PSF Source Lite Demo Read Me

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REV	DATE	DESCRIPTION OF CHANGE
0.92	02-Dec-19	Initial version
0.95	07-Jan-20	Renamed the title of document Changed the order of sections - Software License, Terms and Abbreviations and Introduction Added section 4 Prerequisites Added jumpers list and modified the images in section 5 Modified the image in section 6 Added images in section 7 Removed Appendix section – Harmony Framework usage
1.00	26-Feb-20	Updated document version to align with v1.00 release
1.01	16-Mar-20	Updated document version and title to align with v1.01 release. Updated sections 3, 5 and 6 specifics to Source Lite
1.04	26-May-20	Updated document version to align with v1.04 release
1.05	24-Jul-20	Updated document version to align with v1.05 release
1.06	12-Aug-20	Updated document version to align with v1.06 release
1.07	08-Sep-20	Updated document version to align with v1.07 release
1.12	22-Sep-21	Updated document version to align with V1.12 release

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

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 Source Lite application includes PD Source functionality with the support for Boot time configuration parameters and GPIO based DC-DC controller for port power control. This document is intended to guide a user on setting up the USB Power Delivery Software Framework Evaluation kit with part number EV65D44A to work properly with PSF Source Lite application.

EV65D44A consists of the following:

1 x USB Power Delivery Software Framework EVB (EVB-PSF)
2 x One-Hot Vertical Mount PM-PDs (PMPD-VM-HOT)

4 Prerequisites

Hardware:

1) USB Power Delivery Software Framework Evaluation kit with part number EV65D44A (EVB-PSF)

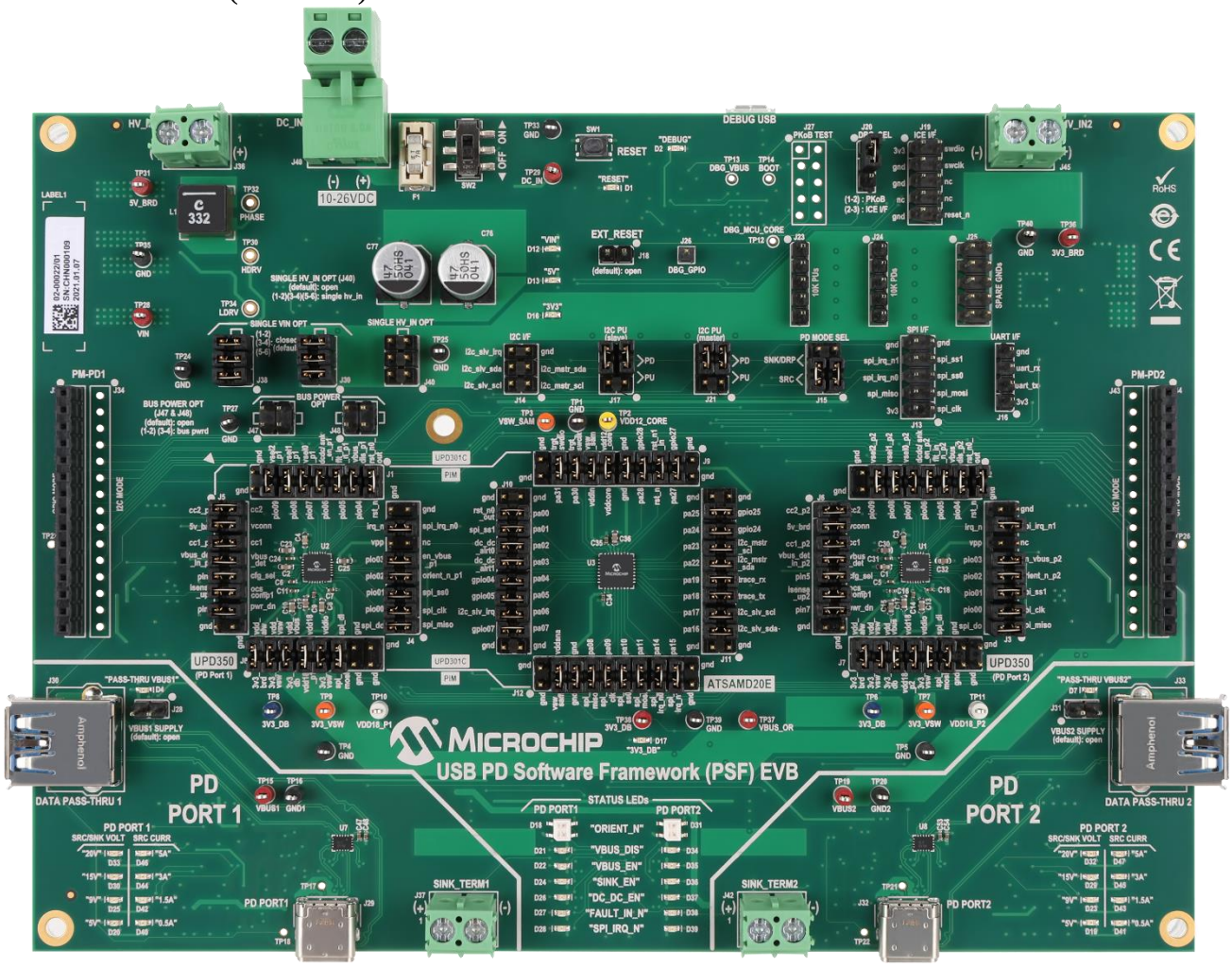

Figure 4.1 USB Power Delivery Software Framework EVB (EVB-PSF)

2) Two vertical mount One-Hot PM-PDs (PMPD-VM-HOT).

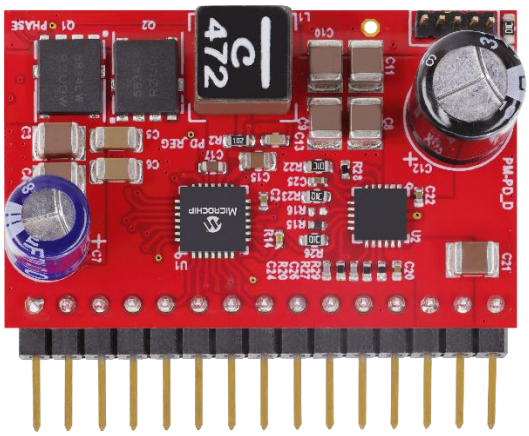

Figure 4.2 One-Hot Vertical Mount PM-PD (PMPD-VM-HOT)

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

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

4) USB-C to USB-C cable

5) Atmel ICE Debugger kit (Optional).

Figure 4.4 Atmel-ICE Debugger Kit

6) USB Power Delivery capable Phones or Laptops

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

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

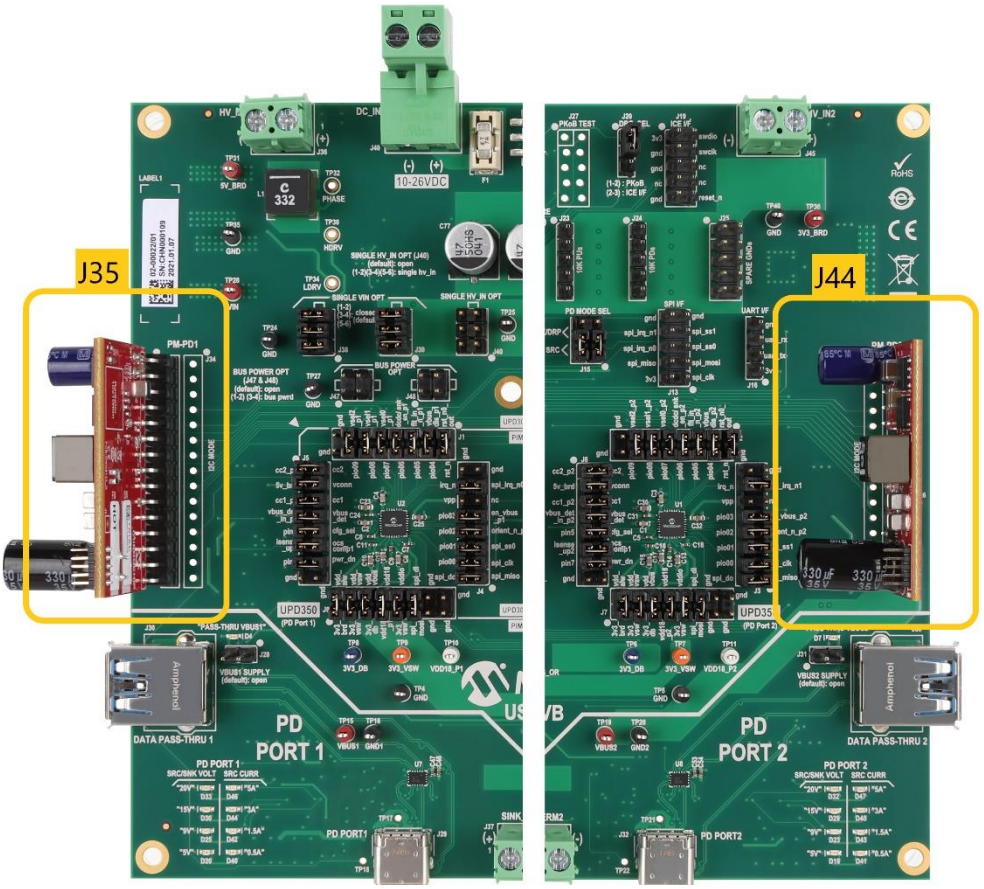

Figure 5.1 PM-PD Installation

2. Ensure the following jumpers are connected in EVB-PSF before proceeding to next step. An image of EVB-PSF 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
J17	3-5,4-6
J15	1-3, 2-4
J1	1-2 3-4 5-6 7-8 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 11-12 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
J12	3-4 5-6 7-8 9-10 11-12 13-14 15-16 17-18
J2	1-2 3-4

	5-6 7-8 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 11-12 13-14
J7	1-2 3-4 5-6 7-8 9-10 11-12

Table 5.1 EVB-PSF Jumper Connections

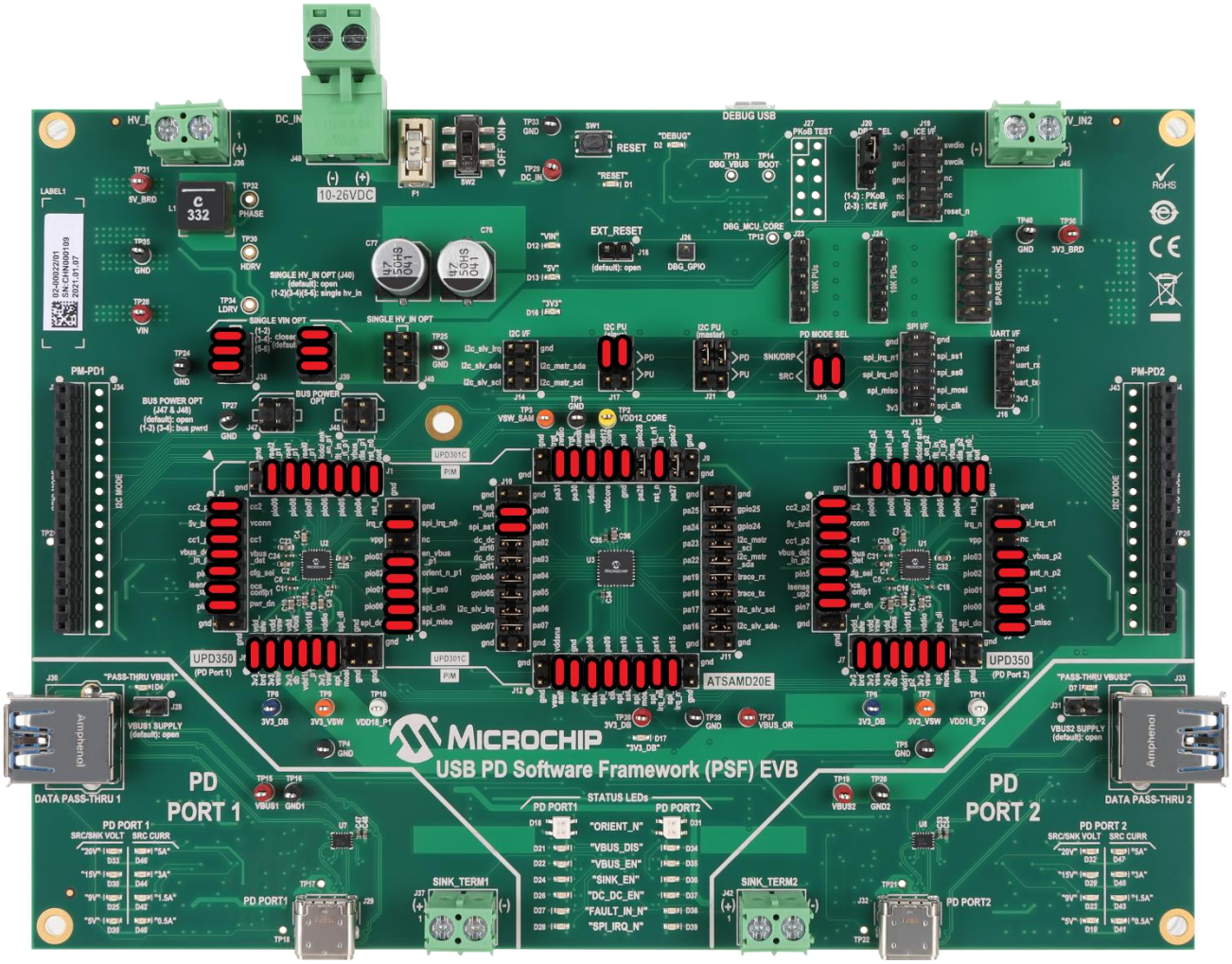

Figure 5.2 EVB-PSF with jumper connections highlighted

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

4. Connect one end of Atmel ICE to PC using USB Micro-B cable and the other end to J19 of EVB-PSF. 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. Refer Fig 5.3

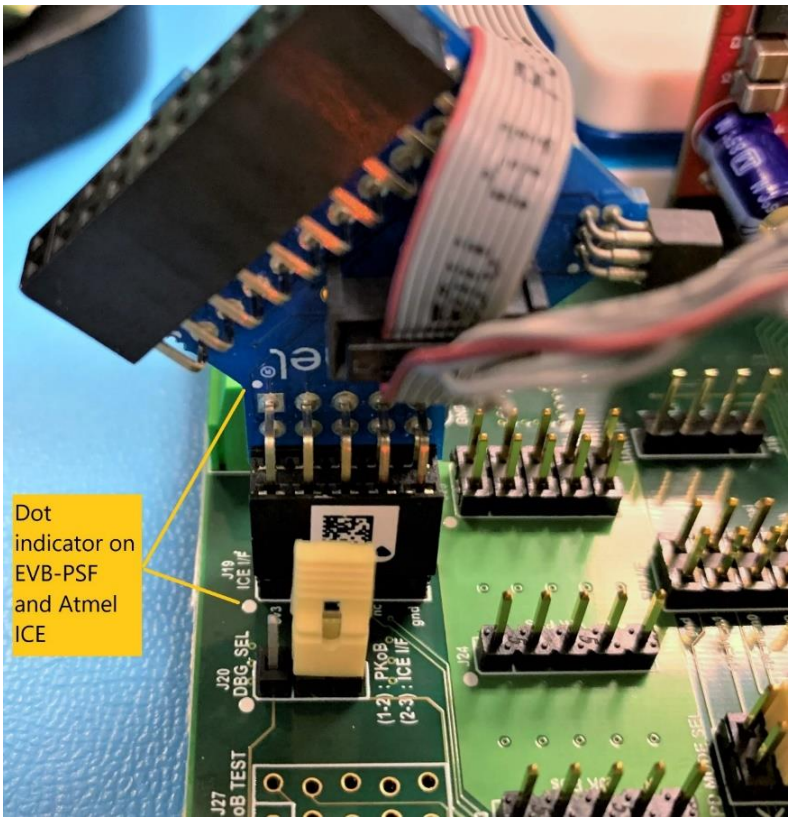

Figure 5.3 Connecting Atmel-ICE Debugger to J19

5. In Case if you are using Onboard Debugger ,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 as shown in the below image.

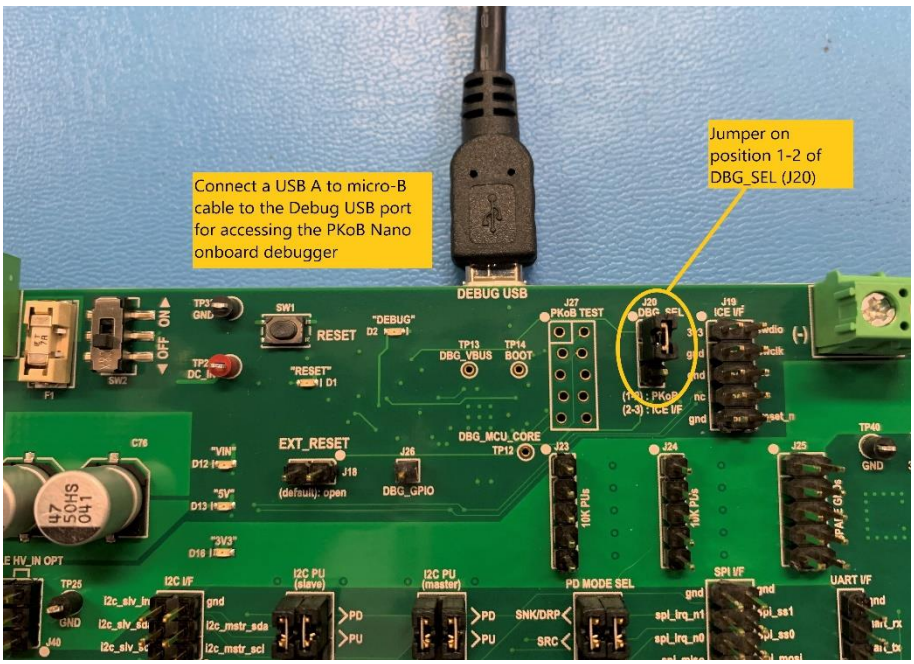

Fig 5.4 On Board Debugger

6. The whole connection is shown in Figure 5.5,

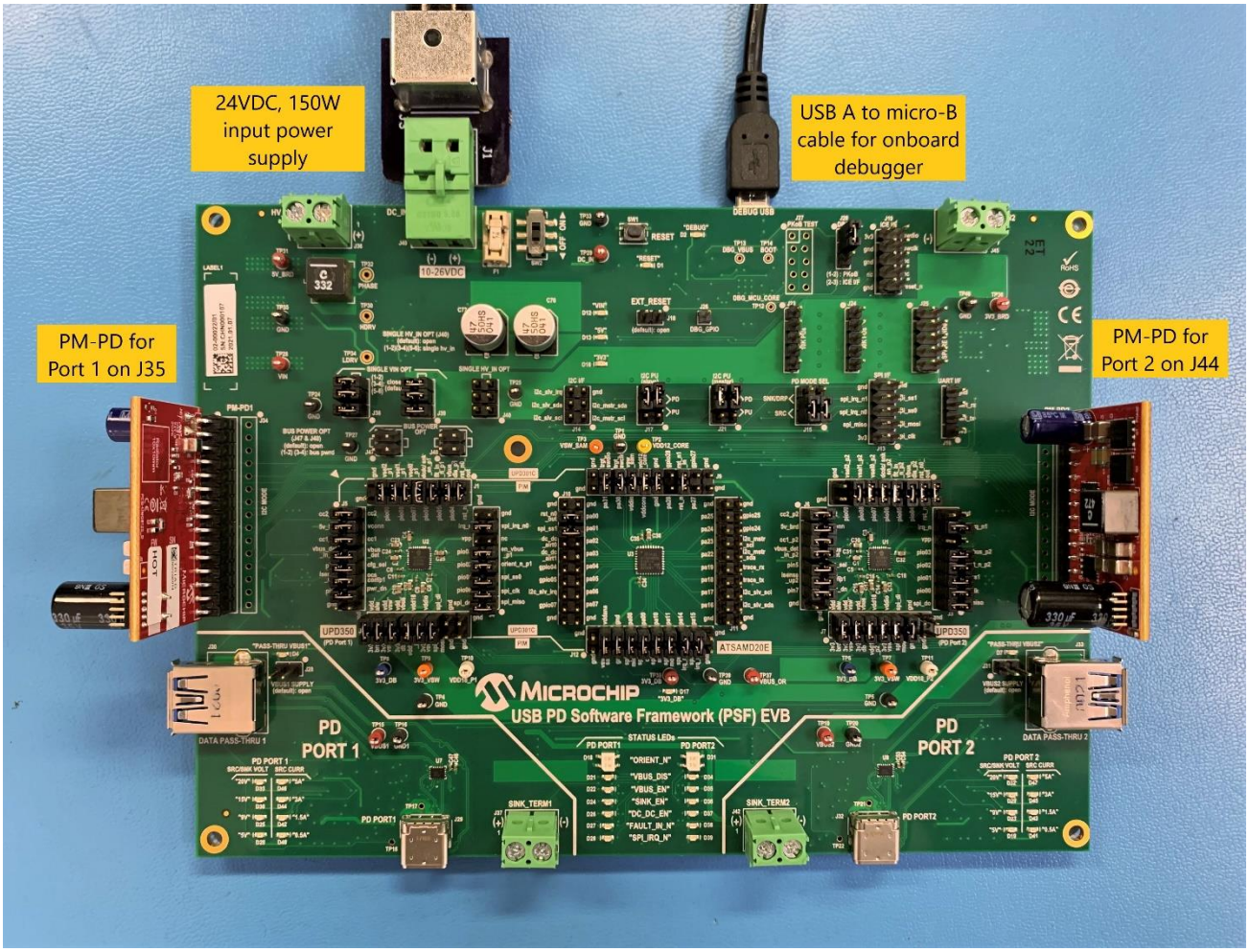

Figure 5.5 EVB-PSF Full Setup

6 Running the demo

Refer Getting Started with PSF document for the detailed steps on setting up the build environment, building the Source Lite PSF project and programming the EVB-PSF.

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

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

2. Program the EVB-PSF by following the steps mentioned in section 7 of Getting Started with PSF

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

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

5. The Fig 6.1 demonstrates a scenario where a USB PD Capable phone has been connected to Port 1 and USB PD Capable laptop has been connected to Port 2

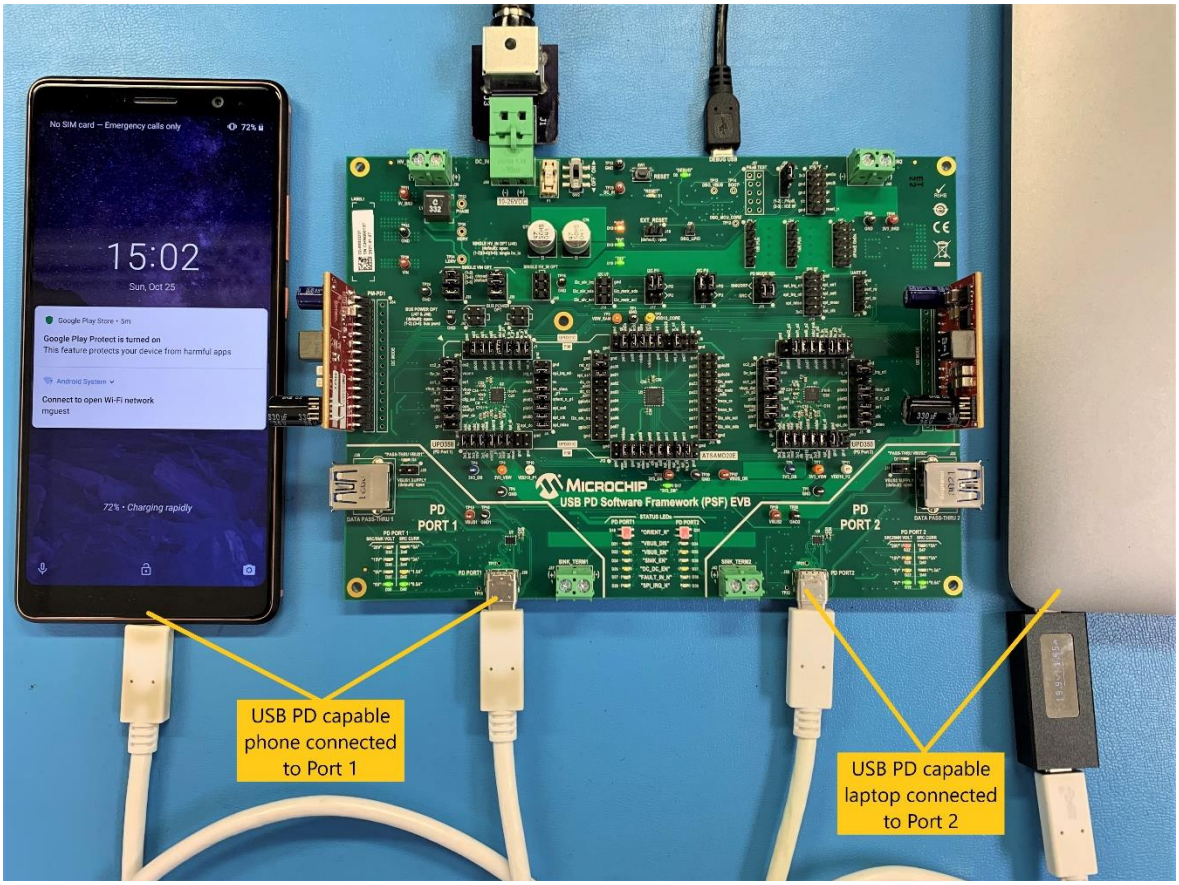

Figure 6.1 One USB PD Capable Phone and one USB PD Capable Laptop connected to Port 1 and Port 2.

6. The Fig 6.2 demonstrates a scenario where two USB PD Capable phone has been connected to Port 1 Port 2.

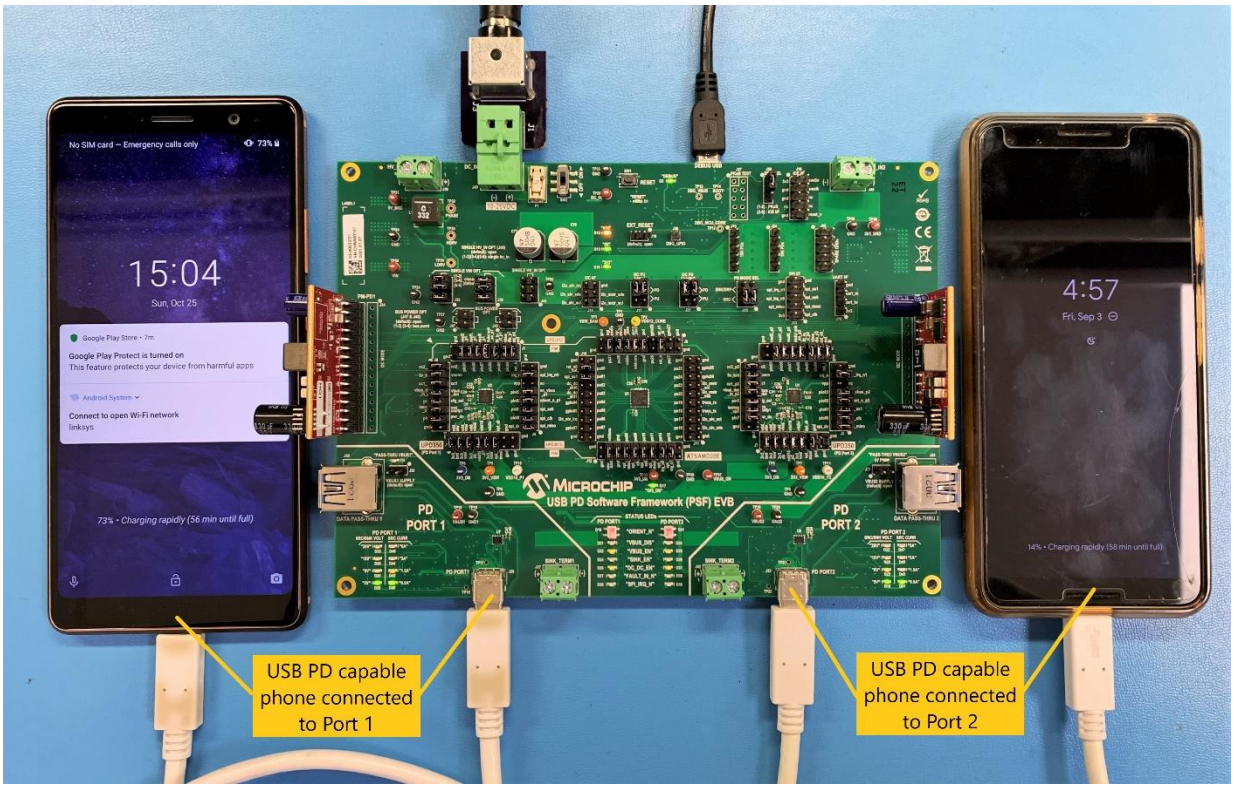

Fig 6.2 Two USB PD Capable Phones connected to both Ports

7 Expected Results

1. Once the hex file is programmed, the SPI_IRQ_N LEDs in both the ports flash and then turn off. DC_DC_EN LEDs will also turn on.

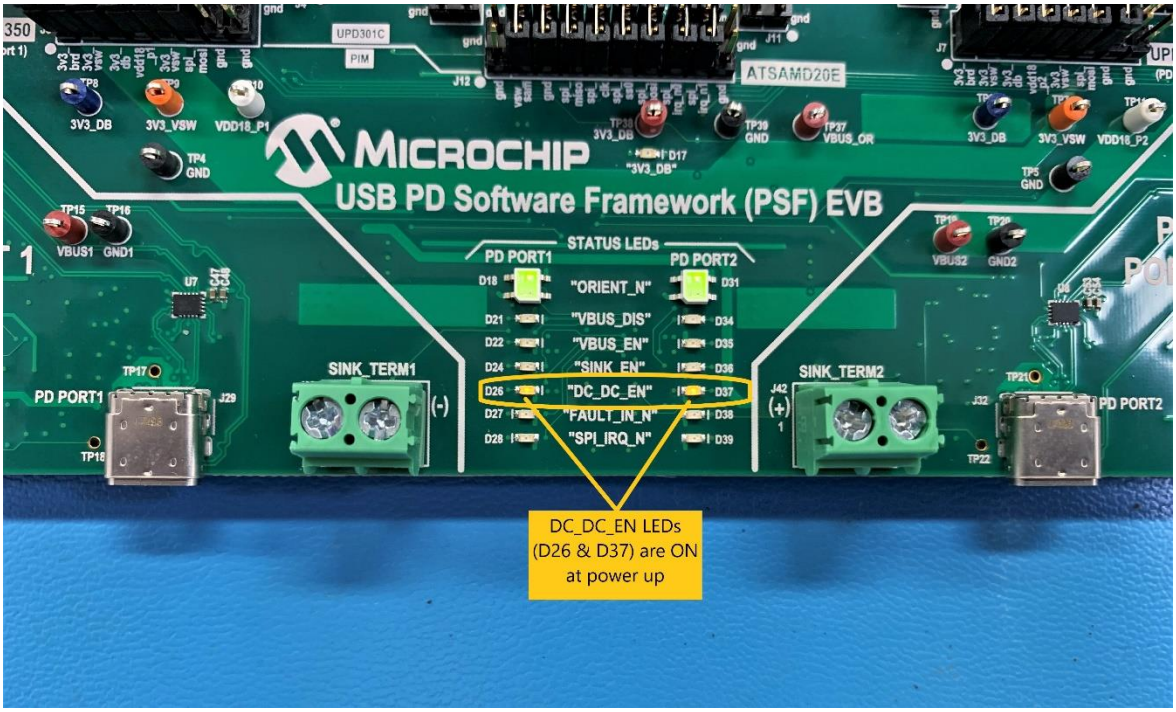

Figure 7.1 Status of DC_DC_EN LEDs after power on

2. Once a PD Device is attached to a PD port, 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. VBUS_EN LED will turn on along with the PDO status LEDs indicating the negotiated voltage as shown in Figure 7.2

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 8.1 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.

5. The status of VBUS_EN and ORIENT_N LEDs after attaching a USB PD Capable Phone in Port1 and a USB PD Capable Laptop in Port2 is shown in Figure 7.2

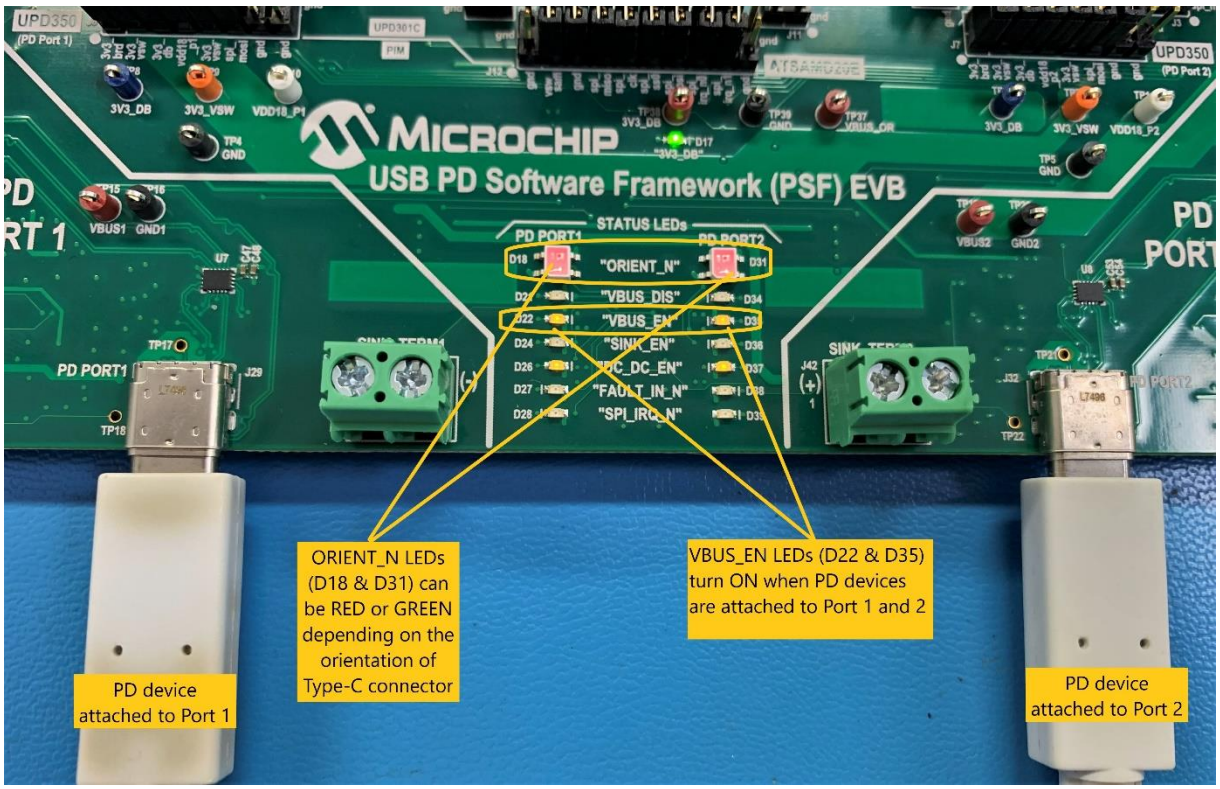

Fig 7.2 Status of VBUS_EN and ORIENT_N LEDs after device attach

6. The status of PDO LED after attaching a USB PD Capable Phone in Port1 and a USB PD Capable Laptop in Port2 are shown in Figure 7.3

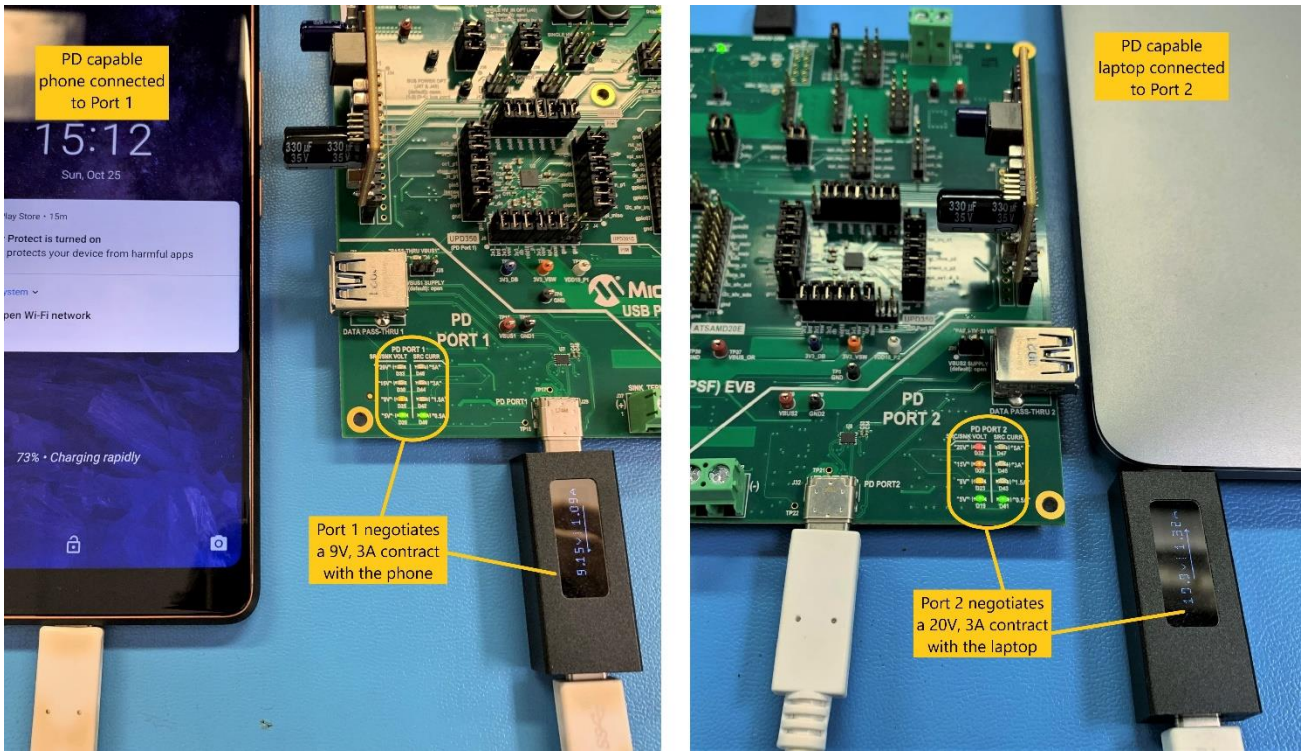

Figure 7.3 PDO Status LEDs after device attach