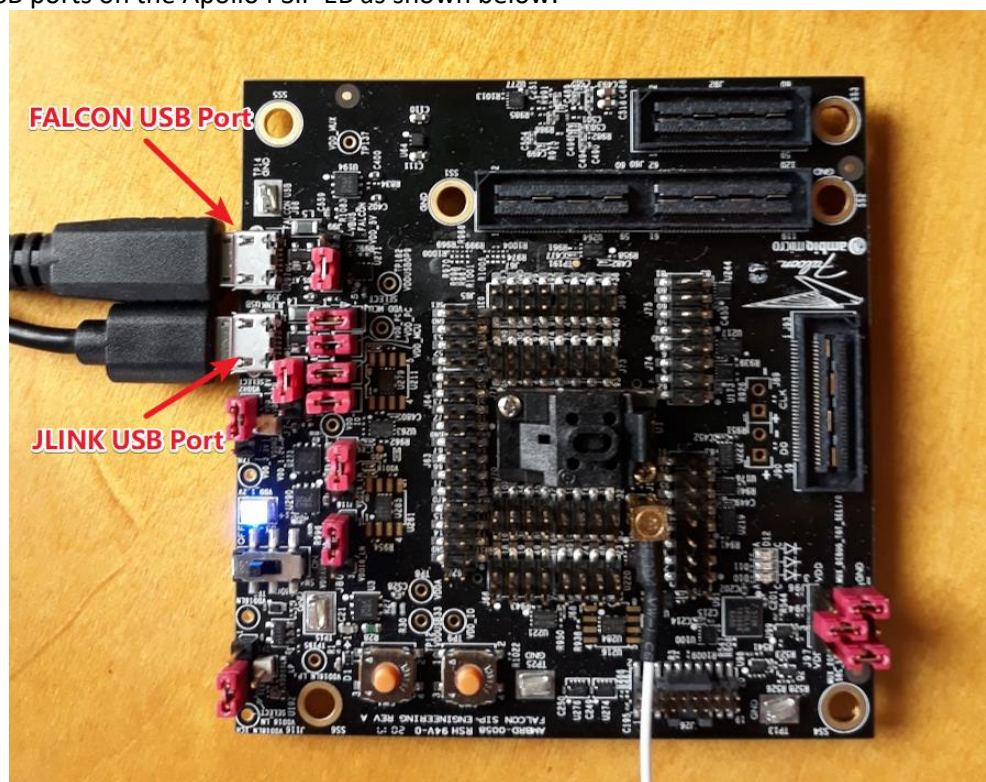


Figure 4. USB ports on EB

## - Running an existing test

AmbiqSuite SDK includes a precompiled test case of random data loopback for Apollo4 Rev.A1 together with FS USB dongle.

The test case is located in ..\tools\fs\_usb\_dongle\test\_scripts\loopback

Steps to follow:

1. Flash the precompiled binary ap4\_tinyusb\_cdc\_loopback\_example.bin into the Apollo4 SIP EB through the J-Link USB port. Note that the FS USB dongle should not ever be used on this path from the PC
2. Connect Apollo4 EB SIP FALCON USB port to the FS USB dongle's female USB port over a USB cable.
3. Run the test script ap4\_cdc\_loopback\_test.exe or ap4\_cdc\_loopback\_test.py.
4. When the script prompt "Looking for Ambiq FS Dongle:" message, connect the dongle to PC

```
=====
Random Data Loop Back Test
Ambiq Micro
www.ambiqmicro.com
Version 1.1, 2020-06-18
=====
Done

Looking for Ambiq FS Dongle: \
```

Figure 5. Test - Looking for dongle

## 5. Test will start automatically

```
=====
Random Data Loop Back Test
Ambiq Micro
www.ambiqmicro.com
Version 1.1, 2020-06-18
=====
Done

Looking for Ambiq FS Dongle: /
-- Ambiq FS Dongle found on COM45
-- Connected.
-- random seed = 8152
-- data length = 8152
17:27:01----->success: loopback
-- interation:1
-- failure: 0
-- random seed = 117
-- data length = 117
17:27:02----->success: loopback
-- interation:2
-- failure: 0
-- random seed = 5222
-- data length = 5222
17:27:02----->success: loopback
-- interation:3
-- failure: 0
-- random seed = 6600
-- data length = 6600
17:27:03----->success: loopback
-- interation:4
```

Figure 6. Test - Running



6. This test sends a random number of bytes (from 1 to 9999 bytes) of random data from PC to the Apollo4 over the USB dongle, once Apollo4 receives the data, it will loop it back to the PC. PC compares the data received with data sent and prints success when match.

## 8. Update dongle firmware

Note that from time-to-time Ambiq may release updated FS USB dongle firmware and we recommend that the latest firmware be upgraded as soon as possible.

User may update the dongle firmware via USB connection using the vDFU feature.

Steps to update:

1. Remove the USB dongle from PC.
2. Remove any connected USB device to the dongle.
3. Navigate to dongle SDK folder: ..\tools\fs\_usb\_dongle\firmware\_updater
4. Start firmware\_updater.exe

When the script prompt "Looking for Ambiq FS Dongle:" message, connect the dongle to PC.

```
=====
FS USB Dongle Firmware Update
Ambiq Micro
www.ambiqmicro.com
Version 1.1, 2020-06-18
=====
----          DO NOT UNPLUG DONGLE DURING UPDATE  !          ----
=====
Looking for Ambiq FS Dongle:  |
```

Figure 7. Update - Looking for dongle

5. Input 2 for action "Update dongle firmware", and hit enter.
6. Select the update firmware package from the open file window.  
The update firmware should be named *dfu\_release\_binary\_vxx.x.bin*

7. Update will start and finish automatically.

```
=====
FS USB Dongle Firmware Update
Ambiq Micro
www.ambiqmicro.com
Version 1.1, 2020-06-18
=====
----- DO NOT UNPLUG DONGLE DURING UPDATE ! -----
=====
Looking for Ambiq FS Dongle: \
Looking for Ambiq FS Dongle: /
-- Ambiq FS Dongle found on COM45
-- Connected.
Select action:
1: Read dongle firmware version (RFU)
2: Update dongle firmware
2
Select the firmware file. (*.bin)
C:\Program Files\Ambiq Micro\tools/fs_usb_dongle/firmware_updater/dfu_release_binary_v2.0.bin
-- MCU1 firmware version in package: 2
-- MCU2 firmware version in package: 2
Starting vDFU
Waiting for Dongle to enter boot mode...
-- Loading Firmware: 100%
-- Firmware loaded, waiting for boot...
Firmware Update Done.
You may now remove the dongle and close this program.
```

Figure 8. Update - Finished

8. When finished you can close the window and unplug the USB dongle.
9. **Do not remove the dongle from the USB port during a firmware update process.**

- **Update firmware via SWD**

When it is necessary to update the bootloader in each MCU of the dongle, user may need to update the dongle firmware over SWD connection.

Steps to update:

1. Remove the dongle from PC.
2. Open the plastic enclosure of the dongle.
3. There are 2 MCUs on the dongle, each MCU has SWD port expanded out.

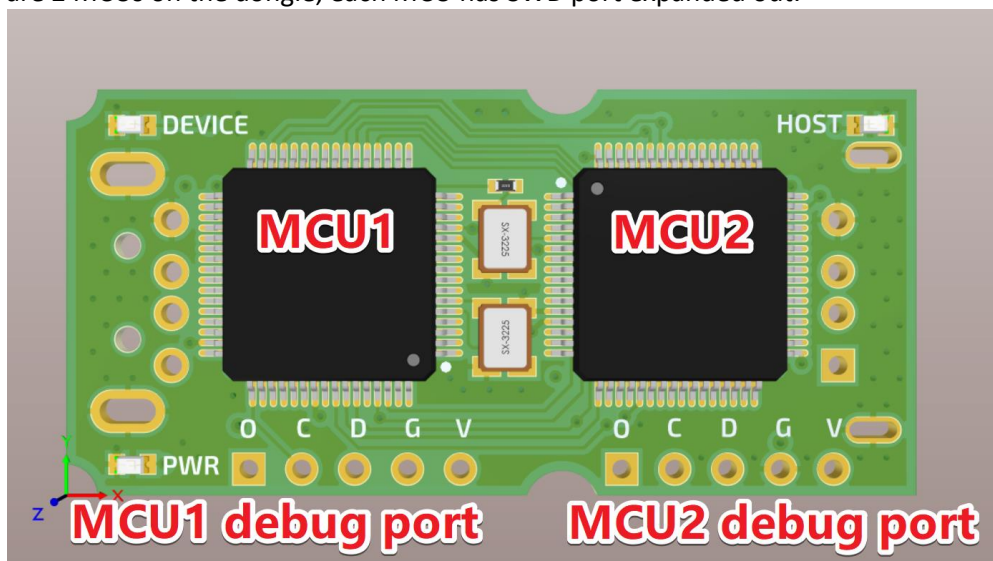


Figure 9. Dongle MCU debug port

Debug port signal sequence (from left to right):

O = SWO, C = SWDCK, D = SWDIO, G = GND, V=VREF (3.3V)

You can use a JLINK debugger or any Apollo EVB with JLINK OB to program the MCUs on the dongle:

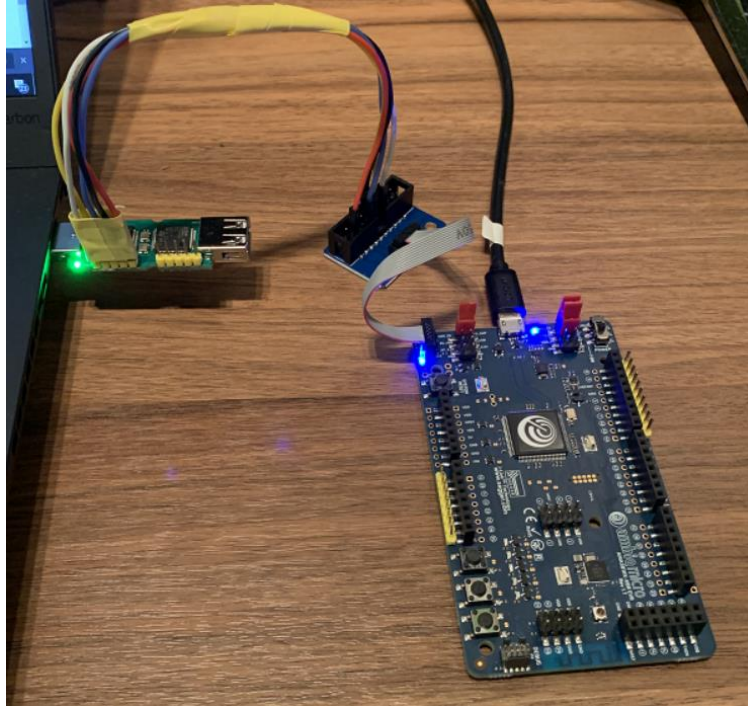


Figure 10. Connect debugger to dongle MCU

4. Plug in USB dongle to a USB port and connect debugger to MCU1 (USB Device).
5. Flash MCU1 firmware using J-Flash lite.  
 Target MCU = STM32F405RG  
 SWD=4000KHz  
 Target address = 0x08000000  
 Once finished, it is recommended to unplug the dongle and plug in again.  
 (To make sure MCU1 is power cycled and running, instead of staying in a reset state.)  
 Dongle MCU firmware for SWD is located in `..\tools\fs_usb_dongle\dongle_firmware` folder.  
 Firmware named `F405RGT_CDC_DEVICE_Dongle_Download_vxx.bin`
6. Flash MCU2 firmware using J-Flash lite, same settings as above.  
 (Be sure to flash MCU1 first, though all dongles are preloaded with firmware, if MCU1 does not have proper firmware inside and running, MCU2 may not be properly powered.)  
 Dongle MCU firmware for SWD is located in `..\tools\fs_usb_dongle\dongle_firmware` folder.  
 Firmware named `F405RGT_CDC_HOST_Dongle_Download_vxx.bin`

## 9. Known Issues:

We have also come across some issues when using this setup, as listed below:

- Status update of Apollo4 USB

- The dongle does not report the status of a connection. If during operation, Apollo4 is unplugged from the dongle, leaving only dongle connected to the PC, the PC software may not know about this disconnect event.
- Get line commands
  - Get line commands from PC are terminated at dongle, and not relayed to Apollo4. e.g. setting baudrate information will not be bridged to Apollo4.
- Half duplex communication mode.
  - The inter-MCU SPI communication on the dongle is half-duplex, and hence the expected USB traffic is also half-duplex.
- Apollo4 device info not reported to PC (e.g. PID/VID)
  - If Fitbit PC software is checking PID/VID information of a device, it will only read PID/VID information of the dongle
- VCP exception not handled
  - If there is any unexpected VCP stop event, user may have to unplug and plug back the dongle to recover from the event.
  - During our test, such “unexpected event” only happens when a key interrupt (ctrl+c) happens during test script running. If in Fitbit’s use case, there is no such event, there should not be any issues.

These issues do not affect our testing, and we’re not sure if they will cause issues with Fitbit usecase. While we’re still working to resolve these, it would be good to get your perspective, if you think any of these may be important to consider.