DP Alt Mode on USB Type-C Overview and Certification

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Agenda

- DP Alt Mode on USB Type-C
- DP Compliance Program Update

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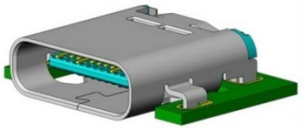
VESA DisplayPort Alt Mode on USB Type-C Summary

- The *VESA DisplayPort Alt Mode Standard, Version 1*, was released on Sept 22, 2014
- Enables the use of the USB Type-C interface for DisplayPort



- Alternate Mode functional extension of the USB Type-C interface
- Developed in liaison with the USB 3.0 Promoter Group

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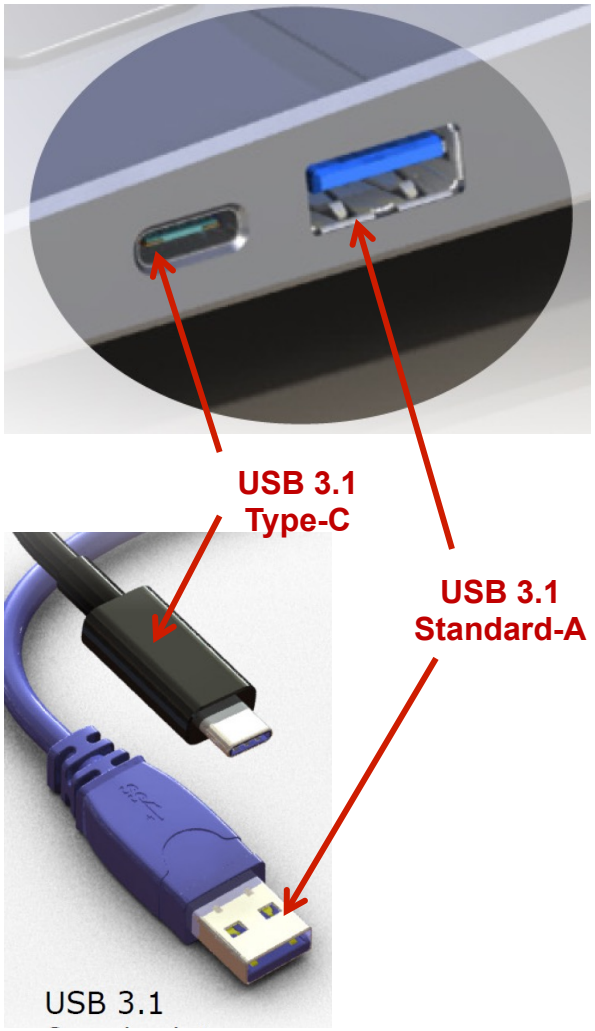
Introduction of USB Type-C

USB Type-C information is provided as an informative overview only, please refer to the USB Type-C Cable and Connector Specification available at www.usb.org for more information

- New generation of USB connector developed to serve the market for next 20 years
- Thin profile suitable for both ultra portable devices and larger devices
- Reversible plug orientation & cable direction
  - USB 3.1 Gen 2 (10Gbps)
  - USB Power delivery, up to 100 watts
  - Supports DisplayPort Alternate Mode

USB Type-C will be the only interface you will need

- *High speed, secure data*
- *Display connection*
- *System Power*



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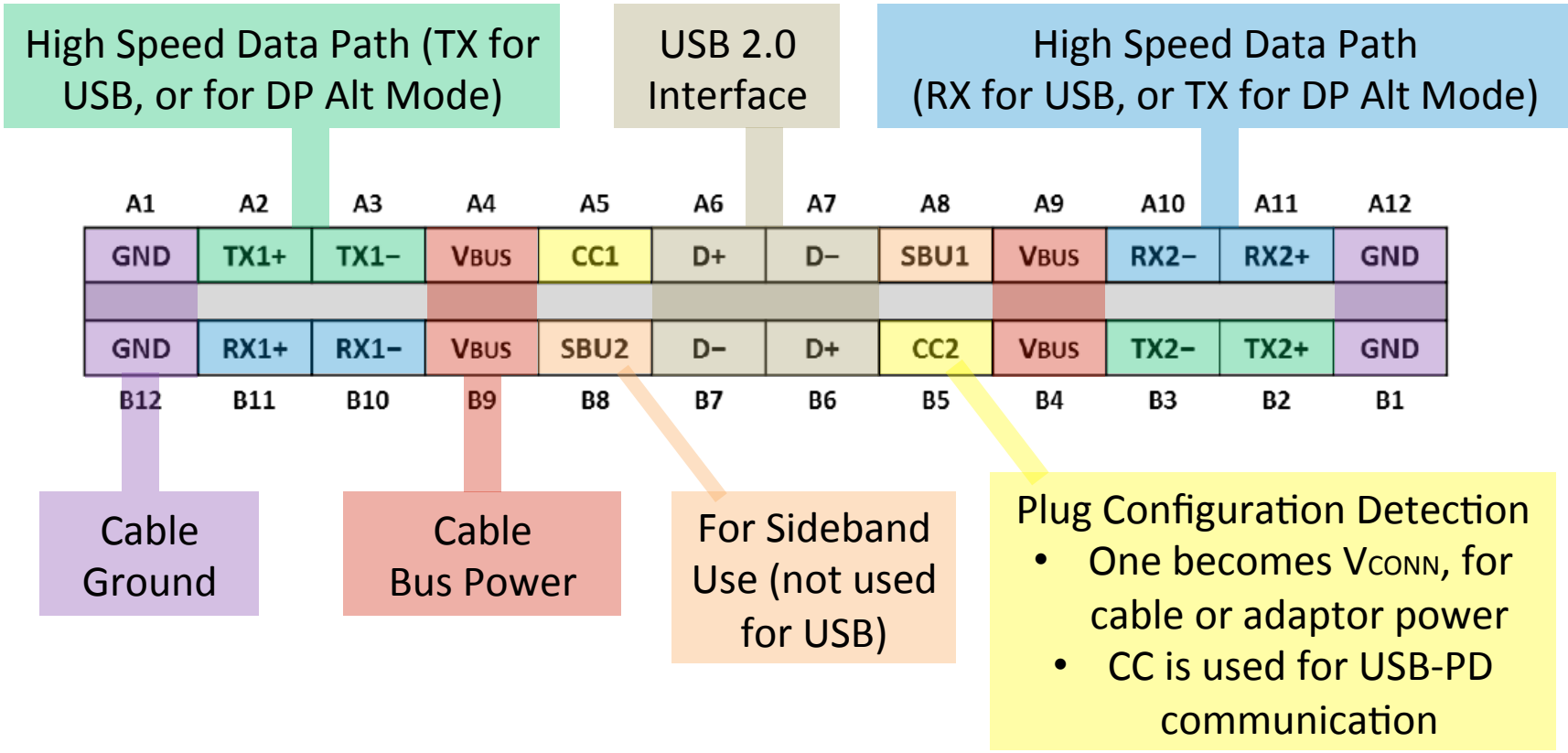
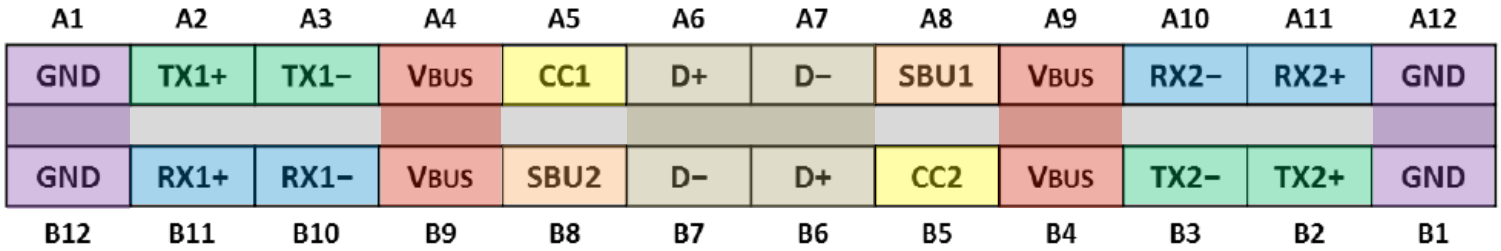
USB Type-C Receptacle Pins

Below is a diagram of the pins defined for system or device receptacle

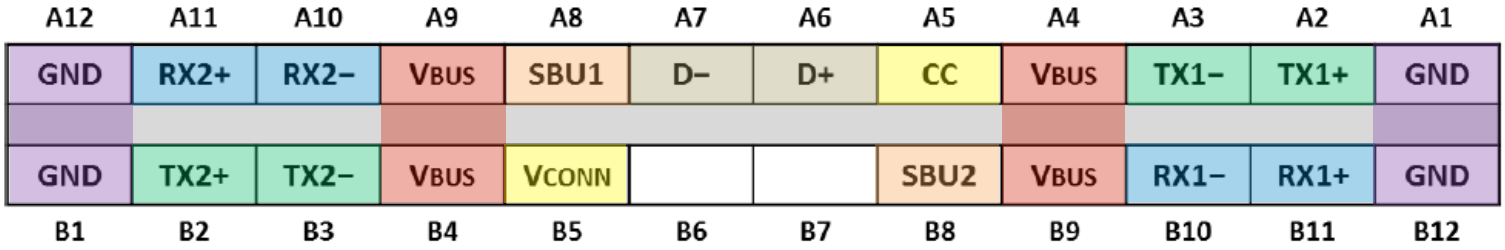


USB Type-C Connector Pin Mating

Receptacle configuration



Plug configuration (for cable, or other plug-in device)



- **Plug can inserted into receptacle in either orientation (can rotate 180 degrees)**
- **Device with receptacle is responsible detecting orientation and routing proper signals to receptacle pins as needed**

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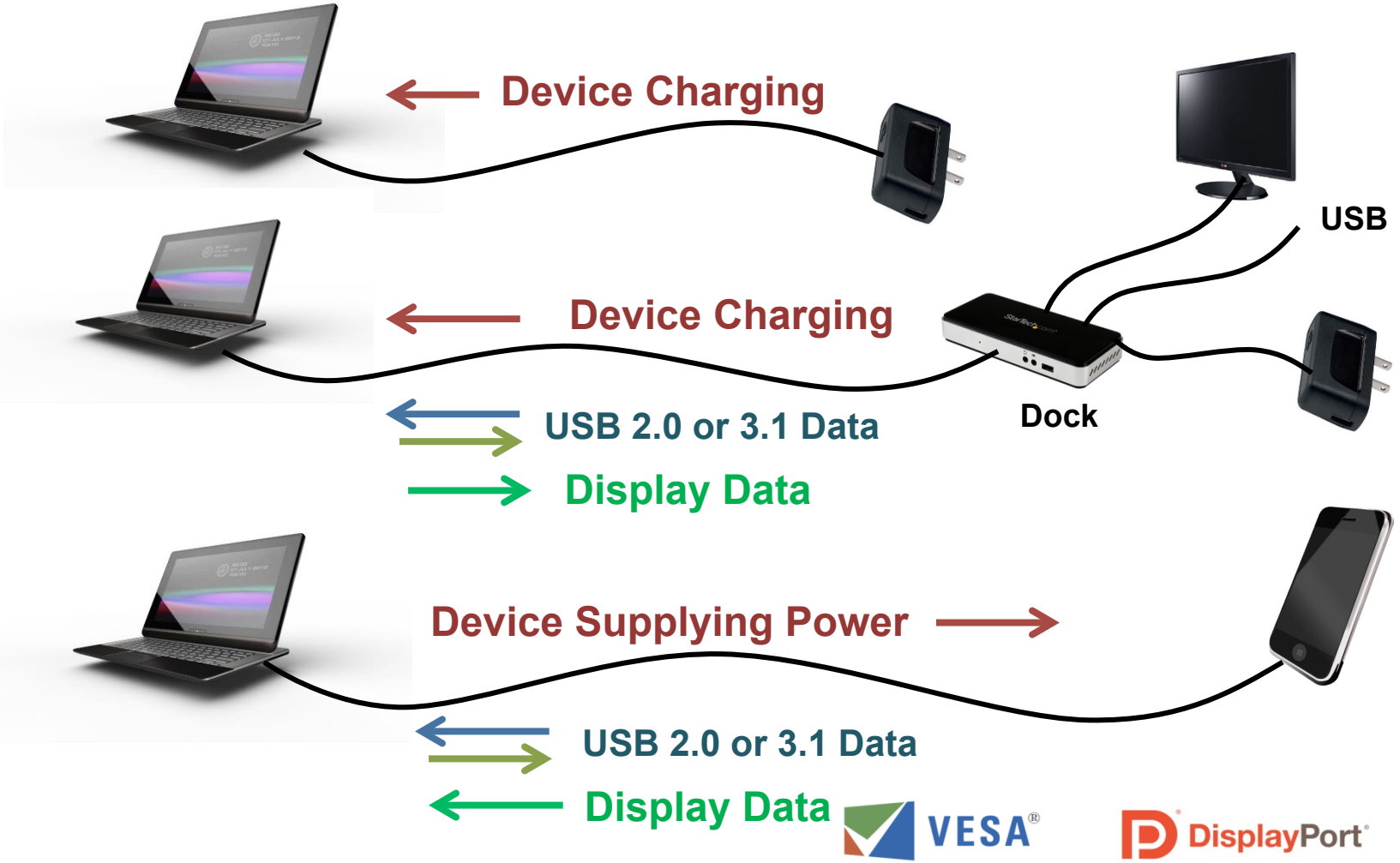
Example USB Type-C Configurations

Either end can serve as USB Host, USB-PD Power Consumer, and DisplayPort Video Source (these services are orthogonal to each other)



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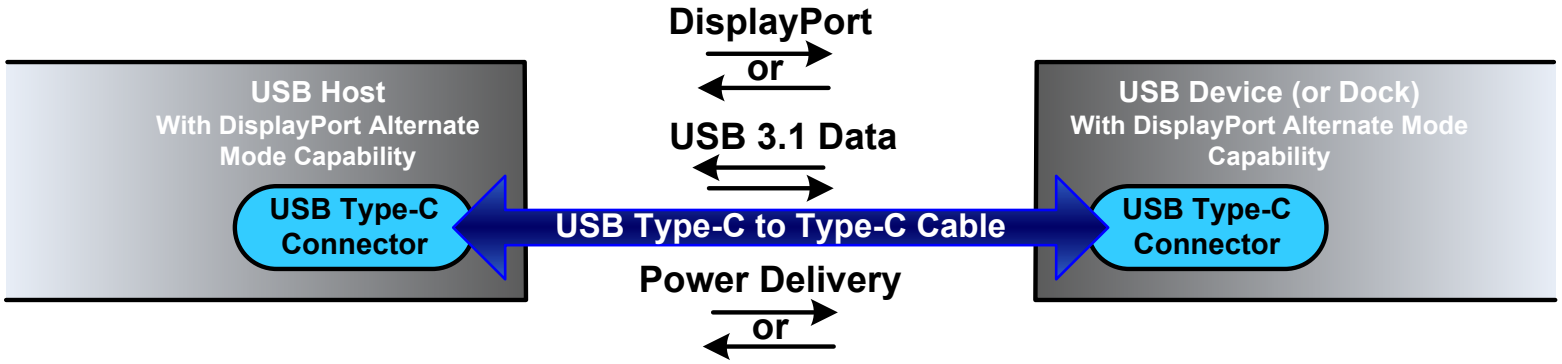
USB Type-C Connector Function Extension

DisplayPort Alternate Mode



- A passive Full Feature USB Type-C to Type-C cable can carry up to four DisplayPort lanes
  - This will offer the same performance and feature capability as a standard DisplayPort connection
  - This will also allow DisplayPort data rates to increase in the future, since the USB Type-C connector has very high data rate capability
- DisplayPort can be combined with USB 3.1 operation over the same USB Type-C cable
  - Implemented with two high speed pairs for DP (using two lane DP operation), and two high speed pairs for USB (USB 3.1 only uses two high speed lanes for normal operation)
  - Useful for docking stations or hubs, or for adding docking station functionality to a display
- USB 2.0 and USB Power Delivery is available in all configurations
  - Because USB 2.0 and USB Power Delivery use dedicated wires in the USB Type-C cable, both of these services are always available, even when using all four USB Type-C high speed pairs for DisplayPort

DP Alt Mode Terminology

- Terminology was needed to describe port capabilities independent of port connector type
  - Downstream facing port (DFP)
  - Upstream facing port (UFP)
  - DisplayPort function (_D)
  - USB C function (_U)

"Connector type" "port direction"_"function"

Ex. DisplayPort DFP_D

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Example DP Alt mode configurations

- USB Type-C DFP_D to USB Type-C to UFP_D
- DisplayPort DFP_D to USB Type-C UFP_D
- USB Type-C DFP_D to DisplayPort UFP_D
- USB Type-C to Protocol Converter

- Each config determines pin-out options, HPD – PD mechanisms, allowed or required features supported, etc
- Different configuration certification requirements will be addressed in the CTS

- See section 3 of DP Alt mode specification for details.

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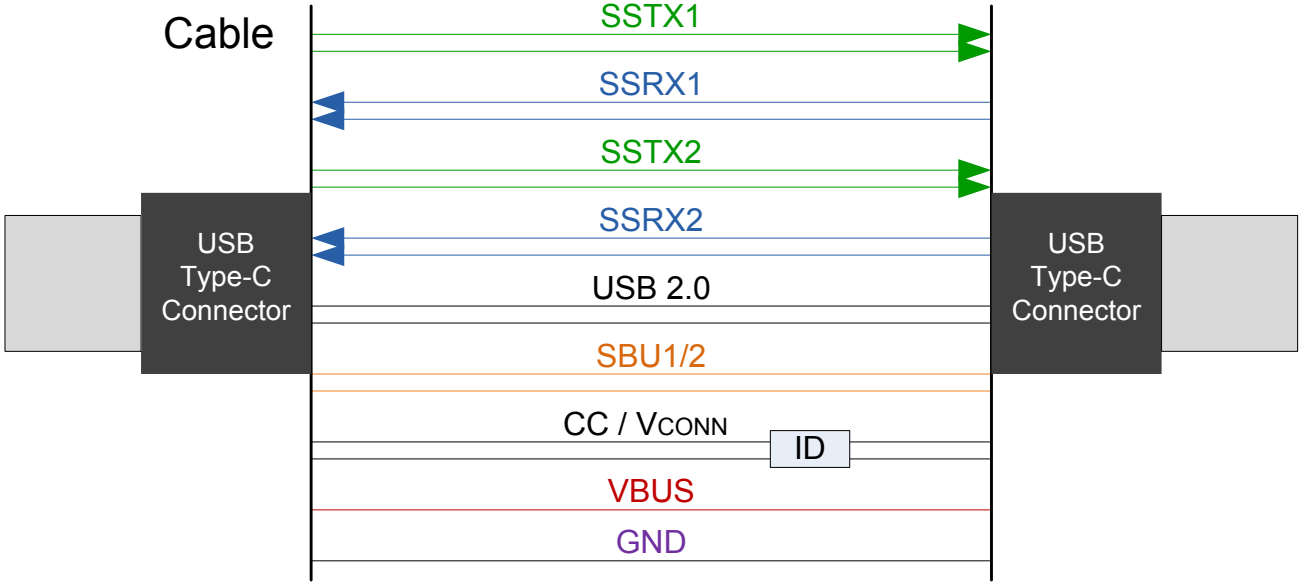
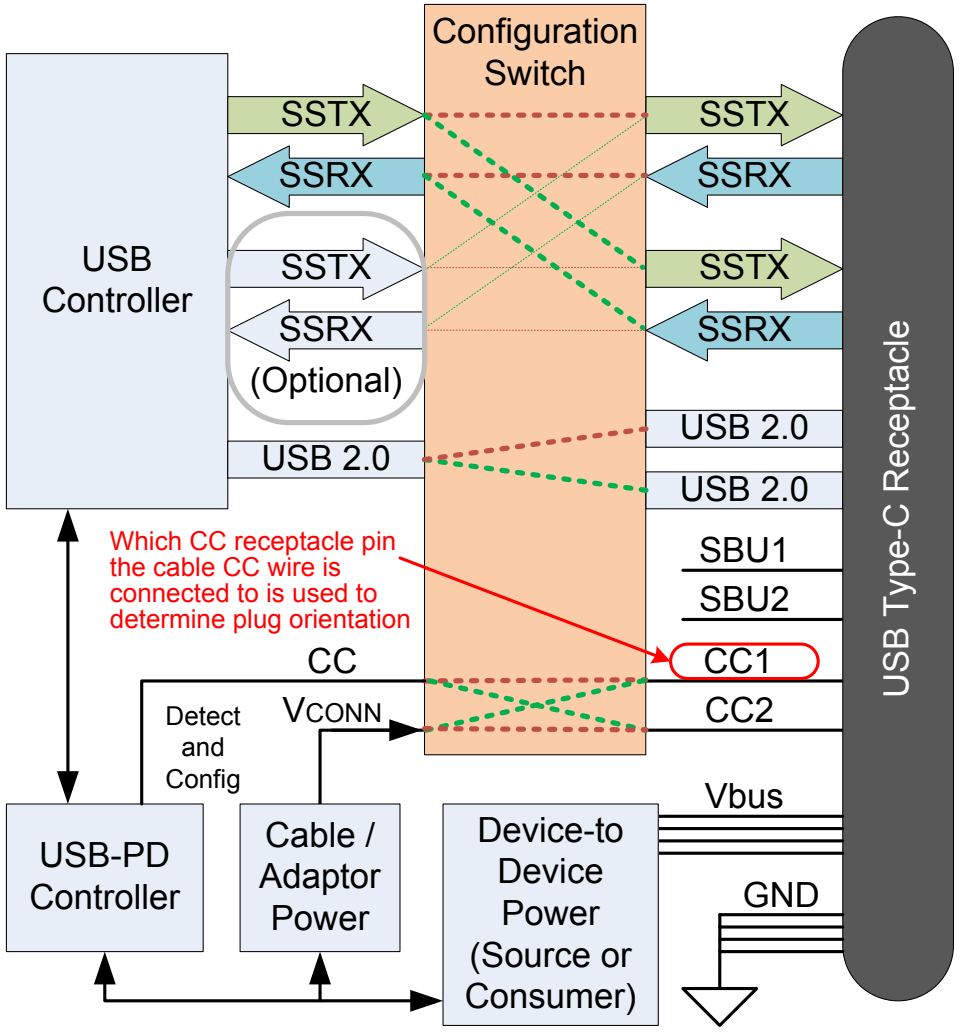
Type-C to Type-C Full Feature Passive Cable



- This will be a common, widely available cable for USB Type-C applications, and it will support the DisplayPort Alt Mode
- Full Feature Type-C cables and certain adapters have an electronic ID that can be read by USB-PD protocol to determine capability
- Passive cables up to 1m are designed to support SS Gen 2 (10 Gbps)
- Passible cable up to 2m are designed support SS Gen 1 (5 Gbps)

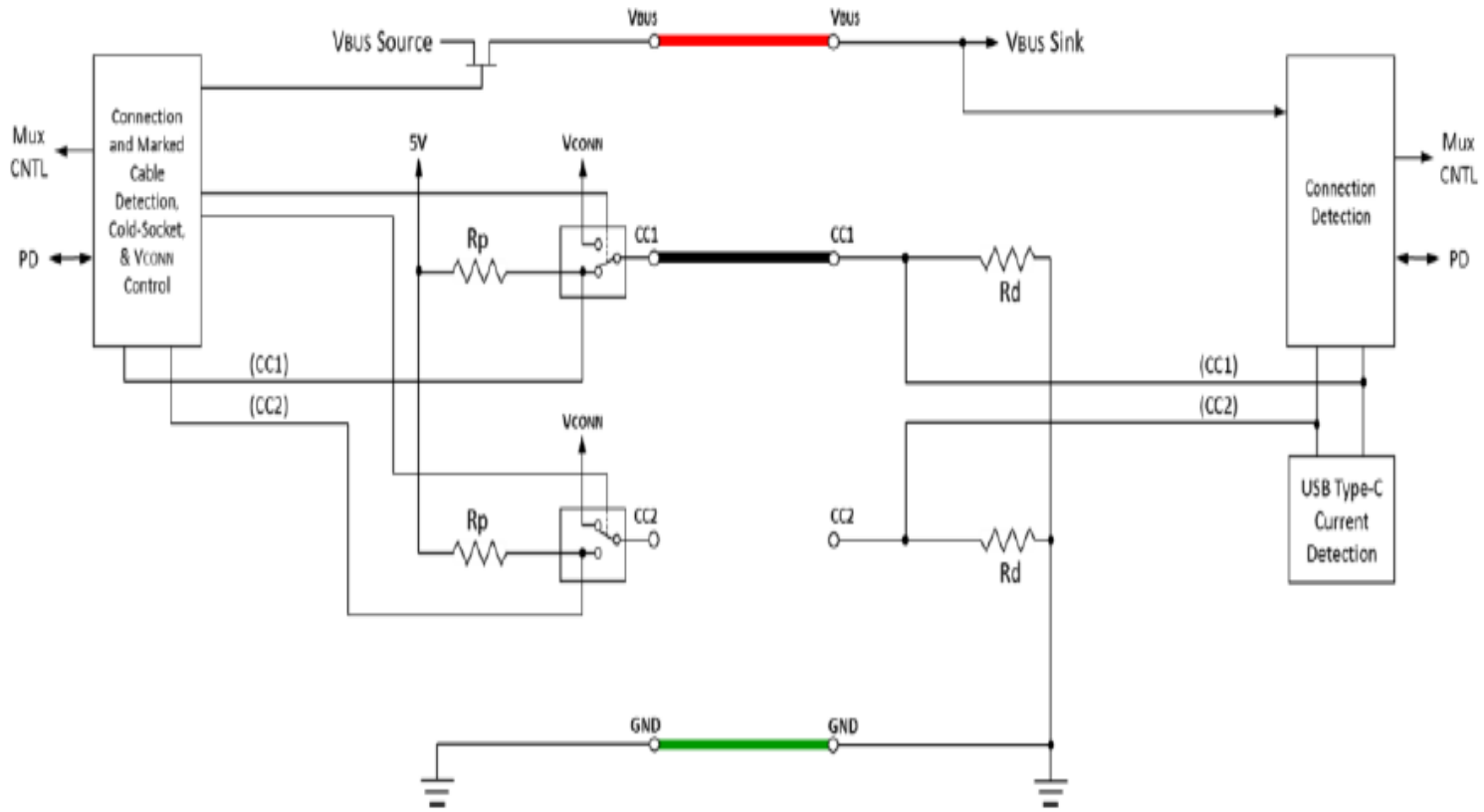
USB Type-C Plug Orientation Reversing is Supported by a Connector PHY Switch



- Example for USB Type-C receptacle that supports USB modes only
- A similar switch is needed at the Device end
- Switch can be integrated with USB function

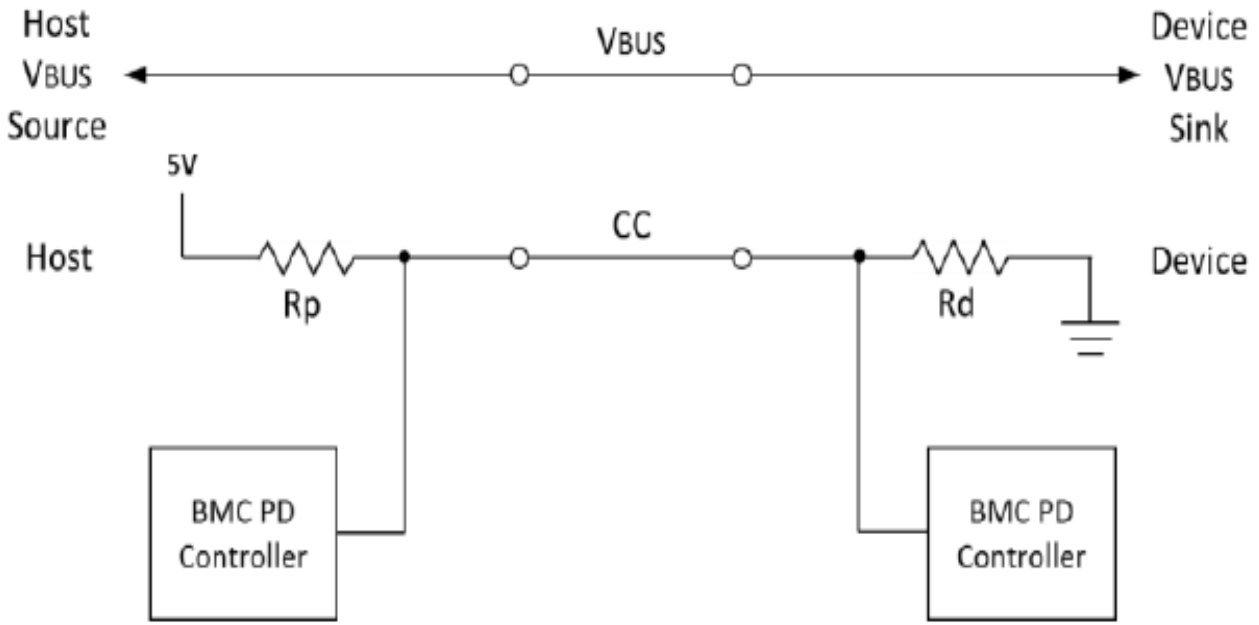
Switching mechanism

- Rp (pullup resistor) and Rd (pulldown resistors) on CC1/CC2 determine polarity

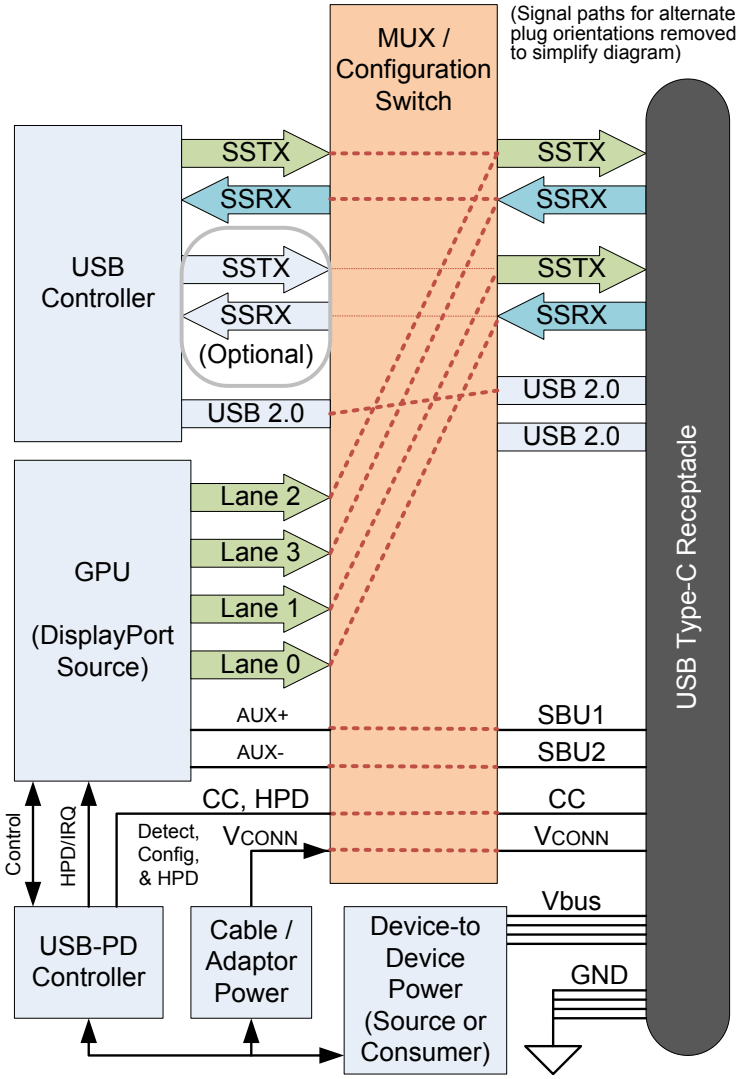


Power Contract/Alt mode detection

- BMC controllers negotiate power and Alt Modes
- Vbus for legacy devices



USB Type-C Connector PHY Switch for Supporting DisplayPort Alternate Mode



- Example for interface that supports USB and DisplayPort Alternate Mode
- Similar switch needed at the Device end
- Switch can be integrated along with the USB and DisplayPort functions

Supported cable types

- USB C to USB C
- USB C to DP
- USB C to Protocol converter
- USB C to Dockport

- USB C to DP cables must include logic to support USB PD and DP connection detect protocols.
- Protocol converters must support some optional features in DP 1.3 specification

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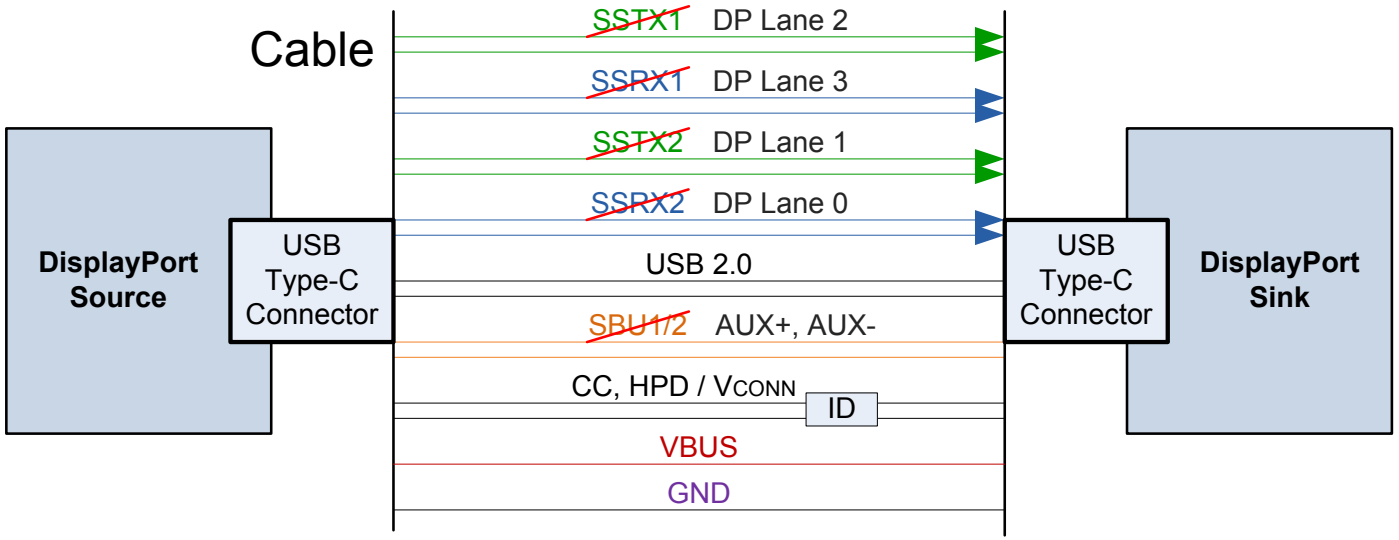
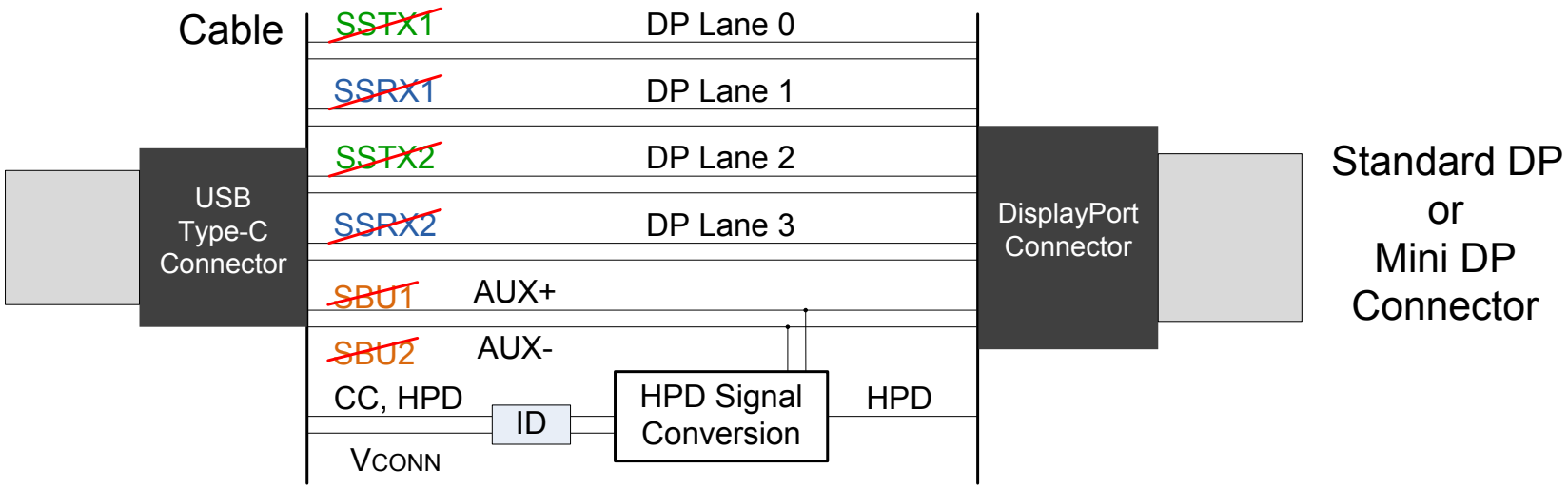
DisplayPort Over a USB Type-C to Type-C Full Feature Passive Cable

Please refer to the VESA DisplayPort Alt Mode on USB Type-C Standard for more information



- Utilizes optional DisplayPort Alt Mode capability of USB Type-C connector
- DisplayPort can use all four high speed lanes to deliver full DisplayPort performance
- The DisplayPort AUX Channel uses the SBU pins
- The DisplayPort HPD / IRQ is transmitted over the CC pin using the USB-PC protocol
- USB 2.0 and USB Power Delivery always available

USB Type-C to DisplayPort Adapter Cable



- Utilizes optional DisplayPort Alt Mode capability of USB Type-C connector
- Cable is reversible, works in either direction; four lanes of DisplayPort
- Supports legacy DisplayPort Source and Sink Devices
- Detected by USB Type-C enabled device that supports DP Alt Mode
- No support for USB or other alt modes
  - These features are not supported by legacy DisplayPort devices

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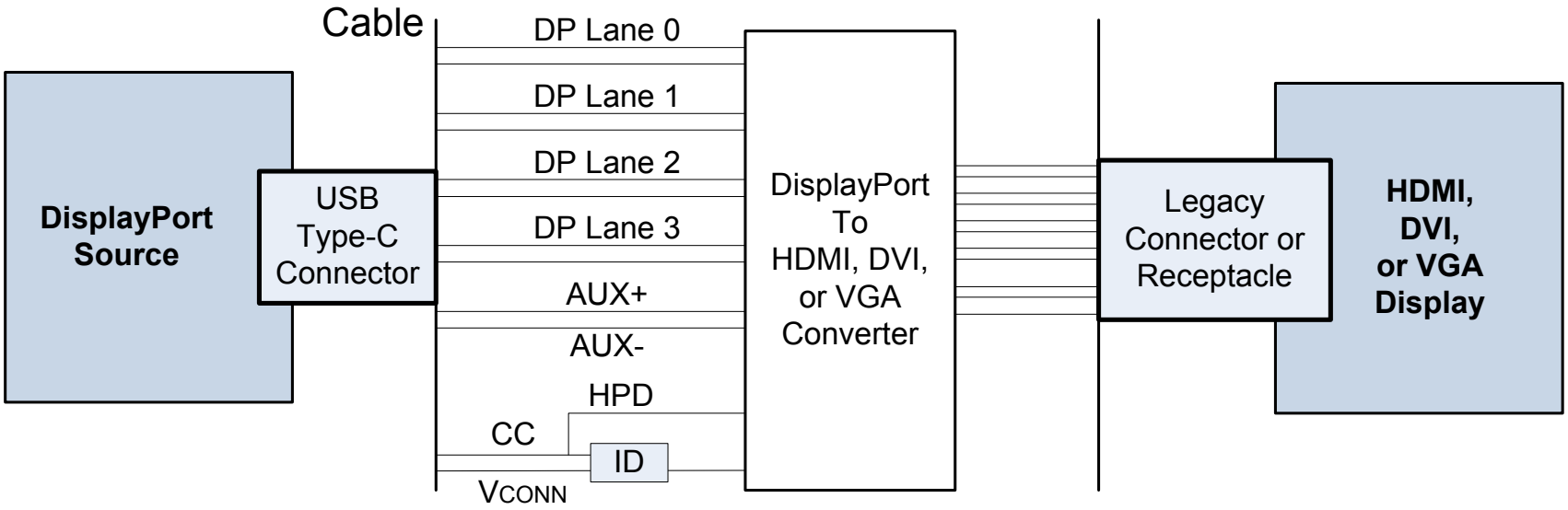
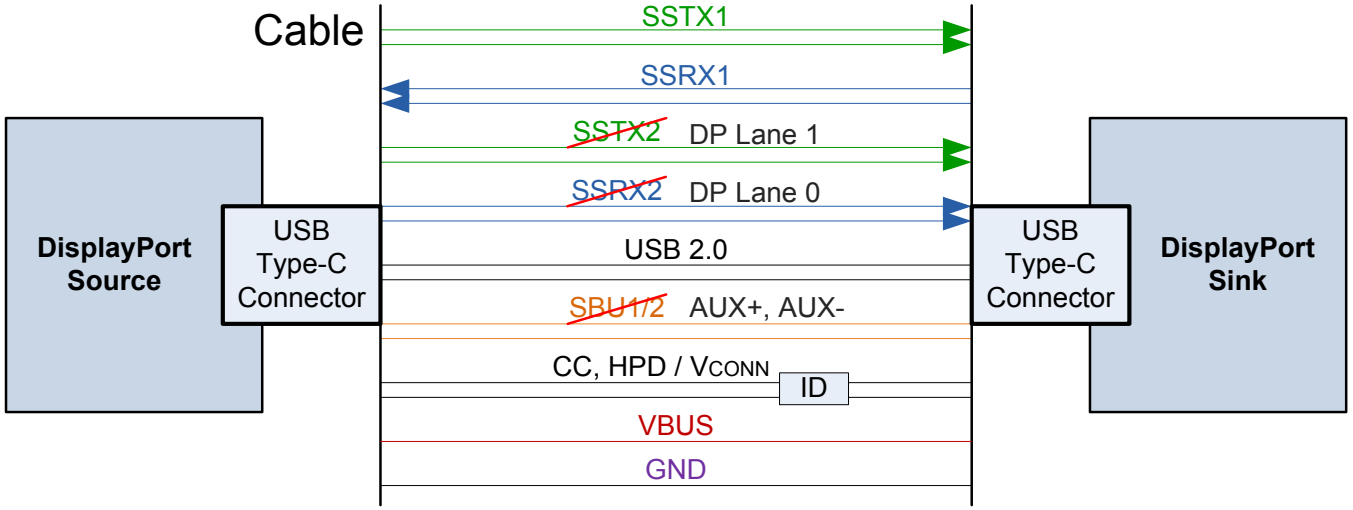
USB Type-C to HDMI, DVI and VGA Adapter Cables / Cable Adapters



- Utilizes DisplayPort Alt Mode capability of USB Type-C connector
- Adapter Cable: USB Type-C plug on one end, legacy plug on other end
- Adapter: USB Type-C plug on one end, legacy receptacle on other end
- USB Type-C will NOT support DisplayPort Dual Mode (DP++)
- USB Type-C to HDMI Converters will support HDMI 2.0 and CEC

DisplayPort and USB 3.1 over a Type-C to Type-C Full Feature Passive Cable

Configuration for Docking Stations



- Utilizes DisplayPort Alt Mode capability of USB Type-C connector
- DisplayPort uses two high speed lanes
  - For DP 1.2a (HBR2), this provides support for 2560x1600 or 2 each 1080p displays
  - For DP 1.3 (HBR3), this will provide support of 4K UHD (3840 x 2160)
- Two high speed lanes used for USB 3.1
- USB 2.0 and USB Power Delivery always available
- DP lane count and USB speed selection is use case determined

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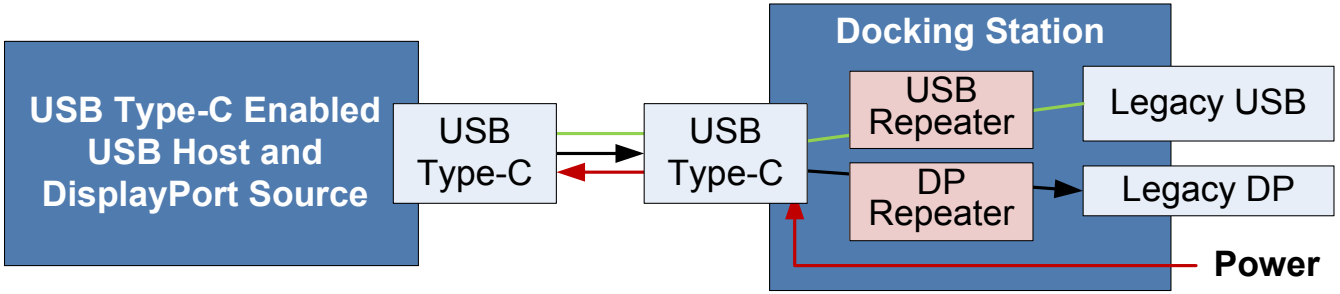
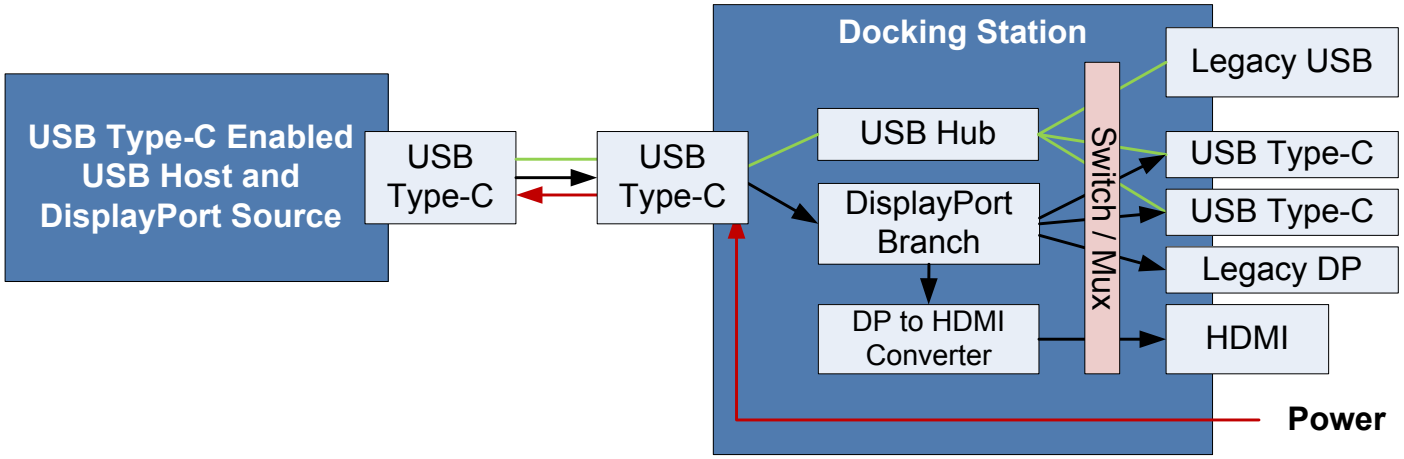
Example Docking Configurations using the USB Type-C DisplayPort Alternate Mode

Simple Docking Configuration



More Complex Docking Configuration



DisplayPort Alternate Mode
Compliance Test Plan

- VESA will develop and publish the DP Alternate Mode compliance test in coordination with the USB-IF
- Compliance test specification work has begun.
- The objective is to enable compliance testing for USB Type-C, and the DP Alt Mode for USB Type-C, at the same ATCs enabling the use of a single test station

DisplayPort Compliance Program Update Plan

Test Reporting

Today:

Docs sent in email

Only DPCPM can review

Lots of duplicate data entry

Manual updating of certified device reports, website database

Extensive document handling

Proposed:

- Create online reporting tool
- Any approver can access
- Submitters access their own data
- Generated reports used to update website

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Two-Tier Certification

- Problem: New features add new tests, cost to certify product continues to increase
- For example: PHY certification tests of DP1.2a source requires up to 13 hours of testing.
- From ASIC to Product, much of DP performance does not or cannot change, tests repeated without value-add
- Interop is the primary concern for products and more is needed

Compliance Test Document updates coming

- Corrections, additions, consolidation and reformatting of documents
- Drive required dates for tests we can and should do but do not today
- Monthly update article for VESA Newsletter to communicate changes and status

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Plug Tests

- PlugTests have significant value to member companies. Particularly as new capabilities and products are deployed.
- VESA plans to host at least 3 PlugTests in 2015.
- Objectives
  - Traditional Interop
  - USB Type-C devices
  - Test Equipment Correlation
- Proposed: 2 in US, 1 in Asia in 2015

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Summary

- DisplayPort Alt Mode over USB Type-C facilitates technology coverage in portable products
- DP Alt Mode CTS will be available mid 2015
- On-line Test Reporting Tool
- Two-Tier Certification
- 3 Plug Tests in 2015

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QUESTIONS?