UPD301C PIM Sink Demo Read Me

Microchip Technology, Inc.

Microchip Technology, Incorporated
2355 W. Chandler Boulevard
Chandler, Arizona 85224
480/792-7200

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1.0	16-June-2021	Initial version

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1. Software License Agreement

2. Terms and Abbreviations

Term	Definition
PSF	Universal Serial Bus Power Delivery Software Framework
EVB	Evaluation Board
PD	Power Delivery
IDE	Integrated Development Environment
PDO	Power Data Object
PM-PD	Power Module-USB Power Delivery
LED	Light Emitting Diode
PIO	General Purpose Input Output

3. Introduction

Microchip's USB Power Delivery Software Framework (PSF) is a configurable USB PD solution that is compliant to USBPD 3.0 specification.

PSF Sink application support basic USB-PD sink functionality with two modes. They are Higher wattage at higher voltage (Mode A) and Higher wattage at lower voltage (Mode B).

This document is intended to guide a user on setting up the PSF-EVB with EV71C90A PIM to work properly with Sink version of PSF along with a demonstration of a PD device attached to the PSF-EVB.

4. Prerequisites

Hardware:

1) Microchip PSF Evaluation Board (PSF-EVB)

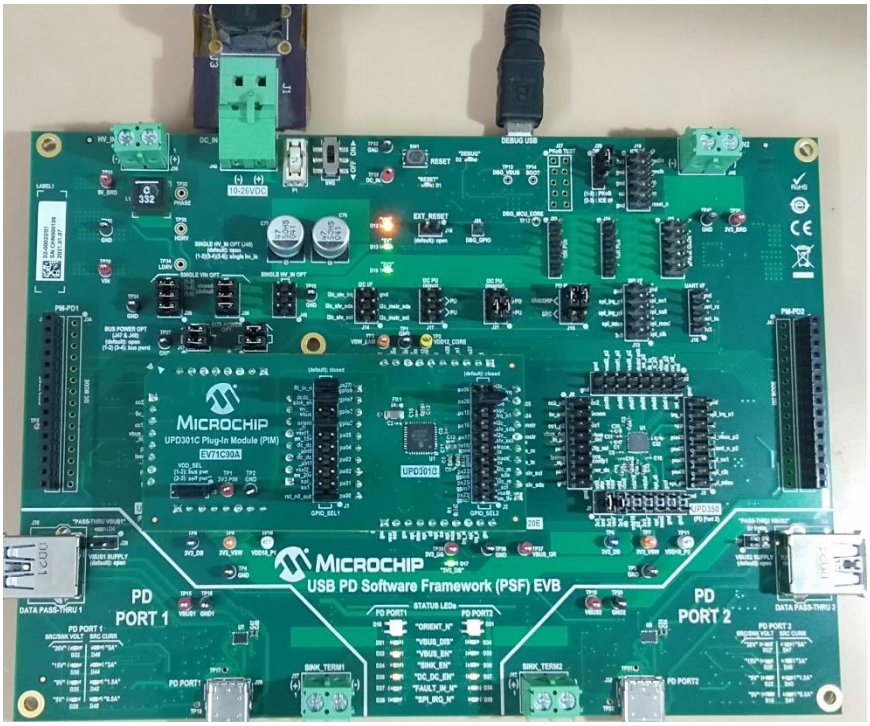

Figure 4.1 Microchip PSF Evaluation Board

2) Microchip UPD301C Plug-In Module

Figure 4.2 UPD301C Plug-In Module

3) Power Adapter with 24V, with 3A to 6.25A output rating

Figure 4.3 Power Adapter with 24V, 6.25A output capacity

4) USB-C to USB-C cable

5) USB Power Delivery capable Phones or Laptops

6) Atmel ICE Debugger kit

Figure 4.5 Atmel-ICE Debugger Kit

5. Setting up the PSF-EVB board for “UPD301C_PIM_Sink”

1. Connect the PIM according to the silk label marking on PSF EVB as shown in the Figure 5.1.

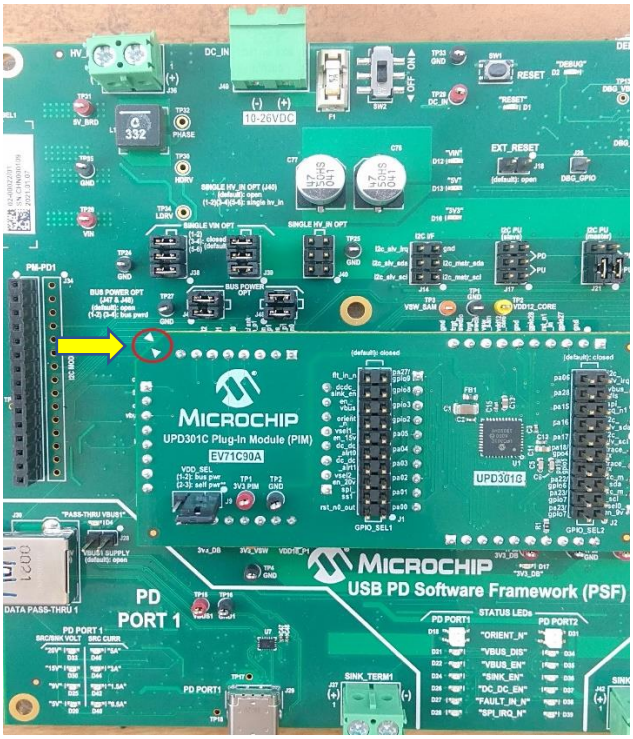

Figure 5.1 PIM Connection

2. Ensure the following jumpers are connected in PSF-EVB before proceeding to next step. An image of PSF-EVB with all the required jumper connections highlighted is shown in Figure 5.2.

Jumper	Pins
J38	1-2, 3-4, 5-6
J39	1-2, 3-4, 5-6
J21	1-3, 2-4
J15	3-5, 2-6
J47	1-2, 3-4
J48	1-2, 3-4
J20	1-2
J7	1-2, 3-4
J9 on PIM	1-2
GPIO_SEL1 on PIM	1-2 13-14 17-18 19-20
GPIO_SEL2 on PIM	17-18

Table 5.1 PSF-EVB Jumper Connections

Figure 5.2 PSF-EVB with jumper connections highlighted

3. Connect power adapter to J49 of the PSF-EVB

4. Connect a USB Micro-B cable to “DEBUG USB” which on the top of the board and connect the other end USB Type-A to the laptop.

5. The whole connection looks like,

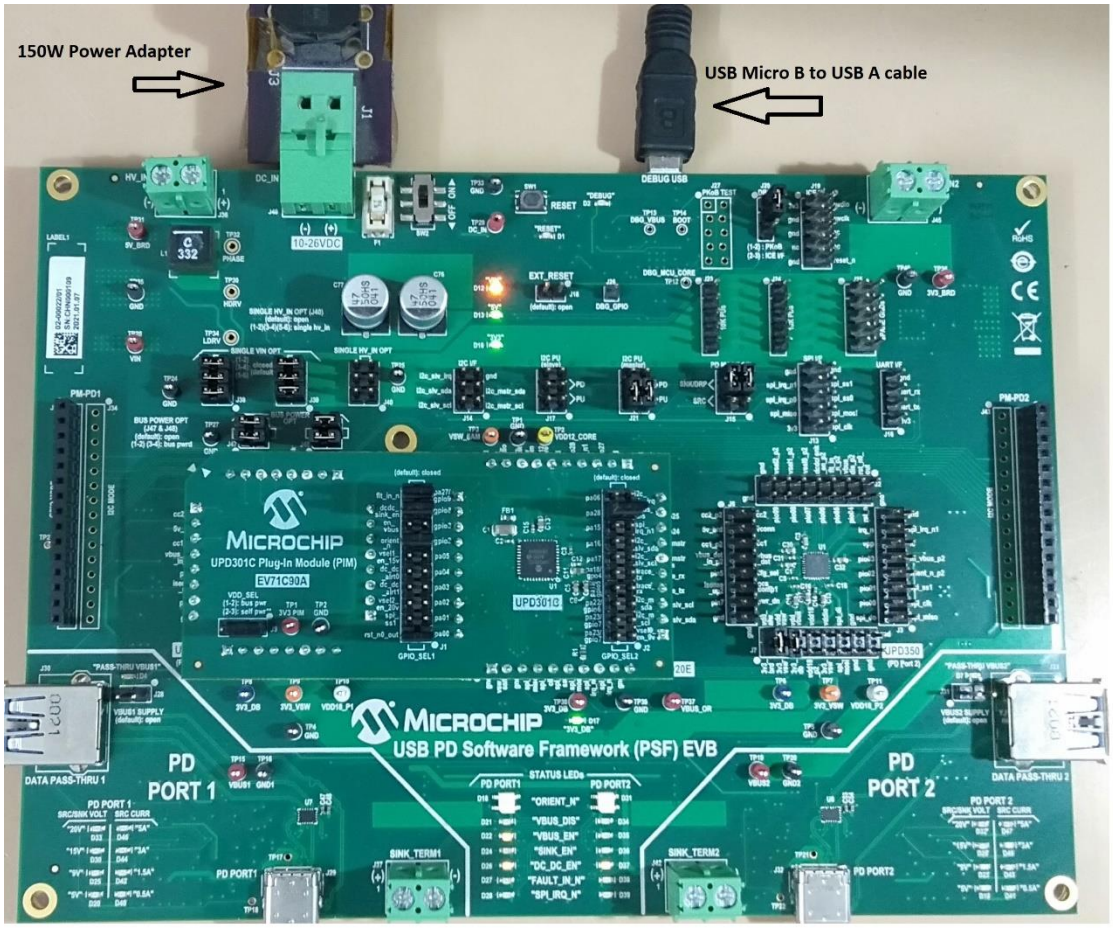

Figure 5.3 Full Setup

6. Running the demo

Refer Getting Started with PSF document for the detailed steps on setting up the build environment, building the Sink PSF project and programming the hex file in the PSF-EVB.

Refer Appendix 8.2 of Getting Started with PSF to change any SAMD20 Harmony configuration. Refer 'Boot time Configuration' section of PSF User Guide to change any configuration parameters.

1. Ensure all the jumpers are in place and Power on the PSF-EVB.

2. Program the UPD301C_PIM_Sink.X.production.hex file by following the steps mentioned in section 8 of Getting Started with PSF

3. Connect a PD Source device to Port 1 of PSF-EVB using a USB-C to USB-C cable.

4. The image demonstrates a scenario where Microchip's UPD301B_Dual_Source_AE has been connected to Port 1.

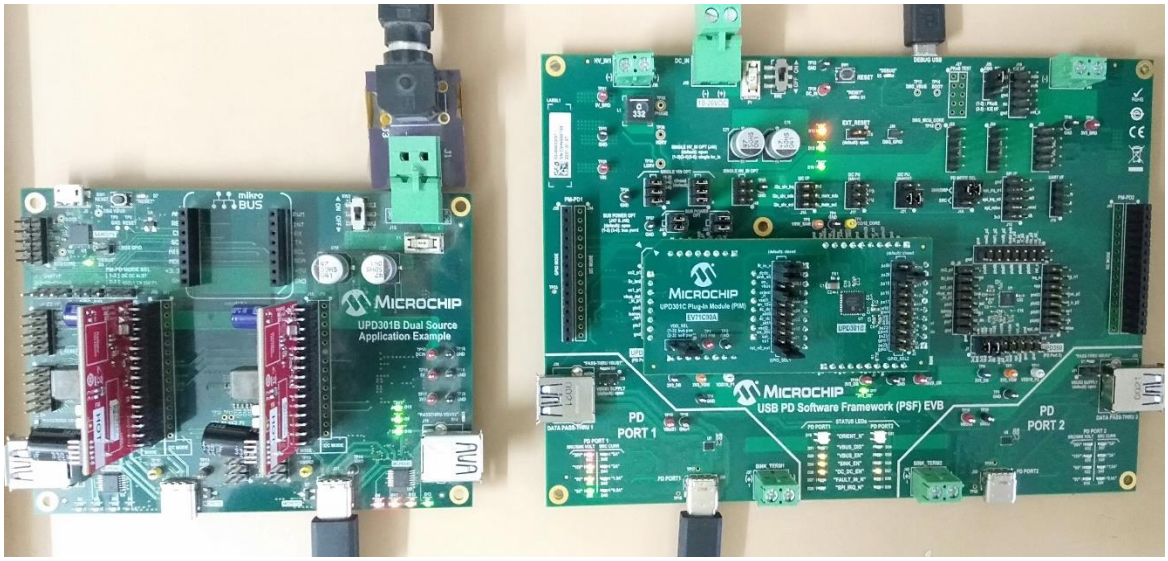

Figure 6.1 A PD source connected to port 1

7. Expected Results

Once the hex file is programmed, the SPI_IRQ_N LEDs in port1 flash and then turn off and DC_DC_EN LED, VBUS_EN LED will glow.

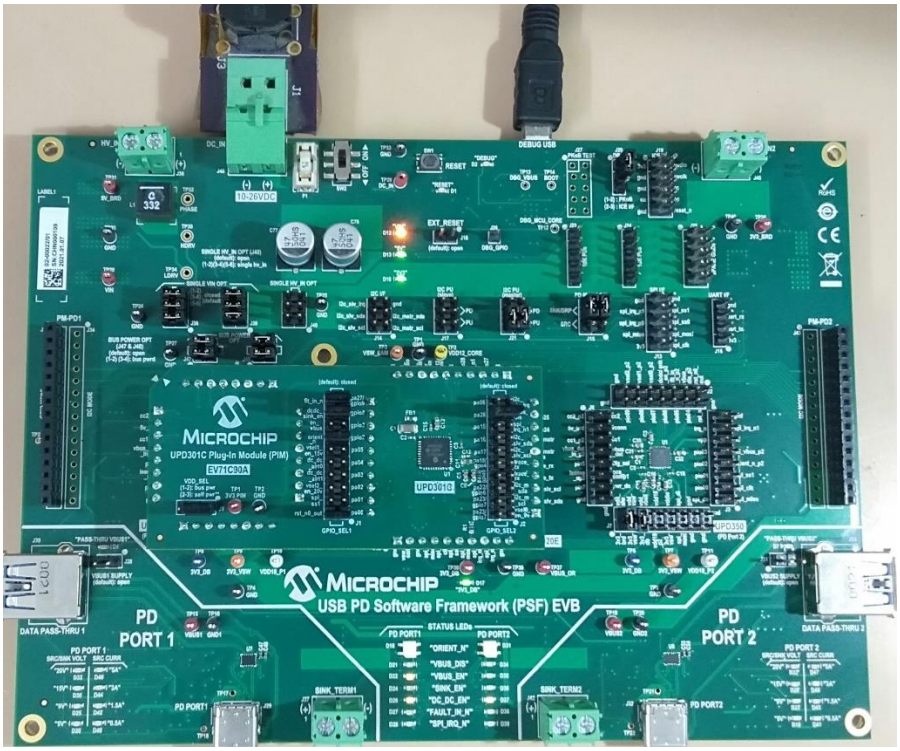

Figure 7.1 Status LEDs after power on

1. Once the Source PD Device is attached to a PD port, the device gives out 5V followed by Source capabilities.

2. PSF request for suitable PDO from source capability based on the configuration. PD negotiation takes place if the source accepts the request and sources the requested power.

3. Once an explicit power contract negotiation is in place, the PSF gets enough power for charging. PDO status LEDs will turn ON indicating the negotiated voltage as shown in Figure 7.2.

PDO	Status LED
5V	Port 1 – D20
9V	Port 1 – D25
15V	Port 1 – D30
20V	Port 1 – D33

Table 7.1 PDO Status LEDs

Example with Port 1: If 5V is negotiated by the device, LED in the D20 of Port 1 PDO will glow. If 9V is negotiated, then LEDs in D20 and D25 will glow. In case of 15V, LEDs in D20, D25 and D30 will glow. If 20V is negotiated, all the LEDs will glow.

4. The DAC indicator will indicate the implicit/negotiated current capability of the attached source partner. In PSF EVB, GPIO_SEL1.5 is the pin corresponding to DAC indicator. The table below relates the negotiated current with DAC indicator pin's output voltage.

S. No	Negotiated Current	DAC Indicator's output
1.	Less than 0.5A	0 V
2.	Greater than 0.5A but less than or equal to 1.5A	0.25 V
3.	Greater than 1.5A but less than or equal to 2A	0.75 V
4.	Greater than 2A but less than or equal to 3A	1 V
5.	Greater than 3A but less than or equal to 4A	1.5 V

6.	Greater than 4A but less than or equal to 5A	2 V
7.	Greater than 5A	2.5 V

Table 7.2 DAC indicator

In our case, UPD301B_Dual_Source_AE is capable of sourcing 20V@3A. Therefore, GPIO_SEL1.5 in PSF EVB, which is the DAC indicator pin, will be driven with 1V.

5. Three GPIO indicators are designed to indicate the status of sink operation.

S. No	GPIO Indicator	Pin number in PSF EVB	Role
1.	1.5A indicator	GPIO_SEL1.3	Asserts when current capability/negotiated is 1.5A or more.
2.	3A indicator	GPIO_SEL2.16	Asserts when current capability/negotiated is 1.5A or more.
3.	Capability mismatch indicator	GPIO_SEL1.9	Asserts when PD negotiation is complete and there was a capability mismatch with the selection.

Table 7.3 GPIO indicators

Since, our source partner, UPD301B_Dual_Source_AE 20V@3A, it is a perfect match. So, 3A indicator, PD Negotiation indicator will go high in our case. 1.5A indicator and capability mismatch indicator GPIOs will remain low.

Figure 7.2 Status LEDs after negotiation