AN14545

How to Implement USB-C Power Delivery Demo on MCX A153

Rev. 1.0 — 22 January 2025 Application note

Document information

Information	Content
Keywords	AN14545, USB-C, power delivery, PTN5110
Abstract	This application note describes how to implement USB-C power delivery demo on MCX A153.

1 Introduction

Now, the USB ports are commonly used for battery charging function. But for fast charging, many companies and institutes define some protocols for USB fast charge such as QC/PD/UFCS. The USB-C PD protocol is defined by USB IF, which can support up to 240 W power delivery. Most fast charging devices such as power docking and wall chargers can support the USB PD protocol. In many PD fast charge solutions, use external PD CC physical layer chips to communicate with MCU through I^2C interface, and the PD protocol stack was implemented in MCU side.

This application note introduces the USB-C PD solution of NXP, which uses MCX A153 to implement the USB-C PD protocol and the PTN5110 USB PD TCPC IC to do CC communication.

1.1 PTN5110 USB PD TCPC IC features

PTN5110 is a single-port TCPC compliant USB Power Delivery (PD) PHY IC that implements Type-C Configuration Channel (CC) interface and USB PD Physical layer functions to a Type-C Port Manager (TCPM) that handles PD Policy management.

It can support various Type-C roles: Sink, Source, Sink with accessory support or DRP. It implements Type-C CC analog portion (Rd/Rp/Ra detection, Rd/Rp indication) and PD Tx/Rx PHY and protocol state machines. Figure 1 shows the block diagram of PTN5110 IC.

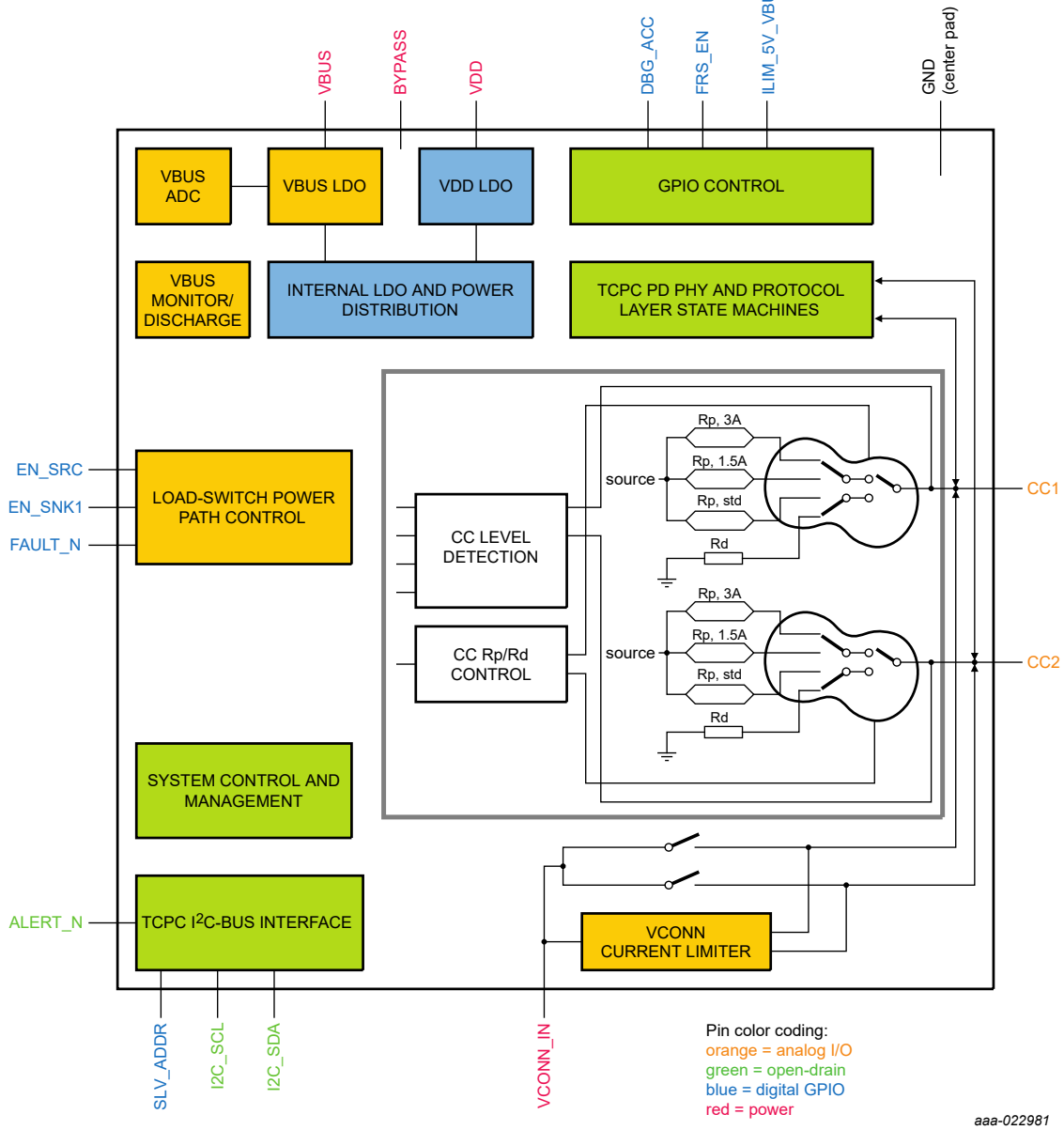

Figure 1. PTN5110 block diagram

2 MCX A153 USB-C PD demo introduction

In the MCX A153 USB-C PD demo, we use FRDM-MCXA153 board and PTN5110 USB PD/Type C shield board to perform the USB charger function. Figure 2 shows the hardware block diagram of this demo. MCX A153 communicates with PTN5110 by I2C interface which was used for CC line implementation and the NX20P3483/NX20P5090 which was used for USB VBUS power switch.

To run this demo, supply VBUS power by power jack and the charge devices can connect to the USB-C port on the USB PD/Type C shield board. This demo provides two source capability PDOs (5 V/3 A, 9 V/2 A) for sink device.

To get the hardware for this demo, see below links:

- FRDM Development Board for MCX A14x/A15x MCUs
- OM13790HOST
- OM13790DOCK

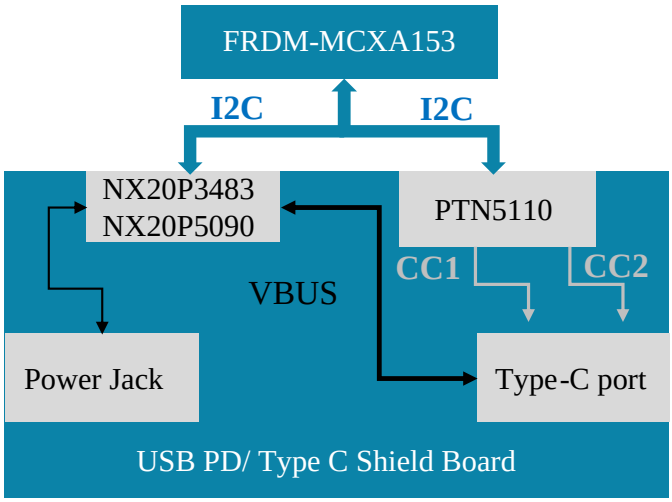

Figure 2. MCX A153 USB-C PD demo hardware block diagram

2.1 MCX A153 USB-C PD demo hardware setup

To perform the MCX A153 USB-C PD demo, use FRDM-MCXA153 board and USB PD/Type C Shield Board. These two boards connect with each other by the Arduino connector. This demo uses `P1_8` (`I3C0_SDA`) and `P1_9` (`I3C0_SCL`) pins communicate with PTN5110 and NX20P3483. Figure 3 shows the hardware connection.

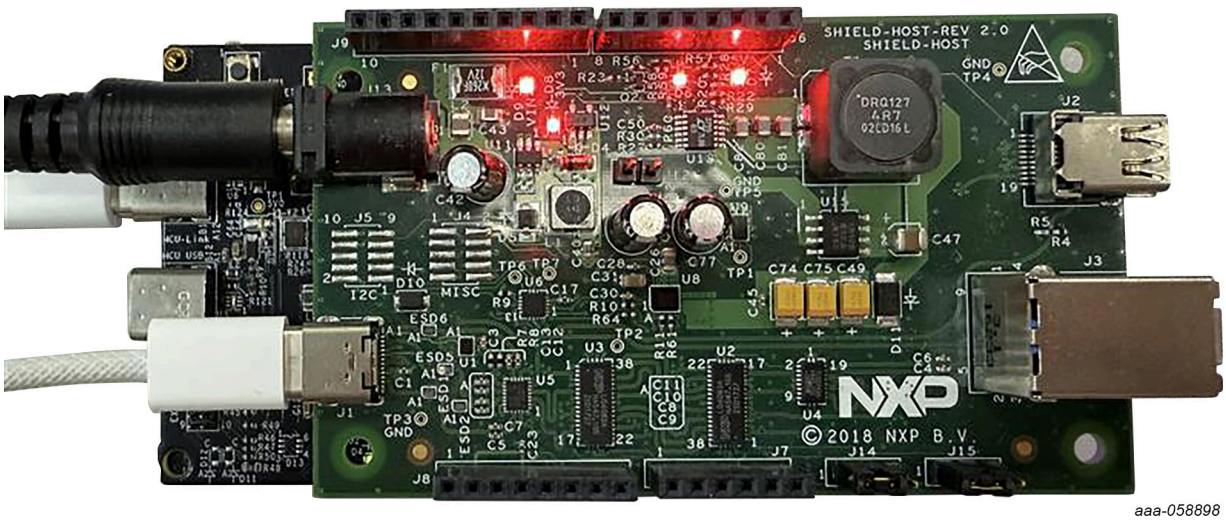

Figure 3. MCX A153 USB-C PD demo hardware setup

2.2 MCX A153 USB-C PD demo software introduction

The MCX A153 USB-C PD demo provides one USB port charge function. Figure 4 shows the software flow of this demo.

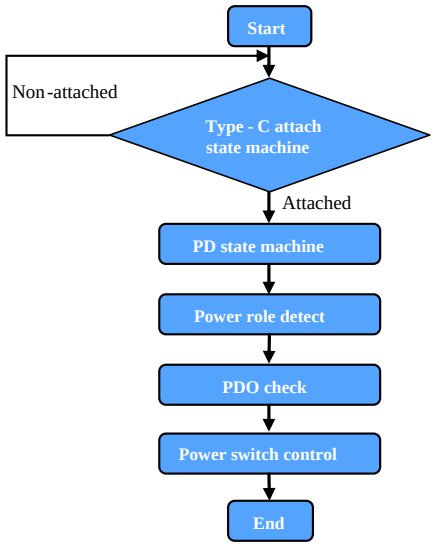

Figure 4. MCX A153 USB-C PD demo software flow

2.2.1 Software implementation

The MCX A153 USB-C PD demo software supports one USB port and provides two source PDOs, 5V/3A and 9V/2A. Check the definition of the `PortSourceCaps[]` parameters.

```
static pd_source_pdo_t s_PortSourceCaps[] = {
    {
/* PDO1: fixed supply: dual-role power; Externally Powered; no USB
 communication; dual-role data; 5V; 3A */
        .fixedPDO.dualRoleData    = 1U,
        .fixedPDO.dualRolePower   = 1U,
        .fixedPDO.externalPowered = 1U,
        .fixedPDO.fixedSupply     = kPDO_Fixed,
        .fixedPDO.maxCurrent      = (3U * 100U),
        .fixedPDO.peakCurrent     = 0U,
#if ((defined PD_CONFIG_REVISION) && (PD_CONFIG_REVISION >=
 PD_SPEC_REVISION_30))
        .fixedPDO.unchunkedSupported = 1U,
#endif
        .fixedPDO.usbCommunicationsCapable = 0U,
        .fixedPDO.usbSuspendSupported      = 0U,
        .fixedPDO.voltage                  = (5U * 1000U / 50U),
    },
    {
        /* PDO2: fixed Supply: 9V - 2A */
        .fixedPDO.fixedSupply = kPDO_Fixed,
        .fixedPDO.maxCurrent  = (2U * 100U),
        .fixedPDO.voltage     = (9 * 1000U / 50U),
    },
};
```

Before running this demo, use a USB-C cable which can support CC communication, download the MCX A153 `USB_PD` demo code to FRDM-MCXA153 board, and connect a power jack to the USB PD/Type C shield board power jack connector. We can connect a mobile phone to the USB-C connector on USB PD/ Type C shield board. Figure 5 shows the demo charge mobile phone.

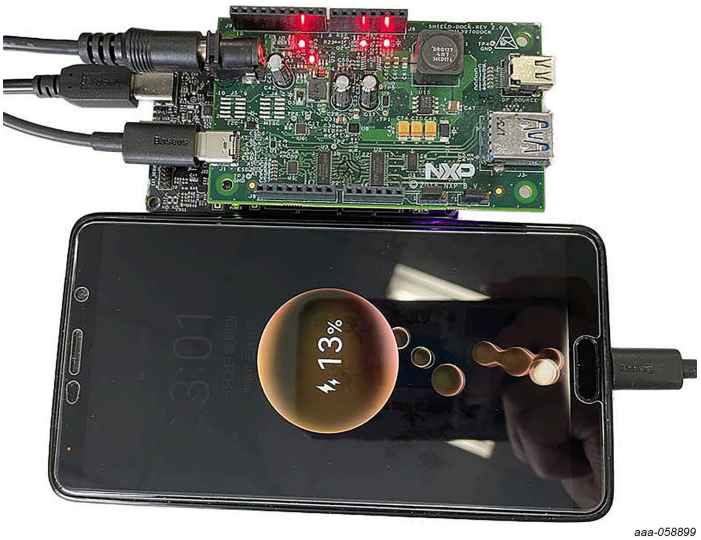

Figure 5. MCX A153 USB-C PD demo show

Also, we can use USB-C PD protocol analyzer to check the PD communication packets. Figure 6 shows the PD communication packets captured by protocol analyzer. According to Figure 6, the MCX A153 USB-C PD demo

sends a source capability which contains 5V/3A and 9V/2A PDO, the sink device requested the 9V/2A PDO and communication between source and sink device success.

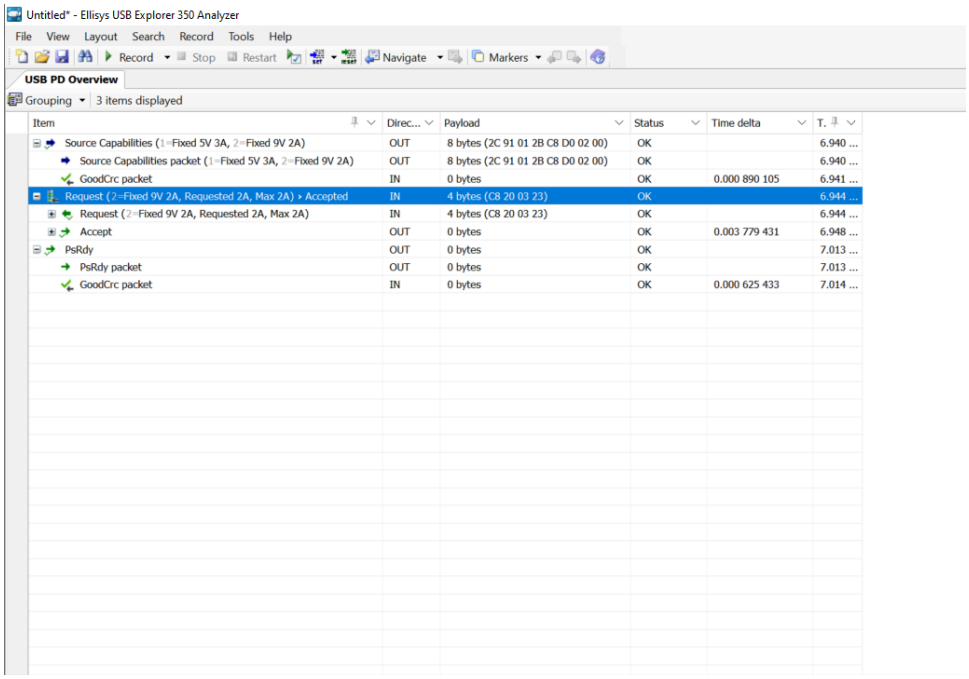

Figure 6. MCX A153 USB-C PD demo PD communication packet

3 Note about the source code in the document

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4 Revision history

Table 1 summarizes the revisions to this document.

Table 1. Revision history

Document ID	Release date	Description
AN14545 v1.0	22 January 2025	Initial public release

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