# USB Type C

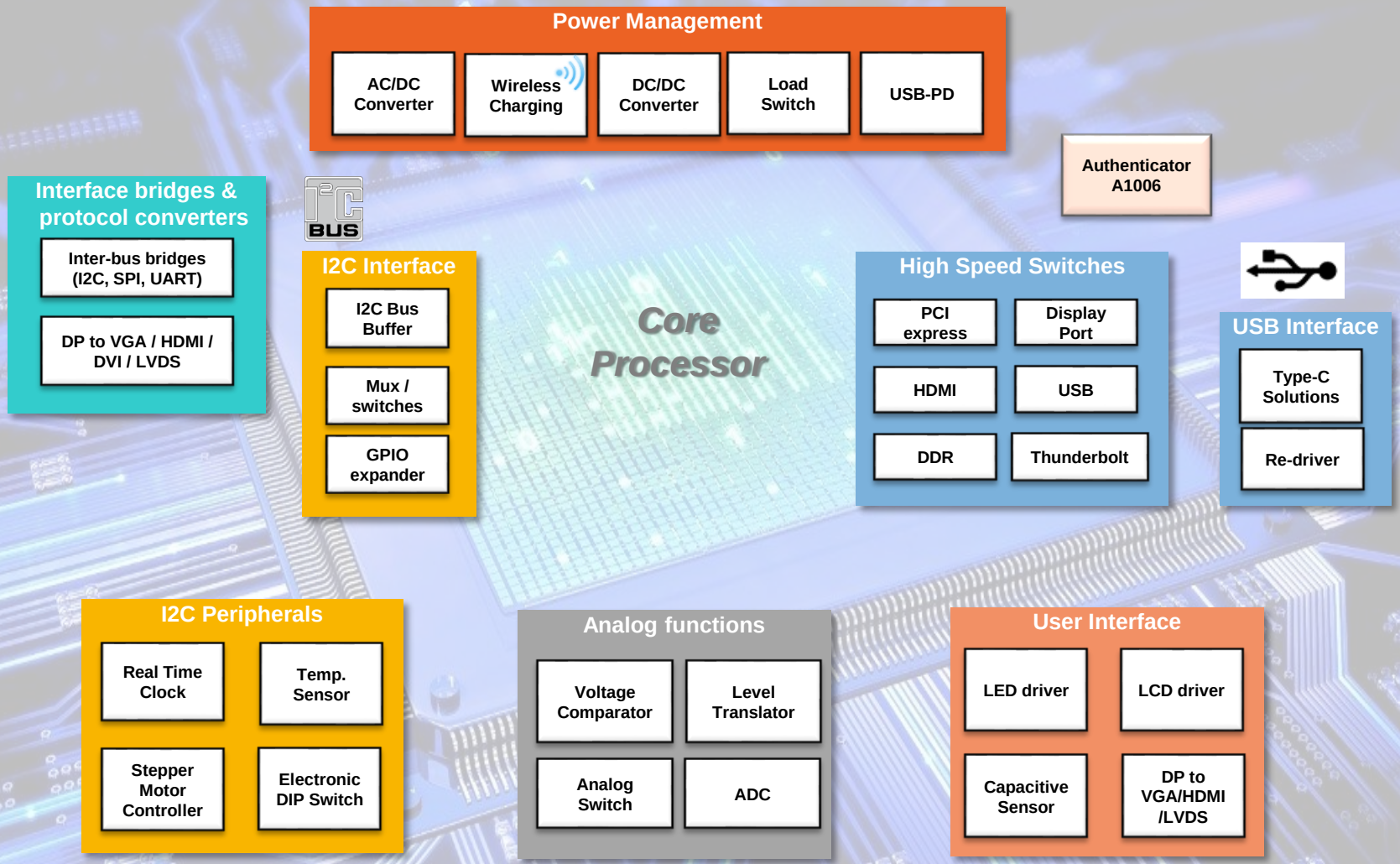
## Seamless connectivity of Data, Video, Security and Power over a single Connector

Business Line Secure Interfaces & Power (BL SIP)

May 2016

SECURE CONNECTIONS FOR A SMARTER WORLD

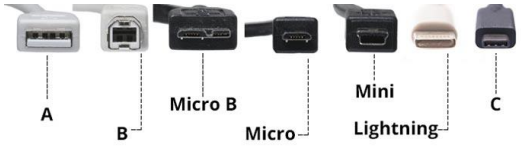
# BL SIP: Solutions Around the Core



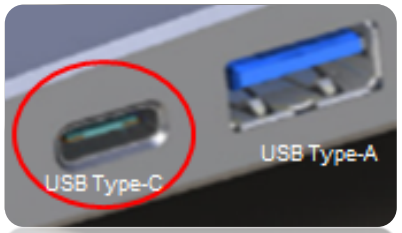
# USB TYPE C INTRODUCTION

# Introduction to USB Type C

- USB Type C is a new connector standard, billed as the '*Last Connector*'
- USB Type C main benefits:
  - **Universal** connector: it is not a proprietary connector
  - **Small**: a third the size of an USB Type A plug.
  - **Reversible**: it plugs in both ways; it is flippable .
  - Support USB 3.1: **10Gbps USB data.**
  - Support flexible *alternate modes* for **non-USB data**, i.e. it allows to have adapters that can output HDMI, VGA, DP or other types of connections.
  - Support up to **100W (20V/5A) Power Delivery** (PD) capability; PD directional control, also from the peripheral to the host ('role swap') and power level management.








# USB Type C Standards

- USB **Type C Standard**
  - USB 2.0 and USB 3.1 (Gen1: 5Gbps, Gen 2: 10Gbps)
  - Up to 15W (5V and 1.5A or 3A)
- USB **Power Delivery (PD)** Standard
  - Scalable power charging up to 100W (20V, 5A)
  - Various power profile defined:
    - Profile # 1 – capable of supplying 5V @ 2A
    - Profile # 2 – capable of supplying 5V @ 2A, 12V @ 1.5A
    - Profile # 3 – capable of supplying 5V @ 2A, 12V @ 3A
    - Profile # 4 – capable of supplying 5V @ 2A, 12V and 20V @ 3A respectively
    - Profile # 5 – capable of supplying 5V @ 2A, 12V and 20V at 5A respectively
    - *Note that these power profiles are guidelines only. A design does not need to stick to one of these profiles.*
  - Possible to change the power flow: “role-swap”
- USB Type C **Alternate Mode** Standard
  - Allows signals other than USB to pass through the Type-C connector.
  - E.g. up to 4-lanes of Display Port (DP) signals can be sent through Type-C interface.

# USB Type C Pins

Receptacle (Front View)

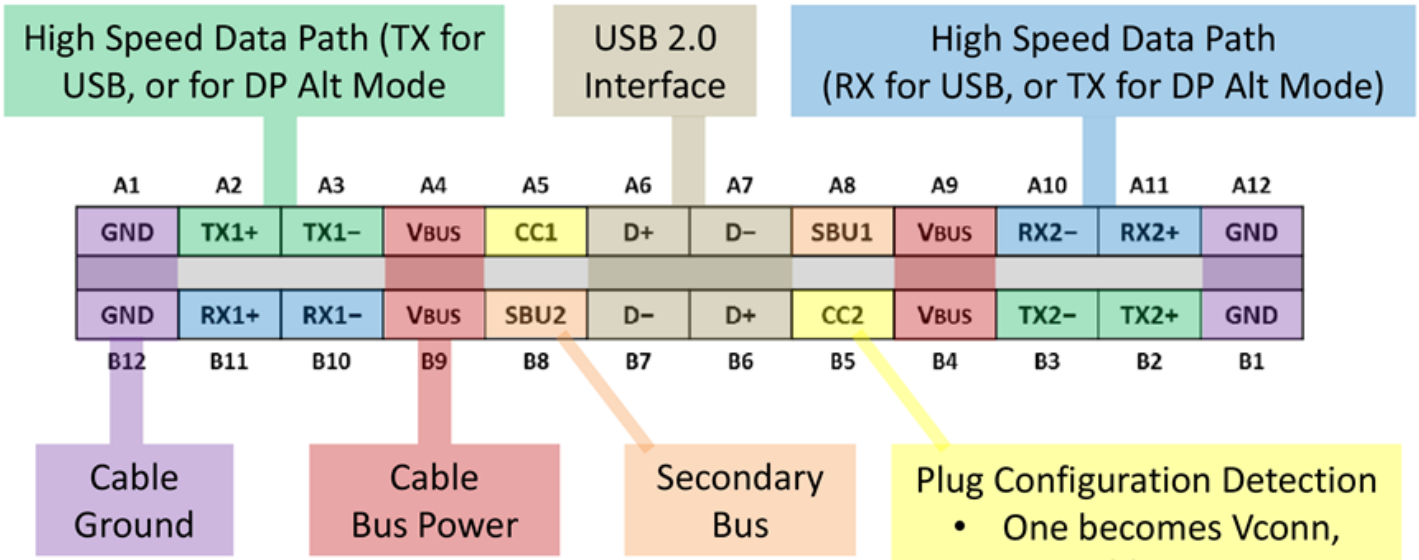



**Table 4-1 USB Type-C List of Signals**

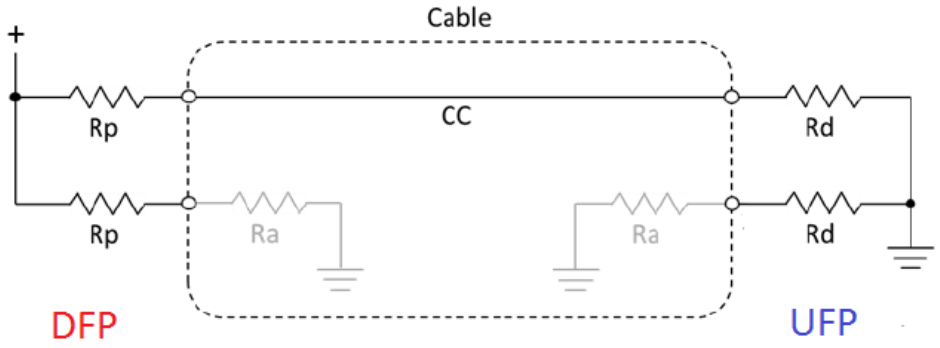
| Signal Group | Signal | Description |
|---|---|---|
| USB 3.1 | SSTXp1, SSTXn1<br>SSRXp1, SSRXn1<br>SSTXp2, SSTXn2<br>SSRXp2, SSRXn2 | SuperSpeed USB serial data interface defines 1 differential transmit pair and 1 differential receive pair. On a USB Type-C receptacle, two sets of SuperSpeed USB signal pins are defined to enable plug flipping feature |
| USB 2.0 | Dp1, Dn1<br>Dp2, Dn2 | USB 2.0 serial data interface defines a differential pair. On a USB Type-C receptacle, two set of USB 2.0 signal pins are defined to enable plug flipping feature |
| Configuration | CC1, CC2 (receptacle)<br>CC (plug) | CC channel in the plug used for connection detect, interface configuration and VCONN |
| Auxiliary signals | SBU1, SBU2 | Sideband Use |
| Power | VBUS | USB cable bus power |
| | VCONN (plug) | USB plug power |
| | GND | USB cable return current path |

$V_{BUS}$: USB cable bus power

$V_{CONN}$: USB plug power

# USB Type C Ports

| Port Type | Description |
|---|---|
| DFP – Downstream Facing Port | "USB host" & initial $V_{BUS}$/$V_{CONN}$ source, Typical Standard-A host |
| UFP – Upstream Facing Port | "USB device" & initial $V_{BUS}$ sink, Typical Standard-B device |
| DRP – Dual Role Port | A port that may operate as a DFP or UFP |




## CC pins and functionality

- Attach/Detach detection
- Determination Plug orientation
- Initial Port role determination
- USB PD Type C Communication *(For PD)*
  - Modification of initial port roles
  - Negotiation of USB PD power contracts
- Management of Functional Extensions *(For PD)*
  - Structured Vendor Defined Messages (VDM)

# USB Type-C Connector – Pinout and Alignment

Receptacle (Front View)

| A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GND | TX1+ | TX1− | VBUS | CC1 | D+ | D− | SBU1 | VBUS | RX2− | RX2+ | GND |
| GND | RX1+ | RX1− | VBUS | SBU2 | D− | D+ | CC2 | VBUS | TX2− | TX2+ | GND |
| B12 | B11 | B10 | B9 | B8 | B7 | B6 | B5 | B4 | B3 | B2 | B1 |

USB3.0 USB2.0 USB3.0

Normal Plug

| A12 | A11 | A10 | A9 | A8 | A7 | A6 | A5 | A4 | A3 | A2 | A1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GND | RX1+ | RX1− | VBUS | SBU2 | | | VCONN | VBUS | TX2− | TX2+ | GND |
| GND | TX1+ | TX1− | VBUS | CC | D+ | D− | SBU1 | VBUS | RX2− | RX2+ | GND |
| B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 |

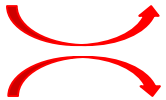
# USB Type-C Connector – Pinout and Alignment

Receptacle (Front View)

| A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GND | TX1+ | TX1− | VBUS | CC1 | D+ | D− | SBU1 | VBUS | RX2− | RX2+ | GND |
| GND | RX1+ | RX1− | VBUS | SBU2 | D− | D+ | CC2 | VBUS | TX2− | TX2+ | GND |
| B12 | B11 | B10 | B9 | B8 | B7 | B6 | B5 | B4 | B3 | B2 | B1 |

USB3.0 USB2.0 USB3.0

Normal Plug



Reverse Plug

| A12 | A11 | A10 | A9 | A8 | A7 | A6 | A5 | A4 | A3 | A2 | A1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GND | RX2+ | RX2− | VBUS | SBU1 | D− | D+ | CC | VBUS | TX1− | TX1+ | GND |
| GND | TX2+ | TX2− | VBUS | VCONN | | | SBU2 | VBUS | RX1− | RX1+ | GND |
| B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 |

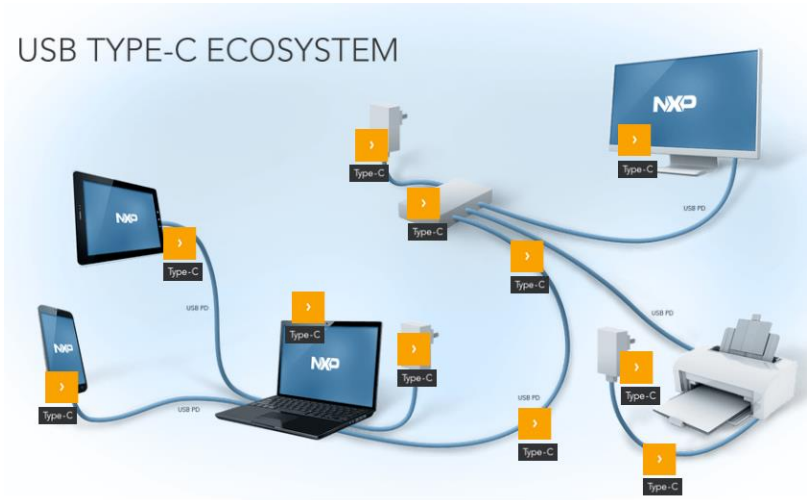
# USB Type C Applications

**Video, Data and Charging over the same cable**

- Computing:
  - Notebook
  - Desktops
  - Docking stations
  - Monitors
- Portable devices
  - Tablets
  - Smartphones
  - Hard drives
  - Cameras
- Accessories:
  - Dongles
  - Cables
- AC/DC wall chargers
- Printers
- Etc.

# NXP USB Type C

- NXP Vision: seamless connectivity of Data, Video, Security and Power over a single Connector
- NXP Value Proposition:
  - A long-time leader in USB systems and member of the USB-IF, NXP helped define the Type-C specification. This gives our engineers a keen understanding of Type-C implementations, complemented by a solutions portfolio fully equipped to support every aspect of Type-C design.
  - Broad portfolio of best-in-class USB Type C solutions, i.e. USB-Power Delivery, X-Bar Switches, Load Switches and ESD/EMI solutions, microcontrollers, authentication, AC/DC adapter components.
- NXP USB Type-C campaign page:
  http://www.nxp.com/technologies/usb-type-c.html#ecosystem

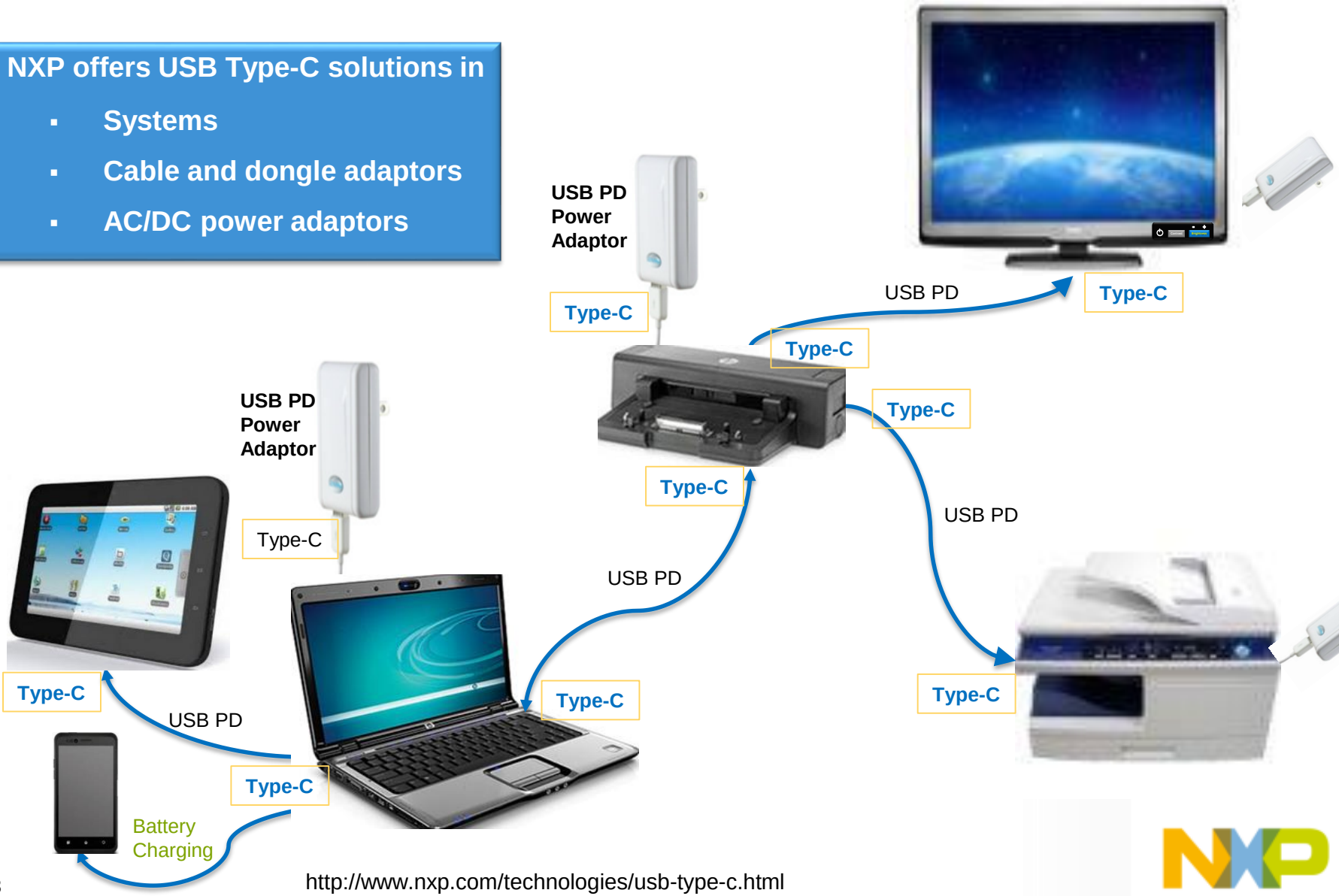


# USB TYPE-C SYSTEM SOLUTION

# Ecosystem Illustration

**NXP offers USB Type-C solutions in**

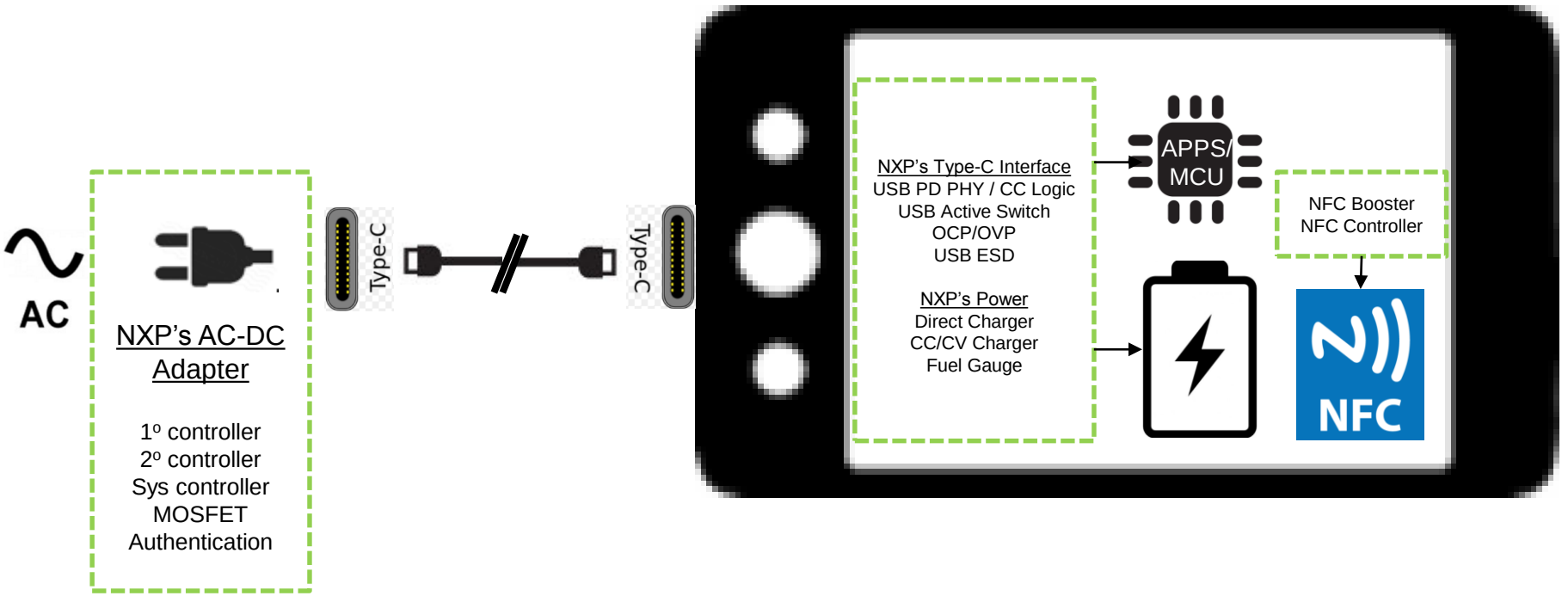
- Systems
- Cable and dongle adaptors
- AC/DC power adaptors




http://www.nxp.com/technologies/usb-type-c.html

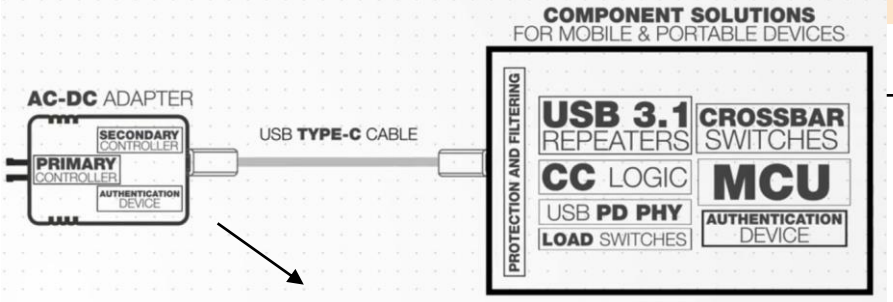
http://www.nxp.com/applications/connectivity/usb-type-c-system.html

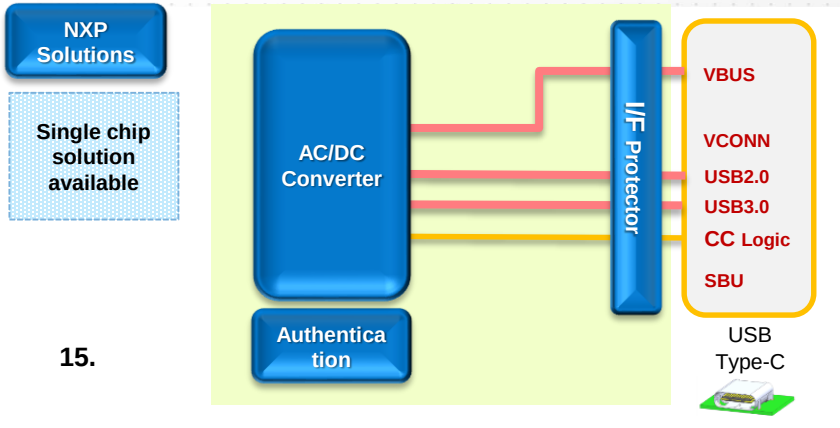
# NXP USB Type-C & Smart charging

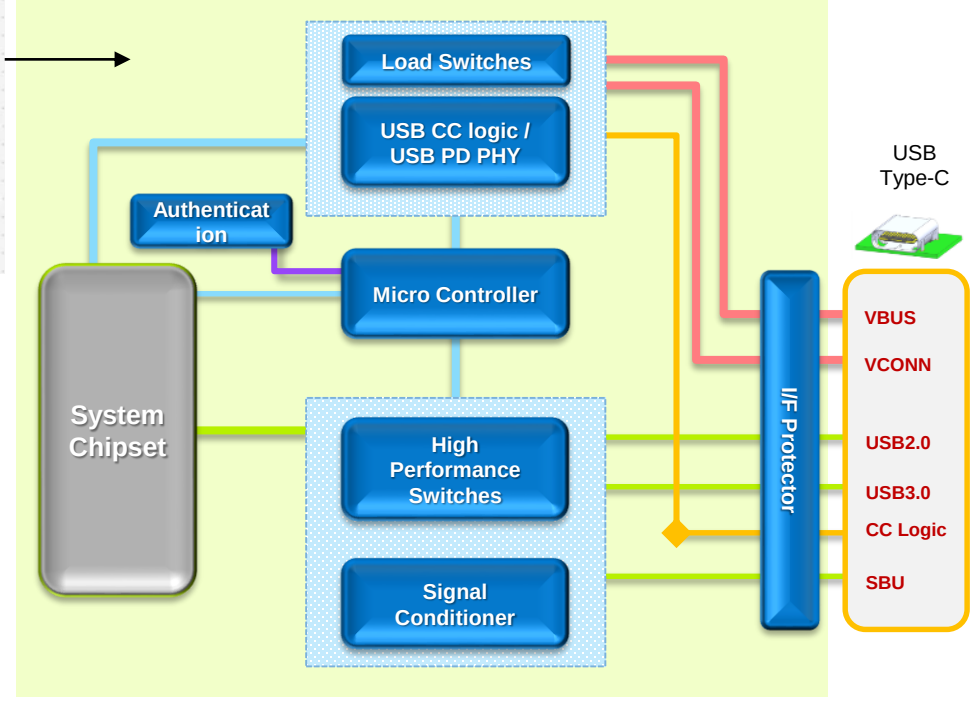


# NXP USB Type-C system solutions

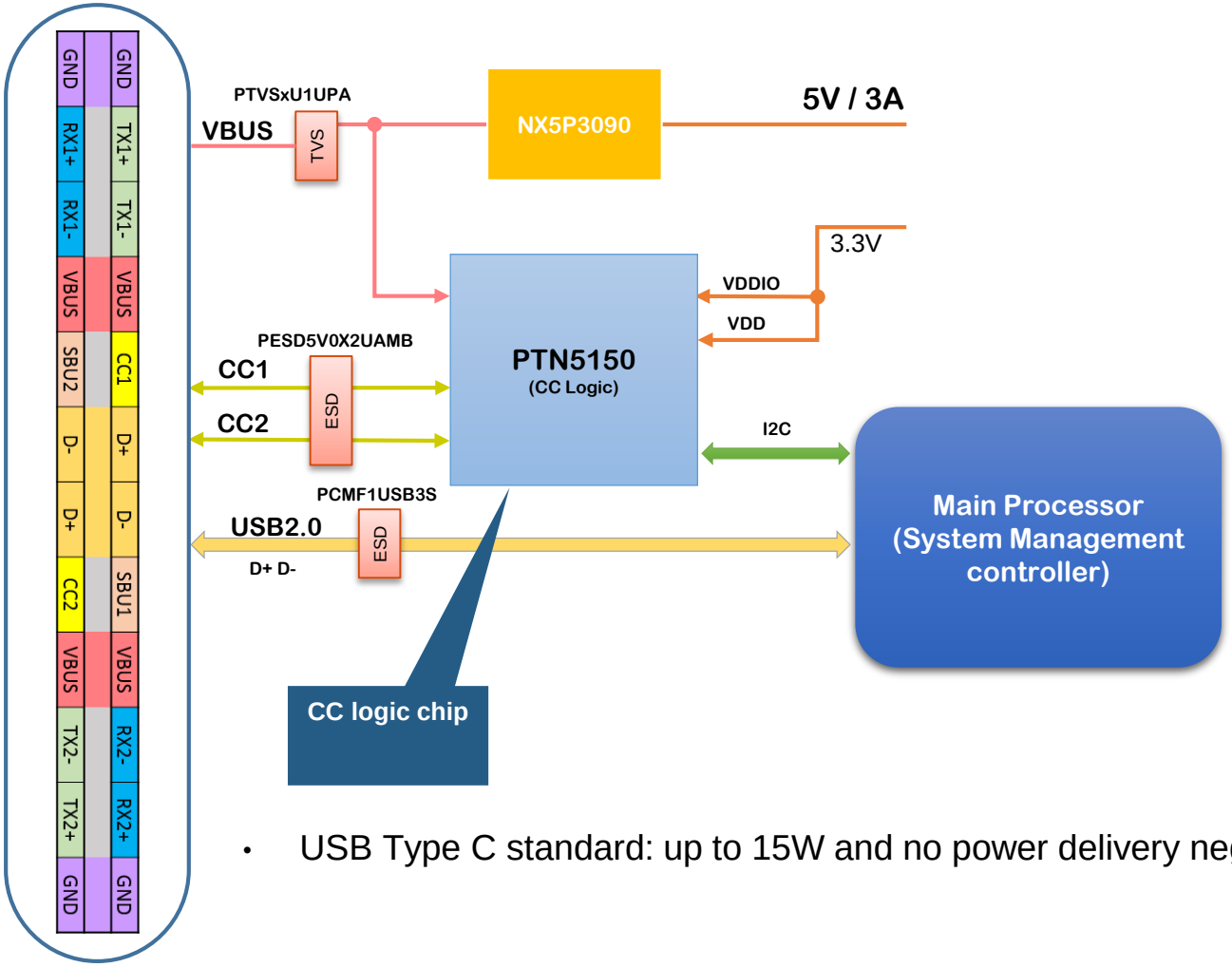
| CC-logic controller | USB Load switches | USB PD PHY | USB Type-C MCU | USB Re-driver | High speed signal switches | Authentication | AC/DC converters |
|---|---|---|---|---|---|---|---|
| CC-logic detection, role detection. USB OTG support. External switch selection. | Low Ron power Switch with UVP, OVP, RCP, OTP, programmable over-voltage and/or current limit. | USB PD 2.0 physical layer controller; with or without VCONN switch; I2C and SPI interface. Version with TCPC register map. | Support power negotiation; in-house USB PD firmware; fully compliant total solution. | Single, dual and quad channel active regenerators. Programmable equalizer and amplitude setting, ultra low power, small packages. | Support 'plug flippable' and 'Alternate mode' functions. High signal bandwidth, low return loss, low crosstalk, low jitter disturbance. | Anti-counterfeiting on Type-C peripherals. Strongest levels of market-proven and certified security; secure key insertion per die. | Complete wall-to-battery USB Type C charging solutions. High efficiency and very low stand-by power. Multi-protocol fast charging controllers. |



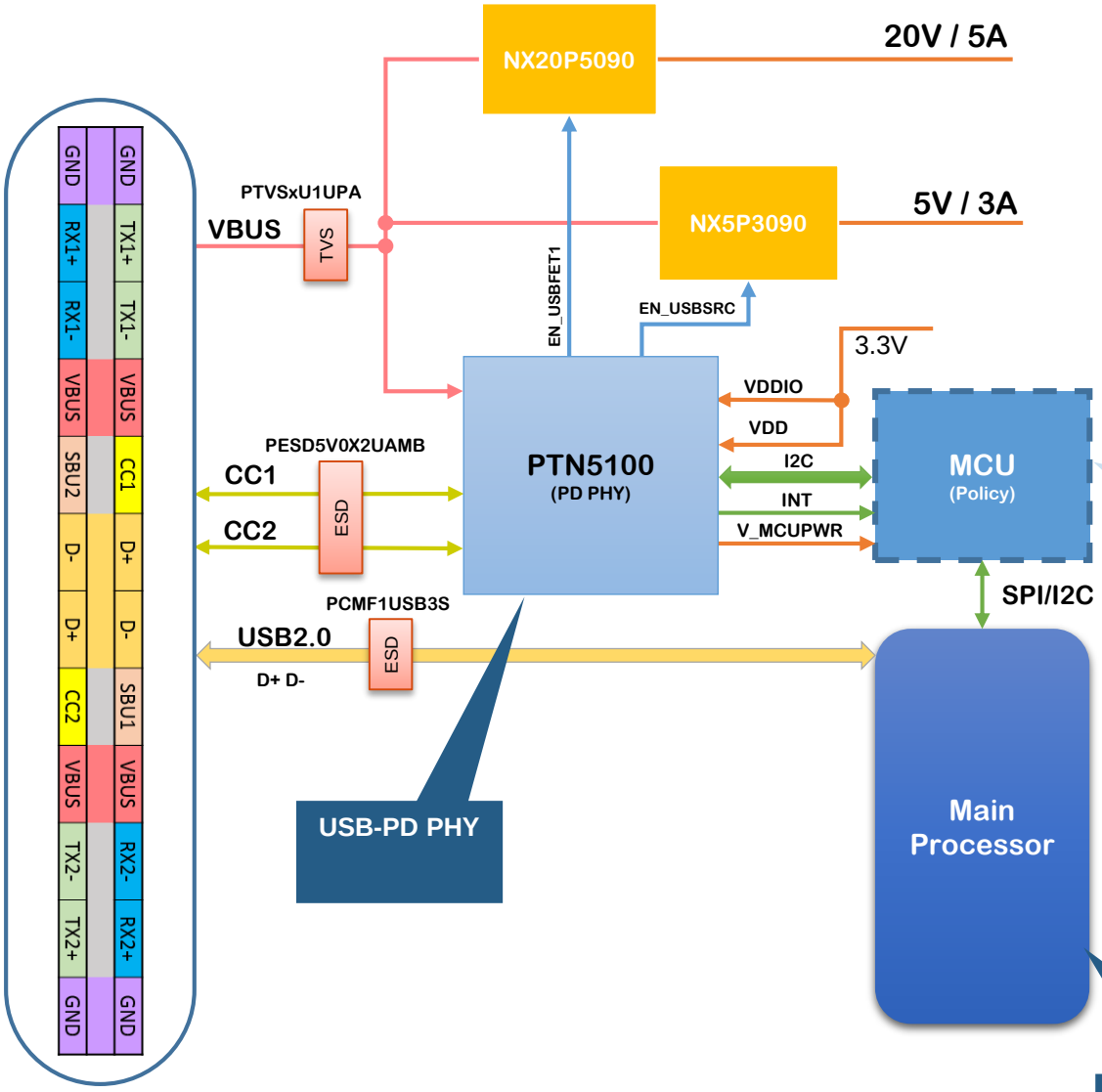



# USB Type-C port + USB 2.0




- USB Type C standard: up to 15W and no power delivery negotiation

# USB Type-C port + USB 2.0 + USB PD




Only one load switch NX20P5090 or NX5P3090 could be used, according to the requirements of the application

**MCU PD Policy**: It is used to store the USB PD firmware stack and handle the USB PD protocol.

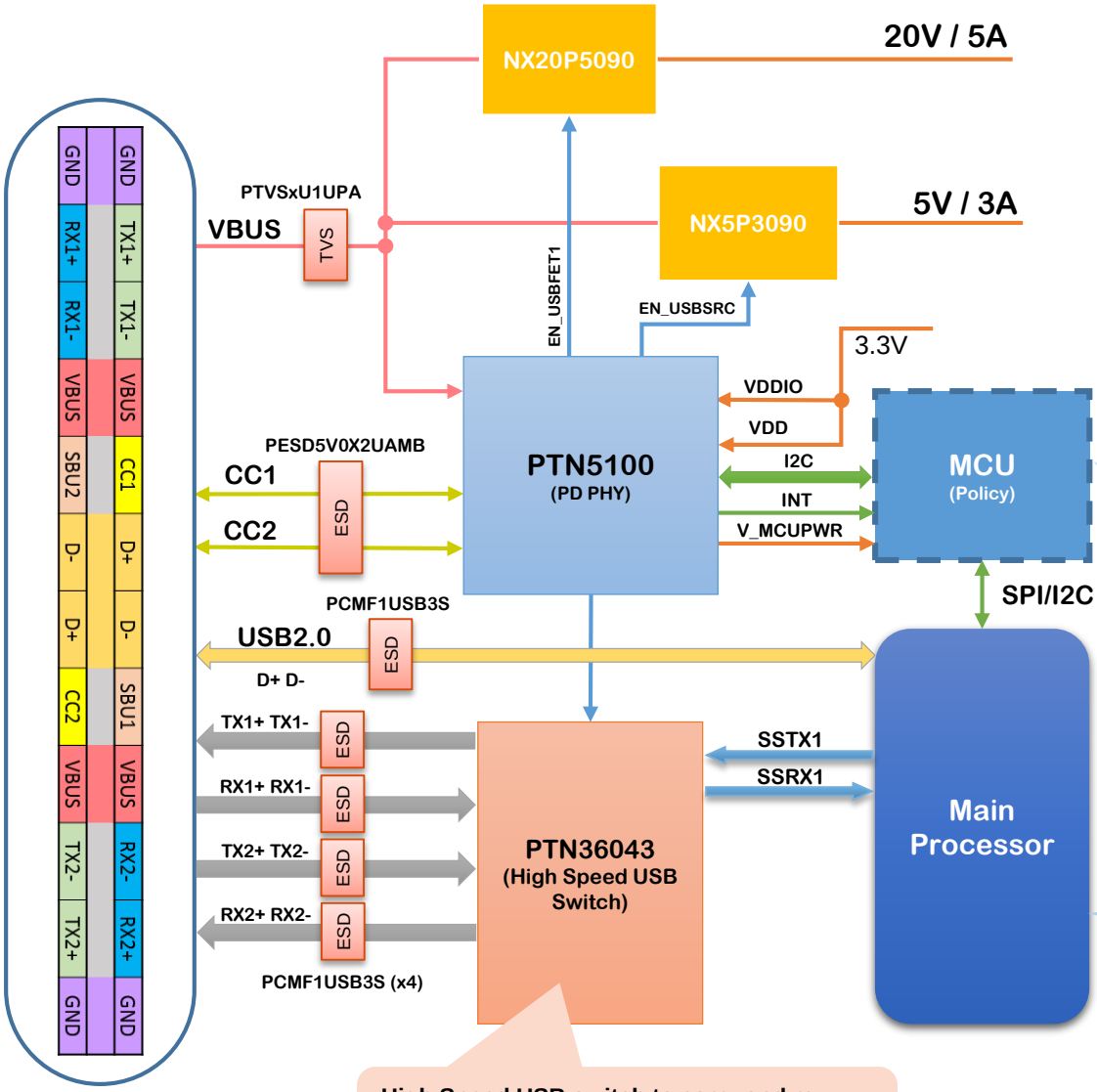
Examples: NXP LPC11xx/LPC15xx

The USB PD software stack can also be implemented in the main processor, depending of the processor load.

**MCU Optional. The USB PD software stack can be also implemented in the main processor, depending of the processor load.**

PTN5100 paired with NXP LPC11xx MCU series. Licensing of the USB-PD Firmware (Protocol & Policy Engine) is available upon request.

# USB Type-C port + USB 2.0/3.0 + USB PD




Only one load switch NX20P5090 or NX5P3090 could be used, according to the requirements of the application

**MCU PD Policy**: It is used to store the USB PD firmware stack and handle the USB PD protocol.

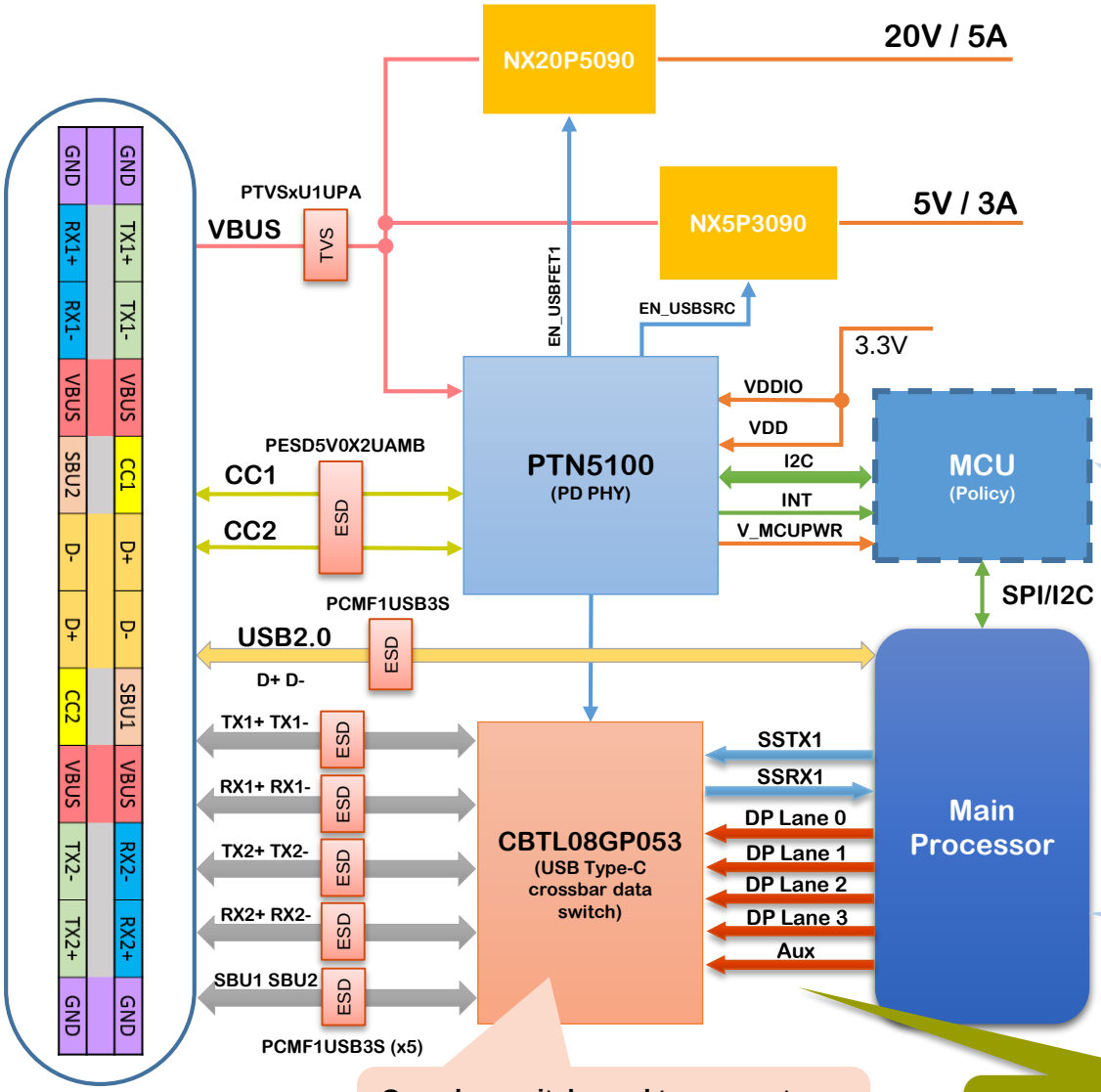
Examples: NXP LPC11xx/LPC15xx

The USB PD software stack can also be implemented in the main processor, depending of the processor load.

**Main processor** that handle the USB 3.0.

**High Speed USB switch to carry and re-drive USB 3.0 signals and support the 'plug flippable" functionality**

# USB Type-C port + USB 2.0/3.0 + USB PD + DP Alt Mode




Only one load switch NX20P5090 or NX5P3090 could be used, according to the requirements of the application

**MCU PD Policy**: It is used to store the USB PD firmware stack and handle the USB PD protocol.

Examples: NXP LPC11xx/LPC15xx

The USB PD software stack can also be implemented in the main processor, depending of the processor load.

**Main processor** that handle the USB 3.0.

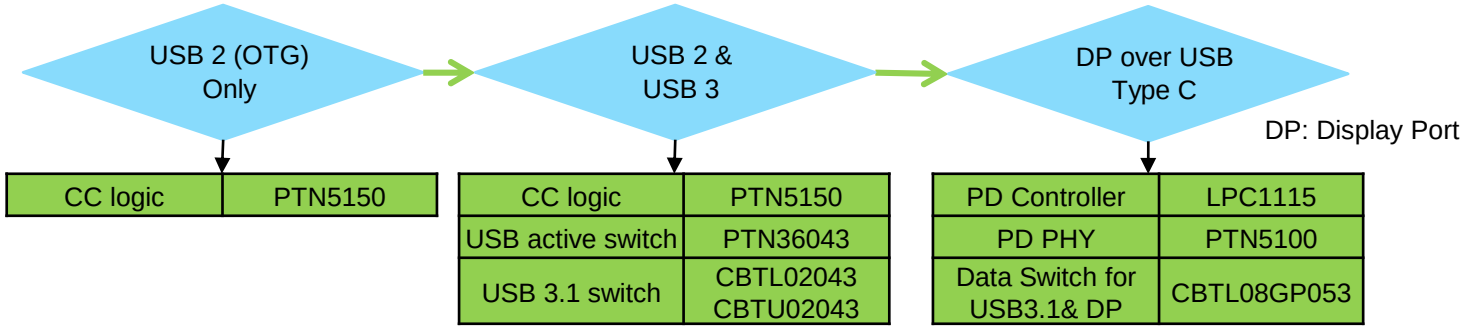
**Crossbar switch used to commute the connection of the different protocols.**

**Alternate mode**: Serial protocol up to 4 lanes + one lane for control (eDP, DP, PCI, etc.). In this case DP is shown.

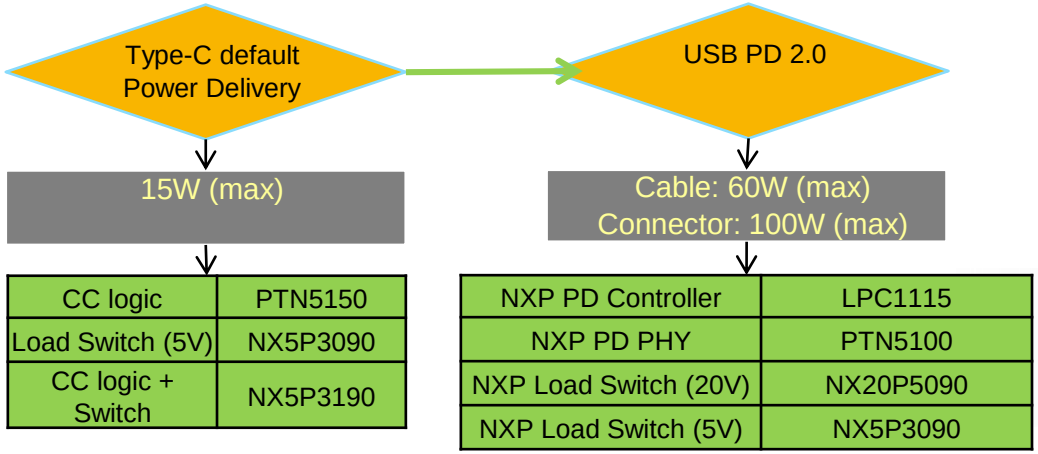
# NXP USB Type C portfolio & selection criteria

| | CC-logic controller | USB Load switches | USB PD PHY | USB Type-C MCU | USB Re-driver | High speed signal switches | Authentic ation | AC/DC converters |
|---|---|---|---|---|---|---|---|---|
| Product Type | PTN5150<br>PTN5150A<br>PTN5150H | NX5P2190<br>NX5P3090<br>NX5P3190<br>NX5P3290<br>NX20P5090 | PTN5100(D)<br>PTN5100A(D)<br>PTN5110 | LPC1115<br>LPC11U35<br>LPC11E36<br>LPC11E37 | PTN36221A<br>PTN36241G<br>PTN36001 | CBTL02043<br>CBTL04GP043<br>CBTL08GP053<br>CBTL02GP044<br>CBTU02043 | A1006<br>A710x | TEA1936<br>TEA1993<br>TEA1903<br>TEA1905 |
| | NX5P3190 | | | | PTN36043 | | | |

**Selection for USB data requirements:**




**Selection for USB power requirements:**



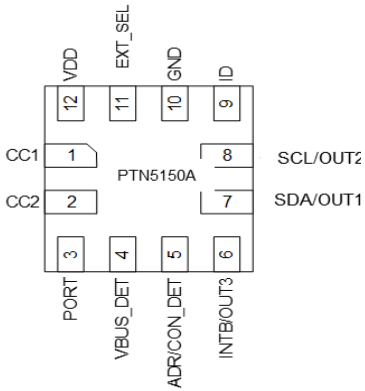
# USB TYPE-C PRODUCTS DETAILS

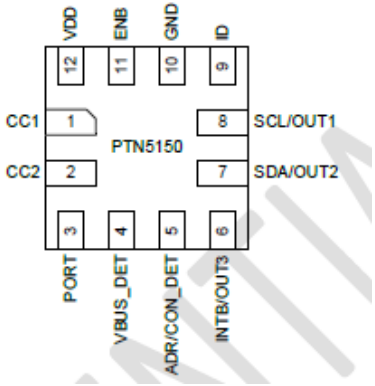
# PTN5150: USB Type-C CC logic device

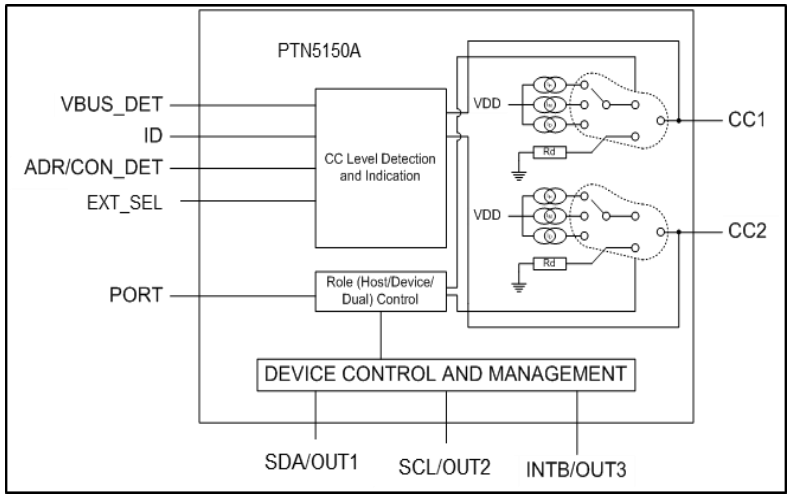
**In Production**

## Description

- Complies with USB Type-C specifications
- Support different Type-C port roles: DFP, UFP, DRP
- Supports Cable/plug insertion / removal detection; orientation detection, role and charging current detection
- PTN5150A: Pin 11 = EXT_SEL  output to control USB data switch, e.g. PTN36043
- PTN5150: Pin 11 = ENB (Enable input pin, active low)
- Available in:  X2QFN12  1.6 x 1.6 x0.35 mm, 0.4 mm pitch



# PTN5100: USB Type-C PD PHY and Protocol IC

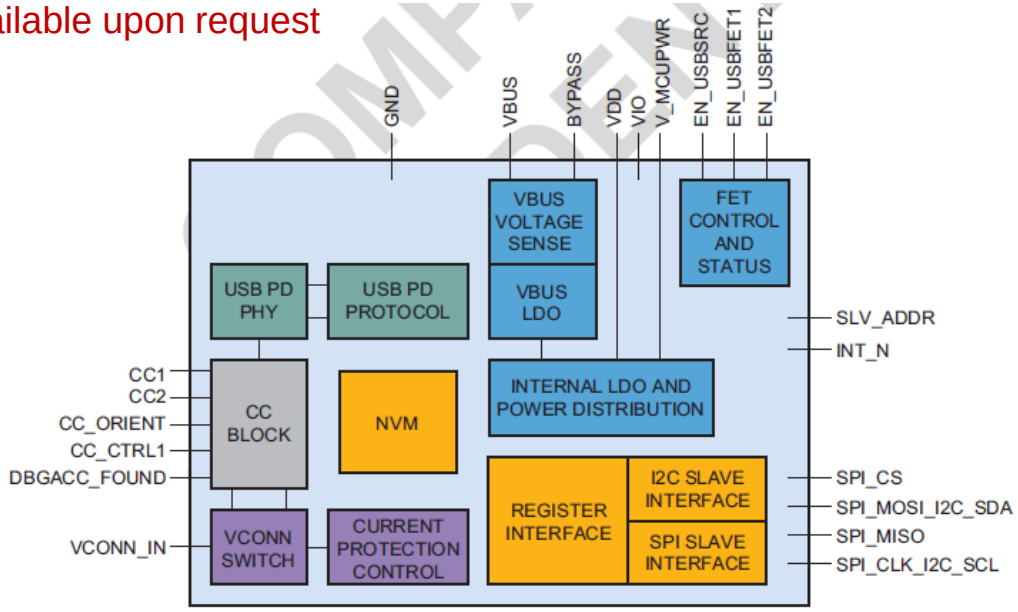
**In Production**

## Description

- Complies with USB PD and USB Type-C specifications
- Support implementations of the different USB PD roles: P, P/C, C, C/P
- Support different Type-C port roles: DFP, UFP, DRP
- Cable/plug insertion / removal detection; orientation detection and indication through CC_ORIENT pin: if low → CC communication on CC1 and VCOMM on CC2
- Communicate with the USB PD policy MCU via I2C or SPI

Available in: HVQFN20 4 x 4 mm, 0.5 mm pitch

- Paired with NXP LPC11xx MCU series.
- Licensing of the USB-PD Firmware (Protocol & Policy Engine) is available upon request




## Features

- VDD, VIO = 3.3 V typ.
- VCONN: 2.7V to 5.5V
- VCONN Ron = 150 mΩ (max)
- I(VCONN) = 1 A (max)
- VBUS up to 25V (30V tolerant)
- CC1, CC2 up to 5.5V
- Enable pins for the USB PD switches up to 28V
- Temp.: -40 to 105°C

# NX20P5090 – 5A/20V USB PD power switch

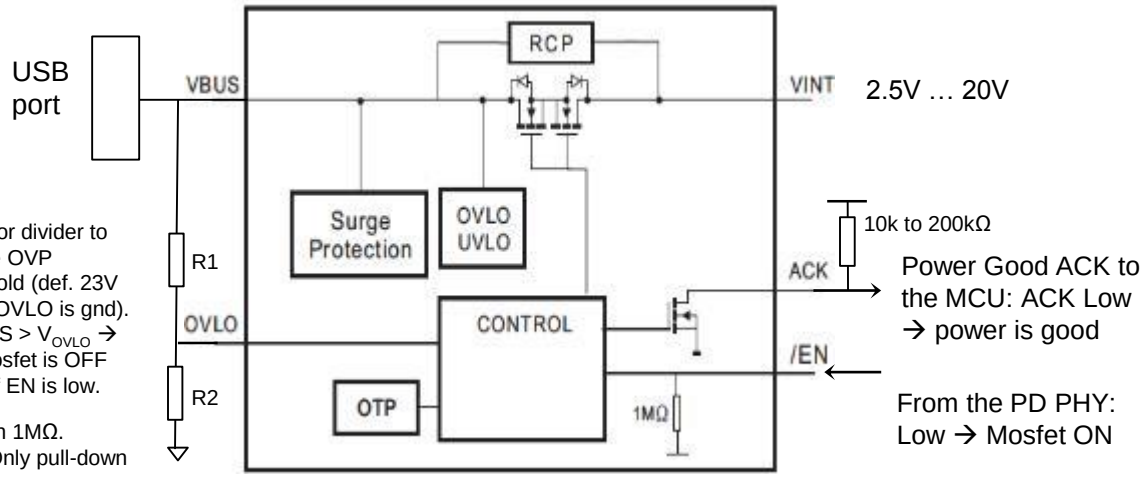
**In Production**

## Description

- 5.0A capable power switch with programmable over-voltage protection (OVP) via external resistor divider.
- Includes under-voltage protection (UVP), reverse-current protection (RCP), and over-temperature protection (OTP). During a fault condition, device opens to protect the load. Slew rate control with 15ms de-bounce time before the switch turns on is also included.
- Enable input integrates logic translation making the device compatible with lower voltage processors
- Operates from 2.5V to 20 V, to support USB PD Type C and power domain isolation applications with high supply currents.

Available in: WLCSP15 1.6 x 2.6 mm, 0.5 mm pitch

Block diagram:




| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | VINT | VINT | VINT | VINT | VBUS |
| 2 | ACK | VBUS | VBUS | VBUS | VBUS |
| 3 | /EN | OVLO | GND | GND | GND |

## Features

- Operates from 2.5 to 20 V.
- Low ON resistance: Ron typ. 30mΩ
- 29 V tolerant VINT/VBUS pins
- Reverse current protection
- Programmable over-voltage protection (4V to 23V via external resistor divider)
- Under voltage protection (2.5V)
- Over-temperature protection @140C
- 1.8V control Logic to enable/disable
- Slew rate control with 15ms de-bounce

# NX5P3090 – 3A/5V USB PD power switch

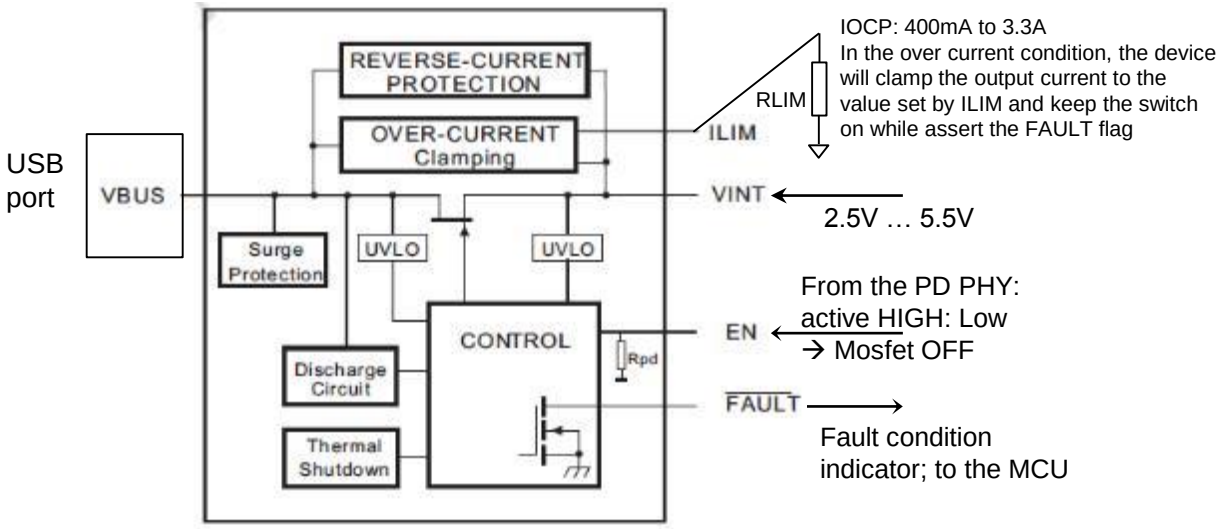
**Production: May ’16**

## Description

- Power switch with programmable current limit from 400mA to 3.3A for USB PD applications. During over-current situations, device clamps the current to a value set by external resistor.
- Device also includes reverse current protection (RCP), under voltage lockout, over-temperature, surge protection, & soft start.
- Enable input integrates logic translation making the device compatible with lower voltage processors.
- Input and output terminals are 30V tolerant to support USB PD rails.

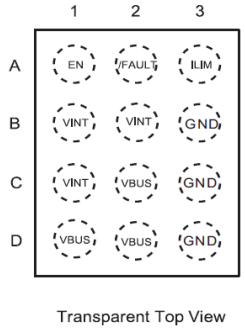
Available in: WLCSP12 1.35 x 1.65, 0.4 mm pitch

Block diagram




## Features

- Operates from 2.5 to 5.5V
- Low ON resistance: Ron typ. 30mΩ
- 29 V tolerant VINT & VBUS pins
- UVLO protection
- Reverse current protection
- Adjustable current limit 0.4 to 3.3A
- 100V surge protection
- Active discharge circuit
- Over-temperature protection @140C
- 1.8V control Logic to enable/disable
- Soft start turn-on, slew rate controlled

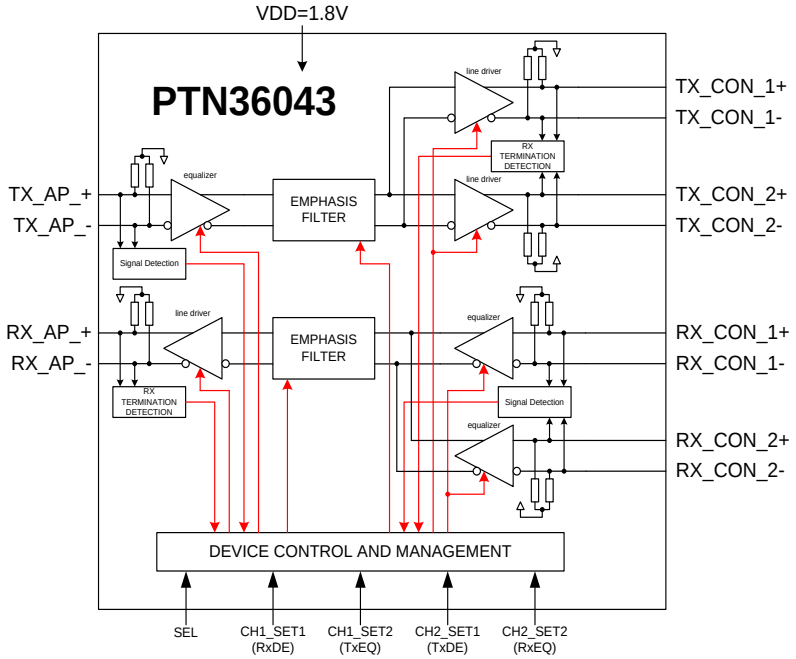



Transparent Top View

In Production

# PTN36043: USB Type C SuperSpeed Redriver Switch

- 5Gbps USB3.0 one port redriver switch
- Compliant to SuperSpeed USB standard
- Optimized data flow for Type-C connector
- Adjustable Receive equalization, Transmit de-emphasis , and output swing functions
- Low crosstalk and excellent differential and common return loss performance
- Low power management scheme
  - 189 mW (105mA)  active power
  - 2.16 mW (1.2mA) in U2/U3 state
  - 0.9 mW (0.5mA) with no connection
- Power supply: VDD=1.8V±5%
- ESD 8kV HBM; 1kV CDM
- Operating Temperature Range: -40ºC to 85ºC
- Very small thin DHXQFN18 package:
  2.4 mm x 2.0 mm x 0.35mm, 0.4 mm pitch

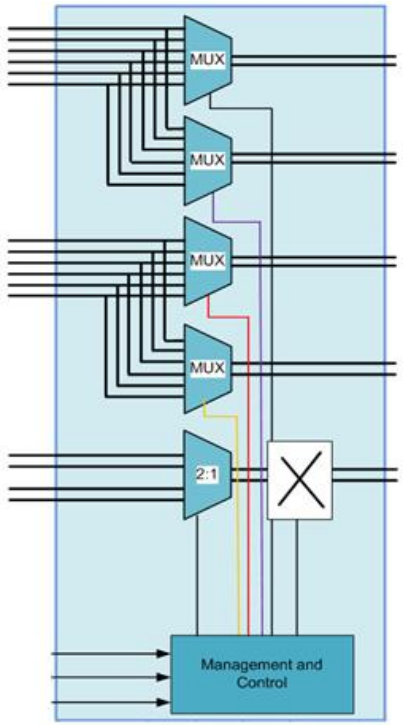


# CBTL08GP053 – USB Type-C Combo Switch

**In Production**

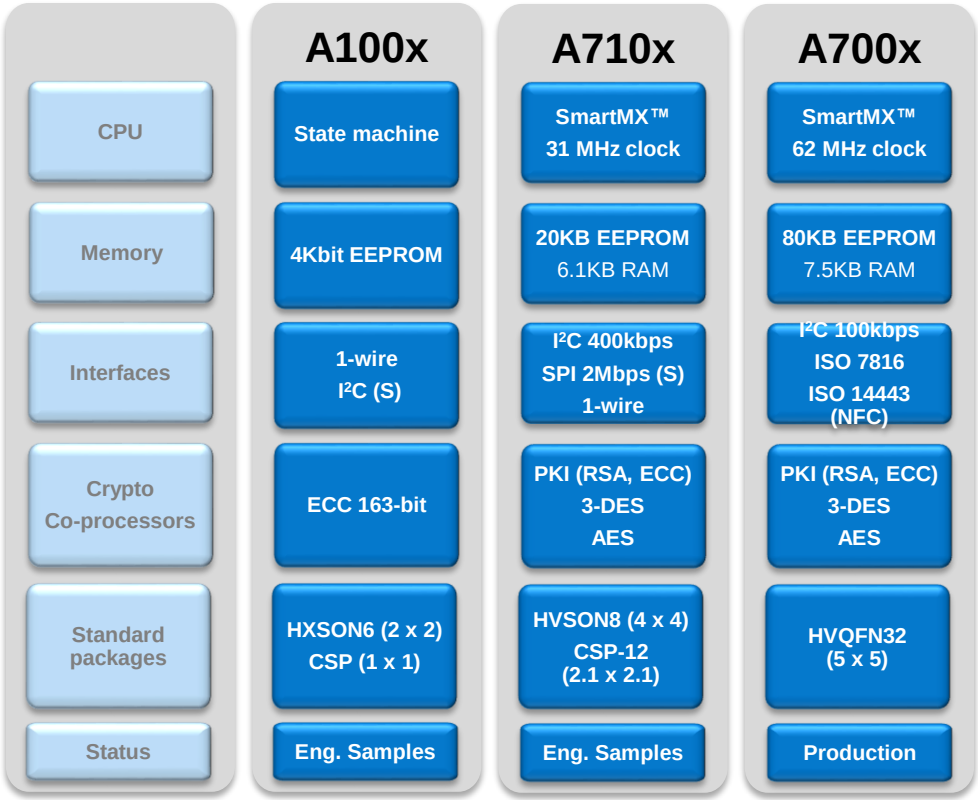
- Applications in platforms supporting Alternate Modes to transport multiple high speed signals over USB Type-C connector
- Supports data rates up to 5.4 Gbps
- Supports several use cases
  - USB3
  - USB3, DP 1/2/4-lanes
  - USB3, PCIe (1-lane)

- High Speed Mux target specs
  - Bi-directional usage support (mux or switch)
  - -3dB BW:  >5 GHz
  - Insertion loss: 1.3 dB@ 2.7 GHz
  - Isolation: 25 dB @ 2.7 GHz
  - Return loss: 18 dB @ 2.7 GHz
  - Cross talk: 35dB @ 2.7 GHz
- High speed and Side band Mux support (controlled via I2C
- Back current protection on control pins
- Side band muxes can handle up to 5V  (rail to rail signaling
- Single 3.3V supply
- Active Current consumption ~500 uA
- ESD 2kV HBM, 500V CDM
- 36-ball BGA, 0.4 mm pitch



# USB Type C Authentication

- Enable or disable capabilities based on trust level established between a host and device
  - For example, a system might authenticate a charger or cable before enabling high powered fast charging, preventing safety issues that can be caused by counterfeit products.
- NXP offers a range of secure authentication solutions to meet different security, form factor, and power consumption design goals.
  - CPU: from simple state machine to secure micros with range of supported clock rates
  - Memory: EEPROM and/or RAM in various sizes
  - Interfaces: I2C slave only, I2C/SPI master and slave
  - Crypto-Coprocessor: ECC only; PKI (RSA, ECC), 3-DES, AES
  - Packages: HVSON, HVQFN, CSP



# A1006 Secure Authenticator

- A1006 is a small footprint, low power, fully secure state machine based authentication solution
- **Asymmetric crypto** protocol based on **ECC** B-163 curve
  - No security IC needed on the host side because of public key authentication
  - Private key securely stored, never leaving the secure element
  - Certificates digitally signed using ECDSA based on NIST B-233 curve
- Very **fast authentication < 50ms**
- Industry leading **advanced tamper resistant features** integrated
- 4 Kbit EEPROM
  - 1 Kbit NXP certificate + 1 Kbit Optional User certificate + 1 Kbit User memory & ID + 1 Kbit system memory
- Industry **smallest footprint**:
  - WLCSP-4: 1 x 1 x 0.5 mm
  - HXSON-6: 2 x 2 x 0.5 mm
- Industry **lowest power**:
  - 500 µA active / 50 µA idle
  - Deep sleep mode with power consumption of < 1 µA at 1.8V
- Flexible interface:
  - 400 Kbps I2C Fast-mode Interface
  - One Wired Interface (OWI) 100 Kbps , bus powered, with no external components. Only One pin required to connect to Host.

# A1006 tamper resistant features

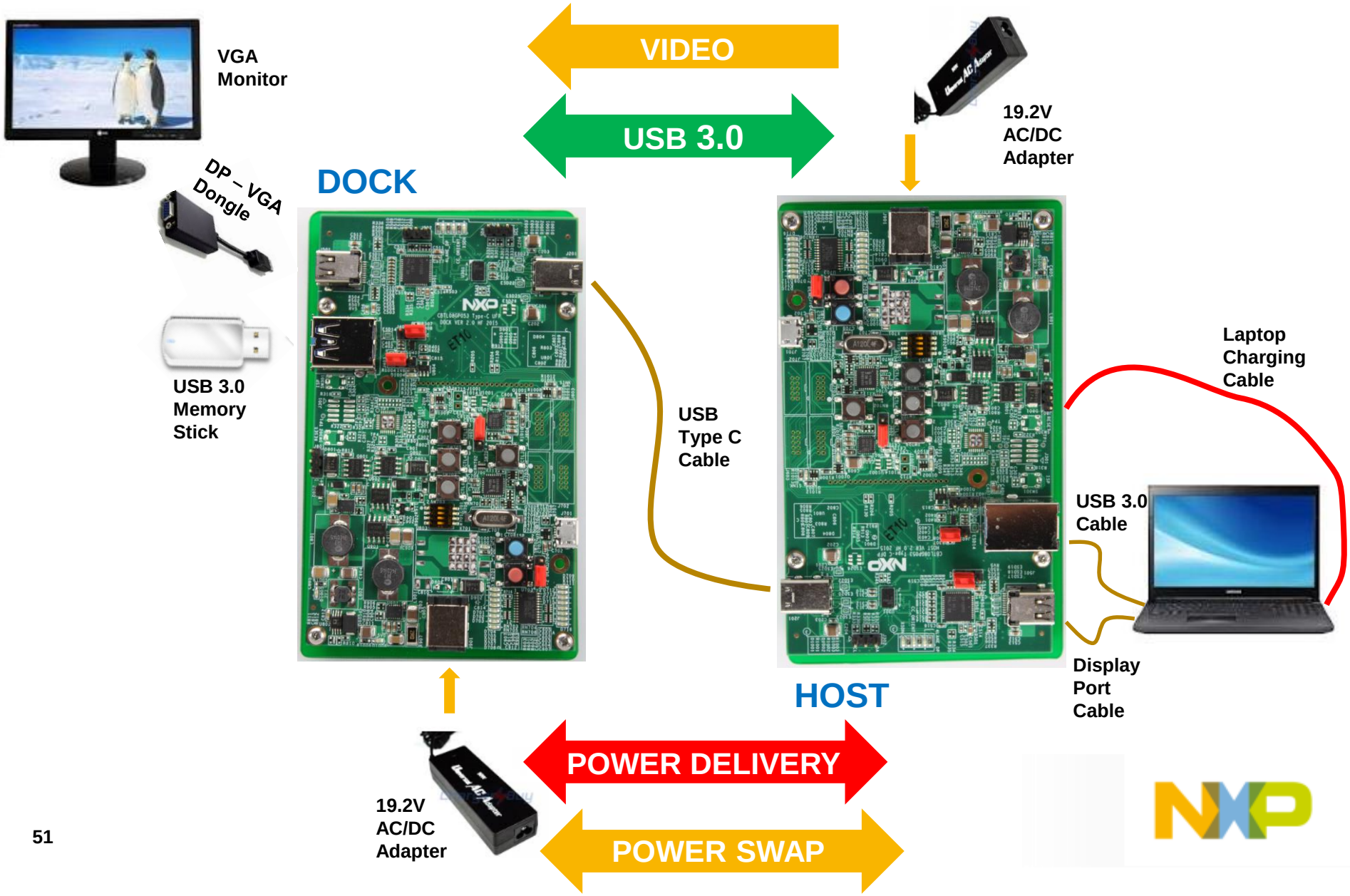
- 140nm CMOS technology providing enhanced protection against reverse engineering and probing attacks
- Security routing on all metal layers
- Shielding: Active and Passive Shielding above digital logic area, analog, EEPROM with independent, randomized content
- NXP-patented GlueLogic™, the most advanced protection against reverse-engineering attacks in the market:
  - Function blocks are chopped up and randomly mixed
- Memory encryption and memory scrambling for unique placement of data for each IC
- Security sensors:
  - Low and high clock frequency sensor
  - Low and high temperature sensor
  - Low and high supply voltage sensor
- Secured state-machine
  - Protection against fault injection attacks
- Secured ECC core:
  - Protection against Timing Analysis
  - Protection against Single Power Analysis (SPA), Differential Power Analysis (DPA), Electromagnetic Analysis (EMA)
  - Protection against Differential fault Analysis (DFA)

# USB Type C protection

- NXP offers **ESD protection** and **Common Mode Filters with integrated ESD protection** for the new USB Type-C connector.
- Products

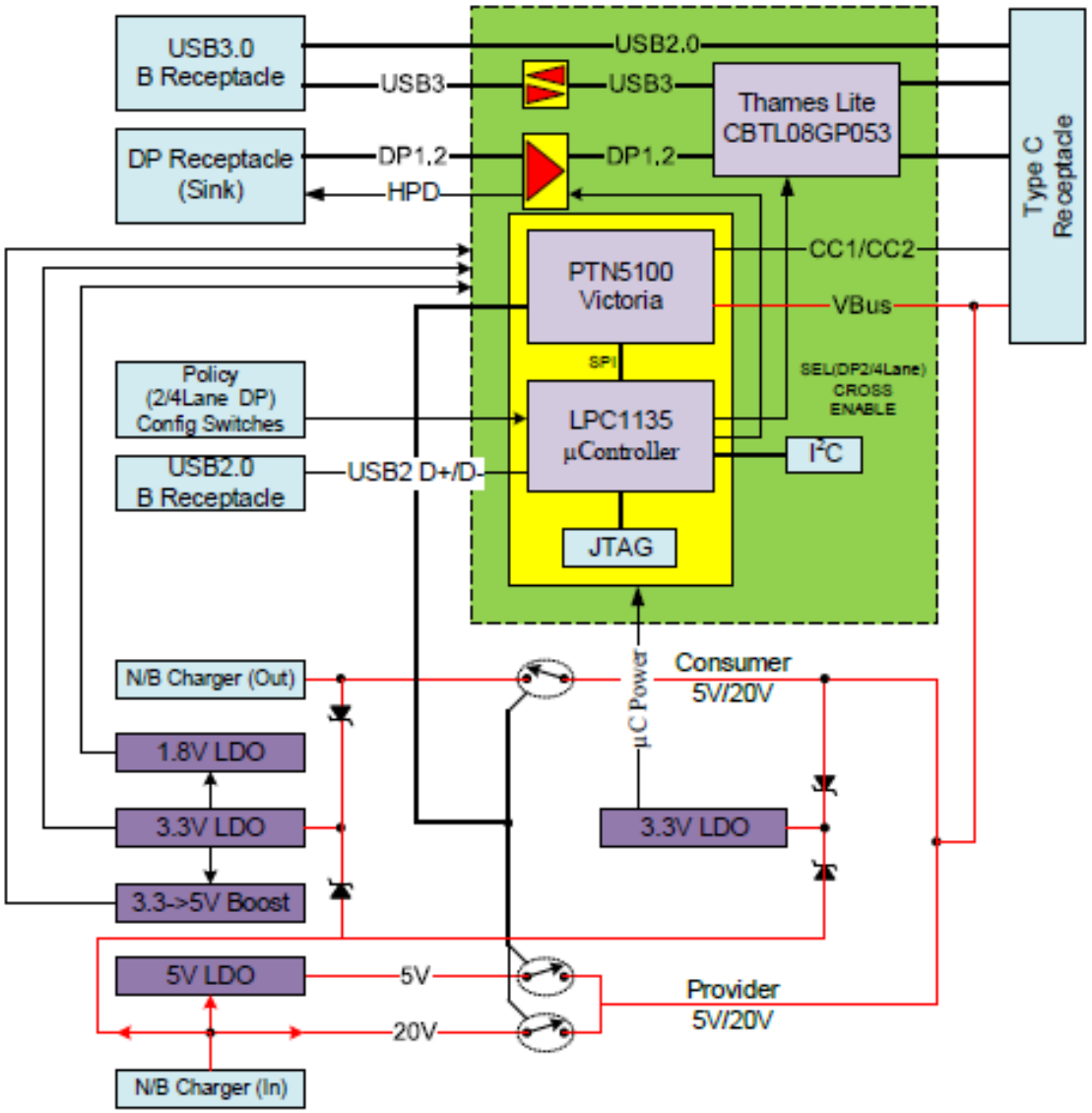
| Type number | Description | Status | Quick access |
|---|---|---|---|
| DSN0603-2 ESD protection diode series | Standard and ultra low capacitance ESD devices in ultra small packages | Production | |
| IP3319CX6 | Single-channel common-mode filter with integrated ESD protection network | Production | Download datasheet<br>Order sample<br>Buy online |
| IP4283CZ10 series | ESD protection for ultra high-speed interfaces | Production | Download datasheet |
| IP4283CZ10 series | ESD protection for ultra high-speed interfaces | Production | Download datasheet |
| IP4283CZ10 series | ESD protection for ultra high-speed interfaces | Production | Download datasheet |
| PESD5V0V2BM | Very low capacitance bidirectional ESD protection diodes | Production | Download datasheet<br>Order sample |
| PESD5V0V2BMB | Very low capacitance bidirectional ESD protection diodes | Production | Download datasheet<br>Order sample |
| PESD5V0X1BCAL | Extremely low capacitance bidirectional ESD protection diode | Production | Download datasheet<br>Order sample<br>Buy online |
| PESD5V0X2UAM | Ultra low capacitance unidirectional double ESD protection diode | Production | Download datasheet<br>Order sample<br>Buy online |
| PUSB3AB6 | ESD protection for ultra high-speed interfaces | Production | Download datasheet<br>Order sample<br>Buy online |
| PUSB3FR4 | ESD protection for ultra high-speed interfaces | Production | Download datasheet<br>Order sample<br>Buy online |
| PUSB3FR6 | ESD protection for ultra high-speed interfaces | Production | Download datasheet<br>Order sample<br>Buy online |

# USB Type C demo kit - OM13580

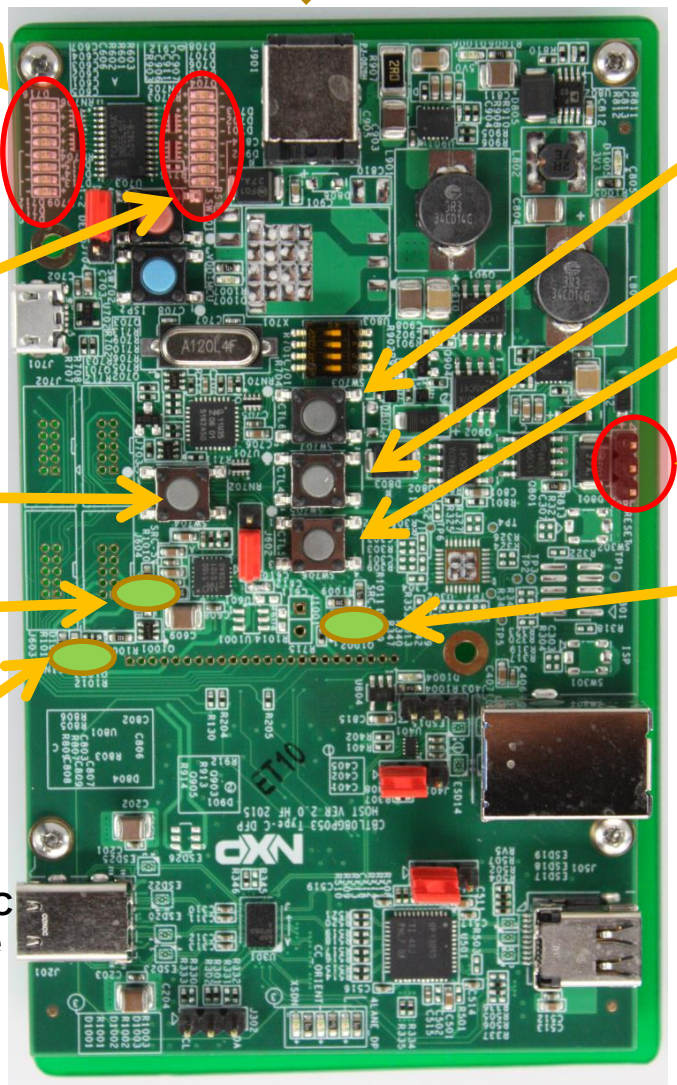


# Host Board Control and LED indication

*Host Board Block Diagram*



# Host Board Control and LED indication



Top four
UC
heartbeat
Alt mode
20V detect
HPD

5V - 20V
Power
In

PD
Sink
Source
UFP
DFP
20V
5 V
USB3
2l DP

Board
Reset

Request
20V

Request
5V

POWER
GROUND
EMPTY
LAPTOP POWER
HEADER

Volt Meter

Source
Sink
Swap

Source
LED

Source
20V LED

Sink
LED

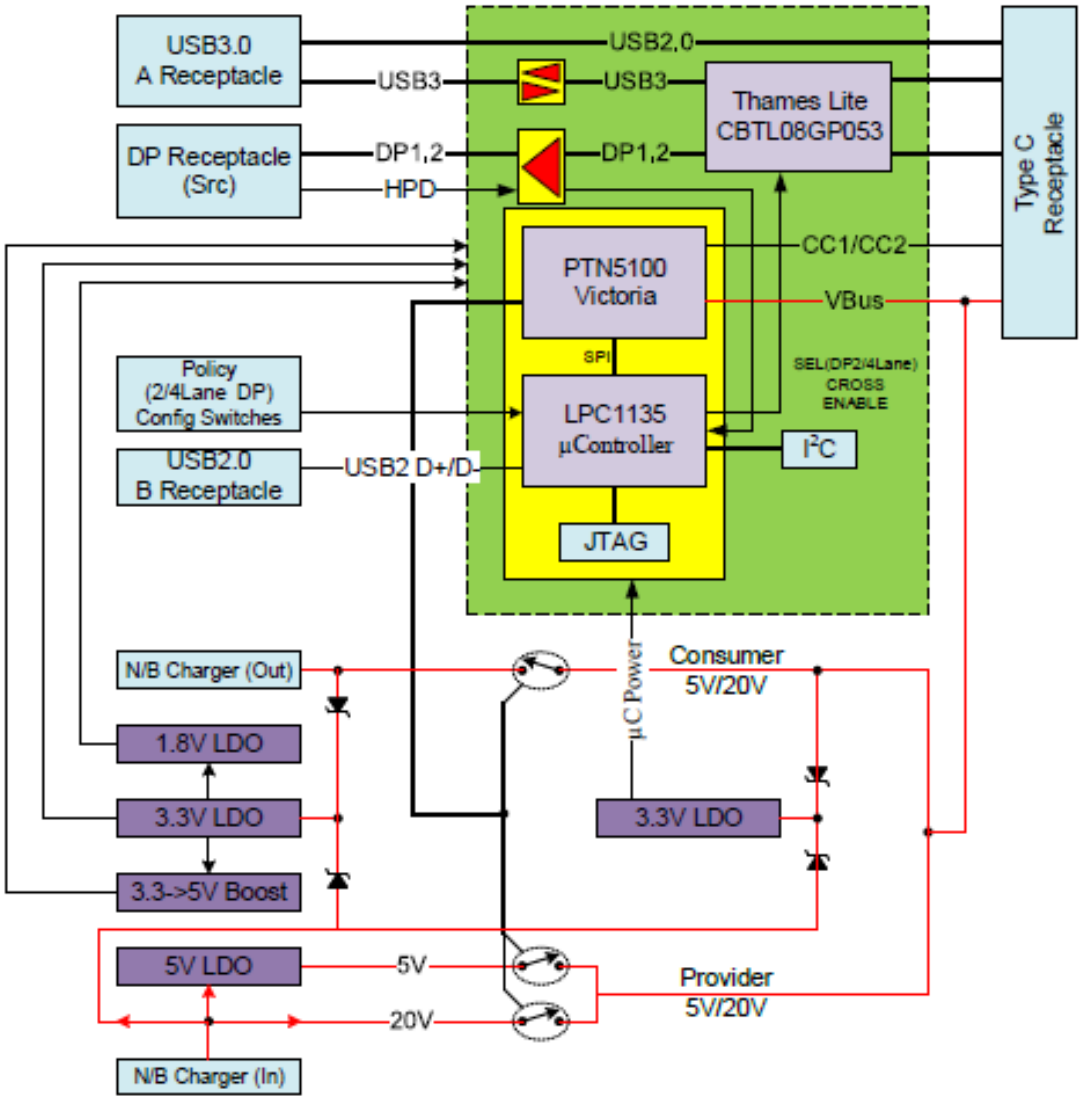
USB-B 3.0
Receptacle

USB Type C
Receptacle

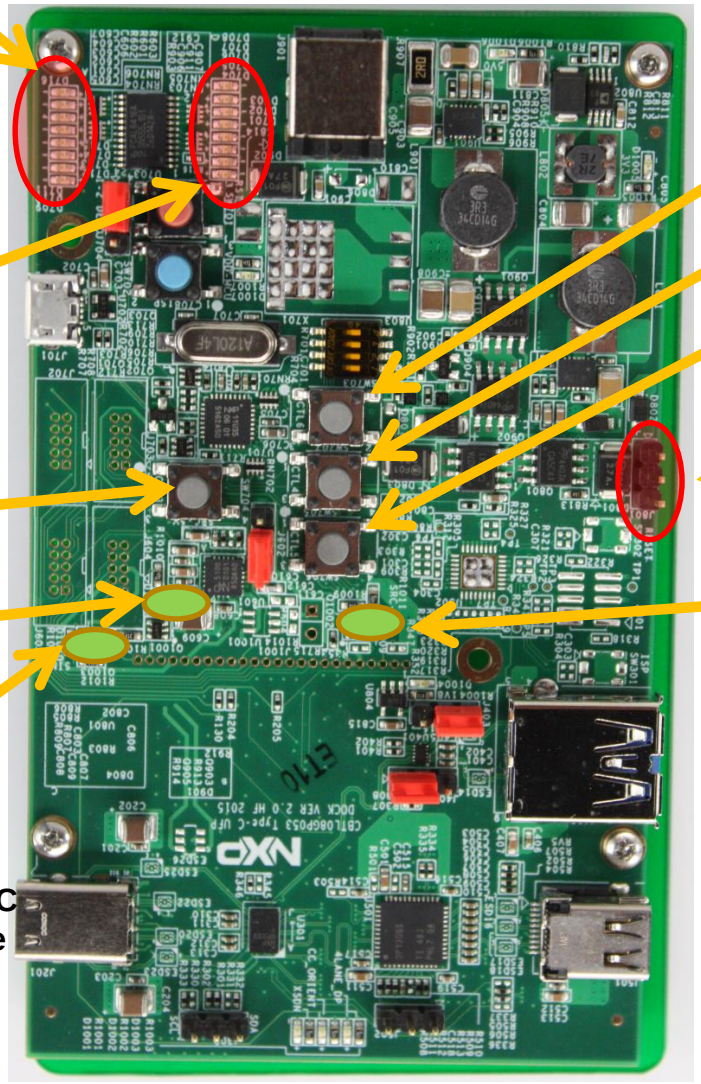
DisplayPort
Source Receptacle

# Dock Board Control and LED indication

*Dock Board*



# Dock Board Control and LED indication



Top four
UC
heartbeat
Alt mode
20V detect
HPD

5V - 20V
Power
In

PD
Sink
Source
UFP
DFP
20V
5 V
USB3
2l DP

Board
Reset

Request
20V

Request
5V

POWER
GROUND
EMPTY

Volt Meter

Source
Sink
Swap

Source
LED

Sink
LED

Source
20V LED

USB-A 3.0
Receptacle

USB Type C
Receptacle

DisplayPort
Sink Receptacle

# USB PD DP Alternate Mode Hardware Setup

## Procedure

1. **Host Board-**
   - plug all the cables to the laptop – USB 3.0 cable, DisplayPort cable, laptop 19.2V power cable or the digital voltmeter.
   - power the board with the 19.2V AC/DC adapter.

2. **Dock Board-**
   - plug the USB drive, DP-VGA dongle, VGA monitor to DP-VGA dongle, digital voltmeter.
   - Power the board with the 19.2V AC/DC adapter.

3. Connect the host and the dock board with a type C cable.

# USB PD DP Alternate Mode Hardware Setup

## Procedure

4. Once the power contract is established, check whether the host board is a power source (if source 5V LED is on) or power sink (if sink LED is on). If the host board is a power source then use the swap button to swap the host board to power sink role.

5. Push request 20 button to request 20V from the dock board.

6. Check the battery monitoring indicator on the laptop. It should indicate that the laptop is being charged.

7. From the laptop you should be able to access the flash drive on the dock board

8. From the laptop you should also be able to play any movie trailer on the flash drive by double click on the icon.

SECURE CONNECTIONS
FOR A SMARTER WORLD