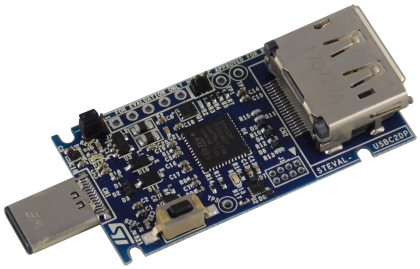
STEVAL-USBC2DP

Data brief

USB Type-C™ to DisplayPort™ adapter



Features

- Full reference design for USB Type-C to DisplayPort adapter with USB Type-C connector and DisplayPort connector.
- Single chip solution based on the STM32F072 series 32-bit microcontrollers with integrated USB 2.0 peripheral.
- Based on certified X-CUBE-USB-PD middleware stack, compliant with the following standards and specifications:
  - USB Type-C Cable and Connector 1.3
  - USB Power Delivery 2.0 and 3.0
  - VESA DisplayPort Alternate Mode on USB Type-C Standard 1.0a
  - USB Device Class Definition for Billboard Devices 1.21
- EMI filtering and ESD protection circuits.
- Compact PCB design: 5.5 x 2.3 cm
- RoHS compliant

Description

The compact USB Type-C to DisplayPort adapter reference design, with USB Type-C connector and DisplayPort connector, exploits Alternate Mode of the USB Type-C and Power Delivery specifications to offer a comprehensive VESA® DisplayPort Standard interface.

With this adapter, you can connect a monitor with a DisplayPort interface to any laptop, tablet or smartphone with a reversible USB Type-C connector that is compliant with the Power Delivery specification.

The DisplayPort Alternate Mode allows video data to be delivered through the SuperSpeed USB lines on the Type-C connector, while Auxiliary lanes (AUX) and hot plug detection (HPD) signals are sent through other Type-C lines.

The high-performance ARM® Cortex®-M0 32-bit STM32F072 microcontroller engages in DisplayPort Alt Mode negotiation through vendor-defined messages (VDM) according to the USB Power Delivery Specification. The messages are transmitted along configuration channel (CC), through a simple discrete analog front end (AFE) interface between the STM32 MCU and the USB Type-C connector.

The STM32 microcontroller running the ST USB Middleware stack and the embedded USB 2.0 controller provide the Billboard Device Class support as required by the USB Power Delivery standard, as well as the Device Firmware Upgrade capability.

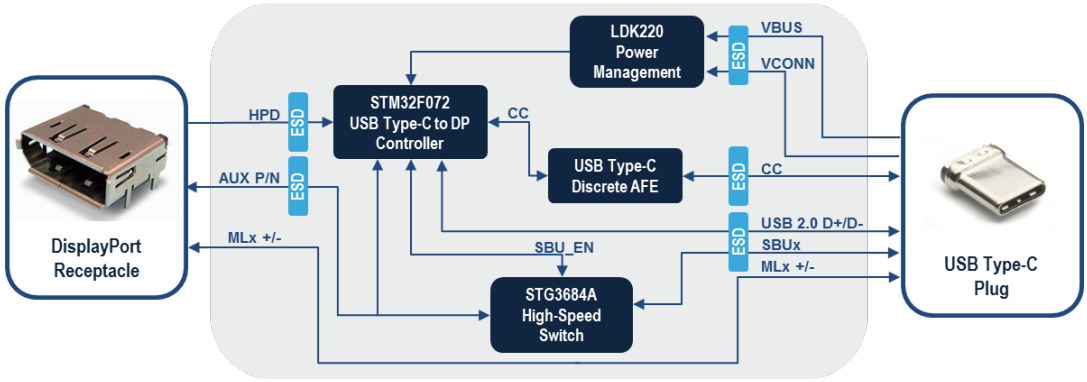
Summary table	
STEVAL-USBC2DP USB Type-C™ to DisplayPort™ adapter	STEVAL-USBC2DP
X-CUBE-USB-PD software expansion for STM32Cube	X-CUBE-USB-PD
STM32F072 series 32-bit ARM Cortex MCU with crystal-less USB 2.0 FS interface	STM32F072
LDK220 200 mA low quiescent current and low noise LDO	LDK220
STG3684A low voltage 0.5 Ω max dual SPDT switch	STG3684A

1 USB Type-C to DisplayPort reference design architecture

The STEVAL-USBC2DP reference design for the USB Type-C to VESA DisplayPort adapter is a complete solution based on the following logical blocks:

1. A USB Type-C reversible connector
2. A DisplayPort connector
3. An STM32F072 MCU running the X-CUBE-USB-PD software package with Middleware stack
4. A USB Type-C discrete analog front end
5. The on-board power management stage controlled by the LDK220 low dropout voltage regulator to supply the dongle through the Type-C connector VBUS or VCONN pins
6. The STG3684A low voltage 0.5 Ω max. dual SPDT switch between the DisplayPort auxiliary (AUX) and the side-band unit (SBU) lines

Figure 1. STEVAL-USBC2DP system architecture block diagram



The adapter reference design also features:

- Dual supply options through USB Type-C connector:
  - VBUS
  - VCONN
- VBUS voltage sensing for power monitoring
- USB 2.0 interface available on Type-C™ port for Billboard Device Class and Device Firmware Upgrade
- A power status LED and USB Power Delivery Status LED
- A RESET button
- On-board SWD connector that can be connected with the ST-LINK/V2-1 debugger/programmer embedded on STM32 Nucleo boards

2 Schematic diagrams

Figure 2. **MCU section**

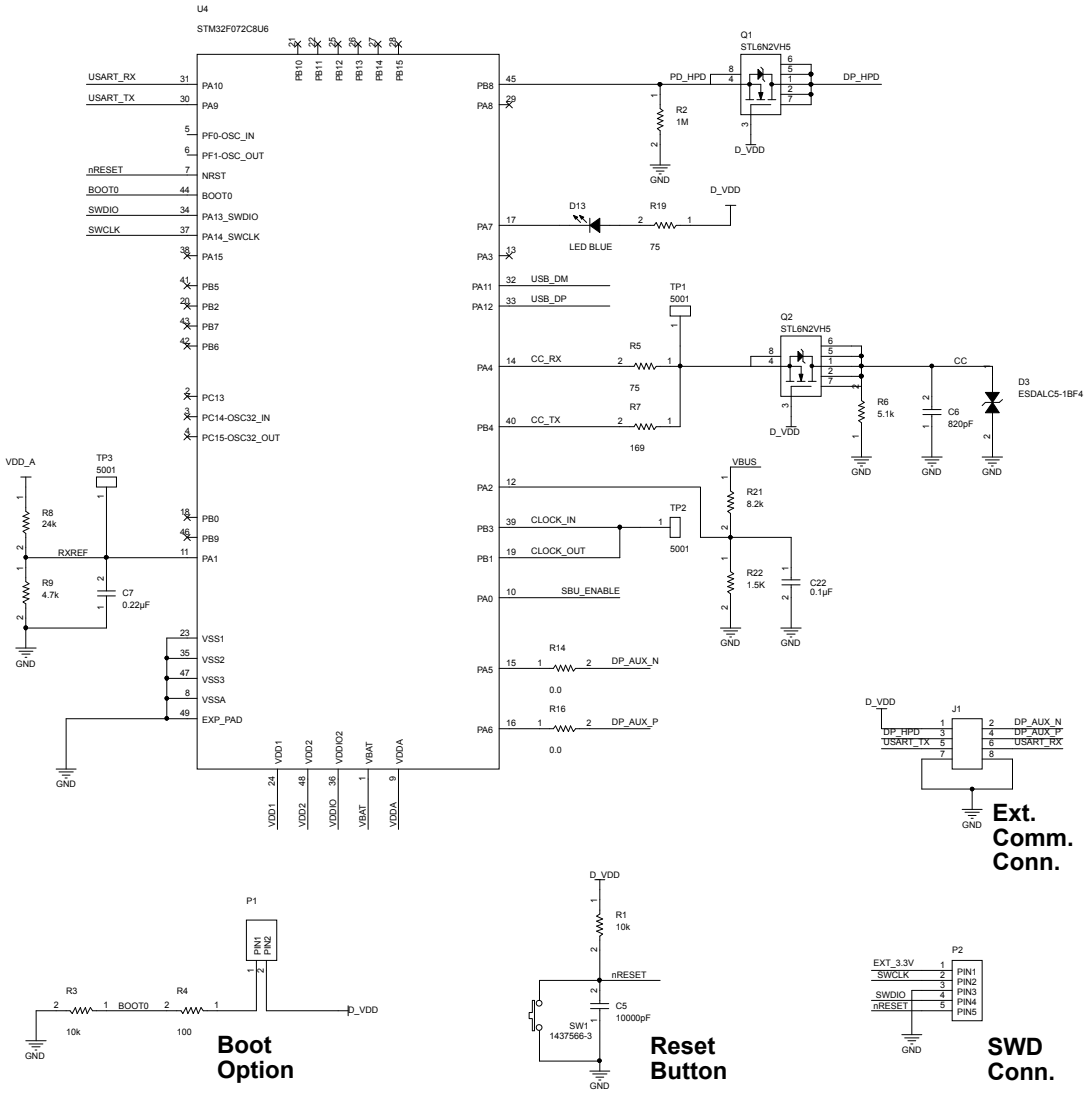


Figure 3. **USB Type-C Plug**

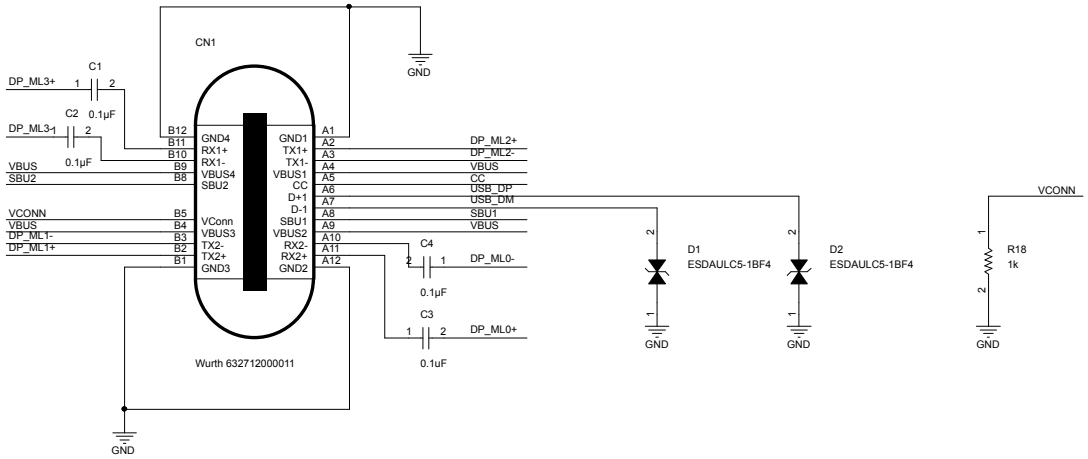


Figure 4. **DisplayPort Receptacle**

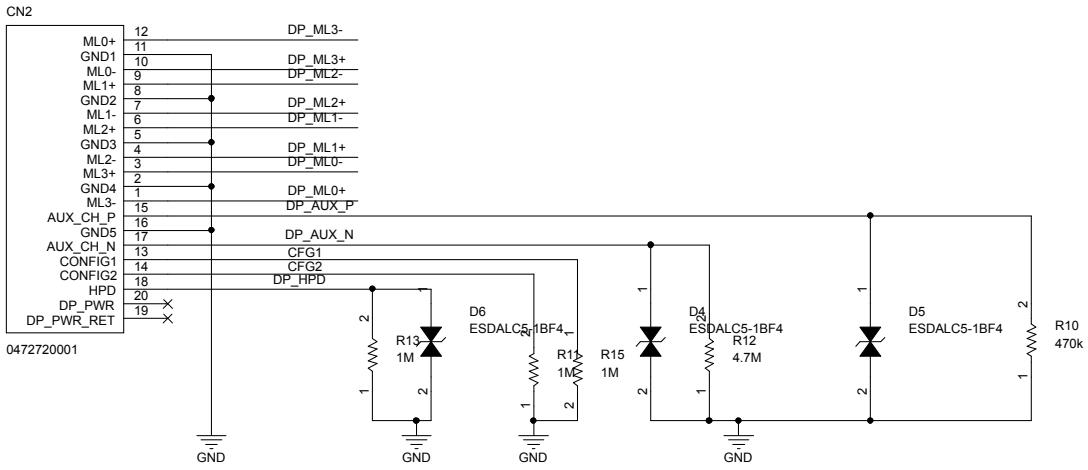
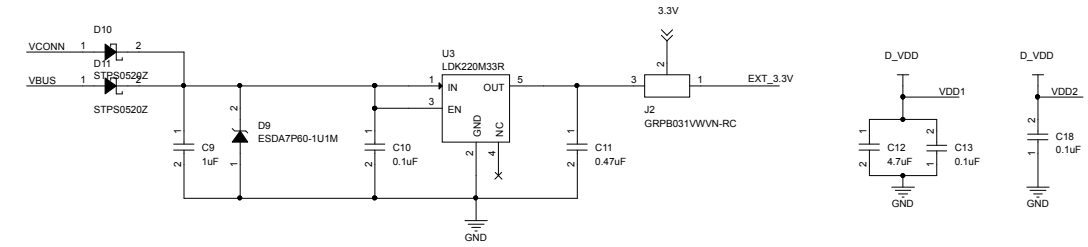


Figure 5. **Power Management Stage**



Power-On LED

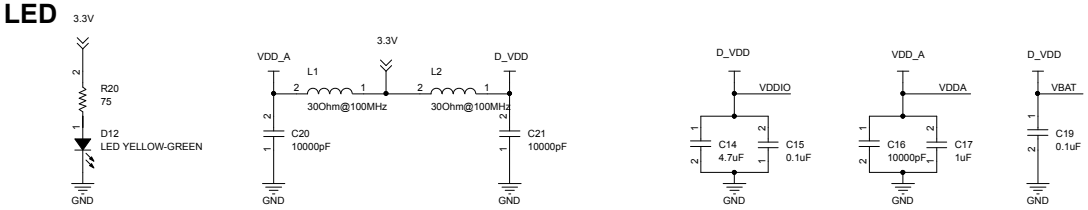
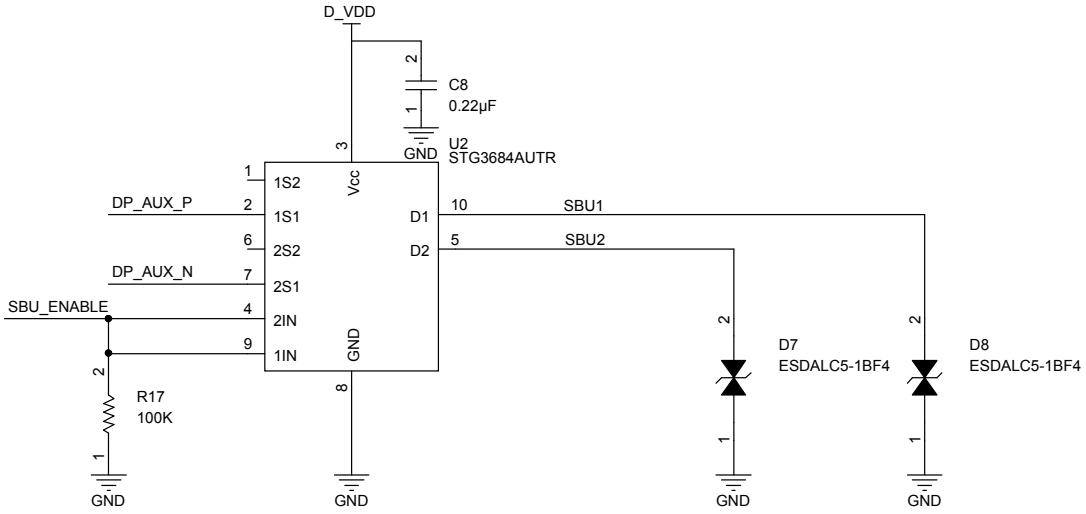


Figure 6. Hi-Speed Data Switch



3 References

1. USB Type-C™ Cable and Connector Specification, Release 1.3, July 12, 2017.
2. USB Power Delivery Specification Revision 3.0, Version 1.1, January 12, 2017.
3. VESA DisplayPort Alternate Mode on USB Type-C Standard, Version 1.0a, August 05, 2015.
4. USB Device Class Definition for Billboard Devices, Revision 1.21, September 8, 2016.

Revision history

Table 1. **Document revision history**

Date	Version	Changes
01-Feb-2018	1	Initial release.
19-Feb-2018	2	Minor text edits
27-Feb-2018	3	Minor text edits

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