UPD301C PIM Sink Demo Read Me

Microchip Technology, Inc.

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

REV	DATE	DESCRIPTION OF CHANGE
0.99	16-June-2021	Initial version

© Microchip Technology Inc.

Table of Contents

1. Software License Agreement....4
2. Terms and Abbreviations....4
3. Introduction....5
4. Prerequisites....5
5. Setting up the EVB-PSF board for “UPD301C_PIM_Sink”....7
6. Running the demo....11
7. Expected Results....12

1. Software License Agreement

Copyright ©[2019-2020] Microchip Technology Inc. and its subsidiaries.

Subject to your compliance with these terms, you may use Microchip software and any derivatives exclusively with Microchip products. It is your responsibility to comply with third party license terms applicable to your use of third-party software (including open-source software) that may accompany Microchip software.

THIS SOFTWARE IS SUPPLIED BY MICROCHIP "AS IS". NO WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY, APPLY TO THIS SOFTWARE, INCLUDING ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGE, COST OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE SOFTWARE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THIS SOFTWARE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THIS SOFTWARE.

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
PIM	Plug In Module

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 USB Power Delivery Software Framework Evaluation kit (EV65D44A) with EV71C90A PIM to work properly with Sink version of PSF along with a demonstration of a PD device attached to EVB-PSF.

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)

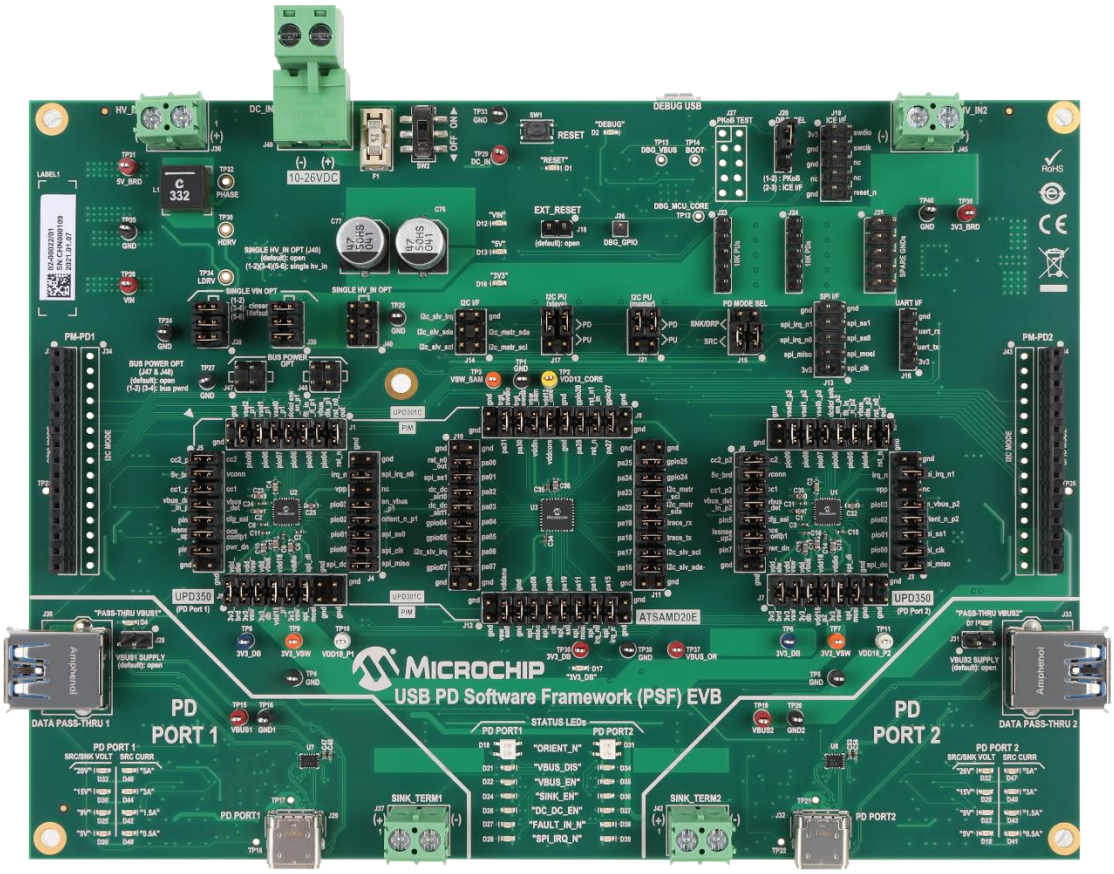

Figure 4.1 USB Power Delivery Software Framework EVB (EVB-PSF)

2) 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 (Optional)

Figure 4.5 Atmel-ICE Debugger Kit

5. Setting up the EVB-PSF 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.

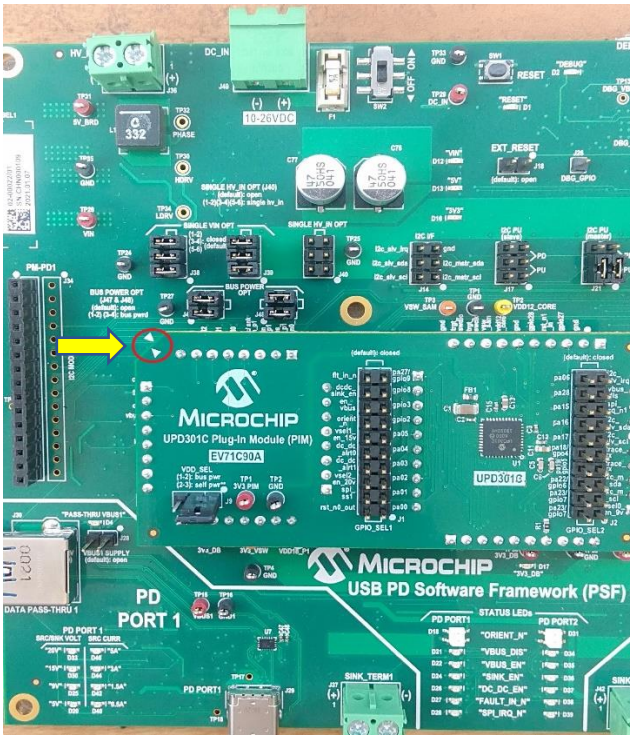

Figure 5.1 PIM Connection

2. Ensure the following jumpers are connected in 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
J21	1-3, 2-4
J15	3-5, 4-6
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 EVB-PSF Jumper Connections

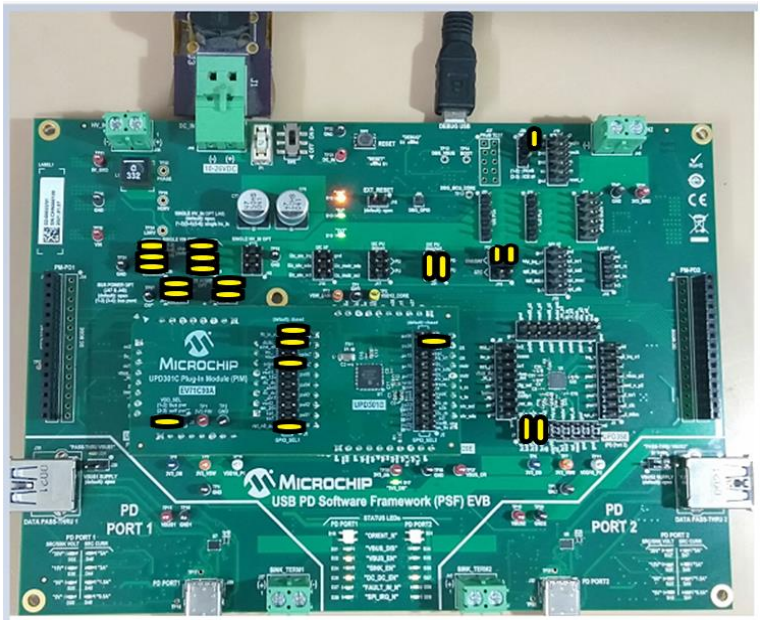

Figure 5.2 EVB-PSF with jumper connections highlighted

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

4. Connect a USB Micro-B cable to “DEBUG USB” which on the top of the board as shown in the figure 5.3 and connect the other end USB Type-A to the laptop for using the on-board debugger for programming

Figure 5.3 Programming using On-board debugger

5. Optionally, Atmel ICE can also be used for programming the board by connecting it to J19 as shown in the figure 5.4. Please ensure the jumper is switched to 2-3 on J20 while using Atmel ICE.

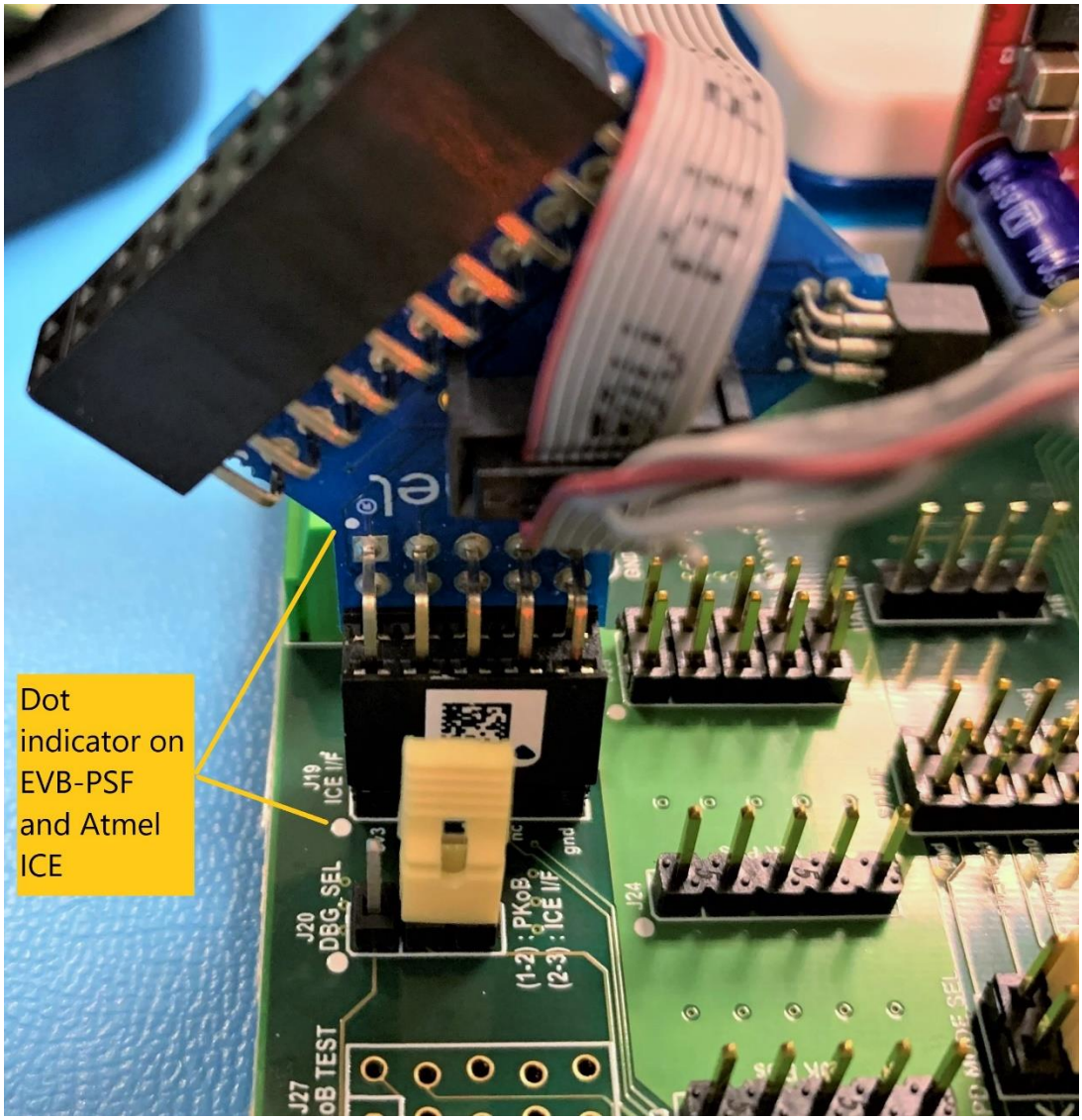

Figure 5.4 Programming using Atmel ICE (Optional)

6. The whole connection looks like,

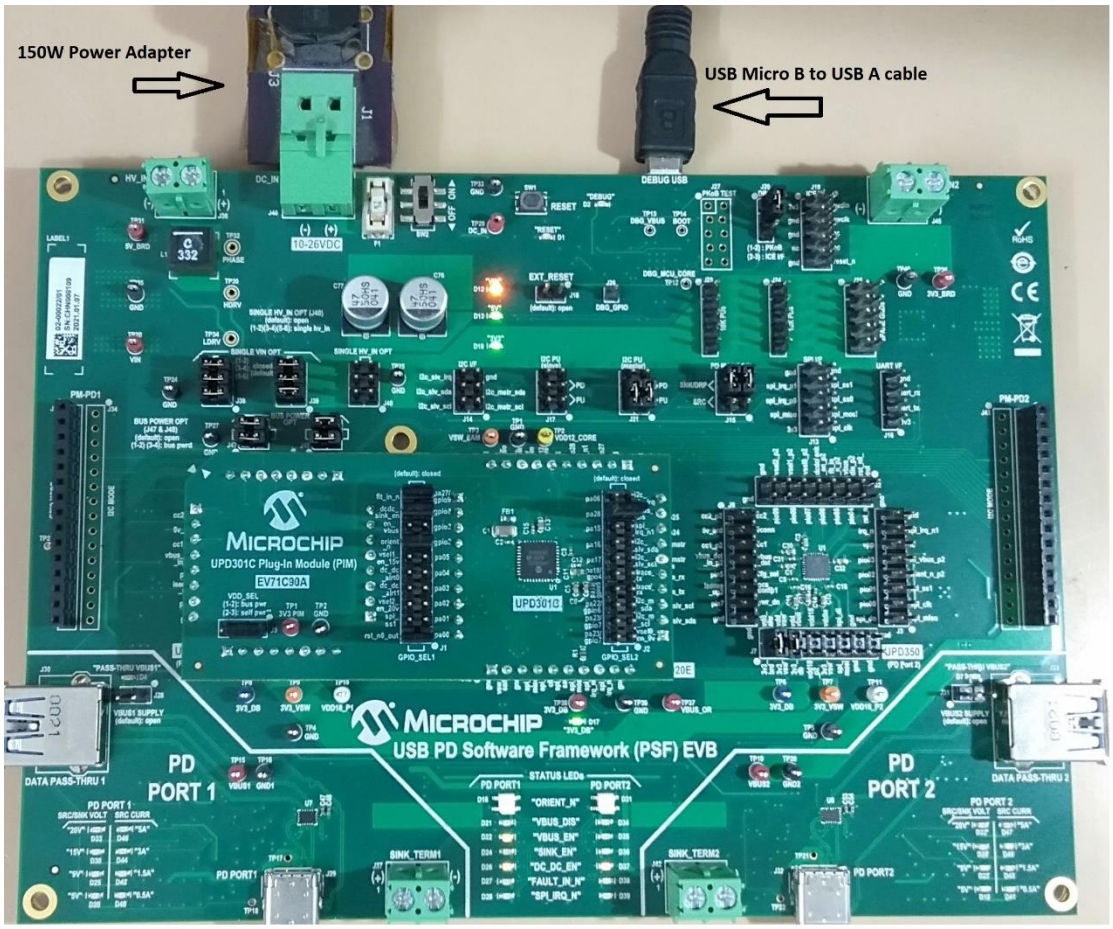

Figure 5.5 EVB PSF Full Setup

6. Running the demo

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

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 EVB-PSF.

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 EVB-PSF 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.

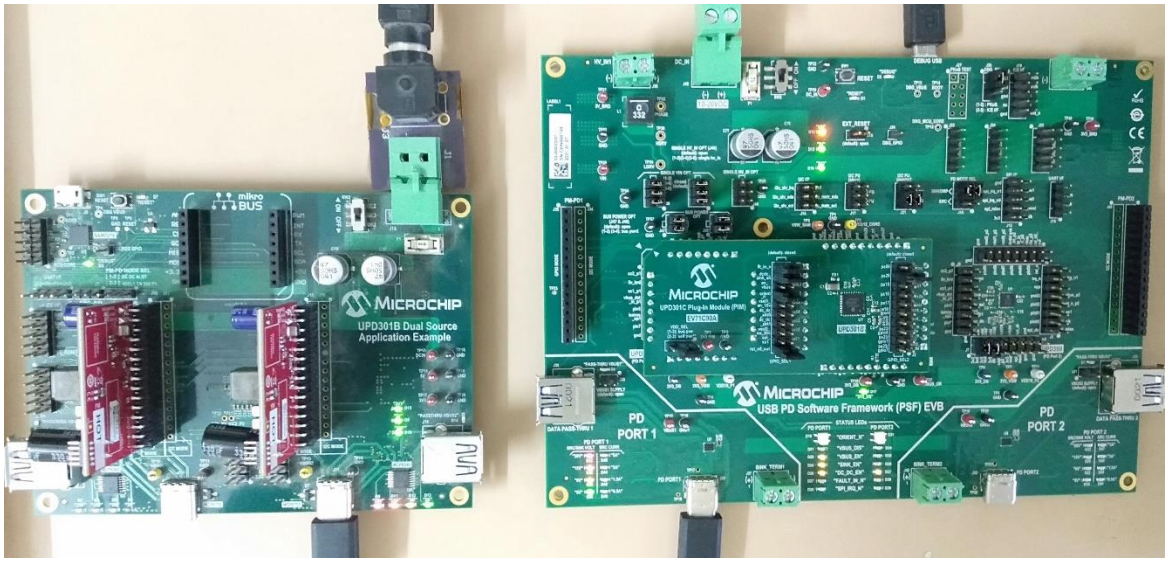

Figure 6.1 A PD source connected to port 1

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.

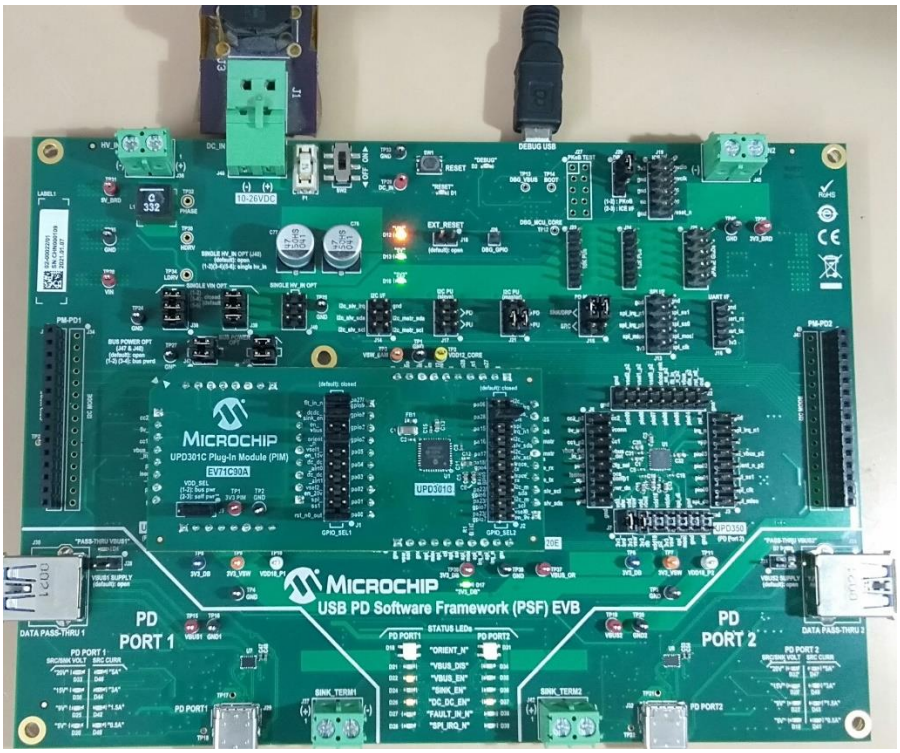

Figure 7.1 Status LEDs after power on

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