Technical Article

USB Type-C Does It All: Data, Video and Power Delivery over a Single Cable Connection

TEXAS INSTRUMENTS

Yoon Lee

The recently released universal serial bus (USB) Type-C connector comes with many enhanced features. The connector is well-known to be "flippable" and reversible, and able to carry data, video and power over one connection. The specification defines the Type-C port so that it always supports USB, while you can enable Alternate Modes of operation such as DisplayPort video within the specification boundary defined for Alternate Modes. The USB Power Delivery (PD) protocol achieves enhanced power delivery up to 20V at 5A.


When the Type-C connector operates in USB-only mode without video or high power delivery, you will need a configuration channel (CC) controller and/or multiplexer (mux) switches. If you plan to enable extended features such as video and power delivery, you'll need additional components such as a PD controller and a mux switch for signal mapping. You can enable the Type-C port with DisplayPort video and PD capability using TI's PD and Type-C solutions: TPS65982 and HD3SS460.

The TPS65982 is a PD controller that is capable of handling CC logic for the Type-C connection protocol. It is also capable of managing the PD message handshake to enable extended features such as power delivery and video transfer. The TPS65982 comes with integrated power FET switches to handle power delivery over USB Type-C. It can also manage the external power FET to support power delivery up to 20V at 5A.

The HD3SS460 is a cross-point switch, enabling USB and PD signal paths based on the orientation and mode of the Type-C connection (which is determined by the PD contract between two connected systems). The PD contract determines the power and data roles. Note that if special features are enabled, the Type-C connector will not lose USB functionality.

You will need to identify Alternate-Mode devices over USB when PD messaging is not available. A new device class, USB Billboard, enables Alternate-Mode device identification over USB. The USB host should be able to access the USB Billboard and indicate the current mode of operation if the desired alternate mode can't be enabled or updated. USB Billboard must be implemented on any USB Type-C devices with Alternate-Mode implementations. The TPS65982 has an integrated USB2 end point to support USB Billboard.

The TI Type-C power and Alternate-Mode solution (TPS65982 + HD3SS460) supports all of the features I've described to enable enhanced VBUS power delivery and DisplayPort Alternate Mode.
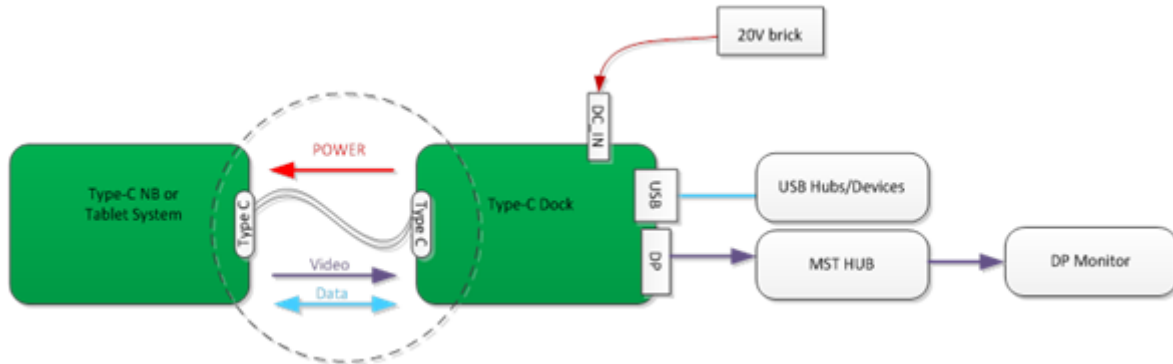
Figure 1. Power Contract and Alternate Mode Negation between Two Ports

USB Type-C system implementation examples using TI's Alternate-Mode USB Type-C solution include:

- A notebook/tablet with a USB Type-C port supporting USB dual-role data, dual-role power and DisplayPort video output.
- A docking station with a USB Type-C port supporting USB upstream-facing port (UFP), power source and DisplayPort sink.
- A DisplayPort + USB dongle-type port extender with a Type-C port supporting USB UFP, power sink and DisplayPort sink.
- A DisplayPort monitor with a USB Type-C port supporting USB UFP, power source and DisplayPort sink (monitor display).

Stay tuned to our USB blog series, including Roland Sperlich's blog about "Why USB Type-C will make life easier," for more information. Please leave us a note in the comments section below and let us know what other topics you would like us to cover.

Additional Resources
- View the datasheet for the TPS65982 device.
- View the datasheet for the HD3SS460 device.
- Learn about TI's USB portfolio.
- Get answers from our experts on the TI E2E™ Community USB forum.

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