

# AN14545

## 如何在MCX A153上实现USB-C电力传输演示

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应用笔记

### 文档信息

信息	内容
关键词	AN14545、USB-C、电力输送、PTN5110
摘要	本应用笔记介绍了如何在MCX A153上实现USB-C电力传输演示。



## 1 介绍

如今，USB端口常被用于电池充电功能。但对于快速充电，许多公司和机构都为USB快速充电定义了一些协议，如QC/PD/UFCs。USB-C PD协议由USB IF定义，可支持高达240W的电力传输。大多数快速充电设备，如电源基座和壁式充电器，都能支持USB PD协议。在许多PD快速充电解决方案中，使用外部PD CC物理层芯片通过I<sup>2</sup>C接口与MCU进行通信，并且PD协议栈是在MCU侧实现的。

本应用笔记介绍了恩智浦的USB-C PD解决方案，该方案使用MCX A153来实现USB-C PD协议，并使用PTN5110 USB PD TCPC IC进行CC通信。

### 1.1 PTN5110 USB PD TCPC IC的功能

PTN5110是一款符合TCPC标准的单端口USB电力传输（PD）PHY IC，它实现了Type-C配置通道（CC）接口和USB PD物理层功能，以连接处理PD策略管理的Type-C端口管理器（TCPM）。

它能够支持多种Type-C角色：受电端（Sink）、供电端（Source）、带辅件支持的受电端或DRP。它实现了Type-C CC模拟部分（Rd/Rp/Ra检测、Rd/Rp指示）和PD Tx/Rx PHY以及协议状态机。[图1](#)所示为PTN5110 IC的框图。

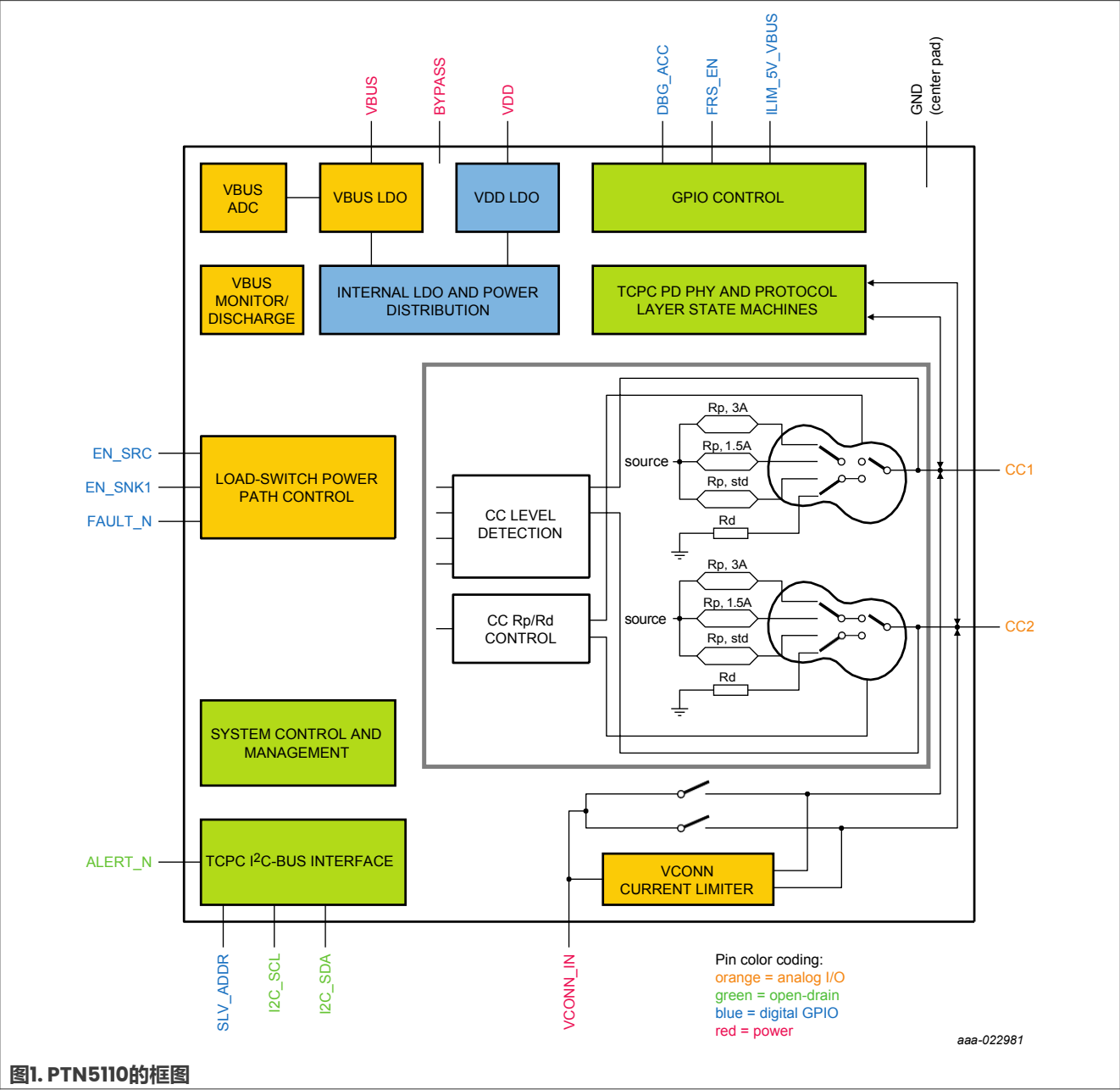


图1. PTN5110的框图

## 2 MCX A153的USB-C PD演示介绍

在MCX A153的USB-C PD演示中，使用了FRDM-MCXA153开发板和PTN5110 USB PD/Type C Shield扩展板来执行USB充电器功能。图2所示为此演示的硬件框图。MCX A153通过I2C接口与PTN5110通信，用于CC连接的实现，并通过I2C接口与NX20P3483/NX20P5090通信，用于USB VBUS电源的切换。

要运行此演示，通过电源插孔提供VBUS电源，充电设备可以连接到USB PD/Type C Shield扩展板上的USB-C端口。此演示为受电端设备提供了两种供电端能力的PDO（5V/3A，9V/2A）。

要获取此演示的硬件，请参阅以下链接：

- [MCX A14x/A15x MCU的FRDM开发板](#)
- [OMI3790HOST](#)
- [OMI3790DOCK](#)

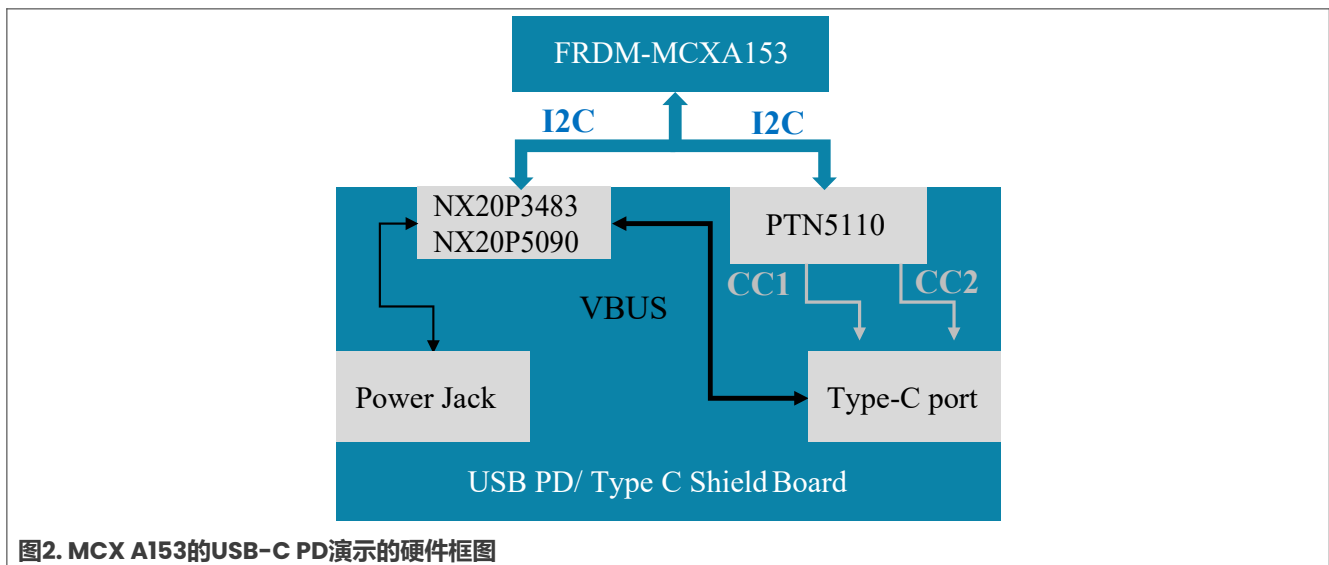


图2. MCX A153的USB-C PD演示的硬件框图

### 2.1 MCX A153的USB-C PD演示的硬件设置

要执行MCX A153的USB-C PD演示，请使用FRDM-MCXA153开发板和USB PD/Type C Shield扩展板。这两块电路板通过Arduino连接器相互连接。此演示使用P1\_8 (I3C0\_SDA) 和 P1\_9 (I3C0\_SCL)引脚与PTN5110和NX20P3483进行通信。图3所示为硬件连接。

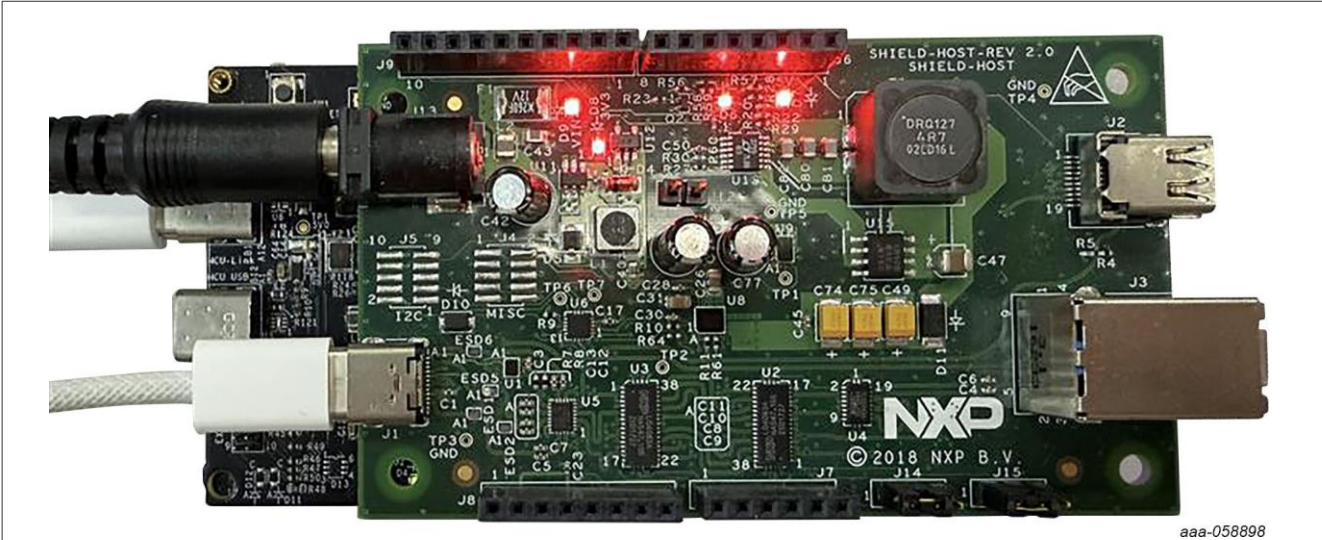


图3. MCX A153的USB-C PD演示的硬件设置

2.2 MCX A153的USB-C PD演示的软件介绍

MCX A153的USB-C PD演示提供了一个USB端口充电功能。图4所示为此演示的软件流程。

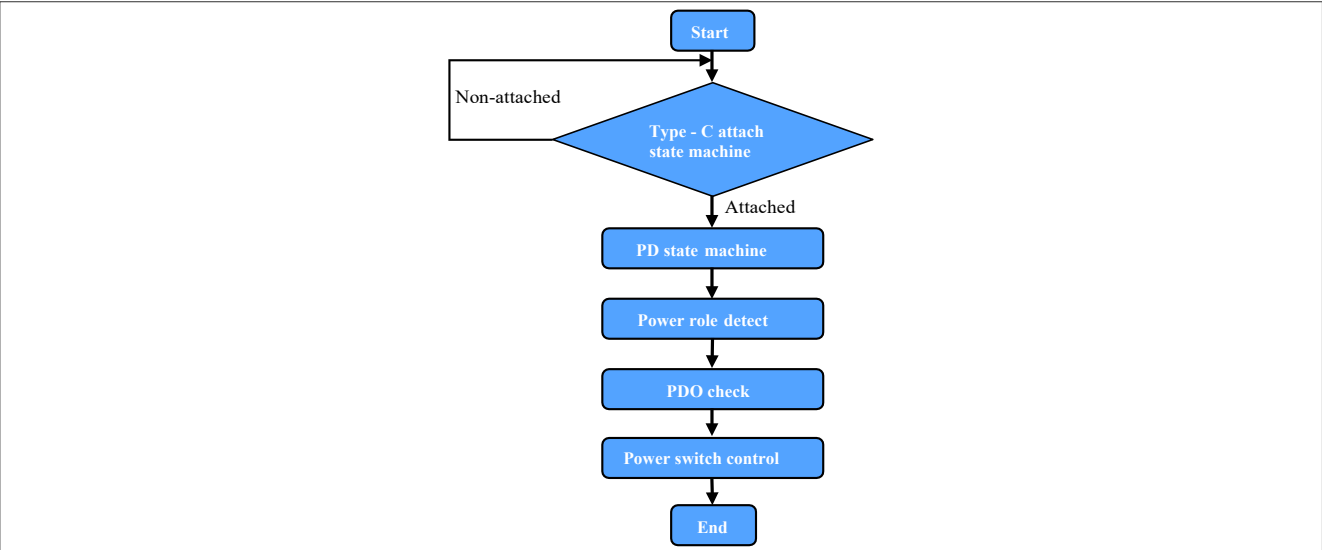


图4. MCX A153的USB-C PD演示的软件流程

2.2.1 软件实现

MCX A153的USB-C PD演示软件支持一个USB端口，并提供两个供电PDO，5V/3A和9V/2A。可查看PortSourceCaps[]参数的定义。

```
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),
},
};
```

在运行此演示之前，使用一根支持CC通信的USB-C线缆，将MCX A153的USB PD演示代码下载到FRDM-MCX A153开发板上，并将电源插头连接到USB PD/Type C Shield扩展板的电源插孔连接器。然后，可以将手机连接到USB PD/Type C Shield扩展板上的USB-C连接器。图5所示为手机充电演示。



图5. MCX A153的USB-C PD演示展示

此外，还可以使用USB-C PD协议分析仪来查看PD通信数据包。图6所示为协议分析器捕获到的PD通信数据包。

根据图6，MCX A153的USB-C PD演示发送了一个包含5V/3A和9V/2A PDO的供电端能力，受电端设备请求了9V/2A的PDO，并且供电端设备和受电端设备之间的通信成功。

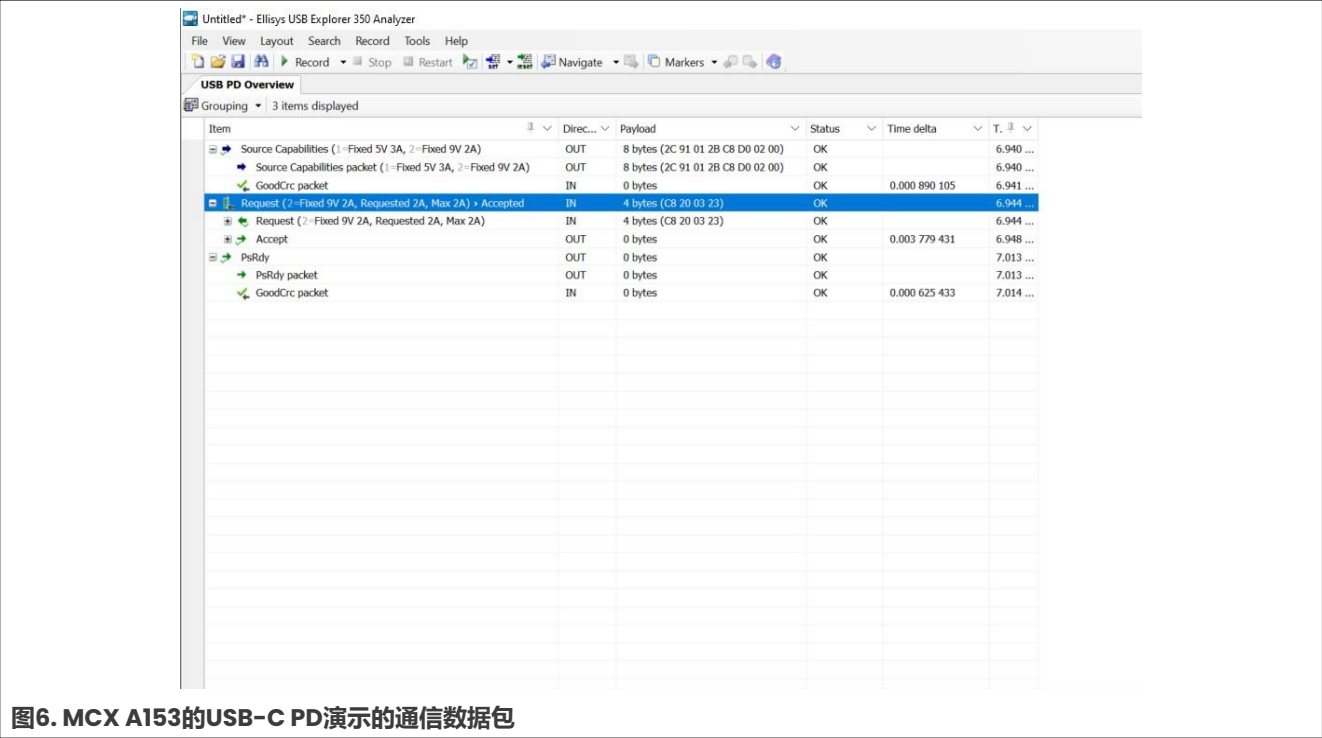


图6. MCX A153的USB-C PD演示的通信数据包

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4 修订历史

[表1](#)汇总了本文档的修订情况。

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文档ID	发布日期	说明
AN14545 v1.0	2025年1月22日	首次公开发布



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