PTN5100

USB Type-C power delivery PHY and protocol IC

Rev. 1.2 — 10 December 2015   **Objective short data sheet**

1. General description

PTN5100 is a single port USB Type-C Power Delivery (PD) PHY and Protocol IC that provides Type-C Configuration channel interface and USB PD Physical and Protocol layer functions to a System PD Port Policy Controller (Policy Engine and Device Policy Manager, Alternate mode controller). It complies with USB PD and Type-C specifications and delta updates of PD spec. This IC is targeted for a wide range of platforms (Standard Notebook PCs, Desktop PCs, Chromebooks, Tablets, Convertibles, Smart phones) and PC Accessories (e.g. Docks, Monitors, Cable adapters etc.) applications. PTN5100 is architected to deliver robust performance, compliant behavior, configurability and system implementation flexibility that are essential to tide over interoperability and compliance hurdles in the platform applications.

PTN5100 can support system realization of the following PD roles: (i) Provider (P) only, (ii) Provider/Consumer (P/C) (iii) Consumer only (C) (iv) Consumer/Provider (C/P). Further, it can be register programmed to operate in Type-C specific Upstream Facing Port (UFP), Downstream Facing Port (DFP) or Dual Role Port (DRP) role.

PTN5100 implements VCONN low RON switch with register programmable Forward Current protection feature. The VCON switch also provides Reverse current protection feature to detect reverse current flow into the system whenever (inductive or) charged cable is unplugged from the connector.

PTN5100 operates from platform power supply VDD, or it can also be powered from USB power VBUS directly, which is especially required for operation under Dead Battery (DB) condition and certain platform use cases. The host interface operates on VIO supply to facilitate interfacing to systems that use IO supply rail different from VDD supply rail.

It provides SPI/I2C interface for system host control/status update. The interface choice is pre- configured in NXP factory.

PTN5100 is available in a small footprint package option: HVQFN20 4 mm x 4 mm, 0.5 mm pitch.

Remark: The terms 'EC' is used interchangeably with 'Embedded Controller', 'AP', 'Application Processor' or 'System Management Controller, SMC' or System Host Controller throughout this document.

Remark: The terms 'PMIC', 'Power Management Interface Controller', 'Charger IC' are used interchangeably throughout this document.

2.   Features and benefits

2.1   USB PD and Type-C Features

Complies with USB PD and USB Type-C specifications.

■ Supports implementation of various system PD roles: P, P/C, C, C/P
■ Supports Type-C role configurability
   ◆ Type-C role (DFP, UFP, DRP) is Non-Volatile Memory (NVM) and register programmable based on OEM platform requirements
   ◆ Implements UFP role pull down behavior to handle dead battery condition on battery powered platforms
   ◆ Supports register programmable and variable 'Rp' indication (for DRP/DFP usage and accessory detection)
   ◆ Implements 'Rd' indication on CC pin (for Device side implementation)
   ◆ CC detection/indication scheme based on Type-C role
   ◆ Indication of orientation detection via CC_ORIENT pin and status register(s)
   ◆ Debug and Audio Accessory detection and indication in status register(s)
■ Cooperatively works under the control of Policy controller MCU for power delivery negotiation and contract(s), Alternate mode and VDM exchanges
   ◆ Implements BMC (de)coding, 4B5B symbol (de)coding, CRC generation/checking, PD packet assembling/disassembling including Preamble, SOP, EOP, Good CRC response, Retries, Hard and Cable resets
   ◆ PD PHY and Protocol layer interface control and status update handled via SPI/I2C interface
■ SOP* Configurability
   ◆ Register programmable to generate and receive SOP, SOP', SOP'-debug, SOP", SOP"-debug" in DFP/DRP (host use case)
   ◆ Register programmable to receive and respond on SOP, SOP'-debug and SOP"-debug commands
■ Supports low RON VCONN switch with enable/disable (Hi-Z) support
   ◆ Capable of maximum current delivery of 1 A over 2.7 V to 5.5 V
   ◆ Supports register programmable Forward current protection control
   ◆ Supports register programmable Reverse current protection

2.2   System protection features

■ Back current protection on all pins when PTN5100 is unpowered
■ CC1 and CC2 pins are 5.5 V tolerant
■ VBUS pin and VBUS power path MOSFET enable pins are 28 V tolerant

2.3   General

■ Delivers (active LOW enable) gate control signals for PMOS Power MOSFETs on VBUS source and sink power paths
■ Provides dedicated IO pin (CC_ORIENT) for indicating Cable/plug orientation and IO pin (DBGACC_FOUND) for indicating Debug accessory detection
■ Delivers up to 30 mA (max) for powering Policy controller MCU
■ Supports SPI slave interface (SPI modes 0 and 3 supported) up to 30 MHz

- Supports I2C slave interface standard mode (100 kHz), Fast mode (400 kHz) and Fast mode plus (1 MHz)
- I2C Device slave address programmable up to 3 values
- Supports 3.3 V or 1.8 V capable I^{2}C-bus or SPI interface
  - ◆ Supports register access - device configuration, control and status/interrupt interfacing through Slave I^{2}C-bus interface
- Power supplies - VDD (3.3 V ±10 %) or VBUS
  - ◆ Tolerant up to 28 V on VBUS and operational up to maximum of 25 V on VBUS
- Operating temperature −20 °C to 85 °C
- ESD 8 kV HBM, 1 kV CDM
- Package: HVQFN20 4 mm × 4 mm, 0.5 mm pitch.

3. Applications

- PC platforms: Notebook PCs, Desktop PCs, Ultrabooks, Chromebooks
- Tablets, 2:1 Convertibles, Smartphones and Portable devices
- PC accessories/peripherals: Docking, Mobile Monitors, Multi-Function Monitors, Portable/External hard drives, Cable adaptors, Dongles and accessories, etc.

4. Ordering information

Table 1. Ordering information

Type number	Topside marking	Package		
		Name	**Description**	**Version**
PTN5100	5100	HVQFN20	plastic thermal enhanced very thin quad flat package; no leads; 20 terminals; body 4 × 4 × 0.85 mm[2]	SOT917-4
PTN5100A	510A	HVQFN20	plastic thermal enhanced very thin quad flat package; no leads; 20 terminals; body 4 × 4 × 0.85 mm[3]	SOT917-4

[1] Total height after printed-circuit board mounting <=1 mm (maximum)

[2] Supported system interface - SPI

[3] Supported system interface - I^{2}C

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4.1 Ordering options

Table 2.   Ordering options

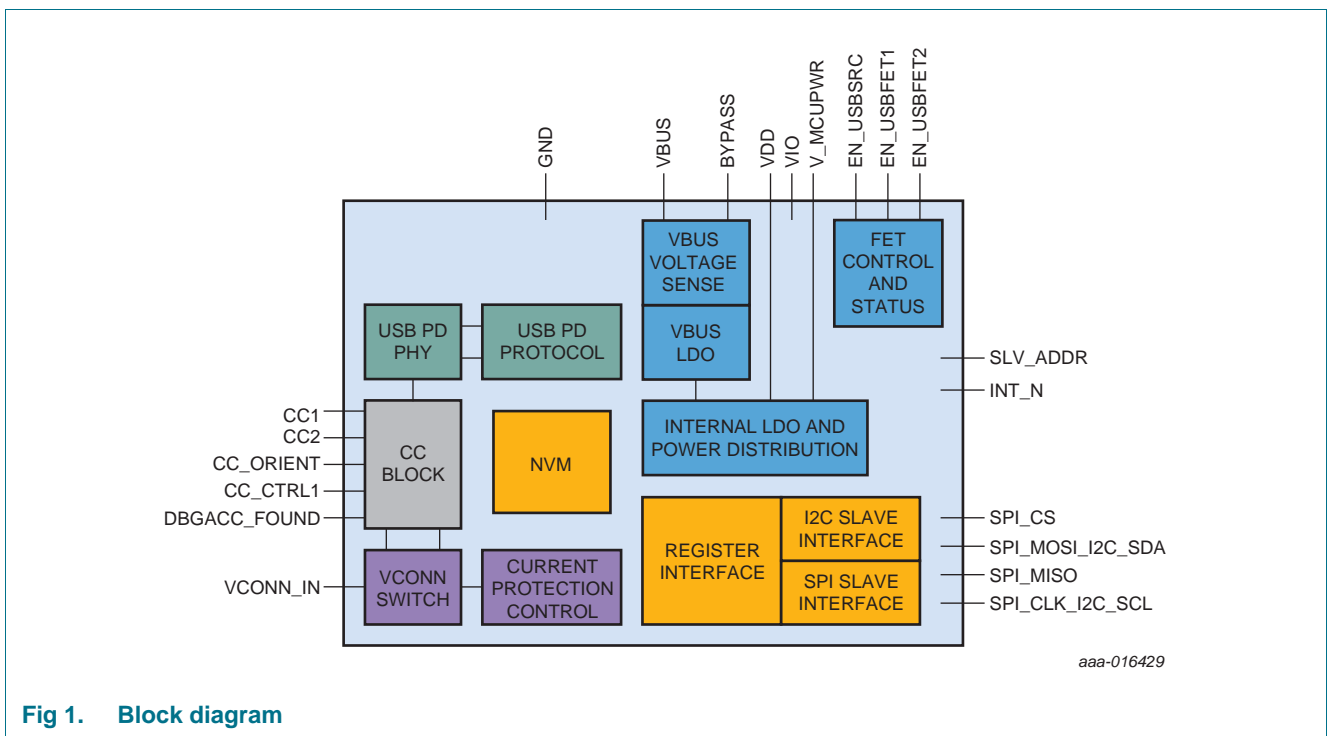| Type number	Orderable part number	Package	Packing method	Minimum order quantity	Temperature
PTN5100BS	PTN5100BSMP	HVQFN20	Reel 13" Q2/T3 *standard mark SMD dry pack	6000	T_{amb} = −20 °C to +85 °C
PTN5100BS	PTN5100BSZ	HVQFN20	Reel 7" Q2/T3 *standard mark SMD dry pack	500	T_{amb} = −20 °C to +85 °C
PTN5100ABS	PTN5100ABSMP	HVQFN20	Reel 13" Q2/T3 *standard mark SMD dry pack	6000	T_{amb} = −20 °C to +85 °C
PTN5100ABS	PTN5100ABSZ	HVQFN20	Reel 7" Q2/T3 *standard mark SMD dry pack	500	T_{amb} = −20 °C to +85 °C

5. Block diagram

Fig 1.   Block diagram

6. Revision history

Table 3.   Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PTN5100_SDS v.1.2	20151210	Objective short data sheet	-	PTN5100_SDS v.1.1
PTN5100_SDS v.1.1	20151201	Objective short data sheet	-	PTN5100_SDS v.1
PTN5100_SDS v.1	20150617	Objective short data sheet	-	-

7. Legal information

7.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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