

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 I²C-bus or SPI interface
 - ◆ Supports register access - device configuration, control and status/interrupt interfacing through Slave I²C-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 - I²C

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

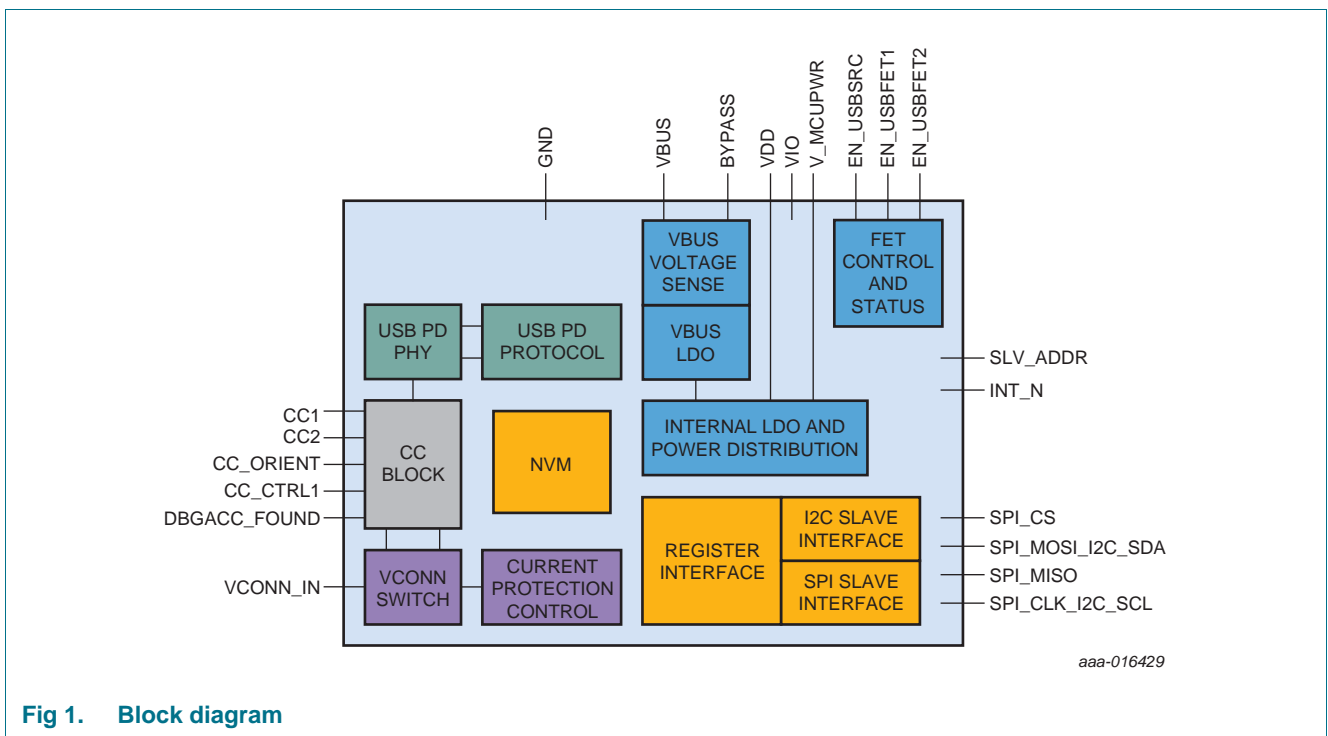


Fig 1. Block diagram

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>.

7.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

7.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Non-automotive qualified products — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b)

whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

7.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

8. Contact information

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

9. Contents

1	General description	1
2	Features and benefits	2
2.1	USB PD and Type-C Features	2
2.2	System protection features	2
2.3	General	2
3	Applications	3
4	Ordering information	3
4.1	Ordering options	4
5	Block diagram	4
6	Revision history	5
7	Legal information	6
7.1	Data sheet status	6
7.2	Definitions	6
7.3	Disclaimers	6
7.4	Trademarks	7
8	Contact information	7
9	Contents	8

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP Semiconductors N.V. 2015.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 10 December 2015

Document identifier: PTN5100_SDS