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# ***VESA DisplayPort Alt Mode for USB Type-C Standard***

## **Feature Summary**





# VESA DisplayPort Alt Mode Summary

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



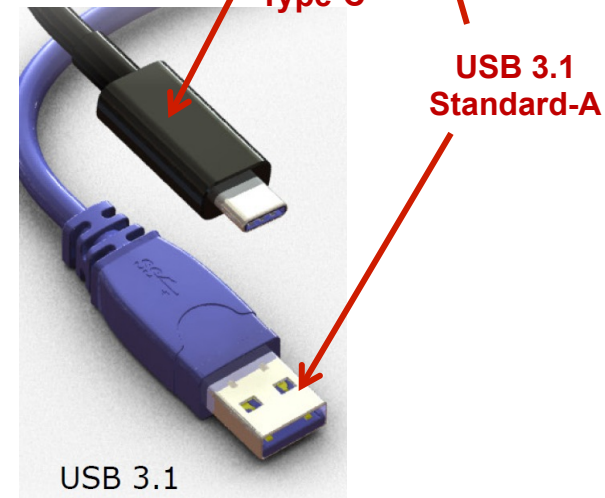
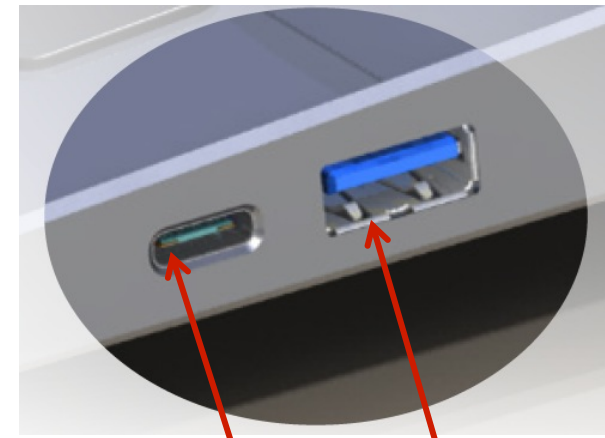
# Introduction of USB Type-C

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](http://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*

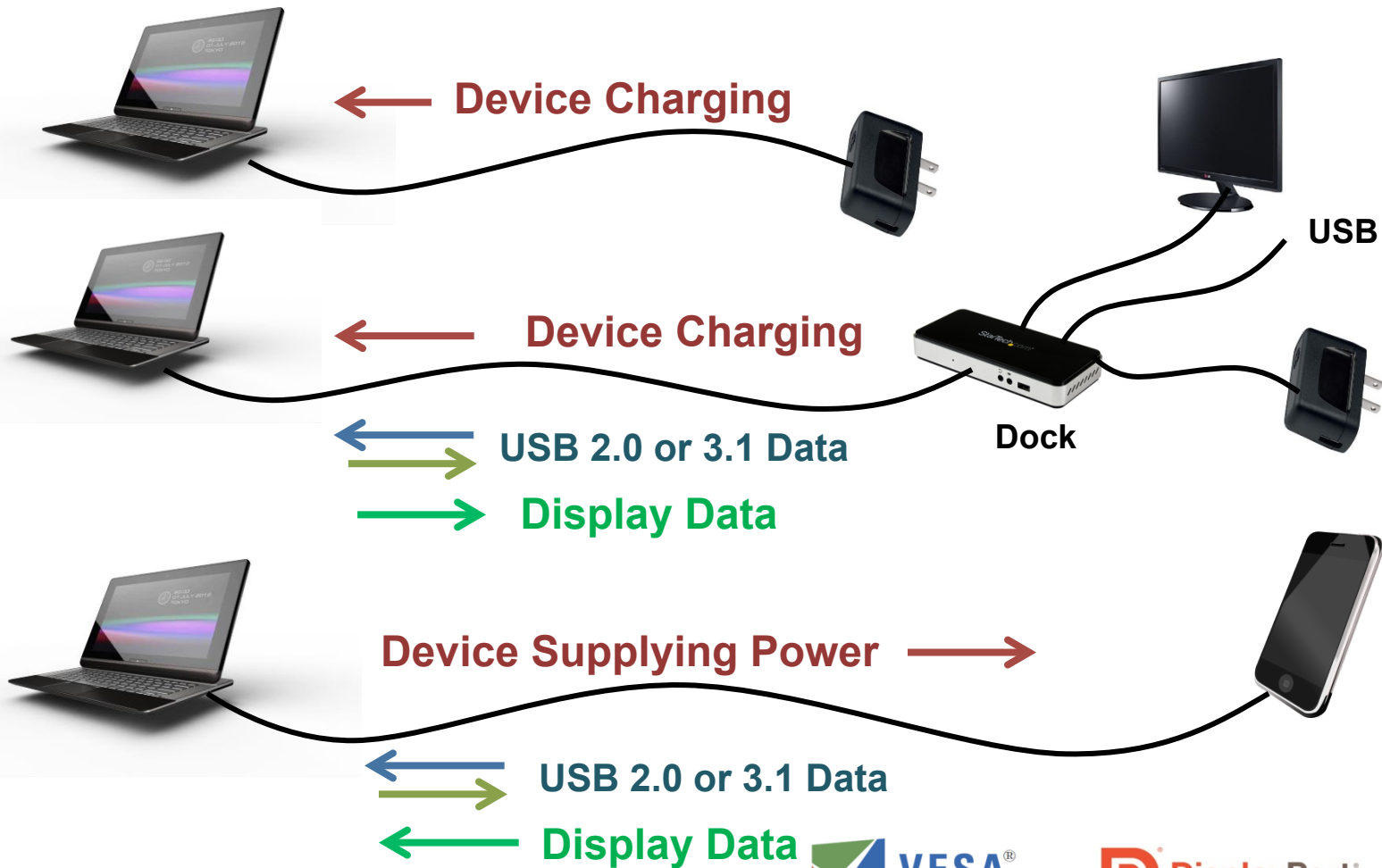
- *High speed, secure data*
- *Display connection*
- *System Power*





# Example USB Type-C Configurations

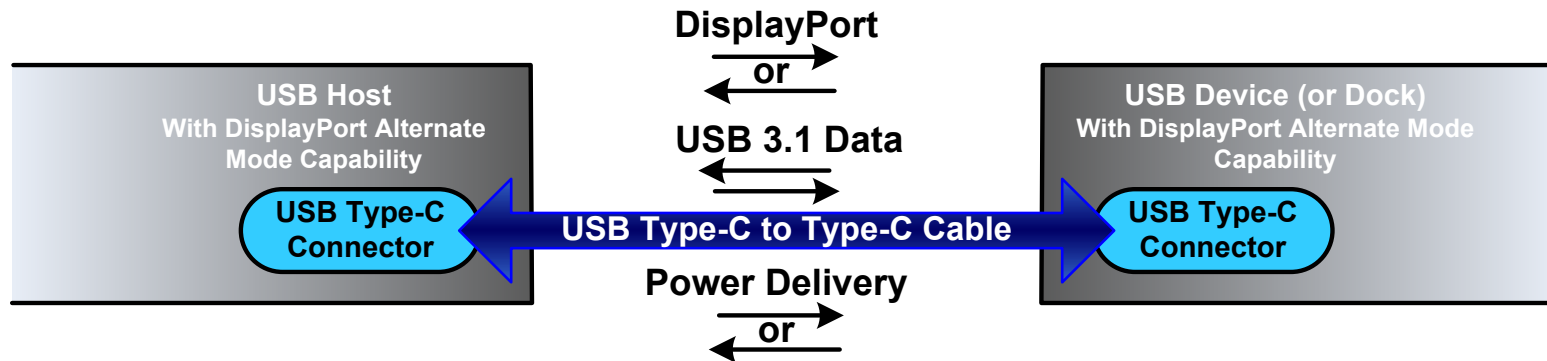
Either end can serve as USB Host, USB-PD Power Consumer, and DisplayPort Video Source (these services are orthogonal to each other)





# USB Type-C Connector Function Extension

## DisplayPort Alternate Mode

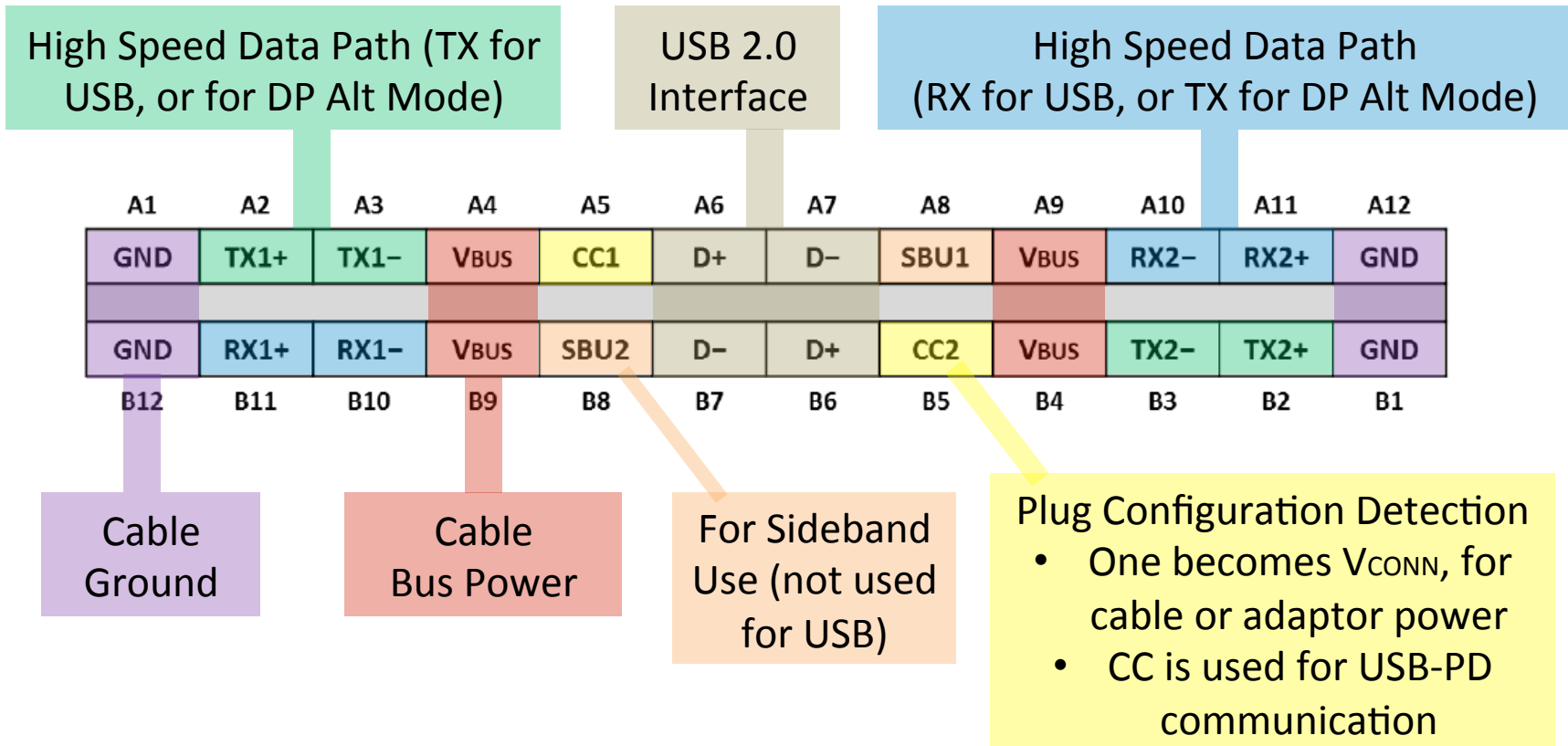


- A passive Full Feature USB Type-C to Type-C cable can carry up to four DisplayPort lanes
  - This will offer the same performance and feature capability as a standard DisplayPort connection
  - This will also allow DisplayPort data rates to increase in the future, since the USB Type-C connector has 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



# 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

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

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

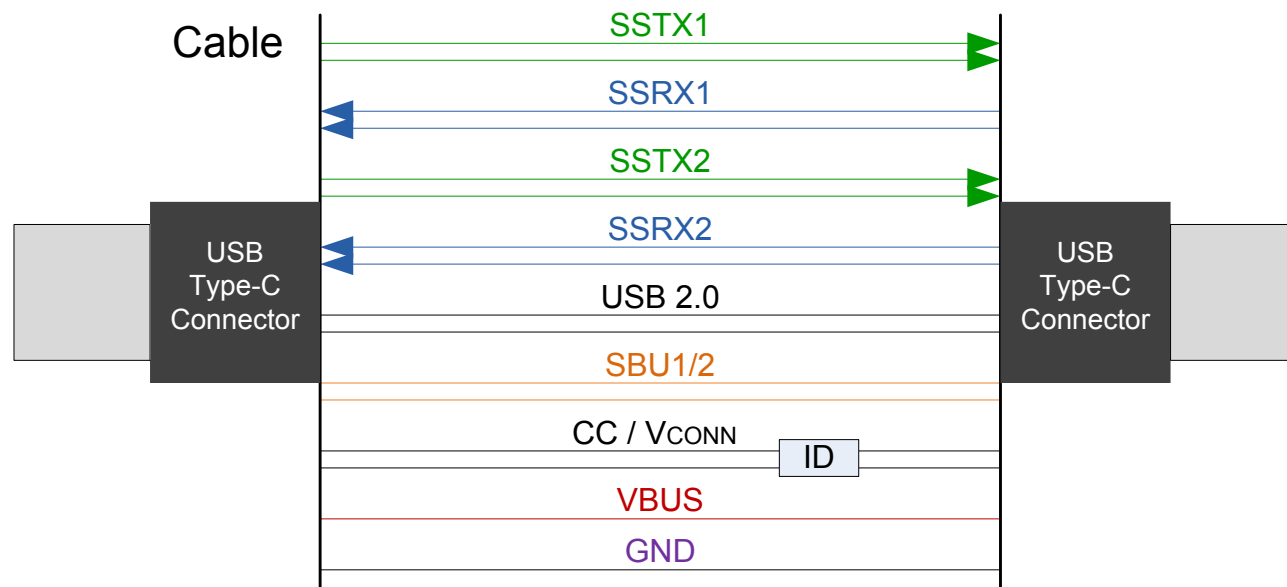
A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
GND	RX2+	RX2-	VBUS	SBU1	D-	D+	CC	VBUS	TX1-	TX1+	GND
GND	TX2+	TX2-	VBUS	VCONN			SBU2	VBUS	RX1-	RX1+	GND
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12

- 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





# Type-C to Type-C Full Feature Passive Cable

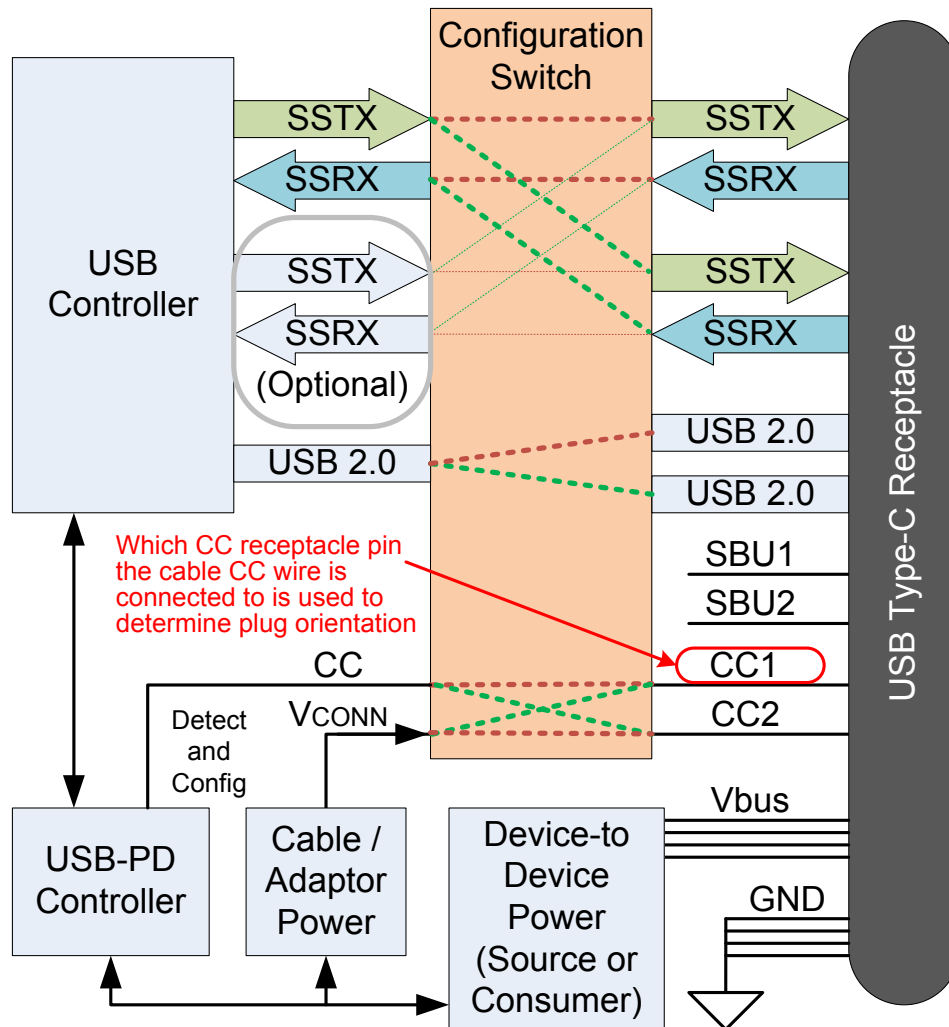


- This will be a common, widely available cable for USB Type-C applications, and it will support the DisplayPort Alt Mode
- Full Feature Type-C cables and certain adapters have an electronic ID that can be read by USB-PD protocol to determine capability
- Passive cables up to 1m are designed to support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





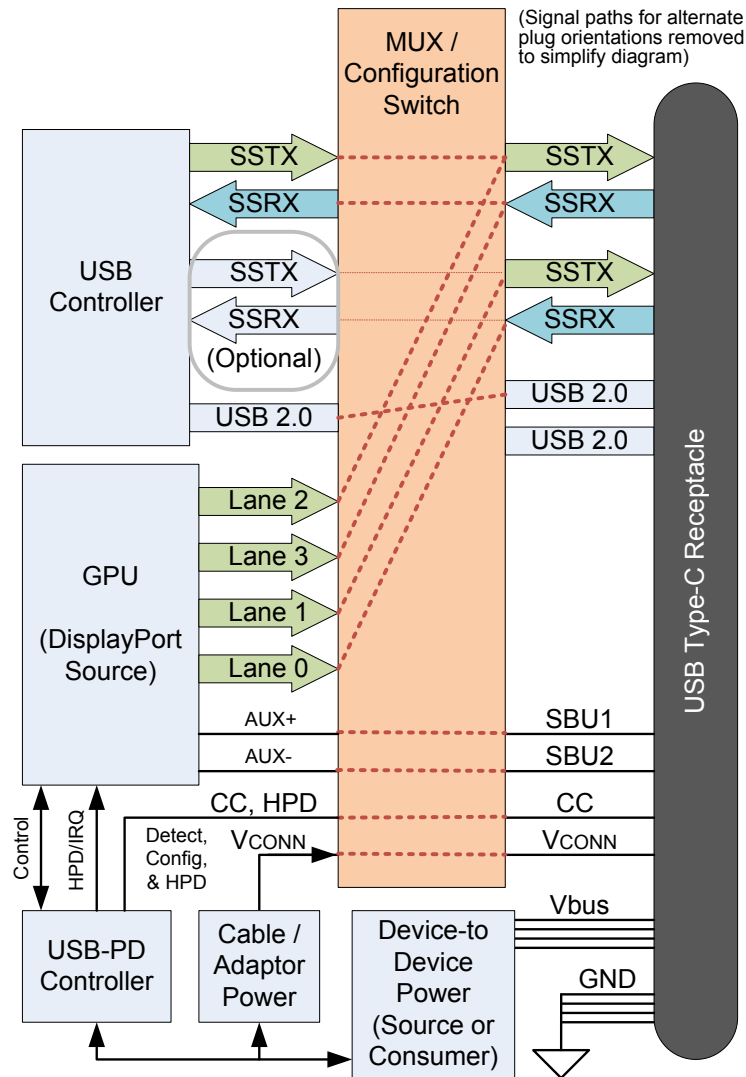
# USB Type-C Plug Orientation Reversing is Supported by a Connector PHY Switch



- 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



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



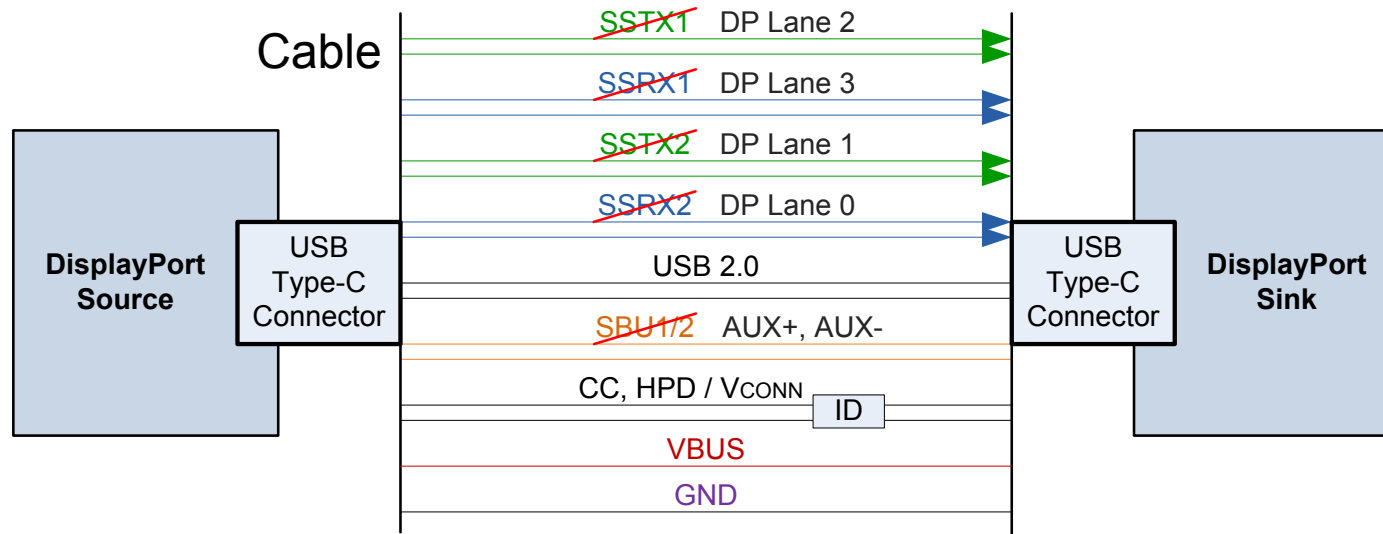
- Example for interface that supports USB and DisplayPort Alternate Mode
- Similar switch needed at the Device end
- Switch can be integrated along with the USB and DisplayPort functions





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

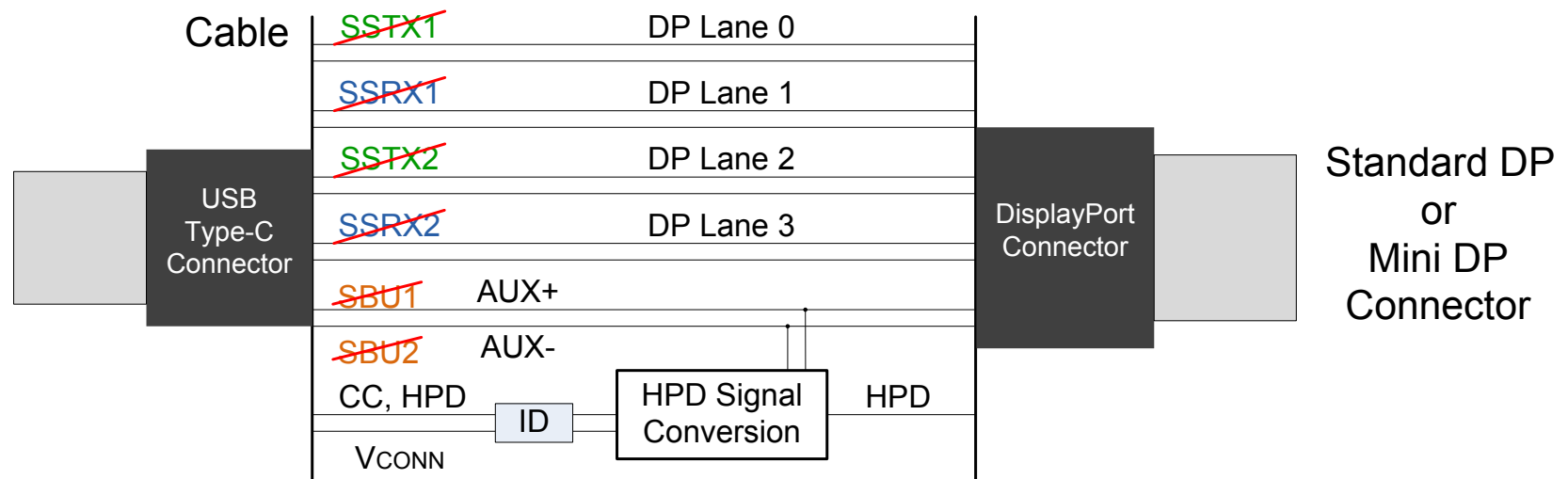
Please refer to the VESA DisplayPort Alt Mode on USB Type-C Standard for more information



- 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



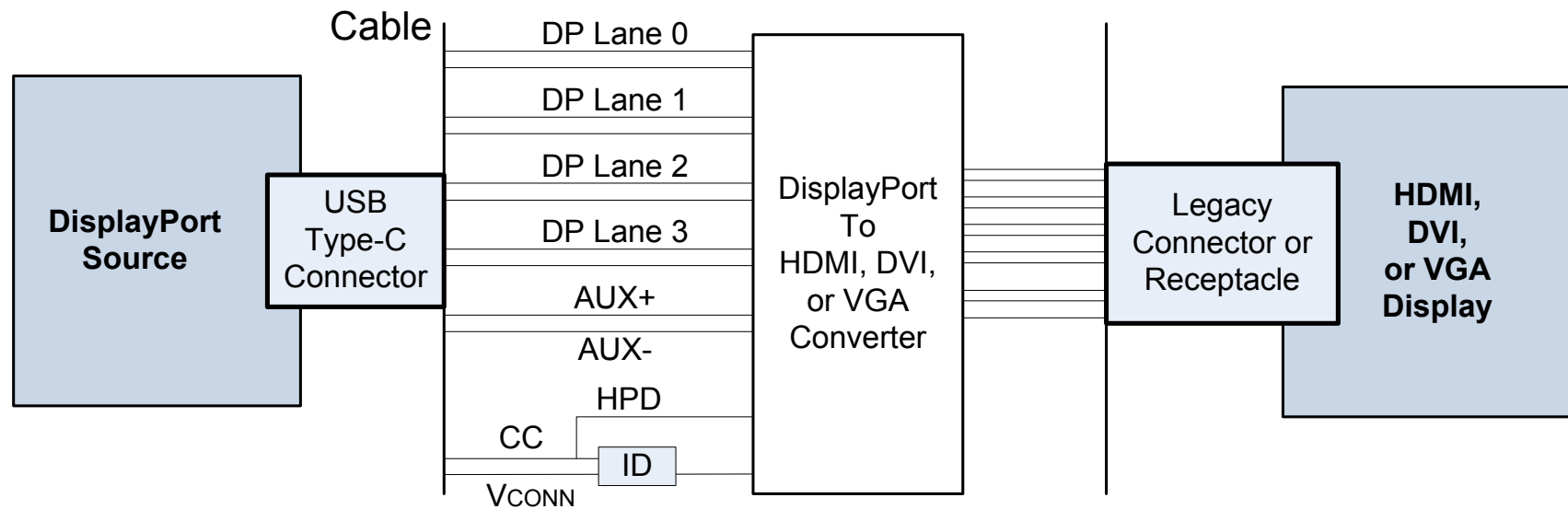
# USB Type-C to DisplayPort Adapter Cable



- 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



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

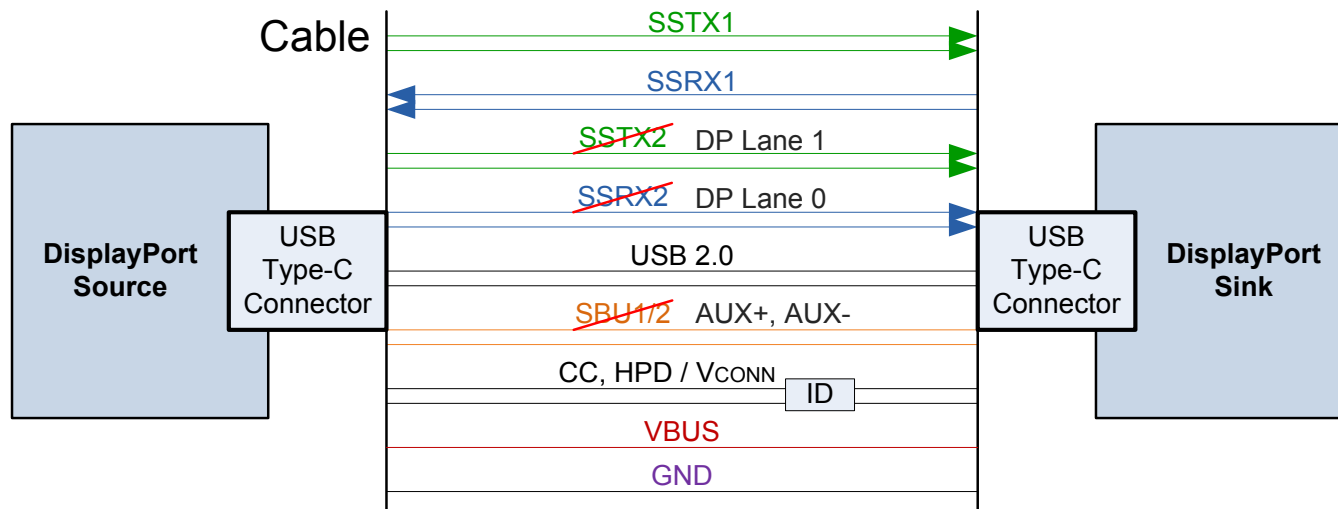


- Utilizes DisplayPort Alt Mode capability of USB Type-C connector
- Adapter Cable: USB Type-C plug on one end, legacy plug on other end
- Adapter: USB Type-C plug on one end, legacy receptacle on other end
- USB Type-C will NOT support DisplayPort Dual Mode (DP++)
- USB Type-C to HDMI Converters will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



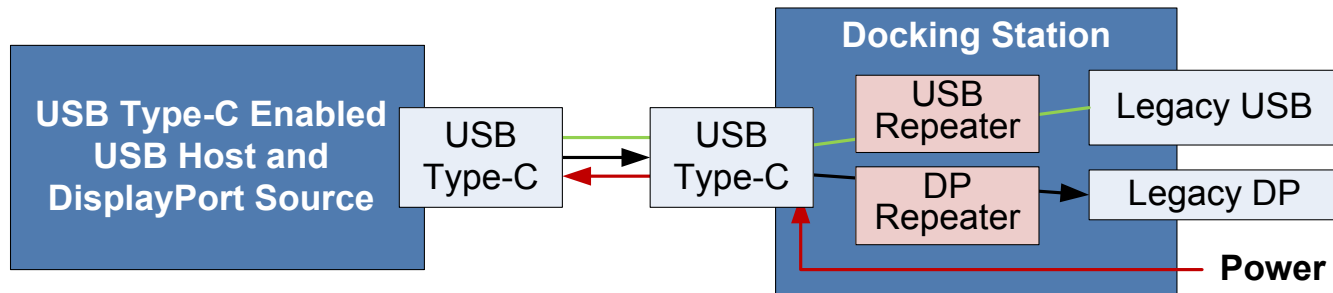
- Utilizes DisplayPort Alt Mode capability of USB Type-C connector
- DisplayPort uses two high speed lanes
  - For DP 1.2a (HBR2), this provides support for 2560x1600 or 2 each 1080p displays
  - For DP 1.3 (HBR3), this will provide support of 4K UHD (3840 x 2160)
- Two high speed lanes used for USB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





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

## Simple Docking Configuration



## More Complex Docking Configuration

