

# TUSB564, HD3SS460 and TS3USBCA410 Pin Assignment C and E Implementation

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## ABSTRACT

The TUSB564 is a VESA USB Type-C™ Alt Mode redriving switch supporting USB 3.1 data rates up to 5 Gbps and DisplayPort 1.4 up to 8.1 Gbps for upstream facing port (DisplayPort Sink). The device is used for UFP pin assignments C, D, and E from the VESA DisplayPort Alt Mode on USB Type-C Standard. For DisplayPort Sink that does not natively support assignment E, this document is intended to describe how to use the TUSB564, HD3SS460 and TS3USBCA410 to implement such user case.

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## 1 Overview

VESA defines different pin assignments on the USB Type-C connector when sending and receiving DisplayPort signaling. Six possible pin assignments are defined for USB Type-C configured to perform as a Display Source (DFP\_D) – A, B, C, D, E, or F. Five possible pin assignments are defined for USB Type-C configured to perform as a Display Sink (UFP\_D) – A, B, C, D, or E.

Pin Assignments A, B, C, and D are intended for use with:

- USB Type-C to USB Type-C Cables
- Adaptors from USB Type-C to other video standards such as VGA, DVI, HDMI.

Pin Assignments E and F are intended for use with adaptors from USB Type-C to DisplayPort plugs or receptacles. For additional details on pin assignment, refer to the *DP\_Alt\_Mode\_on\_USB\_Type-C* specification.

With UFP\_D Pin Assignment E, the polarity of both the main link and AUX signals is inverted on the Type-C receptacle pins relative to Pin Assignment C.

Assignment E normal plug orientation main link signal:

- Lane 0 → DP1
- Lane 1 → DP0
- Lane 2 → DP3
- Lane 3 → DP2

Assignment E normal plug orientation AUX signal:

- SBU1 — AUXP
- SBU2 — AUXN

For DisplayPort sink that has the capability to handle the main link ordering and polarity swap, but does not have the ability to handle pullup/pulldown on AUX, TI proposes the use of TUSB564 and TS3USBCA410. TS3USBCA410 with polarity flip capability will ensure correct pull up/down alignment to enable both Assignment C & E can be supported in the system.

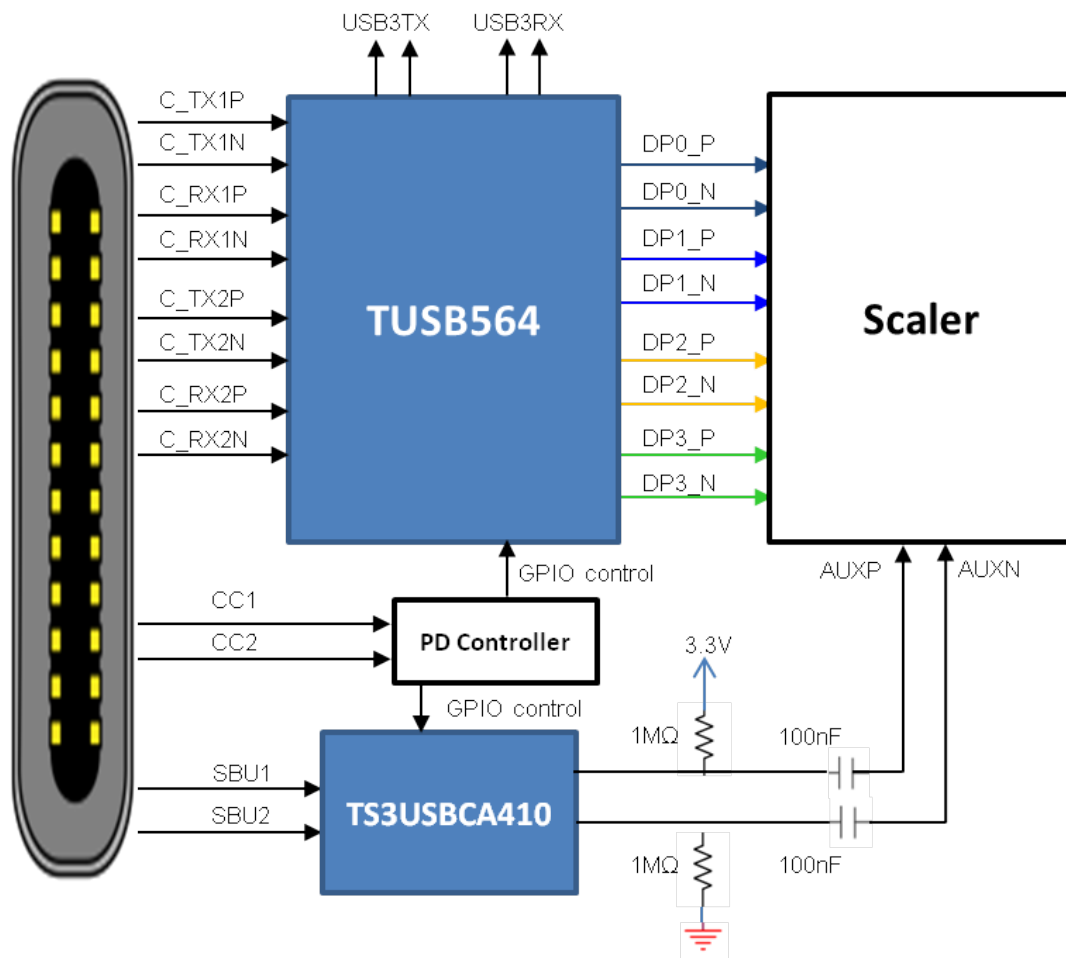


Figure 1. USB-C Block Diagram with Scaler

For DisplayPort sink that cannot perform the main link and AUX inversion. TI proposes the use of TUSB564 and HD3SS460 to support Assignment E implementation. In all these configurations, the TUSB564 passes the polarity of the Main Link signals as received. The DisplayPort sink must change the polarity inversion of those signals.

## 2 TUSB564 and HD3SS460 Pin Assignment C Normal Plug Orientation Implementation

Figure 2 shows the pin assignment C normal plug orientation implementation.

UFP_D Assignment C - Normal Plug Orientation									
SINK Receptacle Pin Number	SINK Receptacle Pin Name	DP signals	564 Input Pin Name	564 Output Pin Name	DP signals	460 Input Pin Name	460 Output Pin Name	DP signals	Scaler Input Pin Name
			564 Control pins: HLL			460 Control pins: LHH			
A2	TX1+	dp3+	TX1+	DP0+	dp0+	CRX1+	LND+	dp0+	DP0+
A3	TX1-	dp3-	TX1-	DP0-	dp0-	CRX1-	LND-	dp0-	DP0-
B11	RX1+	dp2+	RX1+	DP1+	dp1+	CTX1+	LNC+	dp1+	DP1+
B10	RX1-	dp2-	RX1-	DP1-	dp1-	CTX1-	LNC-	dp1-	DP1-
A11	RX2+	dp1+	RX2+	DP2+	dp2+	CRX2+	LNA+	dp2+	DP2+
A10	RX2-	dp1-	RX2-	DP2-	dp2-	CRX2-	LNA-	dp2-	DP2-
B2	TX2+	dp0+	TX2+	DP3+	dp3+	CTX2+	LNB+	dp3+	DP3+
B3	TX2-	dp0-	TX2-	DP3-	dp3-	CTX2-	LNB-	dp3-	DP3-
A8	SBU1	auxn	SBU1	AUXP	auxp	CSBU1	SBU1	auxp	AUXP
B8	SBU2	auxp	SBU2	AUXN	auxn	CSBU2	SBU2	auxn	AUXN

Figure 2. Assignment C Normal Plug Orientation Implementation

## 3 TUSB564 and HD3SS460 Pin Assignment C Flip Plug Orientation Implementation

Figure 3 shows the pin assignment C flip plug orientation implementation.

UFP_D Assignment C - Flip Plug Orientation									
SINK Receptacle Pin Number	SINK Receptacle Pin Name	DP signals	564 Input Pin Name	564 Output Pin Name	DP signals	460 Input Pin Name	460 Output Pin Name	DP signals	Scaler Input Pin Name
			564 Control pins: HLH			460 Control pins: LHH			
A2	TX1+	dp0+	TX1+	DP0+	dp0+	CRX1+	LND+	dp0+	DP0+
A3	TX1-	dp0-	TX1-	DP0-	dp0-	CRX1-	LND-	dp0-	DP0-
B11	RX1+	dp1+	RX1+	DP1+	dp1+	CTX1+	LNC+	dp1+	DP1+
B10	RX1-	dp1-	RX1-	DP1-	dp1-	CTX1-	LNC-	dp1-	DP1-
A11	RX2+	dp2+	RX2+	DP2+	dp2+	CRX2+	LNA+	dp2+	DP2+
A10	RX2-	dp2-	RX2-	DP2-	dp2-	CRX2-	LNA-	dp2-	DP2-
B2	TX2+	dp3+	TX2+	DP3+	dp3+	CTX2+	LNB+	dp3+	DP3+
B3	TX2-	dp3-	TX2-	DP3-	dp3-	CTX2-	LNB-	dp3-	DP3-
A8	SBU1	auxp	SBU1	AUXP	auxp	CSBU1	SBU1	auxp	AUXP
B8	SBU2	auxn	SBU2	AUXN	auxn	CSBU2	SBU2	auxn	AUXN

Figure 3. Assignment C Flip Plug Orientation Implementation

#### 4 TUSB564 and HD3SS460 Pin Assignment E Normal Plug Orientation Implementation

Figure 4 shows the pin assignment E normal plug orientation implementation.

UFP D Assignment E - Normal Plug Orientation									
SINK Receptacle Pin Number	SINK Receptacle Pin Name	DP signals	564 Input Pin Name	564 Output Pin Name	DP signals	460 Input Pin Name	460 Output Pin Name	DP signals	Scaler Input Pin Name
			564 Control pins: HLL			460 Control pins: HHH			
A2	TX1+	dp1-	TX1+	DP0+	dp2-	CRI1+	LND+	dp0-	DP0+
A3	TX1-	dp1+	TX1-	DP0-	dp2+	CRI1-	LND-	dp0+	DP0-
B11	RX1+	dp0-	RX1+	DP1+	dp3-	CTI1+	LNC+	dp1-	DP1+
B10	RX1-	dp0+	RX1-	DP1-	dp3+	CTI1-	LNC-	dp1+	DP1-
A11	RX2+	dp3-	RX2+	DP2+	dp0-	CRI2+	LNA+	dp2-	DP2+
A10	RX2-	dp3+	RX2-	DP2-	dp0+	CRI2-	LNA-	dp2+	DP2-
B2	TX2+	dp2-	TX2+	DP3+	dp1-	CTI2+	LNB+	dp3-	DP3+
B3	TX2-	dp2+	TX2-	DP3-	dp1+	CTI2-	LNB-	dp3+	DP3-
A8	SBU1	auxp	SBU1	AUXP	auxn	CSBU1	SBU1	auxp	AUXP
B8	SBU2	auxn	SBU2	AUXN	auxp	CSBU2	SBU2	auxn	AUXN

Figure 4. Assignment E Normal Plug Orientation Implementation

#### 5 TUSB564 and HD3SS460 Pin Assignment E Flip Plug Orientation Implementation

Figure 5 shows the pin assignment E flip plug orientation implementation.

UFP D Assignment E - Flip Plug Orientation									
SINK Receptacle Pin Number	SINK Receptacle Pin Name	DP signals	564 Input Pin Name	564 Output Pin Name	DP signals	460 Input Pin Name	460 Output Pin Name	DP signals	Scaler Input Pin Name
			564 Control pins: HLH			460 Control pins: HHH			
A2	TX1+	dp2-	TX1+	DP0+	dp2-	CRI1+	LND+	dp0-	DP0+
A3	TX1-	dp2+	TX1-	DP0-	dp2+	CRI1-	LND-	dp0+	DP0-
B11	RX1+	dp3-	RX1+	DP1+	dp3-	CTI1+	LNC+	dp1-	DP1+
B10	RX1-	dp3+	RX1-	DP1-	dp3+	CTI1-	LNC-	dp1+	DP1-
A11	RX2+	dp0-	RX2+	DP2+	dp0-	CRI2+	LNA+	dp2-	DP2+
A10	RX2-	dp0+	RX2-	DP2-	dp0+	CRI2-	LNA-	dp2+	DP2-
B2	TX2+	dp1-	TX2+	DP3+	dp1-	CTI2+	LNB+	dp3-	DP3+
B3	TX2-	dp1+	TX2-	DP3-	dp1+	CTI2-	LNB-	dp3+	DP3-
A8	SBU1	auxn	SBU1	AUXP	auxn	CSBU1	SBU1	auxp	AUXP
B8	SBU2	auxp	SBU2	AUXN	auxp	CSBU2	SBU2	auxn	AUXN

Figure 5. Assignment E Flip Plug Orientation Implementation

## 6 TUSB564 and HD3SS450 Assignment C and E Implementation Reference Schematic

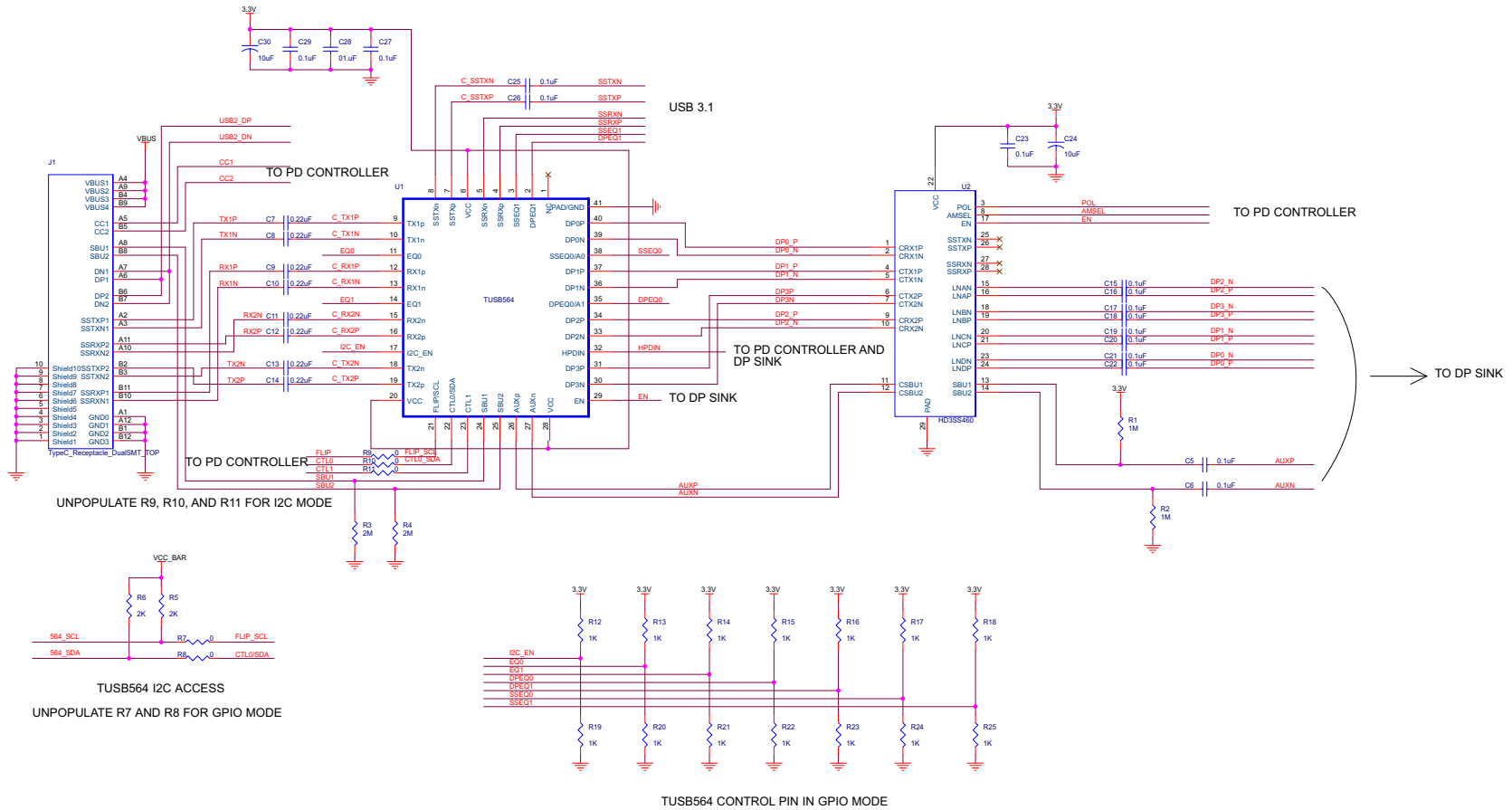


Figure 6. Reference Schematic

## Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<b>Changes from Original (May 2018) to A Revision</b>	<b>Page</b>
• Added information on using TUSB564, HD3SS460 and TS3USBCA410 in a USB-C application with pin assignment C and E implemented. ....	<a href="#">1</a>

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