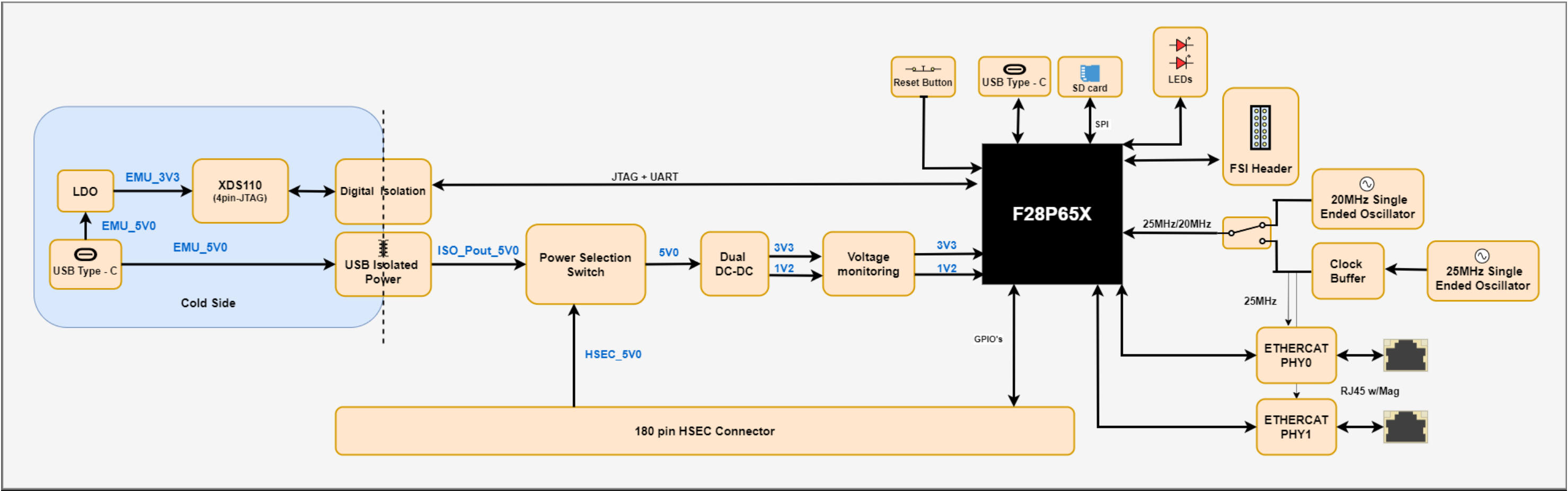
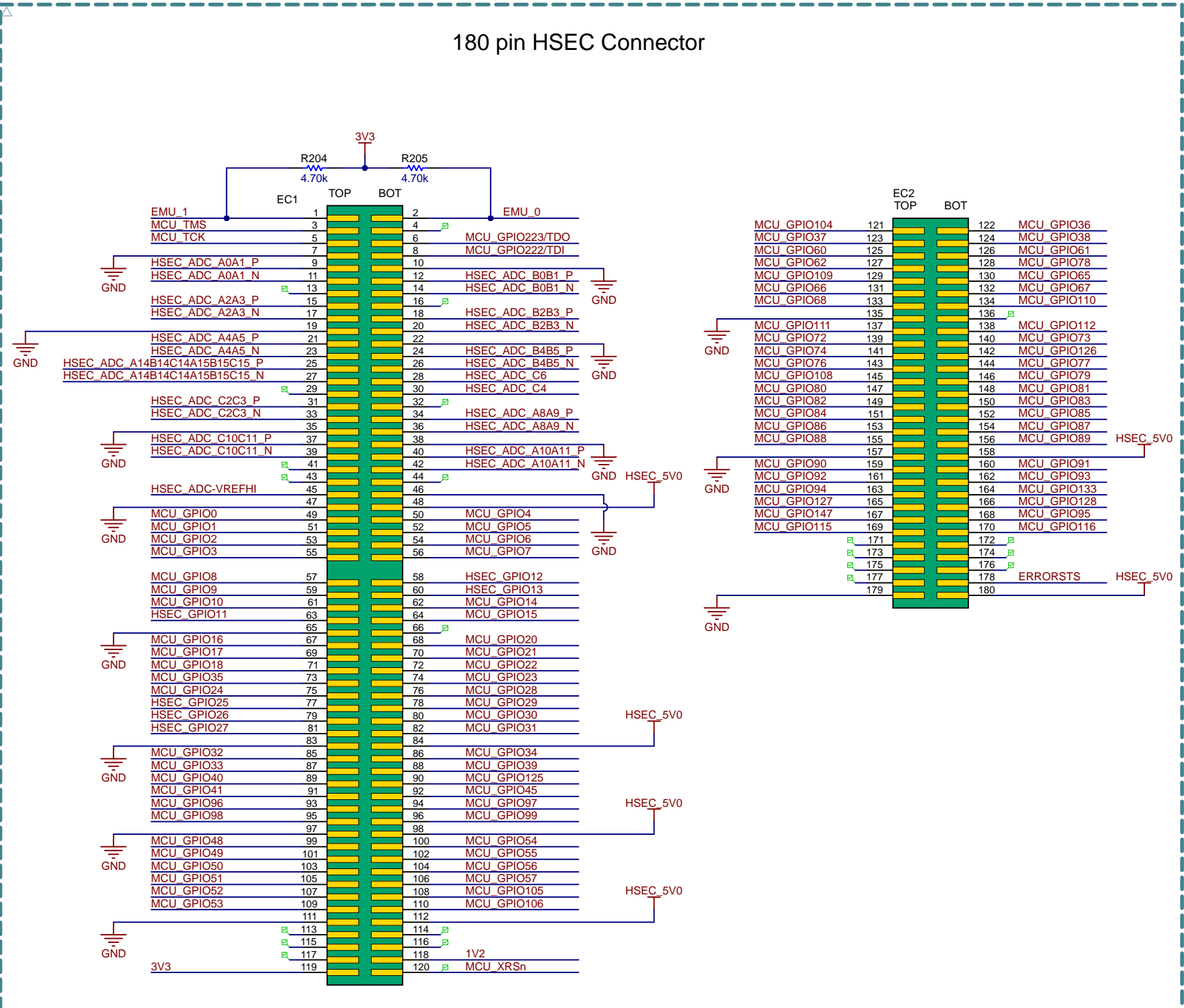
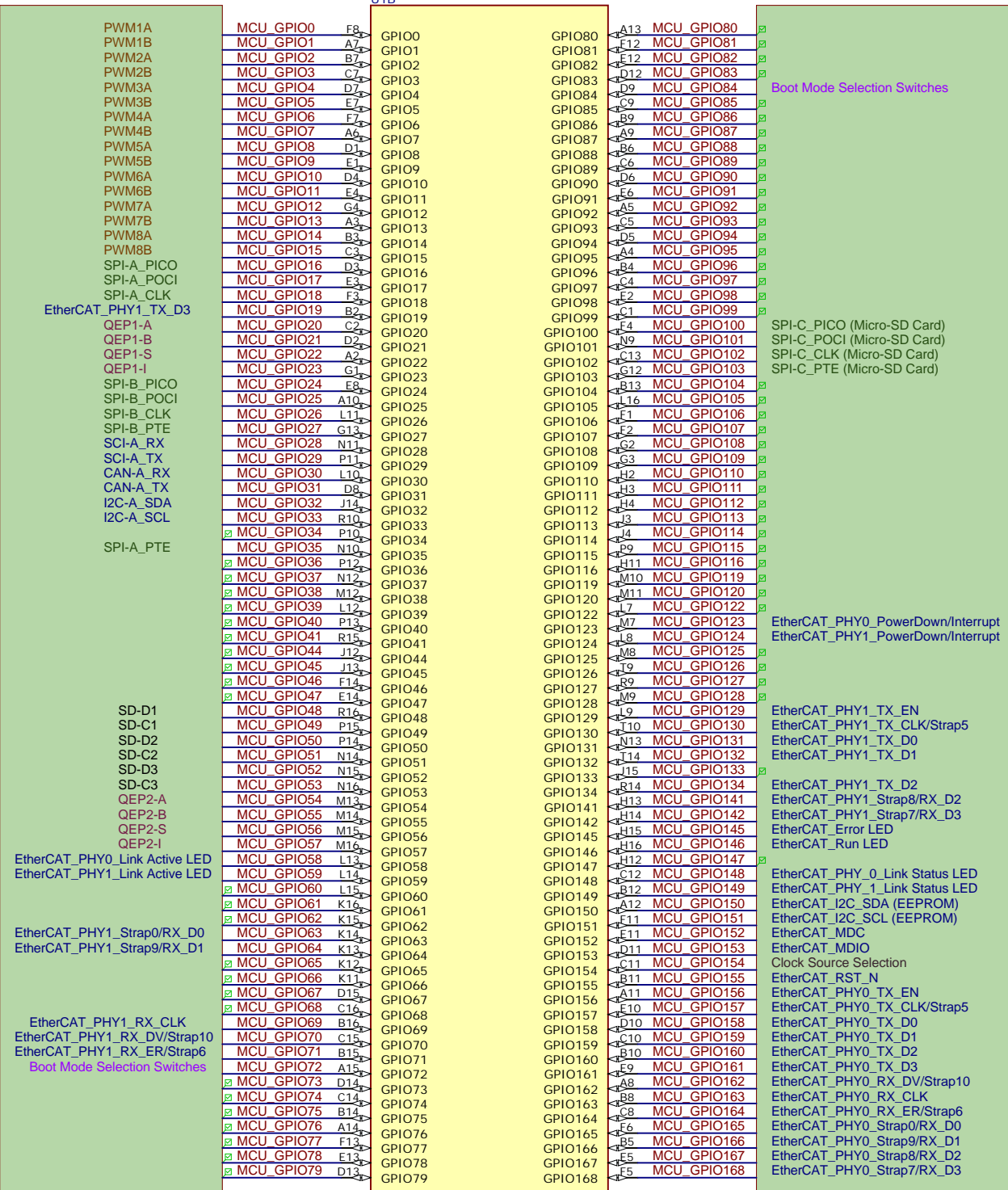


- 1) USB Differential Pairs - 90 Ohm
(A) XDS_D_P and XDS_D_N
(B) USB_D_P (GPIO42) and USB_D_N (GPIO43)
- 2) ADC Differential pair Impedance Matching - 50 Ohm
(A) HSEC_ADC even pins should match with HSEC_ADC + 1 pin(ie ADC-C2 should match with ADC-C3)
(B) MCU_ADC even pins should match with MCU_ADC + 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

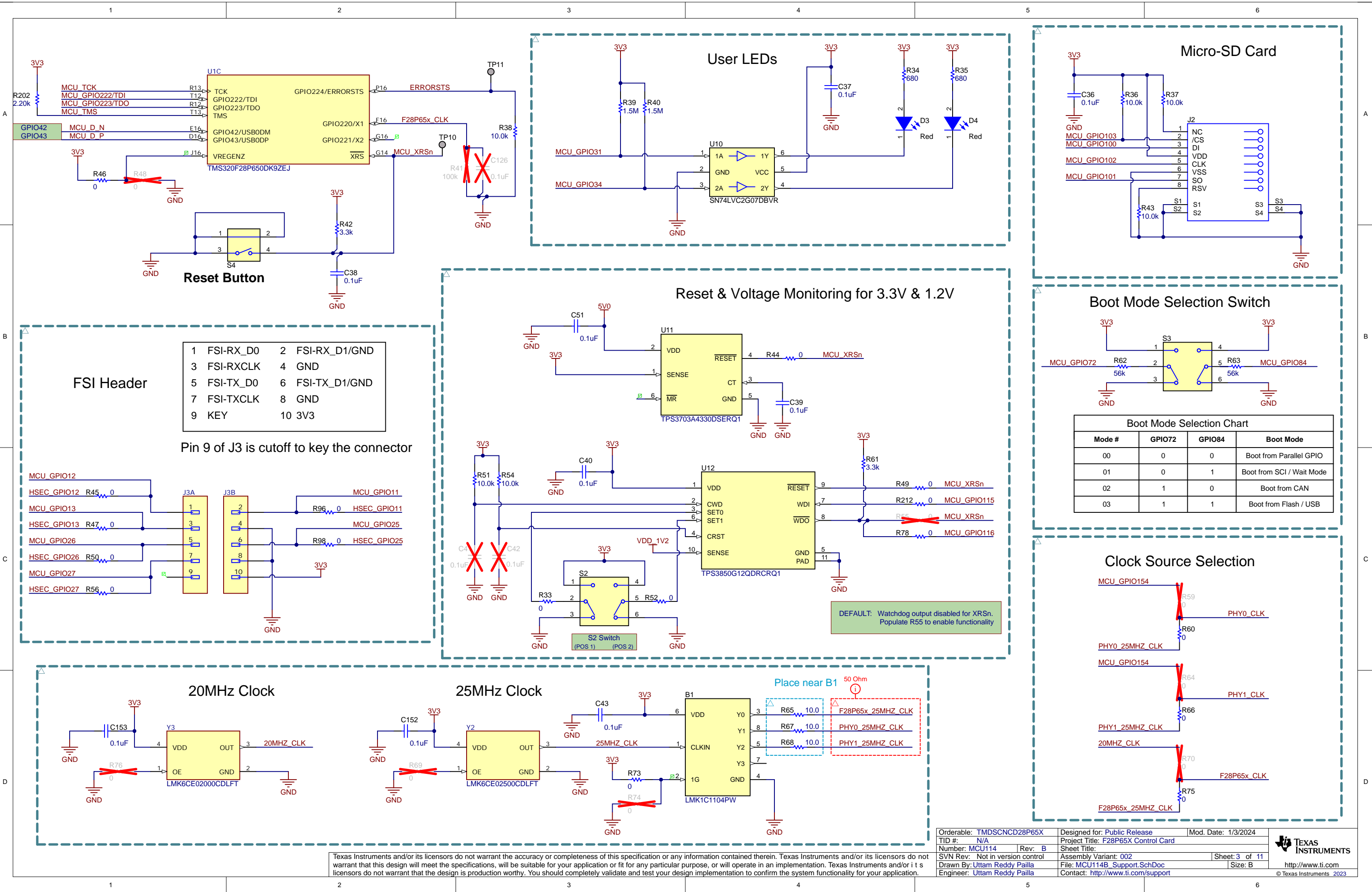
Revision History				
Rev	ECN #	Approved Date	Approved by	Notes
E1	N/A	September 12, 2022	UR	Original engineering release
E2	N/A	April 8, 2023	UR	Refer Errata section in the TMDSCNCD28P65X controlCARD Information Guide
A	N/A	June 7, 2023	UR	Cosmetic changes to PCB silk screen
B	N/A	January 2, 2024	UR	Initial F28P650DK9 has ADC issues resolved



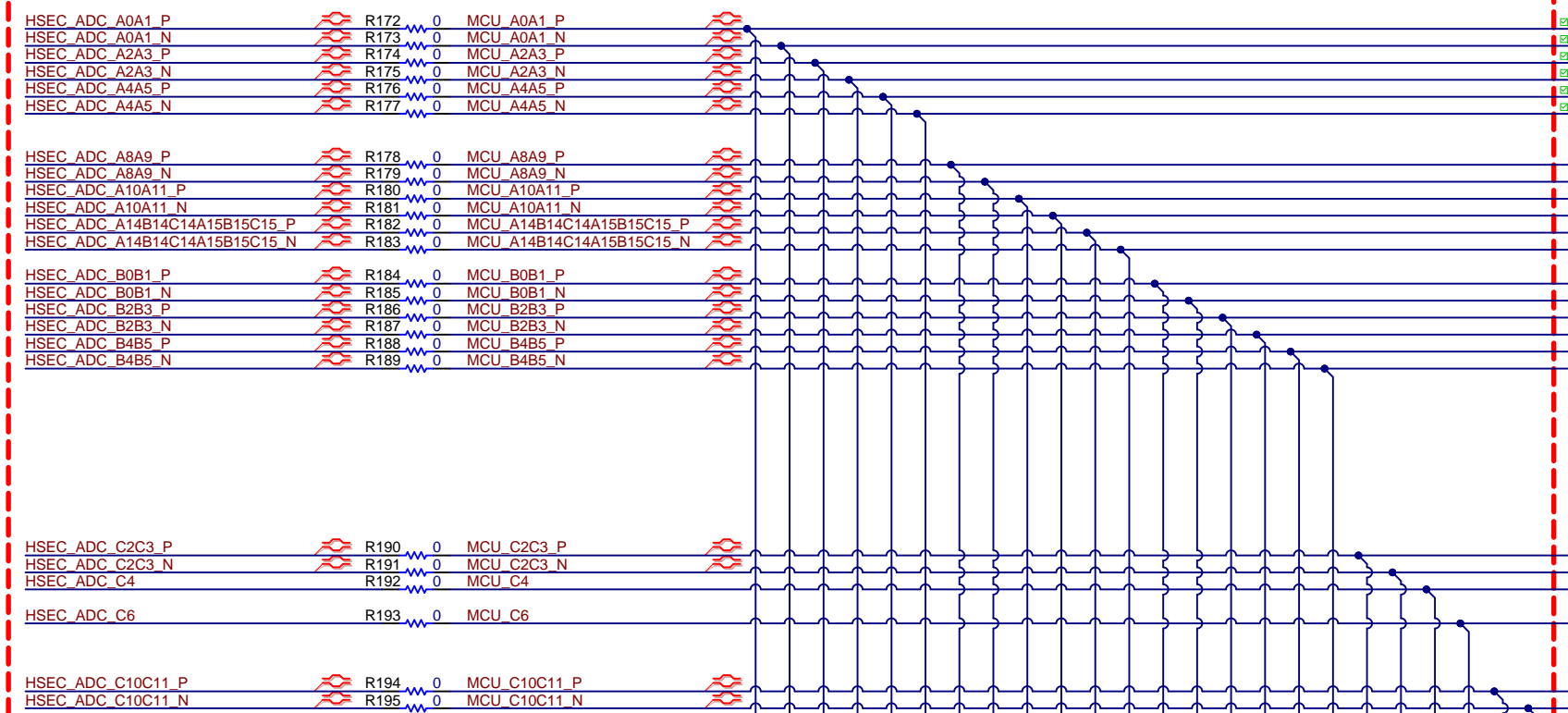
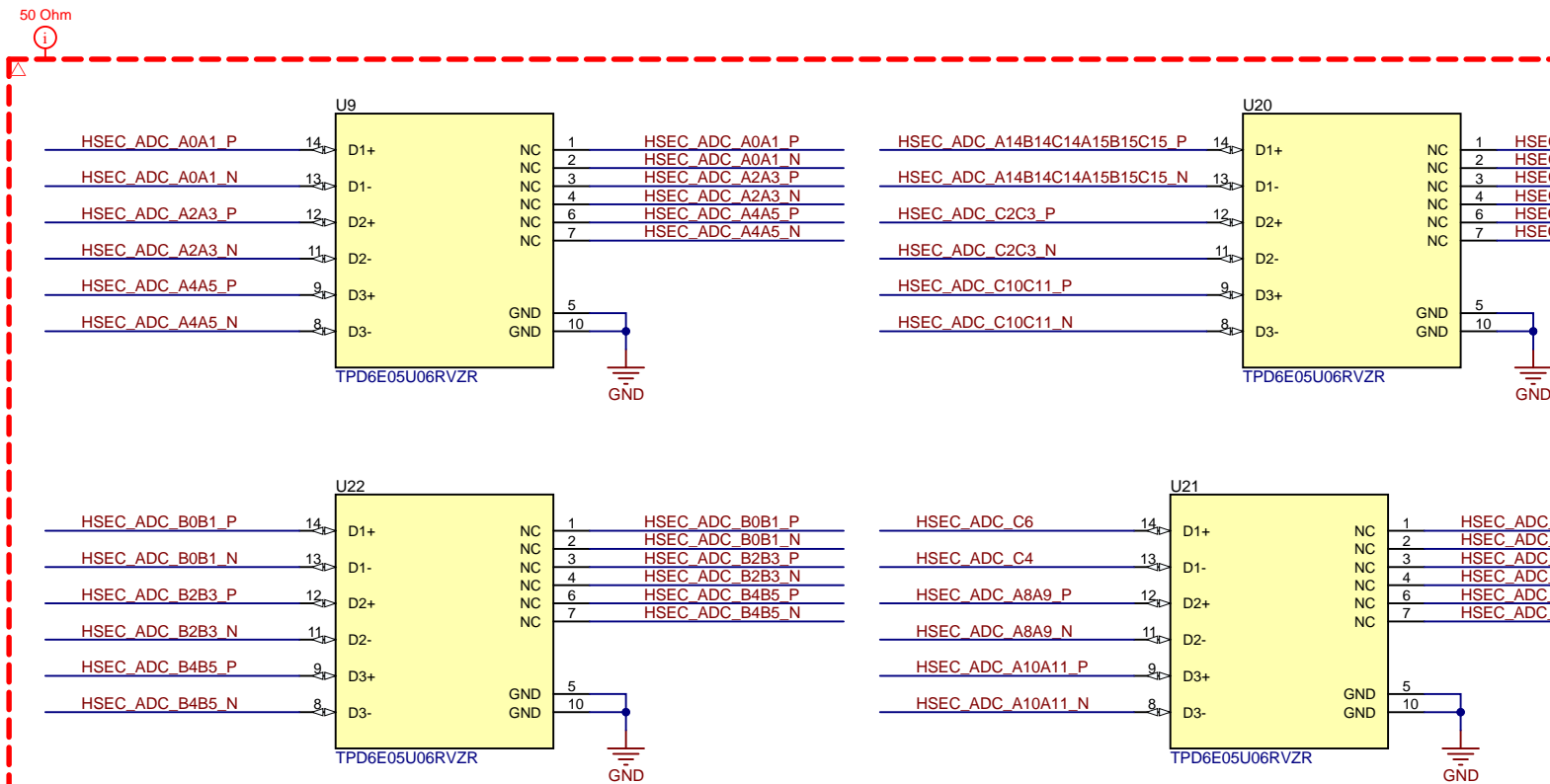
Power to the MCU is either supported by the USB-C on the left or the HSEC 180 pin.



Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.



Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

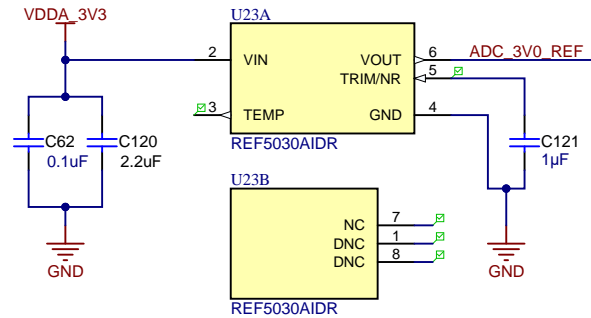


ADC_A0A1_P and ADC_A0A1_N make a differential pair using channels A0 and A1 respectively.

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

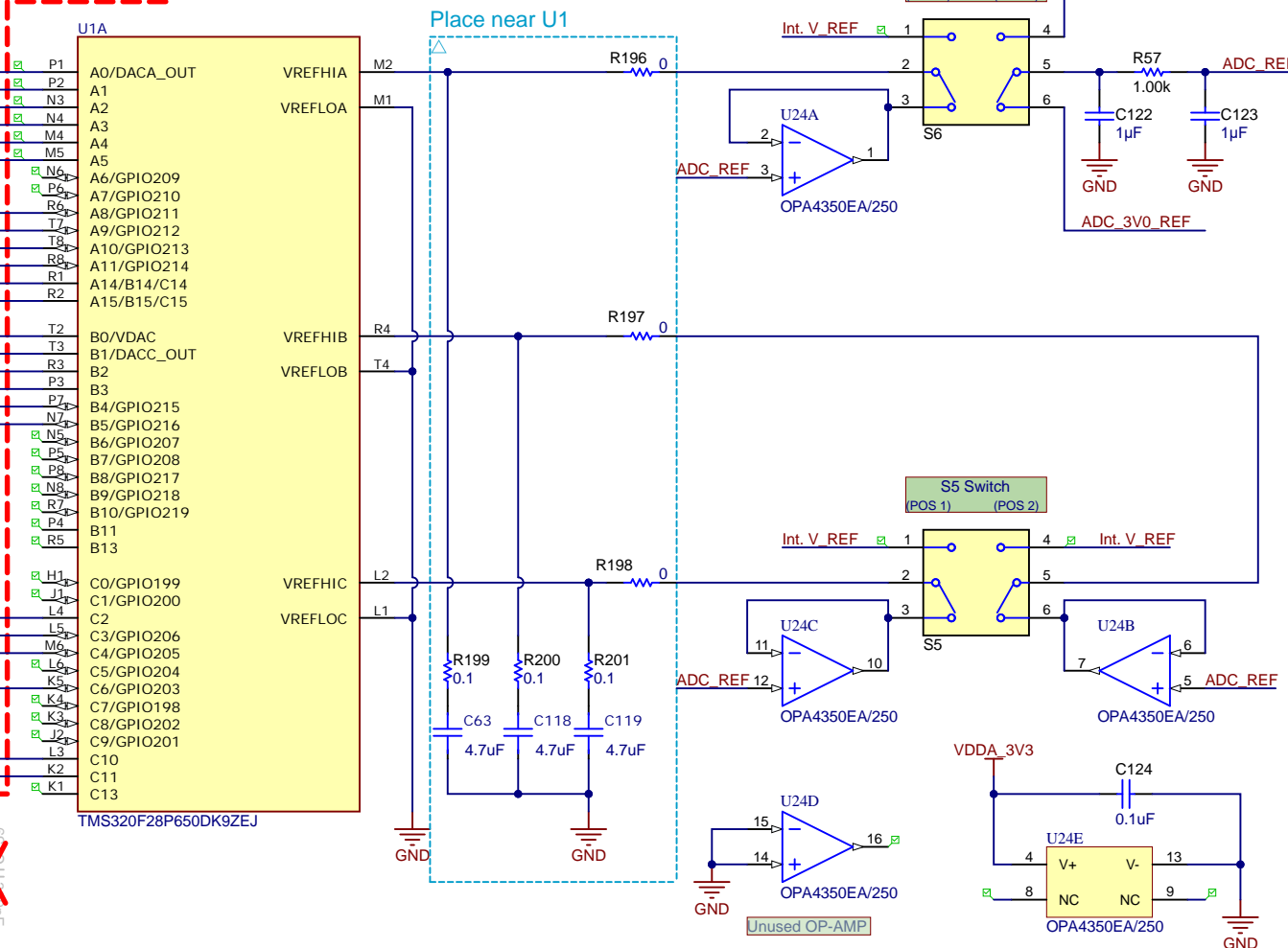
Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

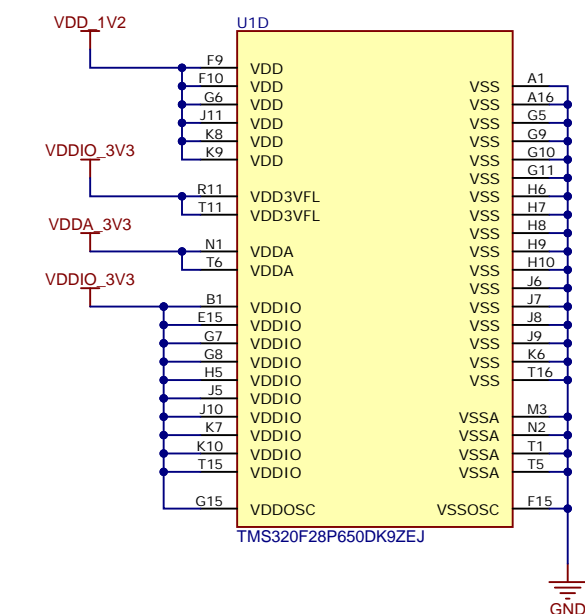
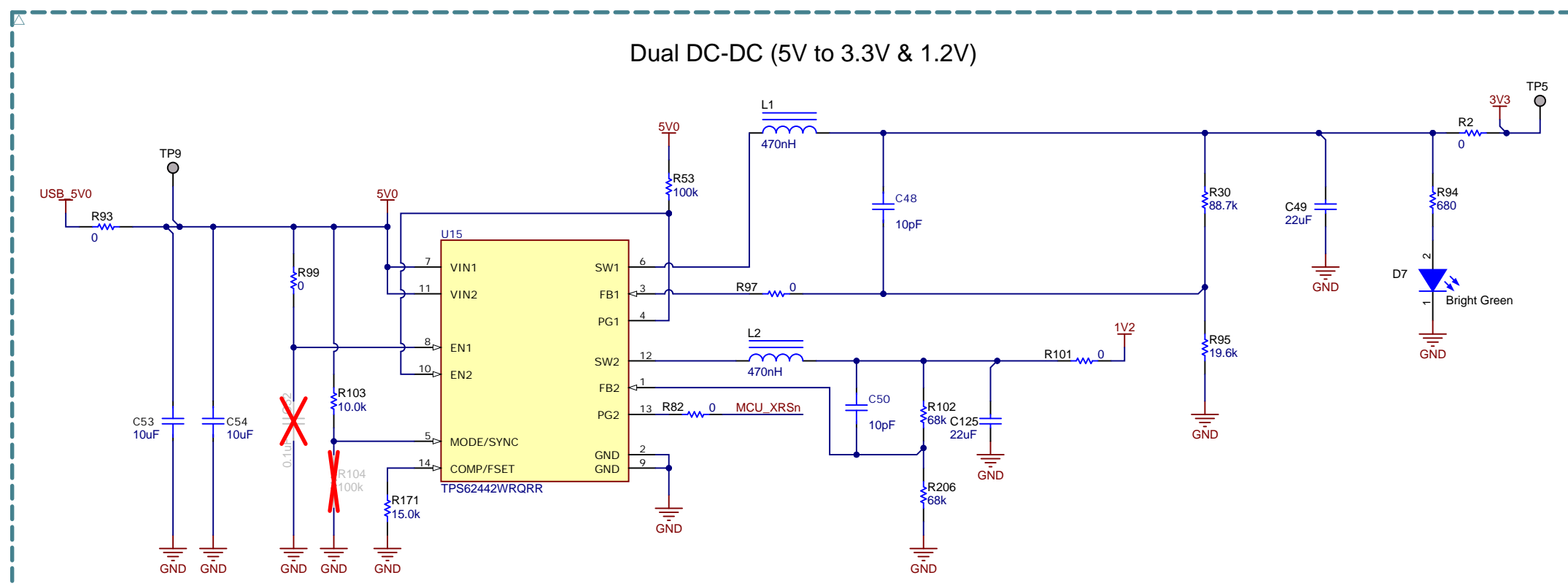


Ext. V_REF Selection	
S6 (POS 2)	ADC_REF
1	HSEC_ADC-VREFHI
0	ADC_3V0_REF (DEFAULT)

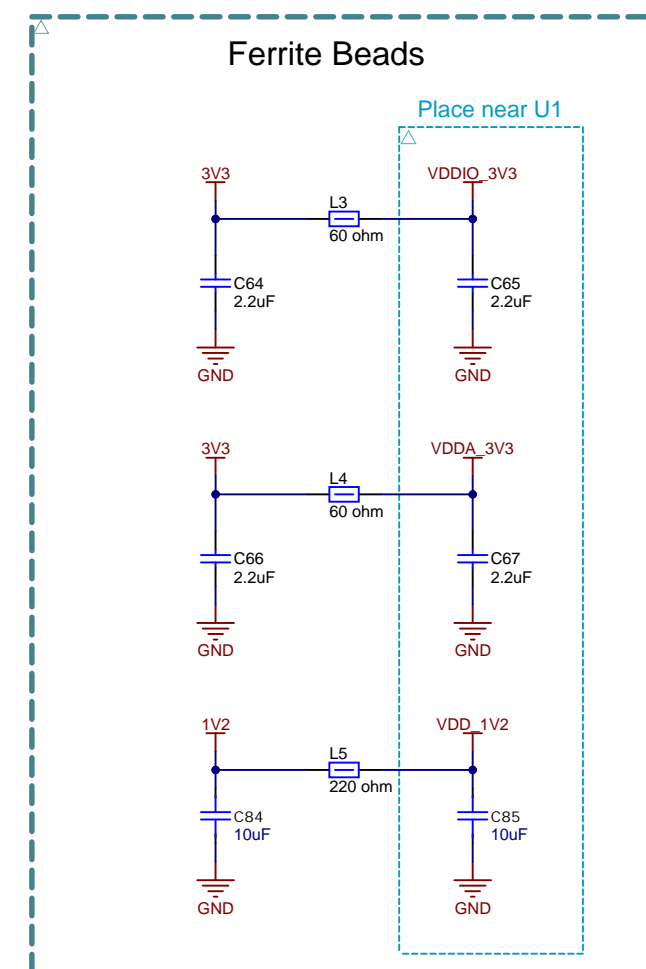
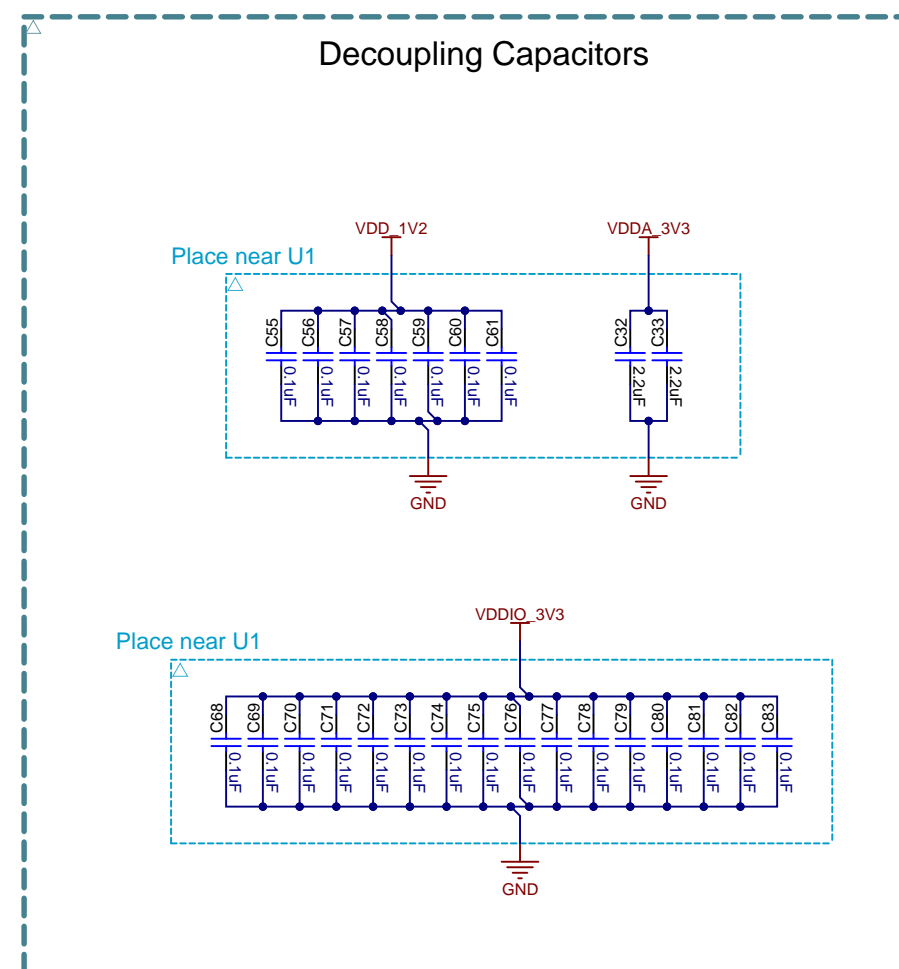
Voltage reference Configuration Switch Truth Table				
S6 (POS 1)	S5 (POS 1)	S5 (POS 2)	C2000 ADC V_REF	DESCRIPTION
1	1	1	Int. V_REF	NC - No reference input
0	0	0	Ext. V_REF	ADC_REF

NOTE: "The reference pins, VREFHIA to VREFHIC and VREFLOA to VREFLOC, can be used to supply an external voltage reference to the associated ADCs. VREFHIA can also be used to supply the voltage reference to DAC A, and VREFHIB can be used to supply the voltage reference to DAC C. A n internal voltage reference is available and connects to VREFHIA. To use the internal voltage reference on ADC B, ADC C or DAC C, connect VREFHIA to VREFHIB and/or VREFHIC externally."





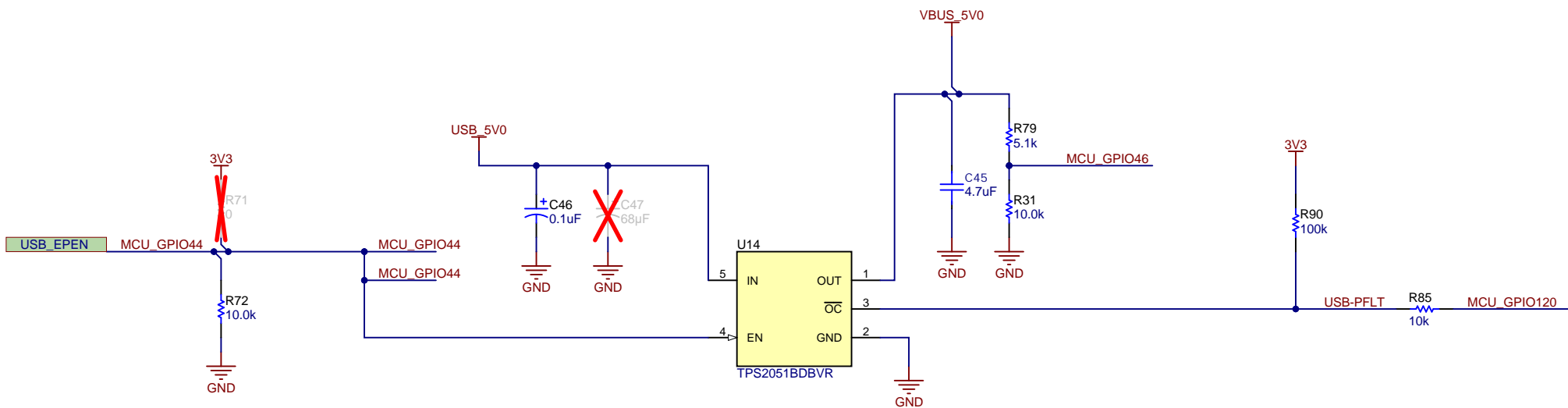
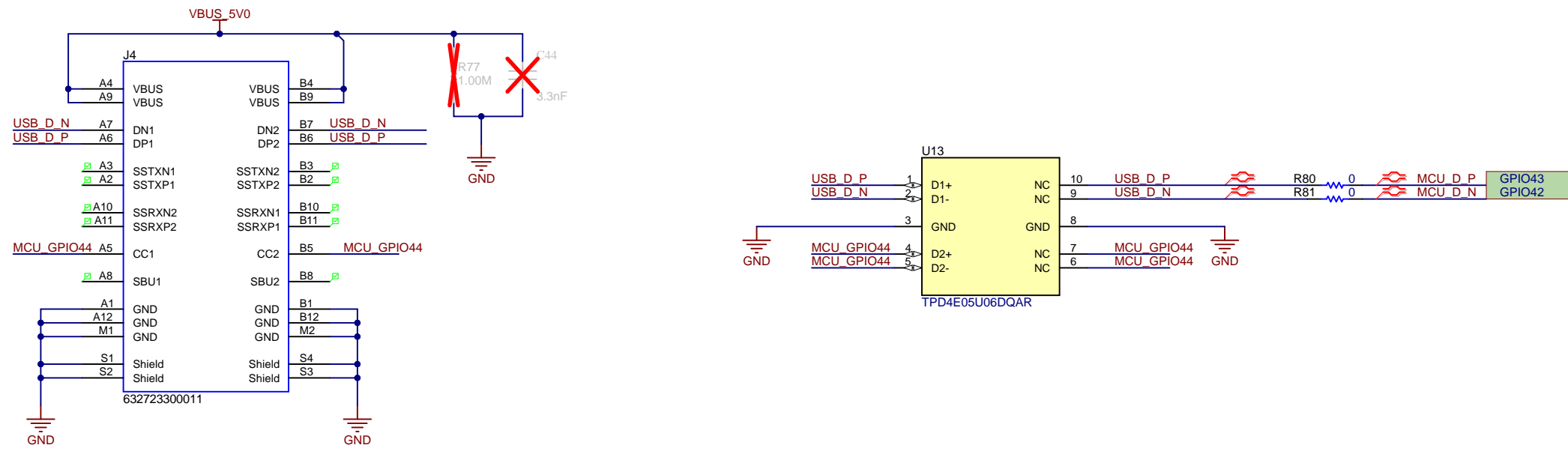
- NOTES:**
- 1) TPS62442 Dual DC-DC provides an output current of 2A/2A or 3A/1A, this amount of current capacity should not be necessary for certain applications using F28P65x. This is just necessary for the control card design
 - 2) Alternative part: TPS62441 Dual DC-DC provides an output current of 1A/1A
 - 3) DC-DC can be used without supervisory circuit in specific applications by considering the slew rates of MCU and DC-DC for proper reset.



Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

Orderable: TMDSCNCD28P65X	Designed for: Public Release	Mod. Date: 2/26/2024
TID #: N/A	Project Title: F28P65X Control Card	
Number: MCU114	Rev: B	Sheet Title:
SVN Rev: Not in version control	Assembly Variant: 002	Sheet: 5 of 11
Drawn By: Uttam Reddy Paila	File: MCU114B_Power.SchDoc	Size: B
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 - DFP
0 (LOW)	UB_CC1 & USB_CC2 are strongly pulled down	Device mode - UFP (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.

NOTE: for TYPE C, the USB2.0 OTG device is referred as a Dual Role Port (DRP)

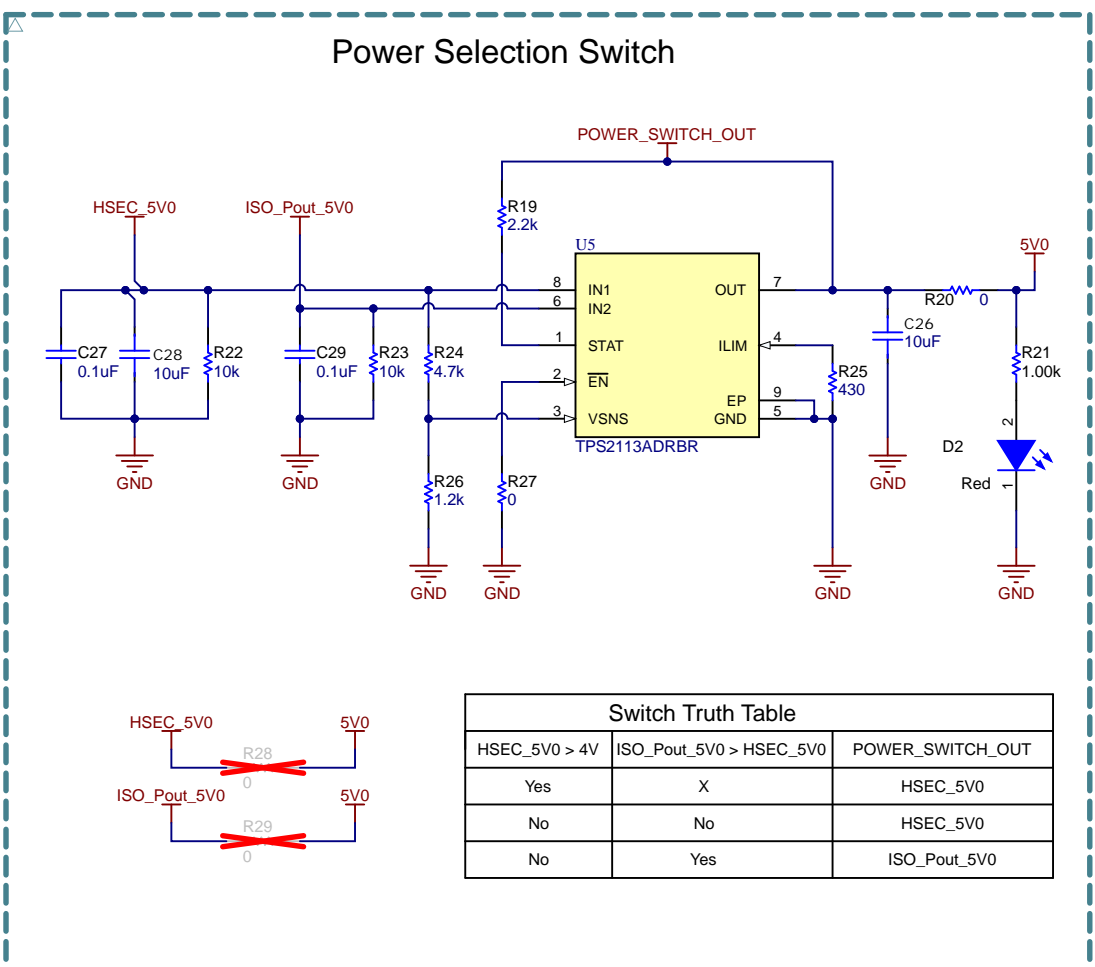
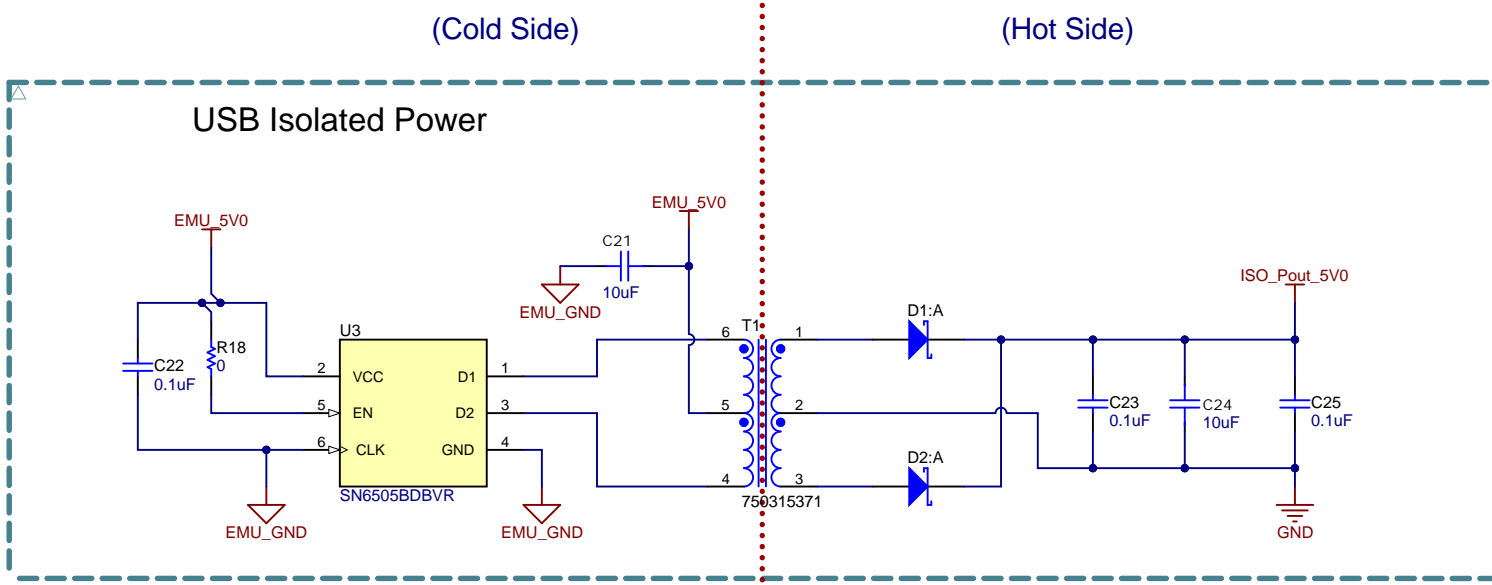
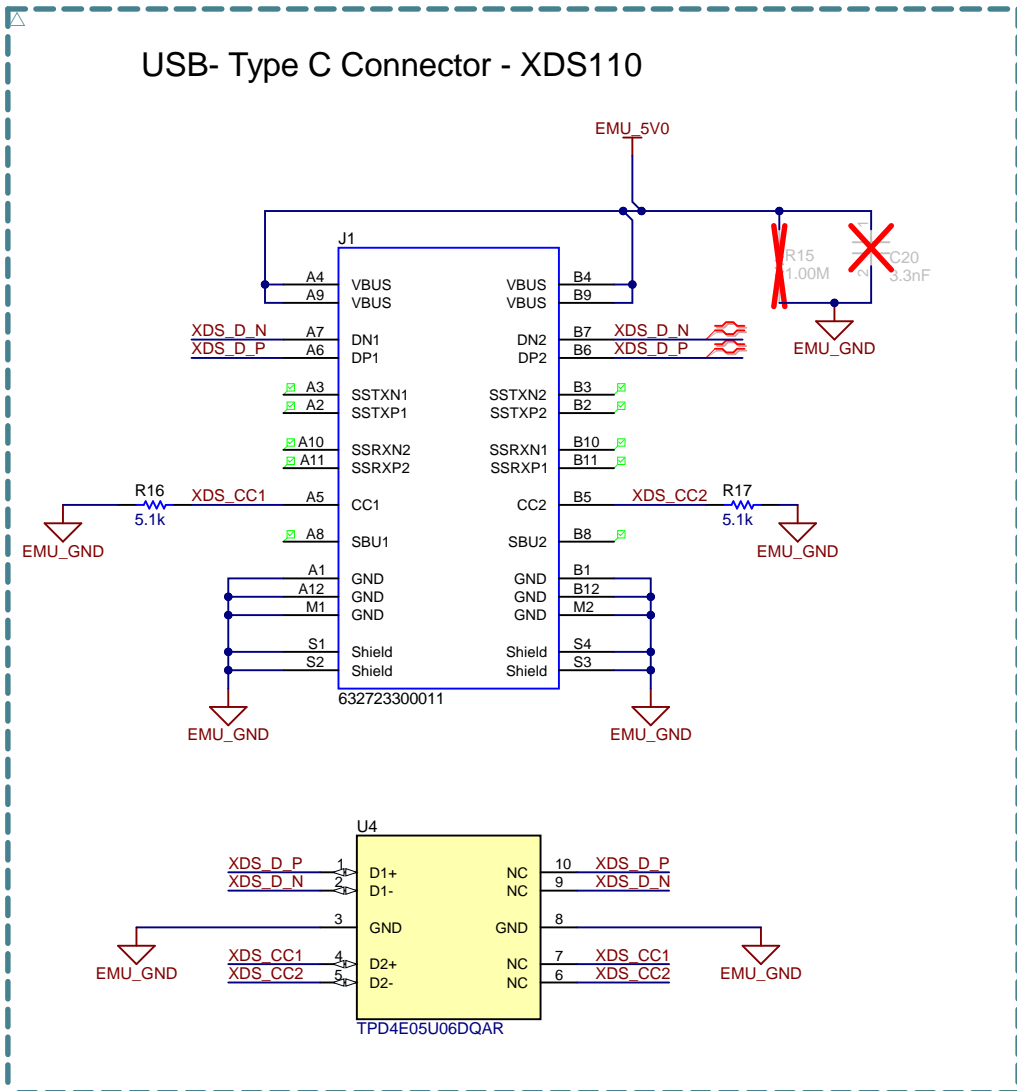
DRP can function either as a USB host or USB peripheral, the selection choice depends on the channel configuration (CC1/CC2).

1. USB host (DFP) - Use pull-up resistors on CC1/CC2 ; Provides Vbus to the attached peripheral

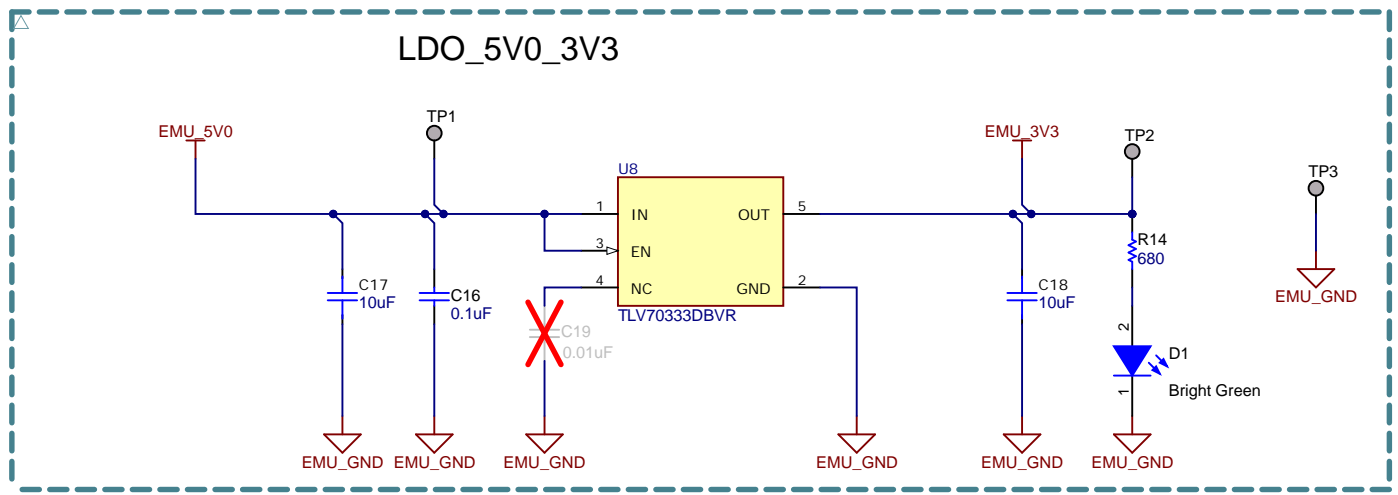
2. USB peripheral (UFP) -Use pull-down resistors on CC1/CC2 ; monitors Vbus to establish a data connection and/or power on board circuits

Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

Orderable: TMDSCNCD28P65X	Designed for: Public Release	Mod. Date: 2/27/2024
TID #: N/A	Project Title: F28P65X Control Card	
Number: MCU114	Rev: B	Sheet Title:
SVN Rev: Not in version control	Assembly Variant: 002	Sheet: 7 of 11
Drawn By: Uttam Reddy Paila	File: MCU114B_USB.SchDoc	Size: B
Engineer: Uttam Reddy Paila	Contact: http://www.ti.com/support	



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



A

B

C

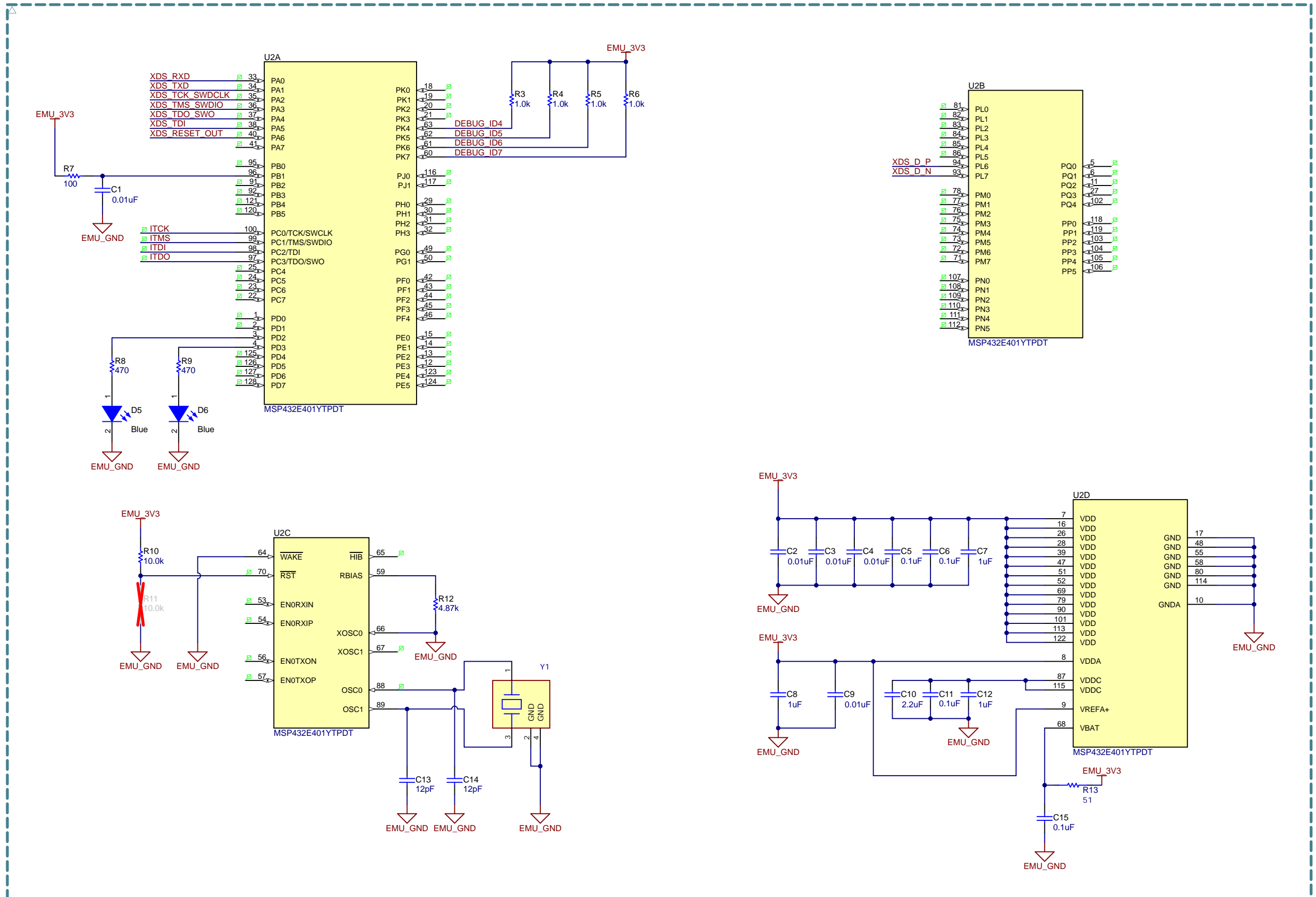
D

A

B

C

D

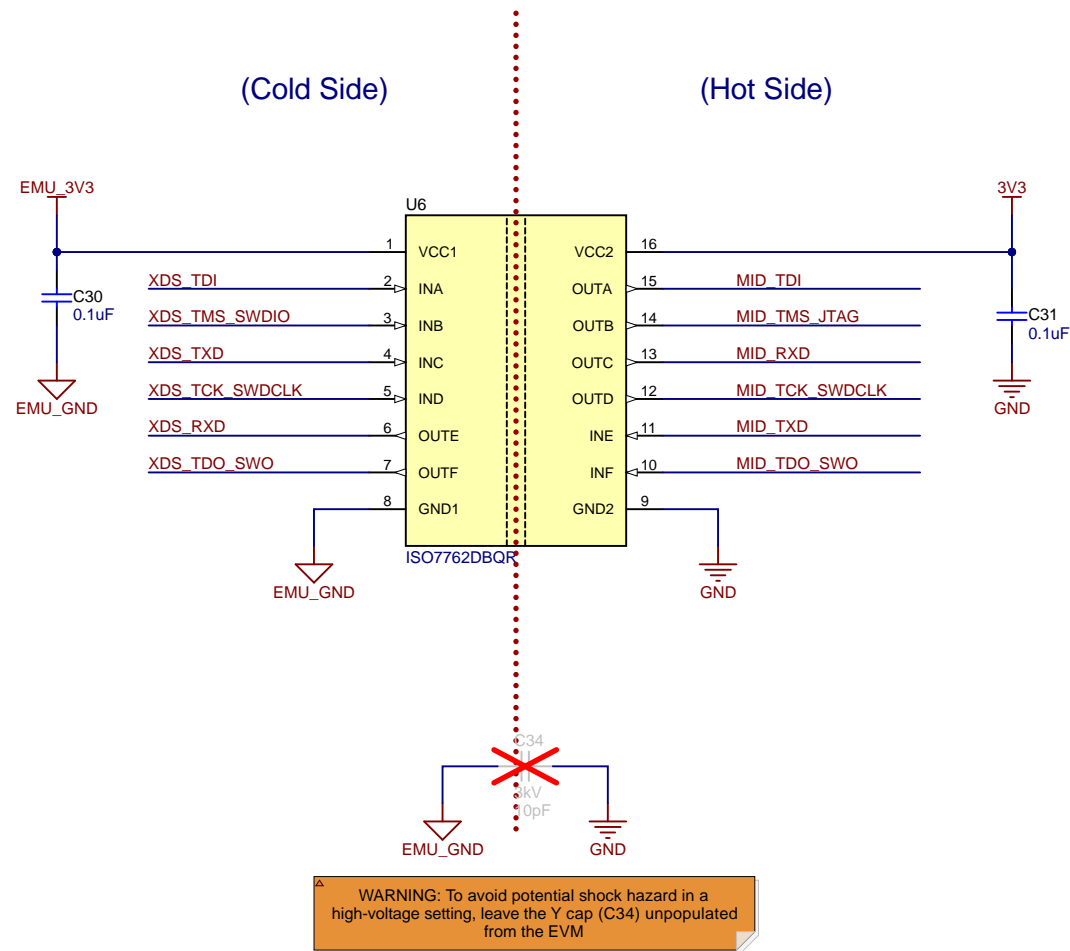


Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

Orderable: TMDSCNCD28P65X	Designed for: Public Release	Mod. Date: 9/27/2023
TID #: N/A	Project Title: F28P65X Control Card	
Number: MCU114	Rev: B	Sheet Title:
SVN Rev: Not in version control	Assembly Variant: 002	Sheet: 9 of 11
Drawn By: Uttam Reddy Pailla	File: MCU114B_XDS110_MCU.SchDoc	Size: B
Engineer: Uttam Reddy Pailla	Contact: http://www.ti.com/support	



NOTE: In this design JTAG signals are isolated.
cJTAG is not supported on this control card.



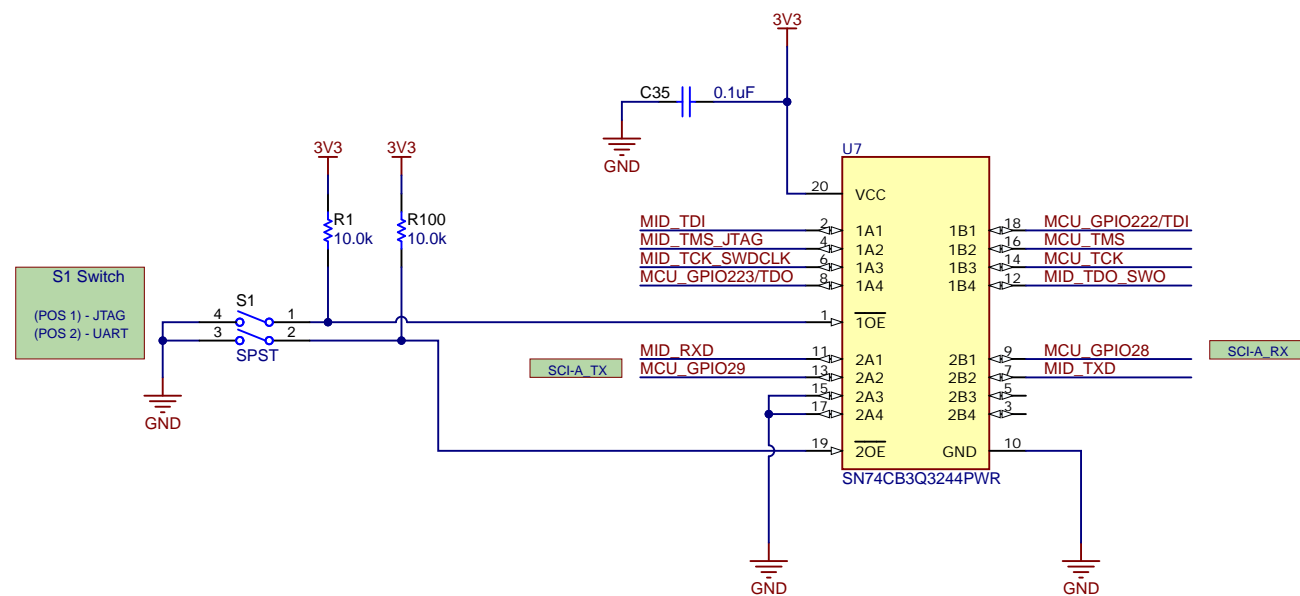
S1 - JTAG Emulation & UART Switch

POS 1 ON: Use XDS110 emulator that is on the cCARD

POS 1 OFF: Boot from FLASH/peripheral (see boot mode switch) OR use emulator on baseboard

POS 2 ON: GPIOs 28 & 29 will be connected to the USB-to-UART adapter on the XDS110 emulator

POS 2 OFF: GPIOs 28 & 29 are disconnected from the USB-to-UART adapter on the XDS110 emulator and connected to the HSEC connector pins



Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular purpose, or will operate in an implementation. Texas Instruments and/or its licensors do not warrant that the design is production worthy. You should completely validate and test your design implementation to confirm the system functionality for your application.

Orderable: TMDSCNCD28P65X	Designed for: Public Release	Mod. Date: 11/3/2023
TID #: N/A	Project Title: F28P65X Control Card	
Number: MCU114	Rev: B	Sheet Title:
SVN Rev: Not in version control	Assembly Variant: 002	Sheet: 10 of 11
Drawn By: Uttam Reddy Pailla	File: MCU114B_Emulator_Interface.SchDoc	Size: B
Engineer: Uttam Reddy Pailla	Contact: http://www.ti.com/support	

PCB Number: MCU114
PCB Rev: B



PCB
LOGO
Texas Instruments

PCB
LOGO
FCC disclaimer

PCB
LOGO
WEEE logo

PCB
LOGO
ETHERCAT LABEL

Variant/Label Table	
Variant	Label Text
001	TMDSCNCD28P65X - 20MHz CLK
002	TMDSCNCD28P65X - 25MHz CLK

ZZ1

Label Assembly Note

Label Assembly Note
This Assembly Note is for PCB labels only

ZZ2

Assembly Note

These assemblies are ESD sensitive, ESD precautions shall be observed.

ZZ3

Assembly Note

These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

ZZ4

Assembly Note

These assemblies must comply with workmanship standards IPC-A-610 Class 2, unless otherwise specified.

Orderable: TMDSCNCD28P65X	Designed for: Public Release	Mod. Date: 9/27/2023	 TEXAS INSTRUMENTS http://www.ti.com © Texas Instruments 2023
TID #: N/A	Project Title: F28P65X Control Card		
Number: MCU114 Rev: B	Sheet Title:		
SVN Rev: Not in version control	Assembly Variant: 002	Sheet: 11 of 11	
Drawn By: Uttam Reddy Paila	File: MCU114B_EVM_Hardware.SchDoc	Size: B	
Engineer: Uttam Reddy Paila	Contact: http://www.ti.com/support		



TEXAS
INSTRUMENTS