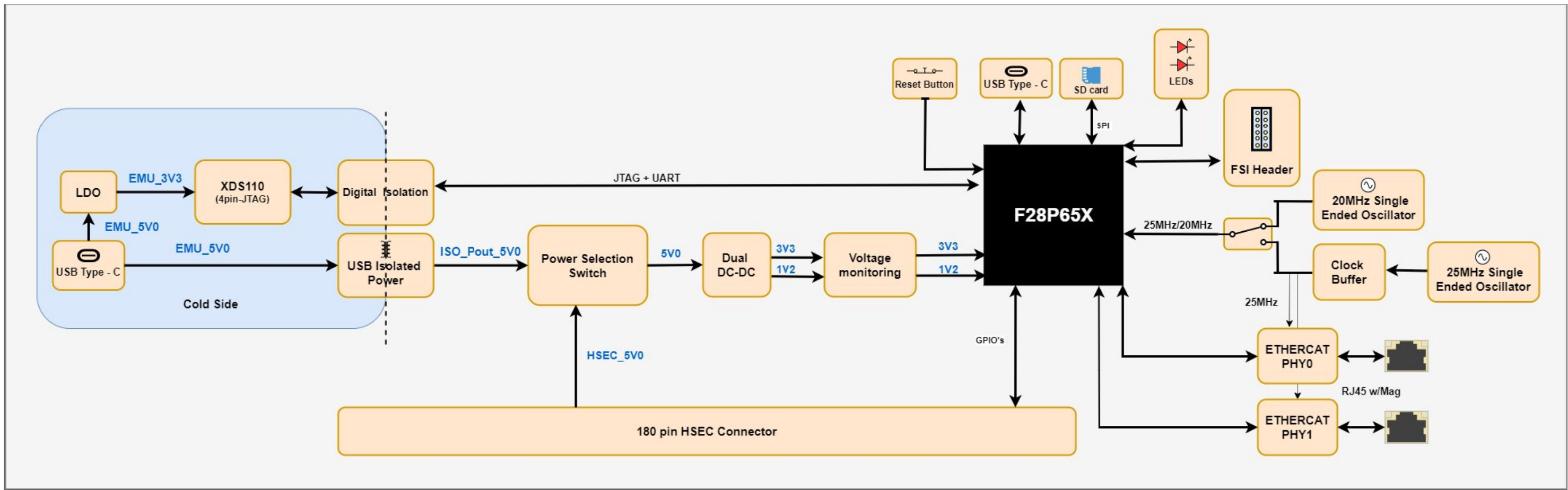


- 1) USB Differential Pairs - 90 Ohm  
(A) XDS\_D\_P and XDS\_D\_N  
(B) USB\_D\_P (GPIO42) and USB\_D\_N (GPIO43)
- 2) ADC Differential pair Impedance Matching - 50 Ohm  
(A) HSEC\_ADC even pins should match with HSEC\_ADC + 1 pin(ie ADC-C2 should match with ADC-C3)  
(B) MCU\_ADC even pins should match with MCU\_ADC + 1 pin(ie MCU\_ADC-A0 should match with MCU\_ADC-A1)
- 3) ETHERCAT Differential pairs - 100 Ohm  
(A) TD\_P and TD\_N  
(B) RD\_P and RD\_N
- 4) CLK Paths - 50 Ohm  
(A) F28P65x\_25MHz\_CLK  
(B) PHY0\_25MHz\_CLK and PHY1\_25MHz\_CLK

Revision History				
Rev	ECN #	Approved Date	Approved by	Notes
E1	N/A	N/A	N/A	Initial



Power to the MCU is either supported by the USB-C on the left or the HSEC 180 pin.

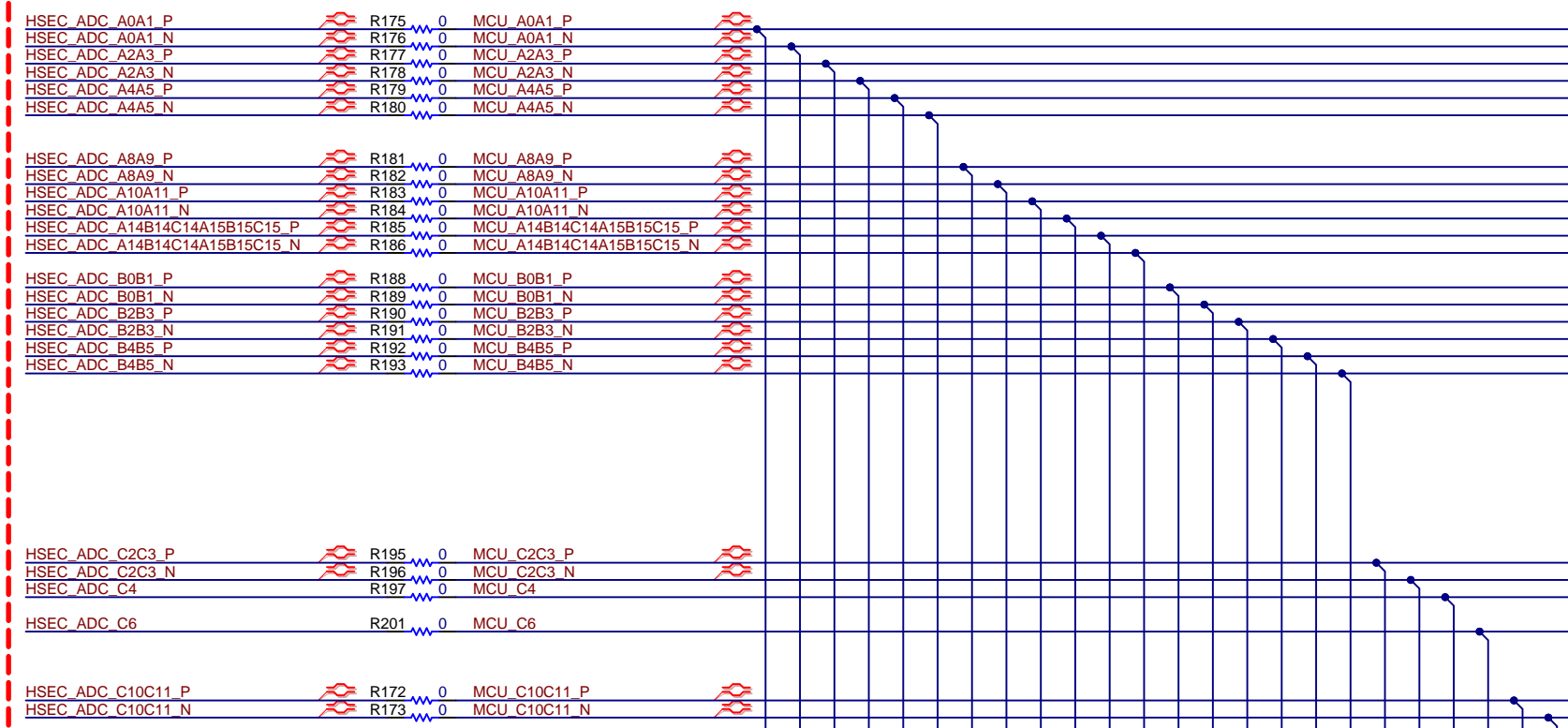
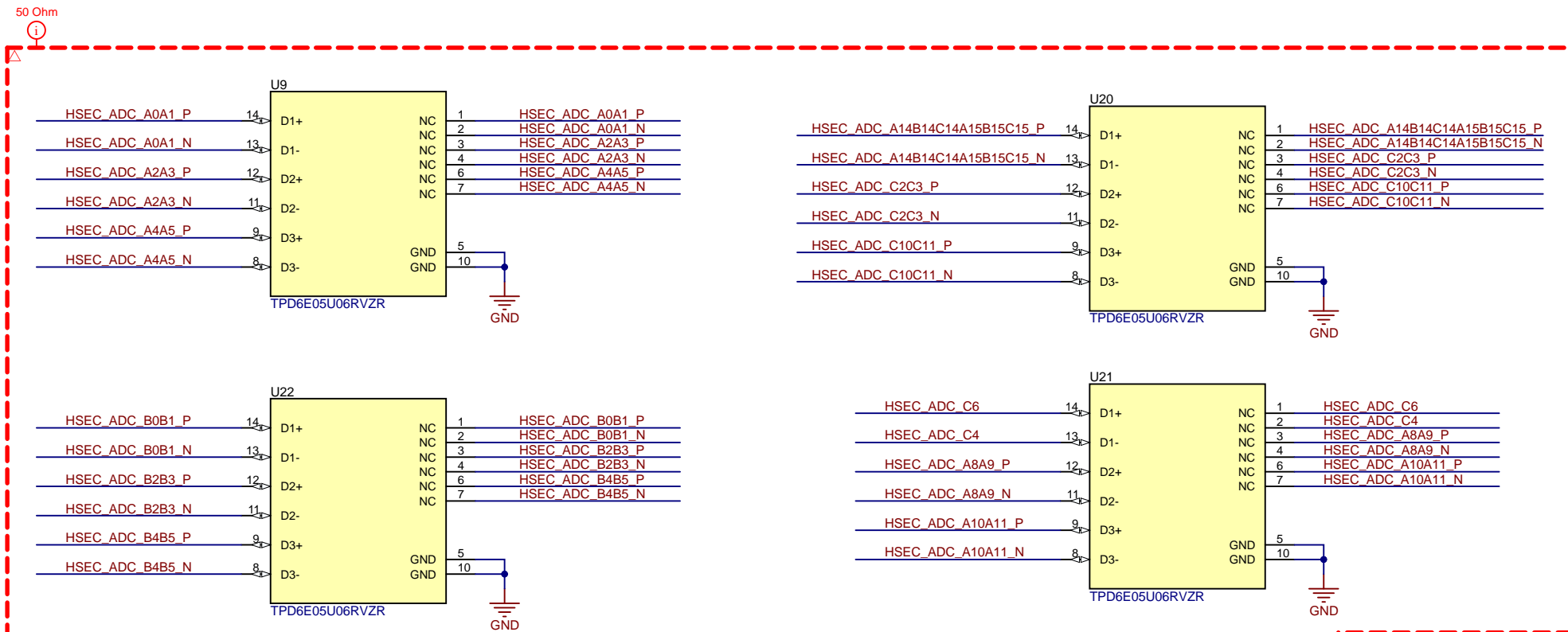
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Orderable: TMDSCNCD28P65X	Designed for: Public Release	Mod. Date: 10/5/2022
TID #: N/A	Project Title: F28P65X Control Card	
Number: MCU114	Rev: E1	Sheet Title:
SVN Rev: 73e91ac938d78e4362d0f066e00b544e0451b	File: MCU114E1_CoverSheet.SchDoc	Sheet: 1 of 11
Drawn By: Uttam Reddy Paila	Size: B	
Engineer: Uttam Reddy Paila	Contact: <a href="http://www.ti.com/support">http://www.ti.com/support</a>	







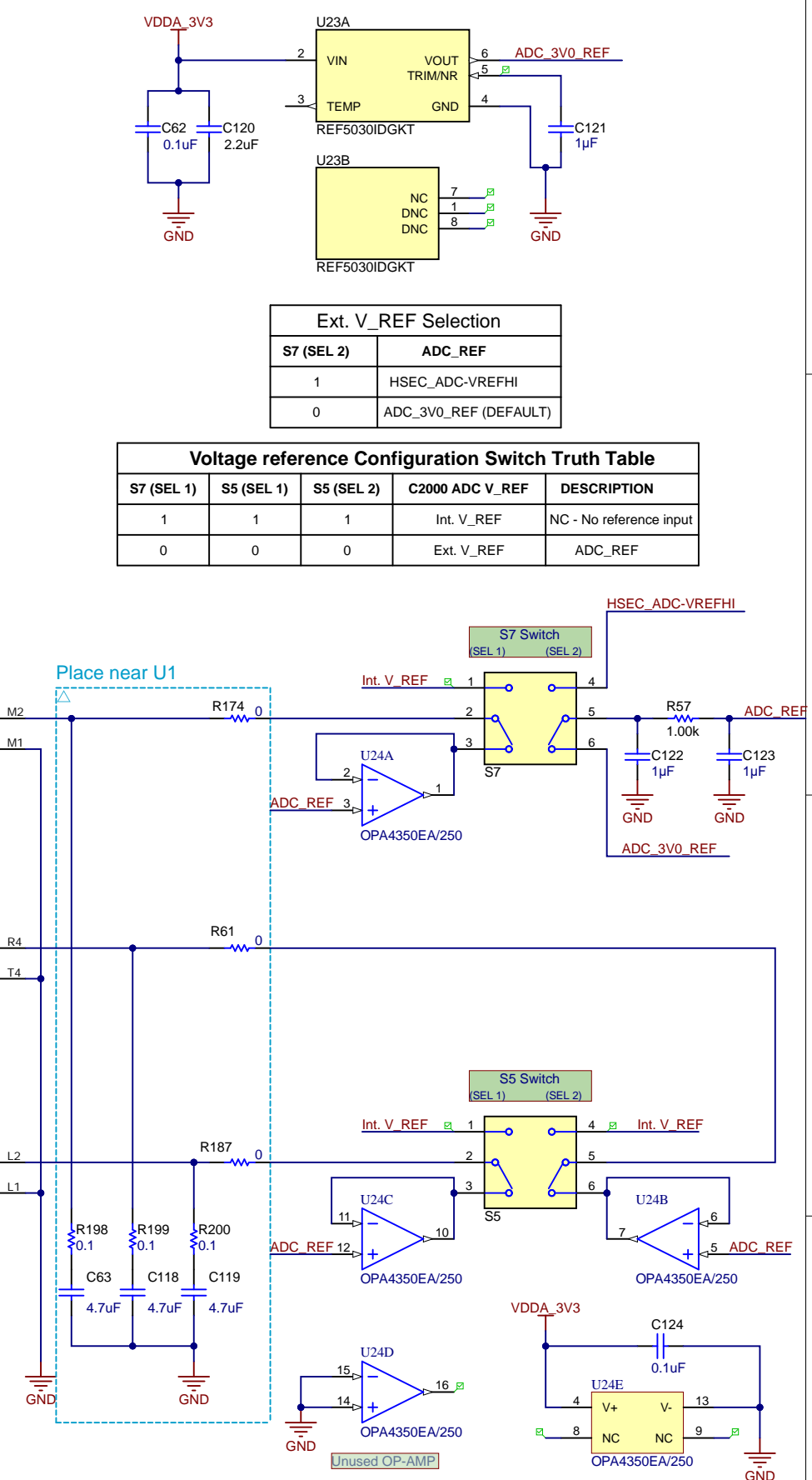


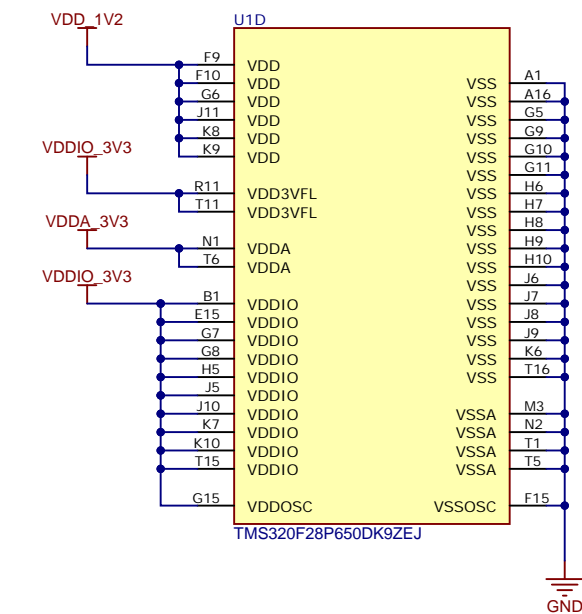
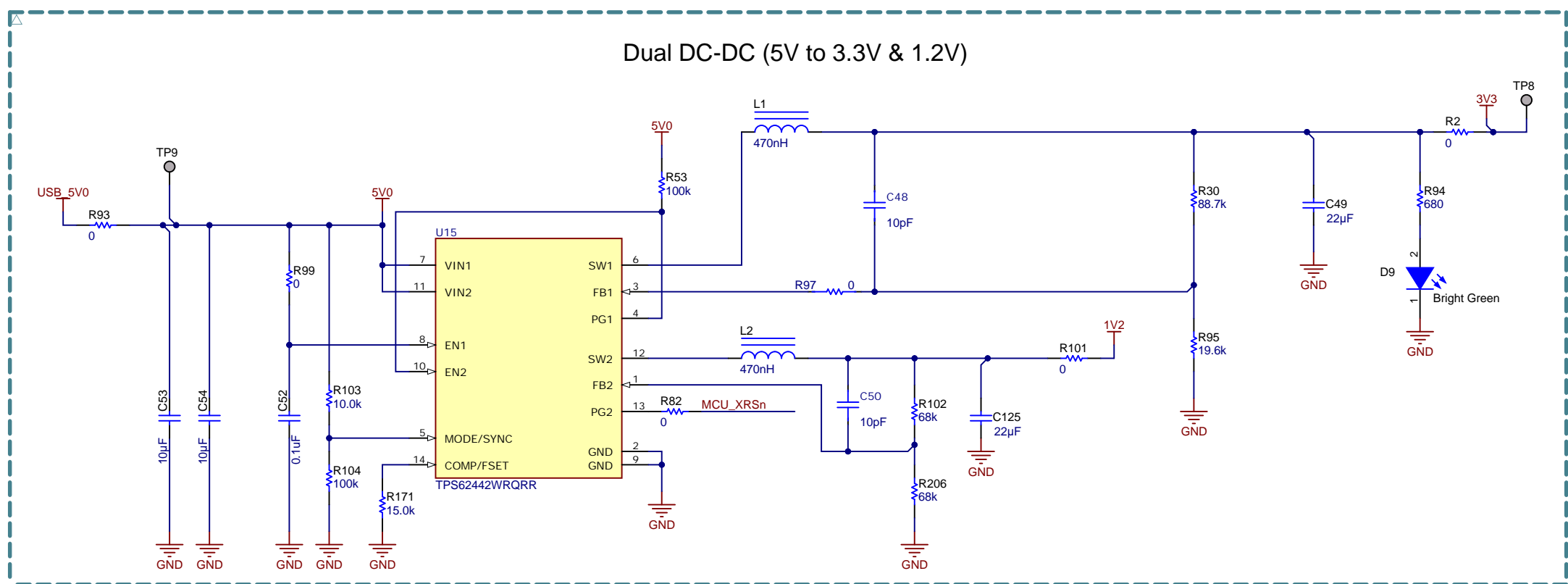
ADC\_A0A1\_P and ADC\_A0A1\_N make a differential pair using channels A0 and A1 respectively.

If you wish to use A0 or A1 independently the "\_P" refers to the first ADC channel (For example A0 in "ADC\_A0A1"). Additionally the "\_N" refers to the second channel, (A1 in "ADC\_A0A1").

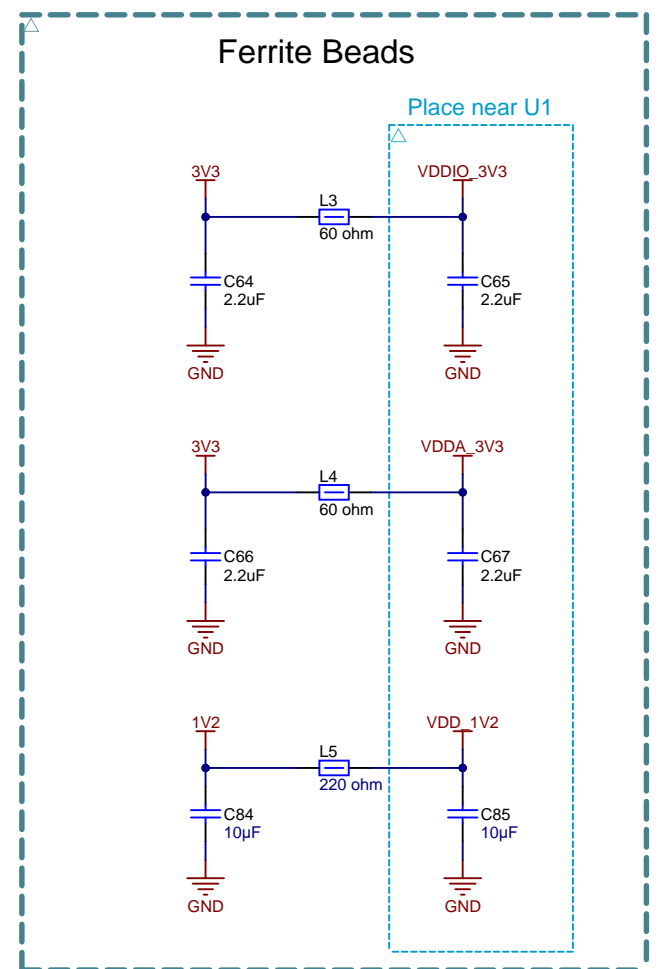
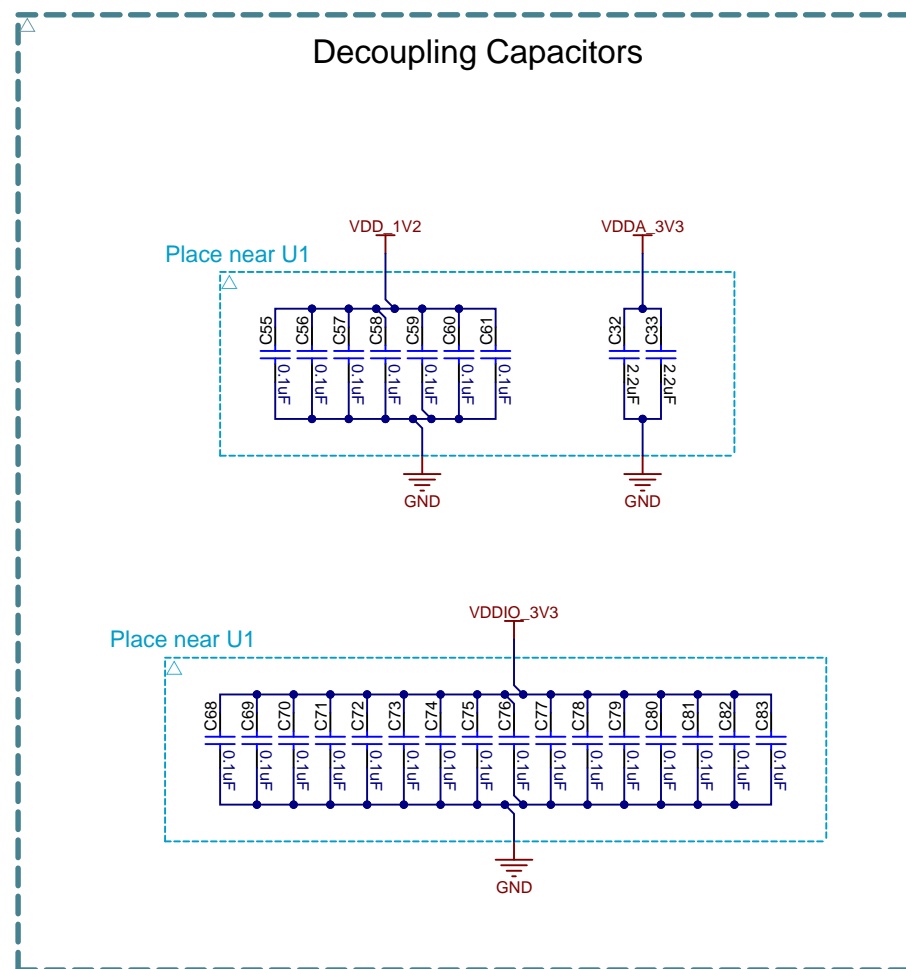
NOTE: C6 and C4 are not differential pairs

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**NOTE:**  
 1) TPS62442 Dual DC-DC provides an output current of 2A/2A or 3A/1A, this amount of current capacity should not be necessary for certain applications using F28P65x. This is just necessary for the control card design  
 2) Alternative part: TPS62420 Dual DC-DC provides an output current of 1A/600mA

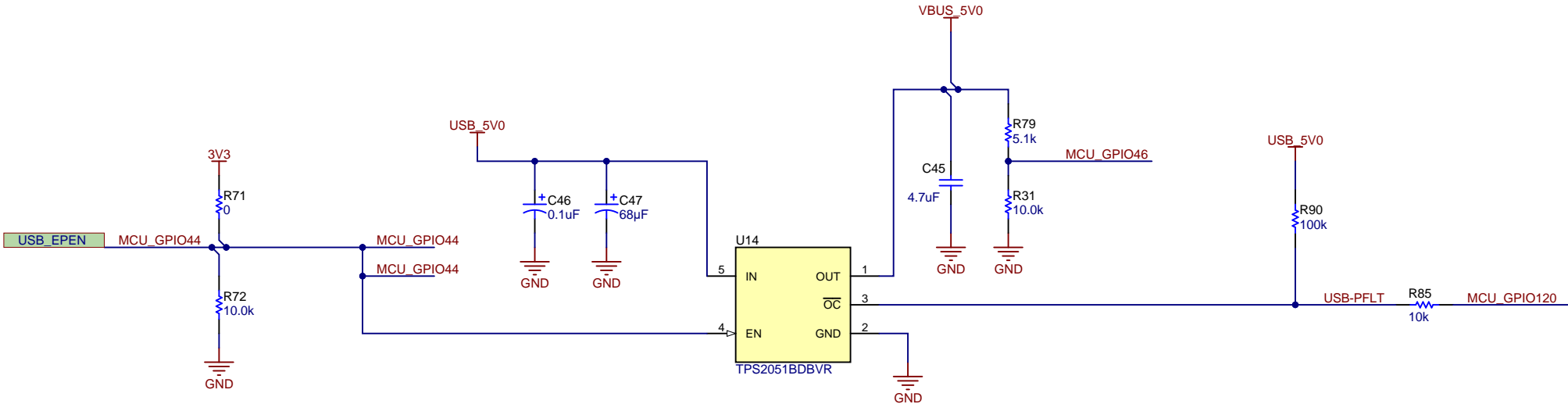
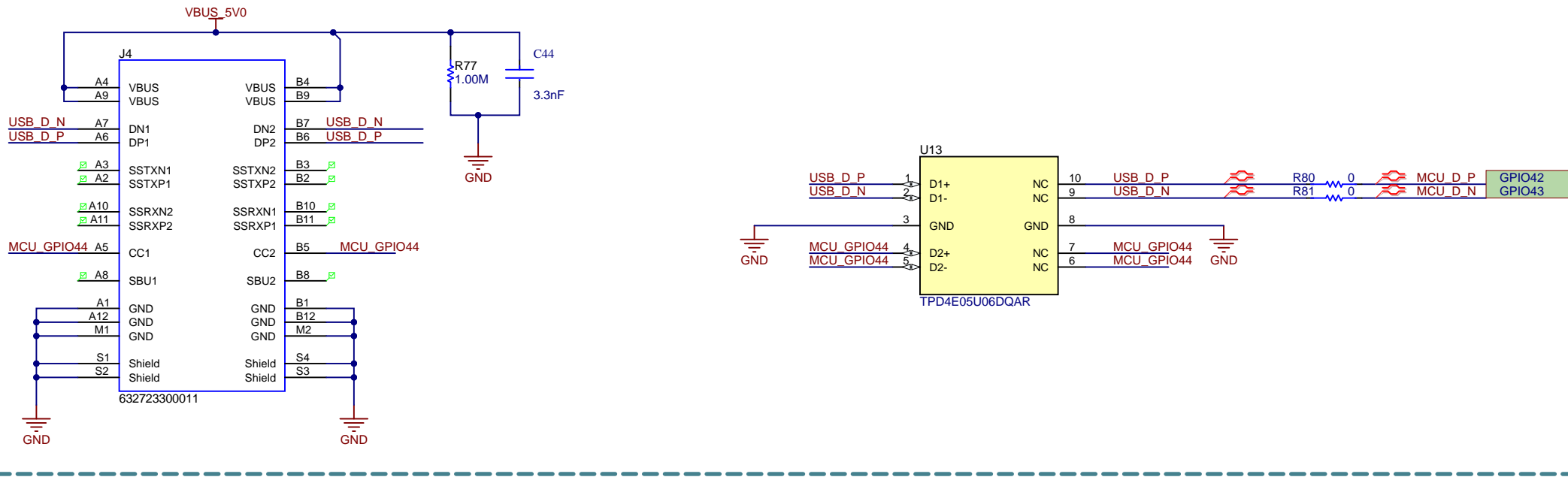


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Orderable: TMDSCNCD28P65X	Designed for: Public Release	Mod. Date: 3/2/2023
TID #: N/A	Project Title: F28P65X Control Card	
Number: MCU114	Rev: E1	Sheet Title:
SVN Rev: 61772283cedce539ca9f5b666d2b7c08e193	File: MCU114E1_Power.SchDoc	Size: B
Drawn By: Uttam Reddy Paila	Engineer: Uttam Reddy Paila	Contact: http://www.ti.com/support



USB- Type C Connector - Data Peripheral to MCU



Switch Truth Table		
MCU_GPIO44 STATUS	DESCRIPTION	USB_MODE
1 (HIGH)	UB_CC1 & USB_CC2 are pulled up	Host mode
0 (LOW)	UB_CC1 & USB_CC2 are strongly pulled down	Device mode (DEFAULT)

NOTE: USB VBUS\_5V0, PFLT & EPEN do not have a specific mux position in this device.

In this controlCARD, a standard GPIO is used to detect changes to these signals.

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Orderable: TMDSCNCD28P65X	Designed for: Public Release	Mod. Date: 10/4/2022
TID #: N/A	Project Title: F28P65X Control Card	
Number: MCU114	Rev: E1	Sheet Title:
SVN Rev: 73e91ac938d78e4362d0f066e00b544e04517b	File: MCU114E1_USB.SchDoc	Size: B
Drawn By: Uttam Reddy Paila	Contact: http://www.ti.com/support	
Engineer: Uttam Reddy Paila		

**USB- Type C Connector - XDS110**

The diagram illustrates the electrical connections for a USB Type C connector (J1) and a USB Type C cable (U4).

**Connector J1 (632723300011) Pinout:**

- VBUS:** A4, A9, B4, B9
- DN1:** A7 (XDS\_D\_N), A6 (XDS\_D\_P)
- DP1:** B7 (XDS\_D\_N), B6 (XDS\_D\_P)
- SSTXN1:** A3, A2
- SSTXP1:** B3, B2
- SSRXN1:** A10, A11
- SSRXP1:** B10, B11
- CC1:** A5 (XDS\_CC1), A8
- CC2:** B5 (XDS\_CC2), B8
- SBU1:** A1, A12, M1
- SBU2:** B1, B12, M2
- Shield:** S1, S2, S3, S4

**Cable U4 (TPD4E05U06DQAR) Pinout:**

- D1+:** 1 (XDS\_D\_P), 2 (XDS\_D\_N)
- D1-:** 10 (XDS\_D\_P), 9 (XDS\_D\_N)
- GND:** 3
- D2+:** 4 (XDS\_CC1), 5 (XDS\_CC2)
- D2-:** 7 (XDS\_CC1), 6 (XDS\_CC2)
- NC:** 8

**Connections and Components:**

- EMU\_USB\_5V0:** Connected to VBUS (A4, A9, B4, B9).
- EMU\_GND:** Connected to DN1 (A7, A6), DP1 (B7, B6), CC1 (A5, A8), CC2 (B5, B8), SBU1 (A1, A12, M1), SBU2 (B1, B12, M2), and Shield (S1, S2, S3, S4).
- Resistors:** R15 (1.00M) and R16 (5.1k) are connected to EMU\_GND. R17 (5.1k) is connected to EMU\_GND.
- Capacitor:** C20 (3.3nF) is connected to EMU\_USB\_5V0 and EMU\_GND.

### USB Isolated Power

The diagram illustrates a USB isolated power circuit. A USB input (EMU\_USB\_5V0) is connected to a transformer (T1) through a diode bridge (D3, D4) and a filter capacitor (C23). The transformer is isolated from ground. The output (ISO\_Pout\_5V0) is connected to a load capacitor (C25).

**Power Selection Switch**

The circuit schematic shows the TPS2113ADRBR IC configured as a power selection switch. The inputs are HSEC\_5V0 and ISO\_Pout\_5V0. The output is POWER\_SWITCH\_OUT. The circuit includes various resistors (R19, R20, R21, R22, R23, R24, R25, R26, R27) and capacitors (C26, C27, C28, C29) for signal conditioning and timing. A red LED (D7) is connected to the output to indicate the selected power source.

Switch Truth Table		
HSEC_5V0 > 4V	ISO_Pout_5V0 > HSEC_5V0	POWER_SWITCH_OUT
Yes	X	HSEC_5V0
No	No	HSEC_5V0
No	Yes	ISO_Pout_5V0

DRP can function either as a USB host or USB peripheral, the selection choice depends on the channel configuration (CC1/CC2).

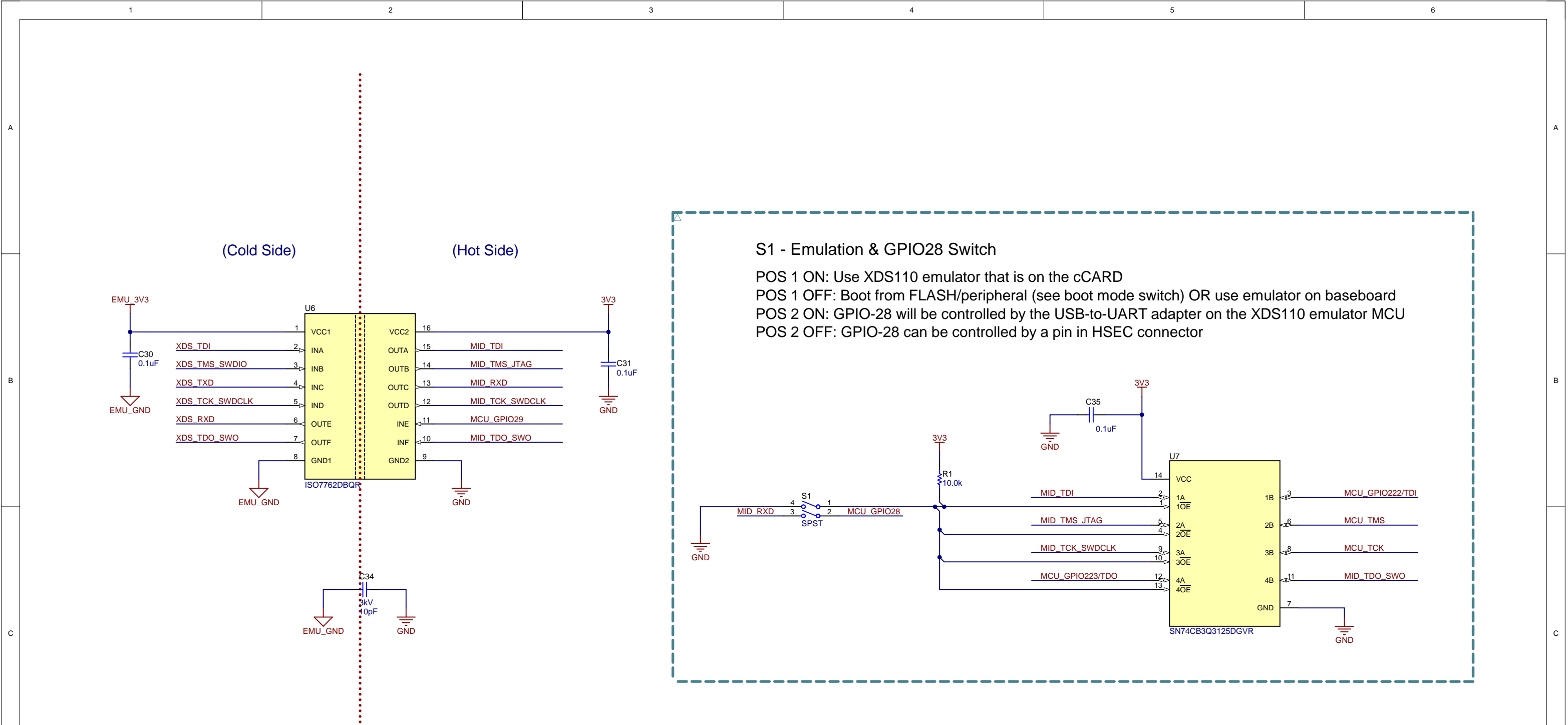
1. USB host (DFP) - Use pull-up resistors on CC1/CC2 ; Provides Vbus to the attached peripheral
2. USB peripheral (UFP) -Use pull-down resistors on CC1/CC2 ; monitors Vbus to establish a data connection and/or power on board circuits

(Hot Side)

Switch Truth Table		
HSEC_5V0 > 4V	ISO_Pout_5V0 > HSEC_5V0	POWER_SWITCH_OUT
Yes	X	HSEC_5V0
No	No	HSEC_5V0
No	Yes	ISO_Pout_5V0







NOTE: If control Card is specifically used for high voltage applications, It is recommended not to use 10pF capacitor between EMU\_GND and GND to prevent shock on the cold side.

NOTE: cJTAG is not supported on this control card

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Orderable: TMDSCNCD28P65X	Designed for: Public Release	Mod. Date: 3/13/2023
TID #: N/A	Project Title: F28P65X Control Card	
Number: MCU114	Rev: E1	Sheet Title:
SVN Rev: 43eacd879db6182caed8e703eb006a00a04d	File: MCU114E1_Emulator_Interface.SchDoc	Sheet: 10 of 11
Drawn By: Uttam Reddy Paila	Size: B	
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