PSF DRP Demo Read Me

Microchip Technology, Inc.

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

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1.06	12-Aug-20	Initial version

Table of Contents

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
GPIO	General Purpose Input Output
DRP	Dual Role Power

3 Introduction

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

PSF DRP application includes PD DRP functionality with the support for Boot time configuration parameters, Data Role Swap, VCONN Swap, Power Role Swap and GPIO based DC-DC controller for port power control. This document is intended to guide a user on setting up the PSF-EVB to work properly with PSF DRP application along with a demonstration of a PD device attached to the PSF-EVB.

4 Prerequisites

Hardware:

1) Microchip PSF Evaluation Board (PSF-EVB)

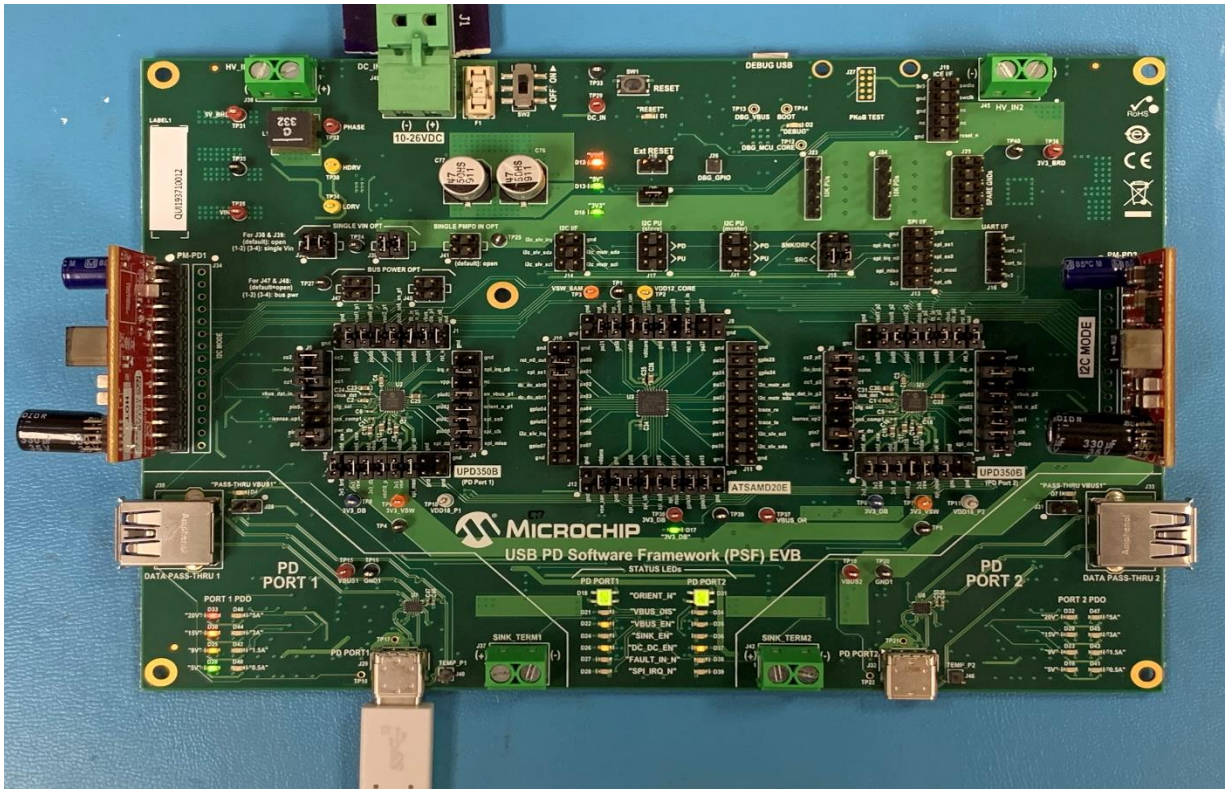

Figure 4.1 Microchip PSF Evaluation Board

2) 2 Microchip UNG 8122 Rev D PM-PD Cards – 1 per port

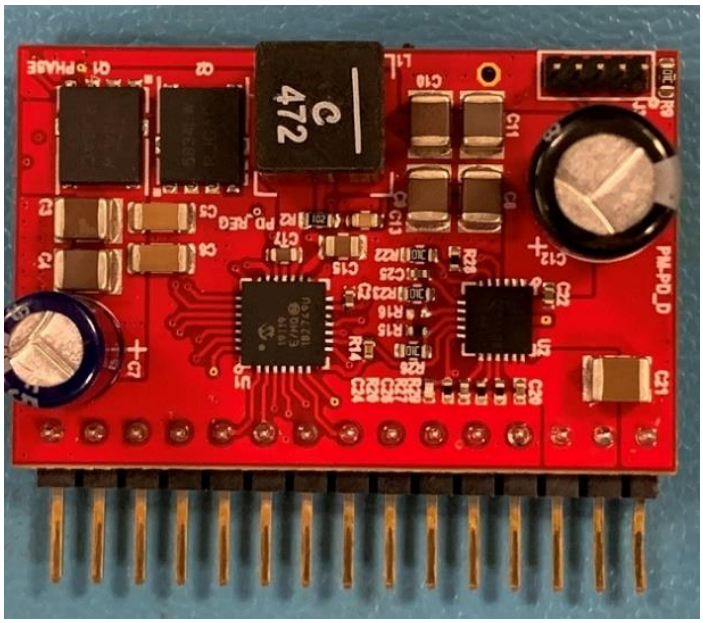

Figure 4.2 Microchip UNG 8122 Rev D PM-PD Card

3) 150W Power Adapter with 24V, 6.25A output

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

4) USB-C to USB-C cable

5) Atmel ICE Debugger kit

Figure 4.4 Atmel-ICE Debugger Kit

6) USB Power Delivery capable Phones or Laptops

5 Setting up the PSF-EVB board for “PSF_EVB_DRP”

1. Connect PM-PD cards to J35 and J44 of the PSF-EVB in correct orientation as shown in Figure 5.1

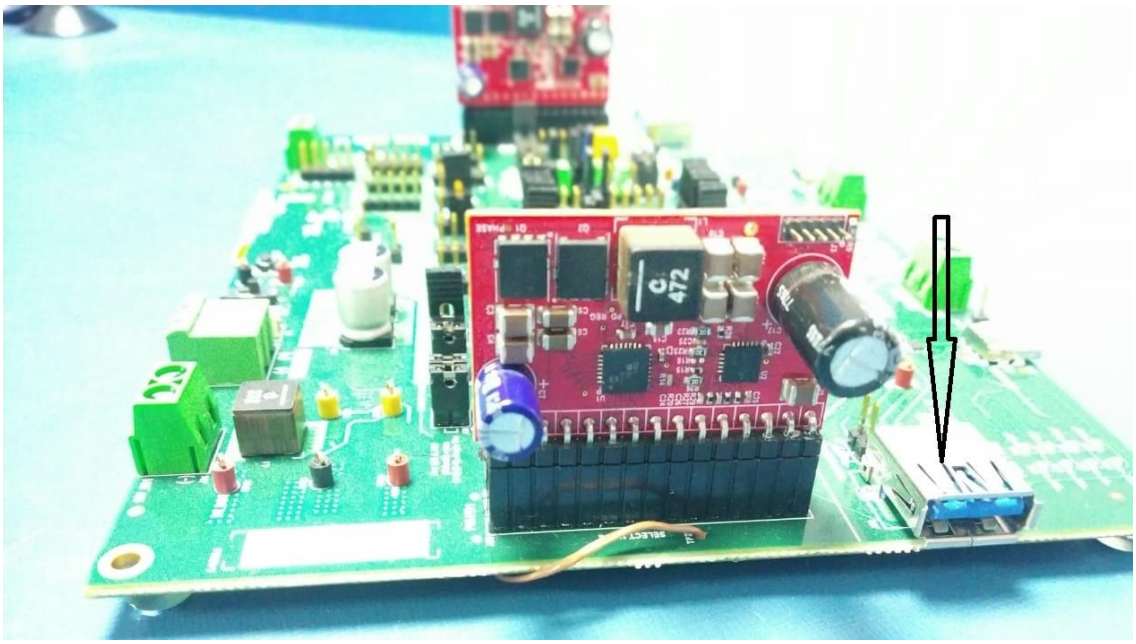

Figure 5.1 PM-PD Orientation

2. Ensure the following jumpers are connected in PSF-EVB before proceeding to next step.

Jumper	**Pins**
J38	1-2, 3-4
J39	1-2, 3-4
J17	3-5, 4-6
J21	3-5, 4-6
J15	3-5, 5-6
J1	1-2 3-4 5-6 9-10 11-12 13-14
J4	1-2 3-4 5-6 7-8 9-10 13-14
J5	1-2 3-4 5-6

	7-8 9-10 13-14
J8	1-2 3-4 5-6 7-8 9-10 11-12
J9	5-6 9-10 11-12 13-14 15-16 17-18
J10	3-4 5-6
J11	11-12 13-14
J12	3-4 5-6 7-8 9-10 11-12 13-14 15-16 17-18
J2	1-2 3-4 5-6 9-10 11-12 13-14
J3	1-2 3-4 5-6 7-8 9-10 13-14
J6	1-2 3-4 5-6 7-8 9-10 13-14
J7	1-2 3-4 5-6 7-8

	9-10 11-12

Table 5.1 PSF-EVB Jumper Connections

3. Connect J1.7 to J10.14 and J9.8 to J2.7 to enable DC_DC_EN_0 and DC_DC_EN_1 functionality respectively

4. Connect 150W power adapter to J49 of the PSF-EVB

5. Connect one end of Atmel ICE to PC using USB Micro-B cable and the other end to J19 of PSF-EVB. A dot (encircled in image) will be present in Atmel ICE Adapter board which gives an indication that this pin should be connected to 3v3 of J19. The right way to connect is,

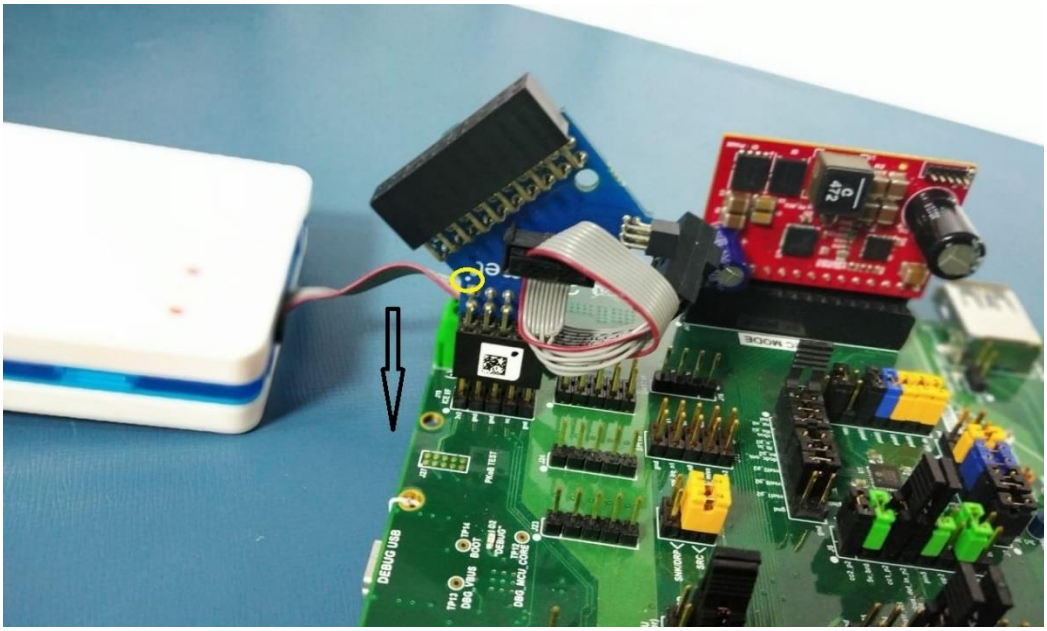

Figure 5.2 Connecting Atmel-ICE Debugger to J19

6. The whole connection looks like,

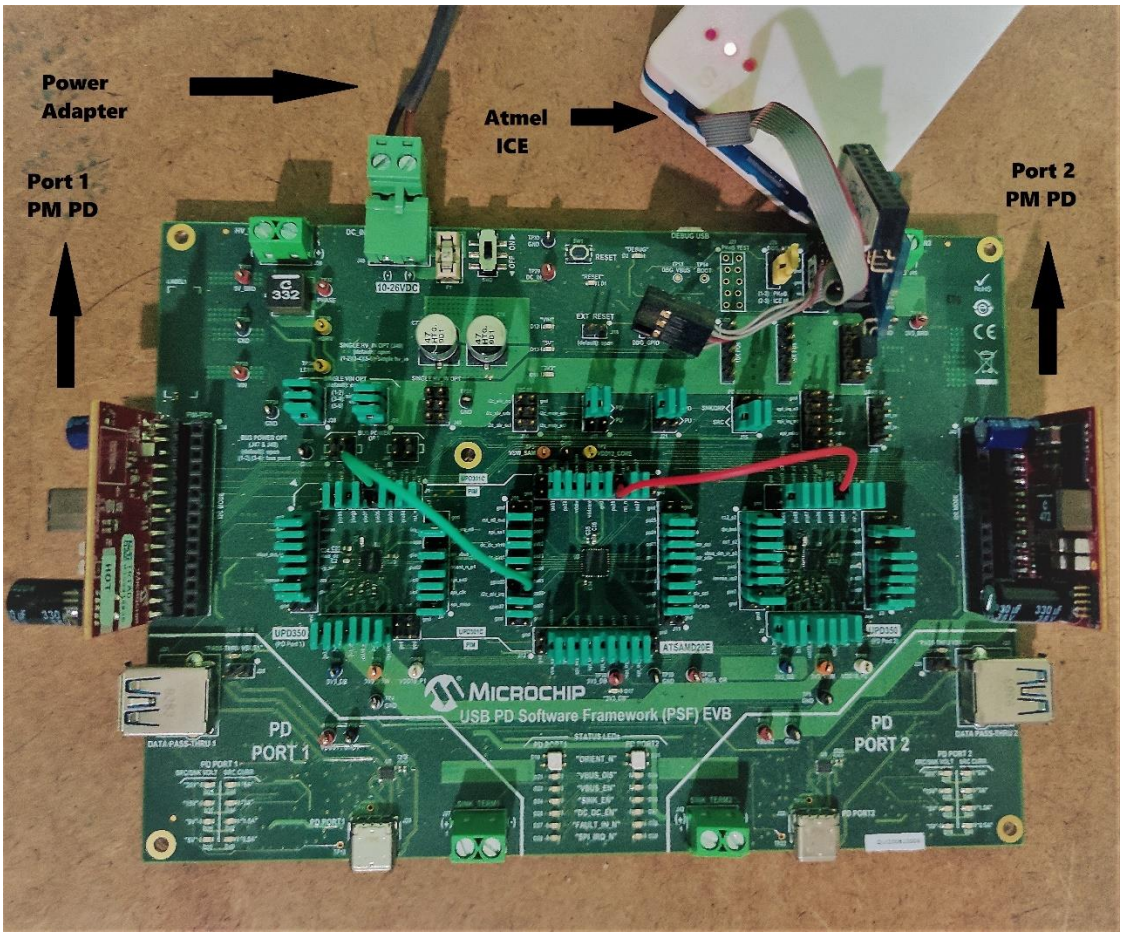

Figure 5.3 PSF-EVB Full Setup

6 Running the demo

Refer Getting Started with PSF document for the detailed steps on setting up the build environment, building the DRP 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 PSF_EVB_DRP.X.production.hex file by following the steps mentioned in section 8 of Getting Started with PSF

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

4. Connect another PD device to Port 2 of PSF-EVB using a USB-C to USB-C cable.

5. This document demonstrates two scenarios with PSF DRP Firmware.

   Scenario 1: Dell XPS laptop (DRP capable partner) connected to PSF DRP Port 2 using a USB-C to USB-C cable

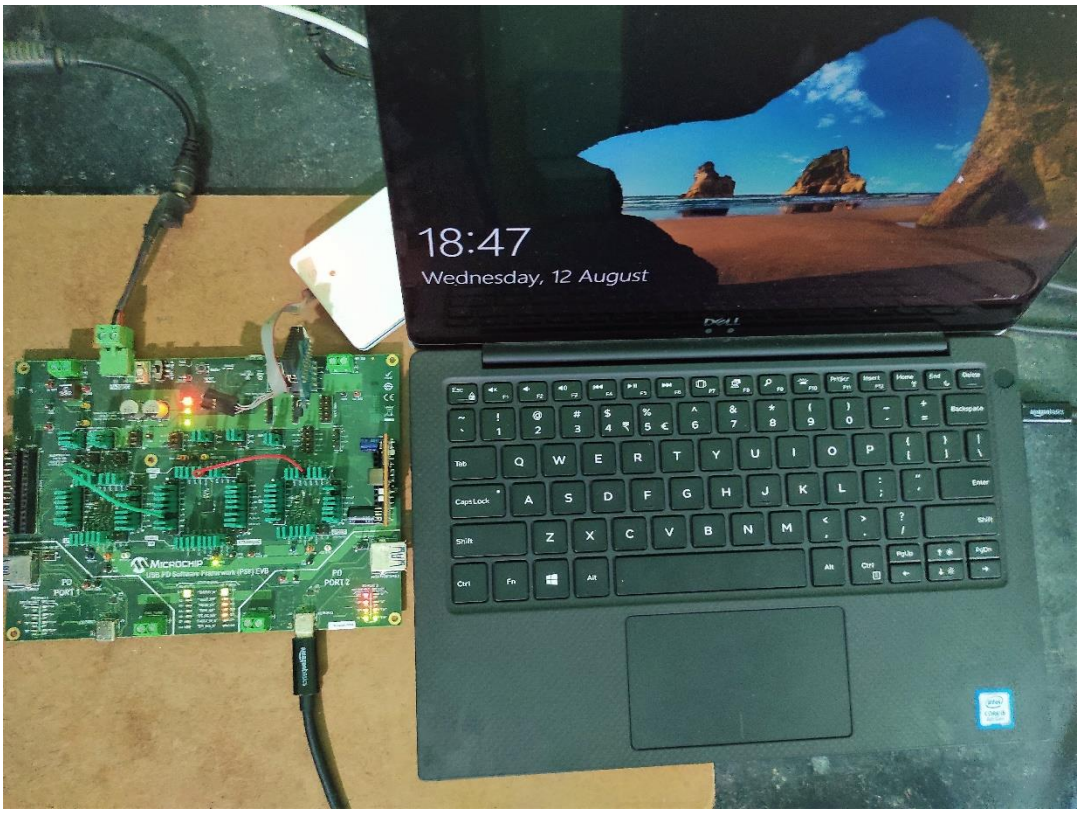

Figure 6.1 Dell XPS connected to PSF DRP Port 2

Scenario 2: Two DRP ports of PSF-EVB connected using a USB-C to USB-C cable

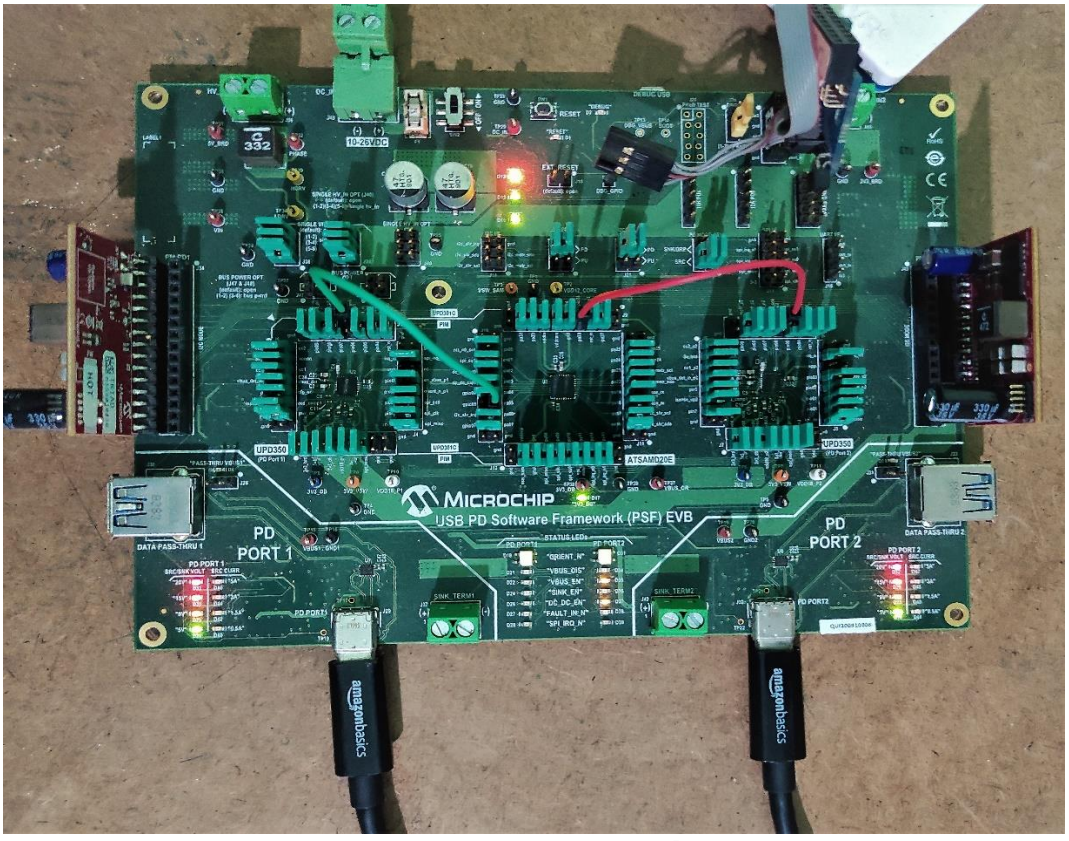

Figure 6.2 PSF DRP Port 1 connected to PSF DRP Port 2

7 Expected Results

1. Once the hex file is programmed, the SPI_IRQ_N LEDs in both the ports flash and then turn off. None of the other LEDs will be ON when the ports are in unattached state.

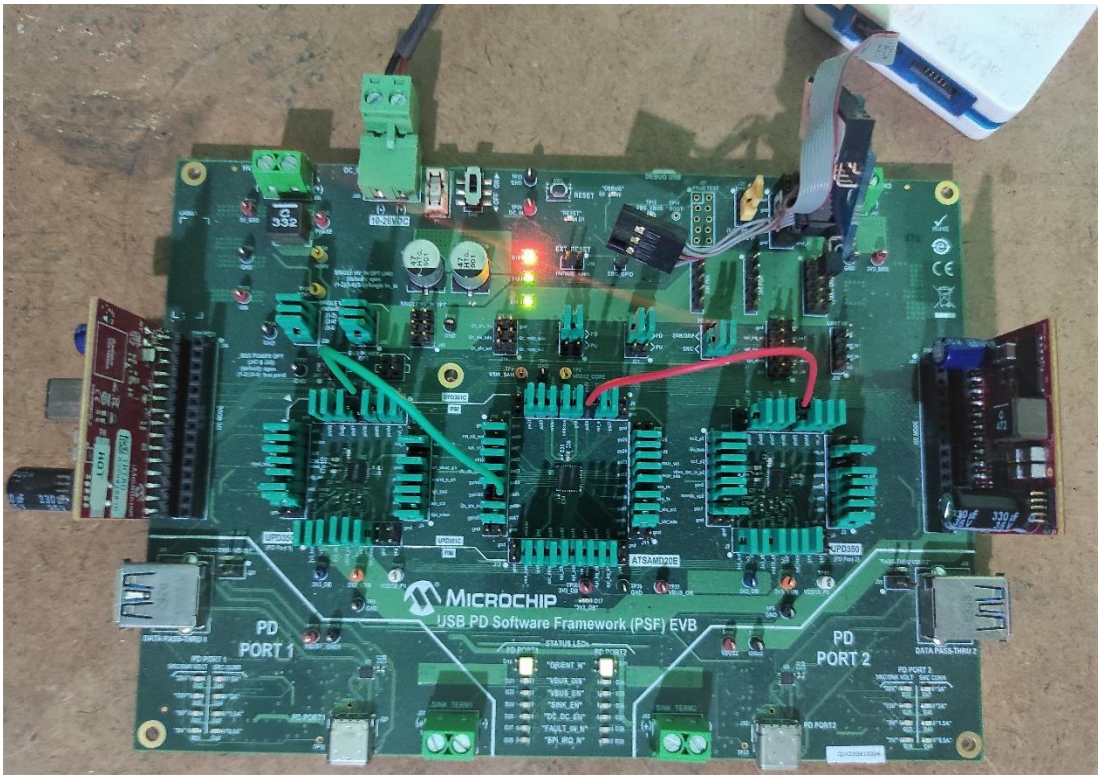

Figure 7.1 Status of LEDs after power on

2. If a Source only PD port partner is attached, PSF would become the Sink. If a Sink only PD port partner is attached, PSF would become the Source. If a DRP port partner is attached, there are chances that PSF would either attach as Source or as Sink depending on partner's power role.

3. The behaviour of PSF DRP port when attached as Source and Sink is described below.

   PSF DRP port attached as Source:

   1. EN_VBUS and DC_DC_EN LEDs of the port will turn on.

   2. Source capabilities will be advertised by the PSF, followed by a PDO request from the device.

   3. PSF checks if the PDO requested by the device is within the range of its capabilities. If so, it accepts the request and starts driving the requested voltage in the VBUS.

   4. Once an explicit power contract negotiation is in place, the device starts charging. PDO status LEDs will turn on indicating the negotiated voltage as shown in Figure 7.2

5. The following image depicts the status of Port 2 when attached as Source. Here the negotiated voltage is 20V

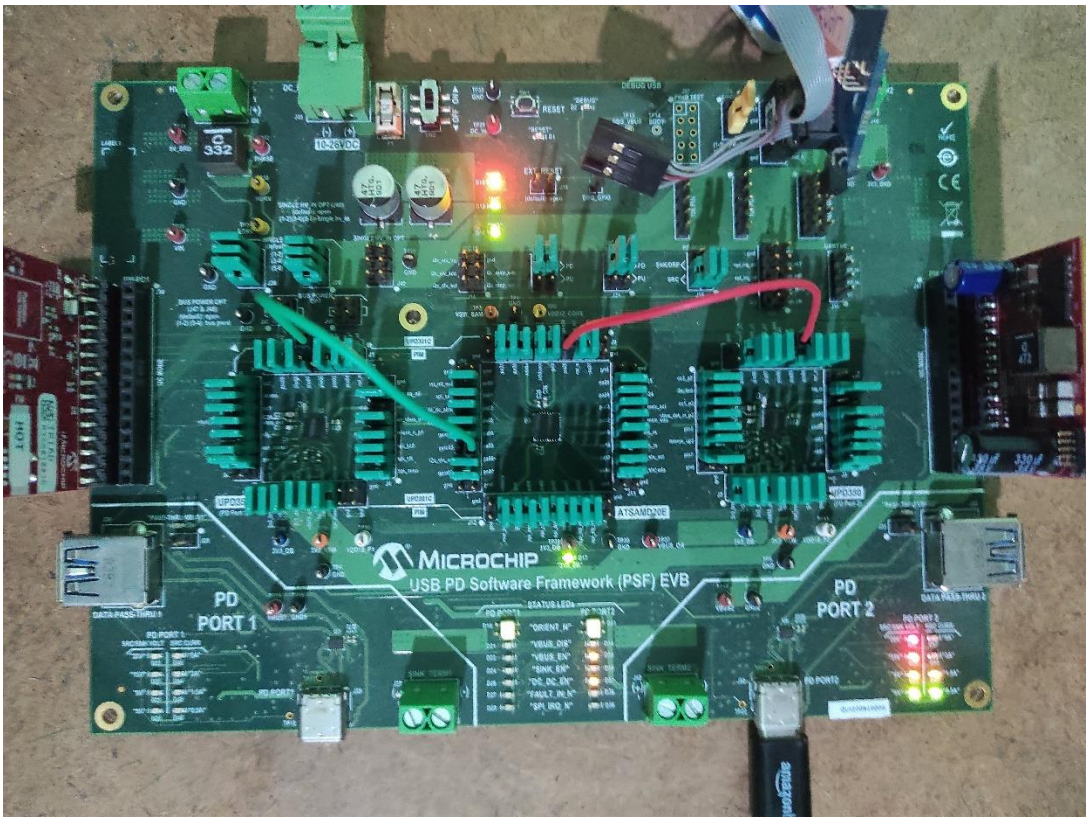

Figure 7.2 VBUS_EN, DC_DC_EN and PDO Status LEDs when attached as Source

PSF DRP port attached as Sink:

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

2. PSF requests for suitable PDO from source capability based on the configuration. PD negotiation take 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 7.3

4. The following image depicts the status of Port 1 when attached as Sink. Here the negotiated voltage is 5V.

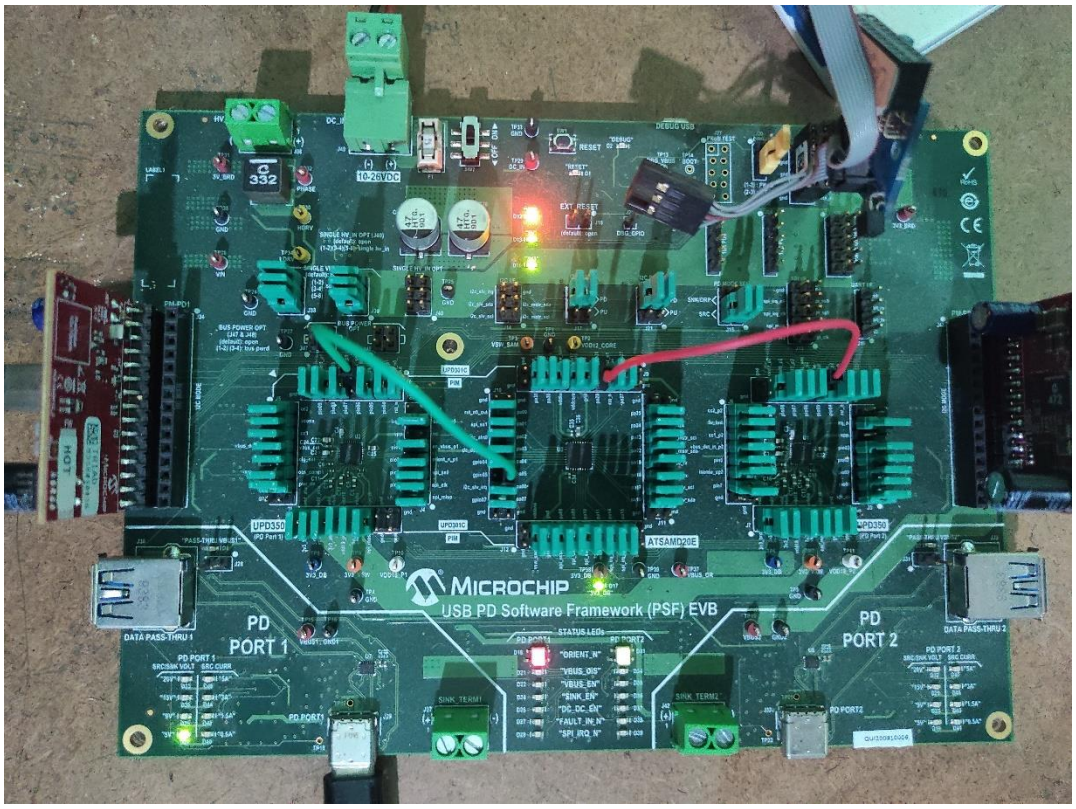

Figure 7.3 PDO Status LEDs when attached as Sink

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.

PDO	Status LED
5V	Port 1 – D20, Port 2 – D19
9V	Port 1 – D25, Port 2 – D23
15V	Port 1 – D30, Port 2 – D29
20V	Port 1 – D33, Port 2 – D32

Table 7.1 PDO Status LEDs