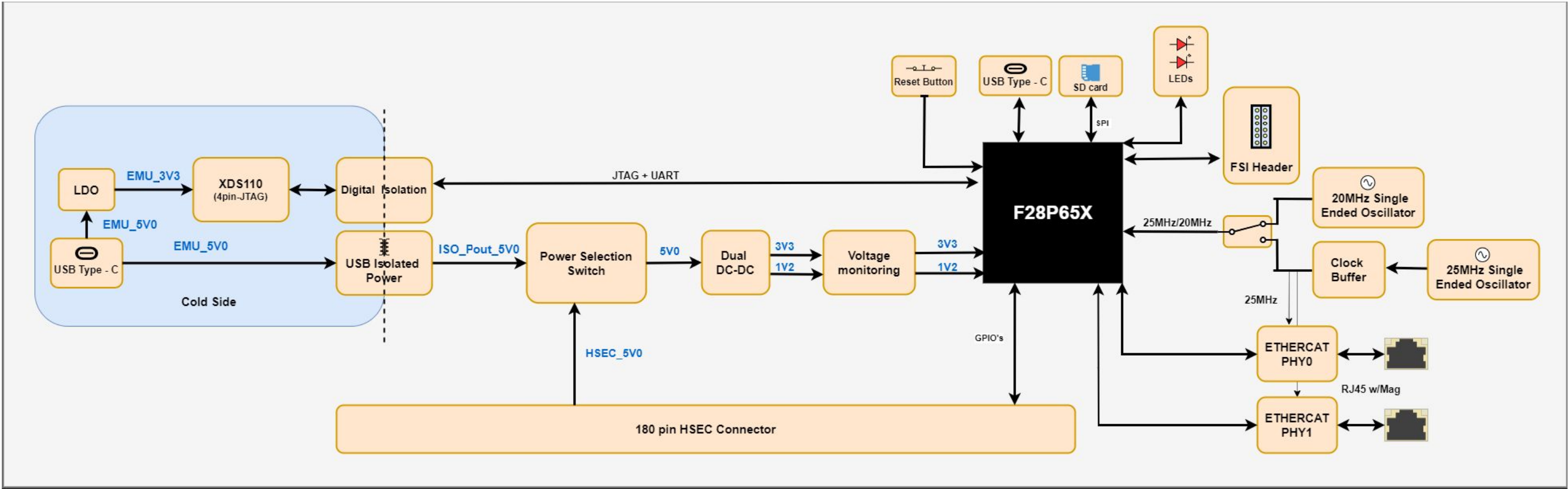


- 1) USB Differential Pairs - 90 Ohm  
(A) XDS\_D\_P and XDS\_D\_N  
(B) USB\_D\_P (GPIO42) and USB\_D\_N (GPIO43)
- 2) ADC Differential pair Impedance Matching - 50 Ohm  
(A) HSEC\_ADC even pins should match with HSEC\_ADC + 1 pin(ie ADC-C2 should match with ADC-C3)  
(B) MCU\_ADC even pins should match 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

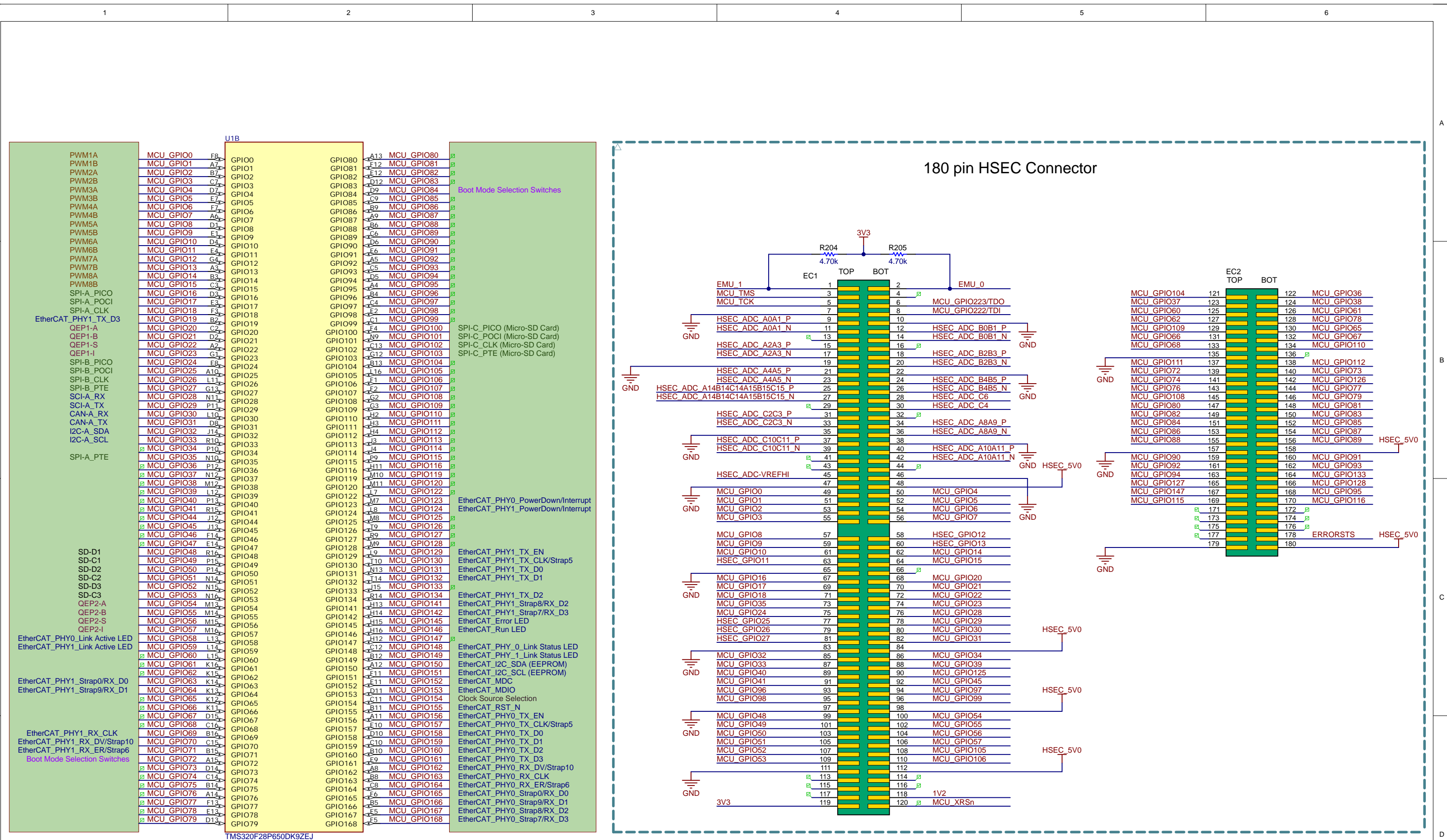
| Revision History |       |                    |             |  |
|------------------|-------|--------------------|-------------|--|
| Rev              | ECN # | Approved Date      | Approved by | Notes  |
| E1               | N/A   | September 12, 2022 | UR          | Original engineering release   |
| 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                                      |

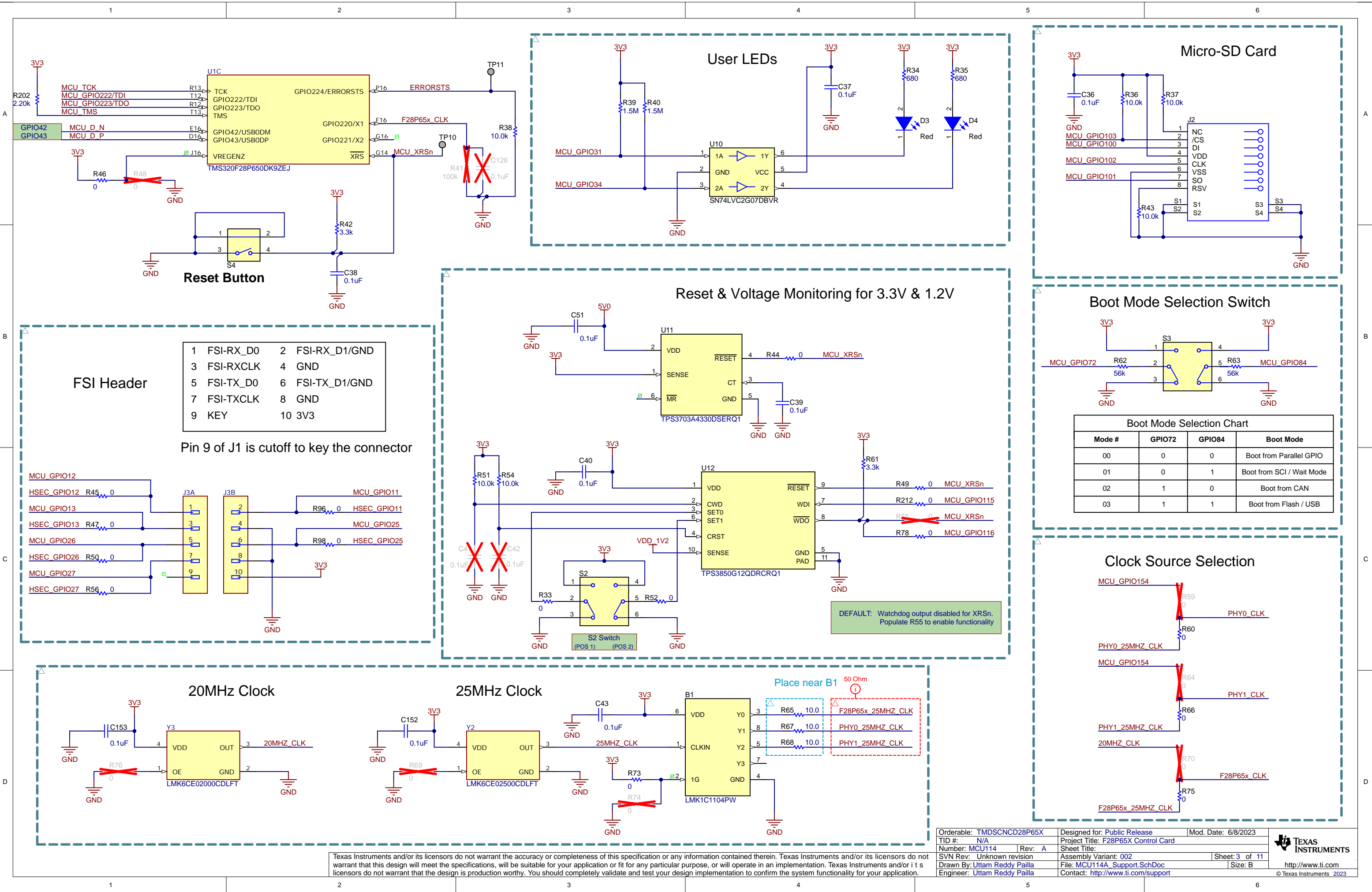


Power to the MCU is either supported by the USB-C on the left or the HSEC 180 pin.

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.

|                             |                                     |                     |
|-----------------------------|-------------------------------------|---------------------|
| Orderable: TMDSCNCD28P65X   | Designed for: Public Release        | Mod. Date: 6/7/2023 |
| TID #: N/A                  | Project Title: F28P65X Control Card |                     |
| Number: MCU114              | Rev: A                              | Sheet Title:        |
| SVN Rev: Unknown revision   | Assembly Variant: 002               | Sheet: 1 of 11      |
| Drawn By: Uttam Reddy Paila | File: MCU114A_CoverSheet.SchDoc     | Size: B             |
| Engineer: Uttam Reddy Paila | Contact: http://www.ti.com/support  |                     |

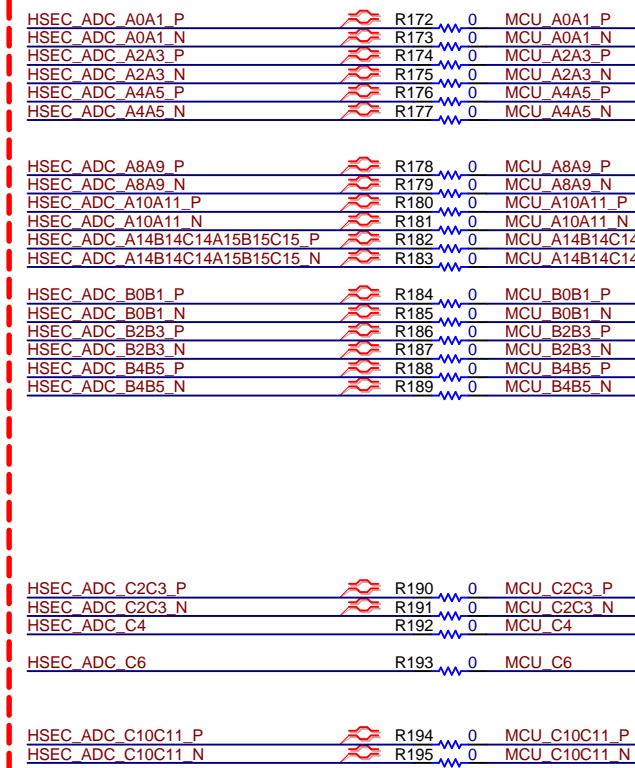
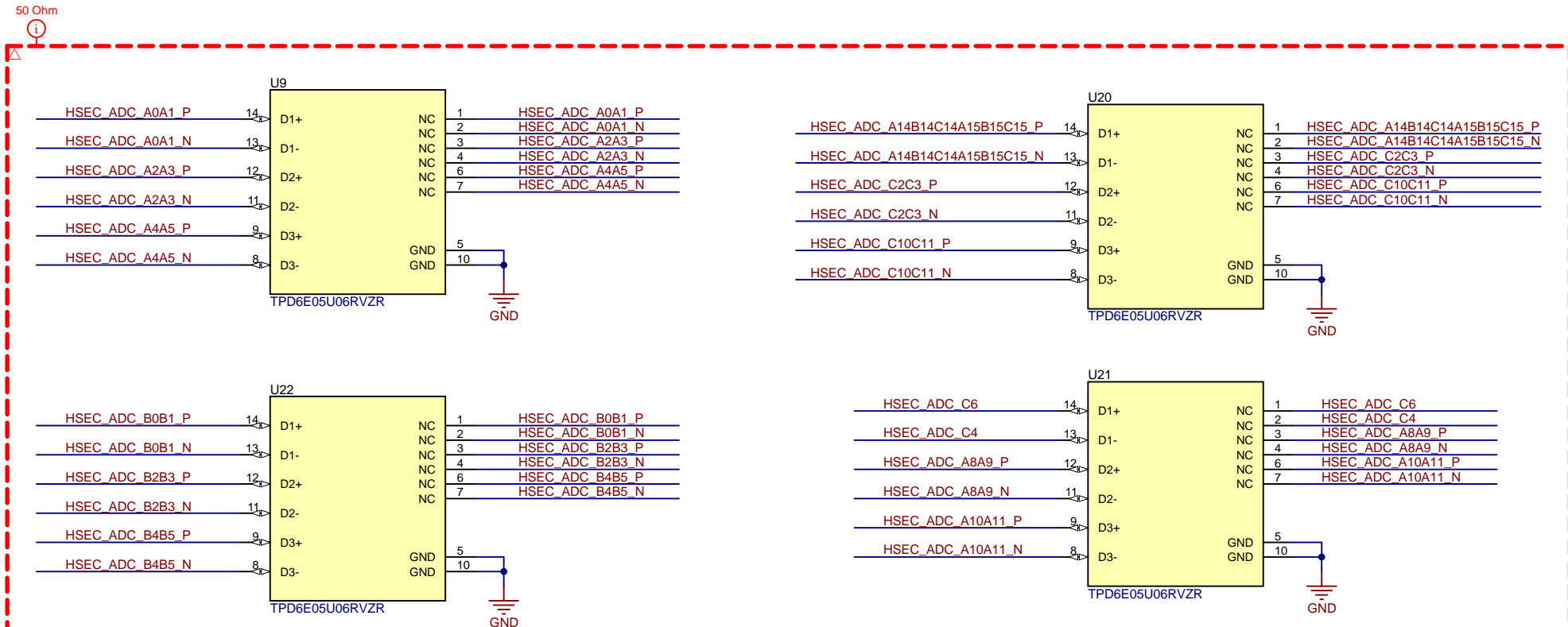




Texas Instruments and/or its licensors do not warrant the accuracy or completeness of this specification or any information contained therein. Texas Instruments and/or its licensors do not warrant that this design will meet the specifications, will be suitable for your application or fit for any particular 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: 6/8/2023 |
| TID #: N/A                  | Project Title: F28P65X Control Card |                     |
| Number: MCU114              | Rev: A                              |                     |
| SVN Rev: Unknown revision   | Assembly Variant: 002               | Sheet: 3 of 11      |
| Drawn By: Uttam Reddy Paila | File: MCU114A_Support_SchDoc        | Size: B             |
| Engineer: Uttam Reddy Paila | Contact: http://www.ti.com/support  |                     |



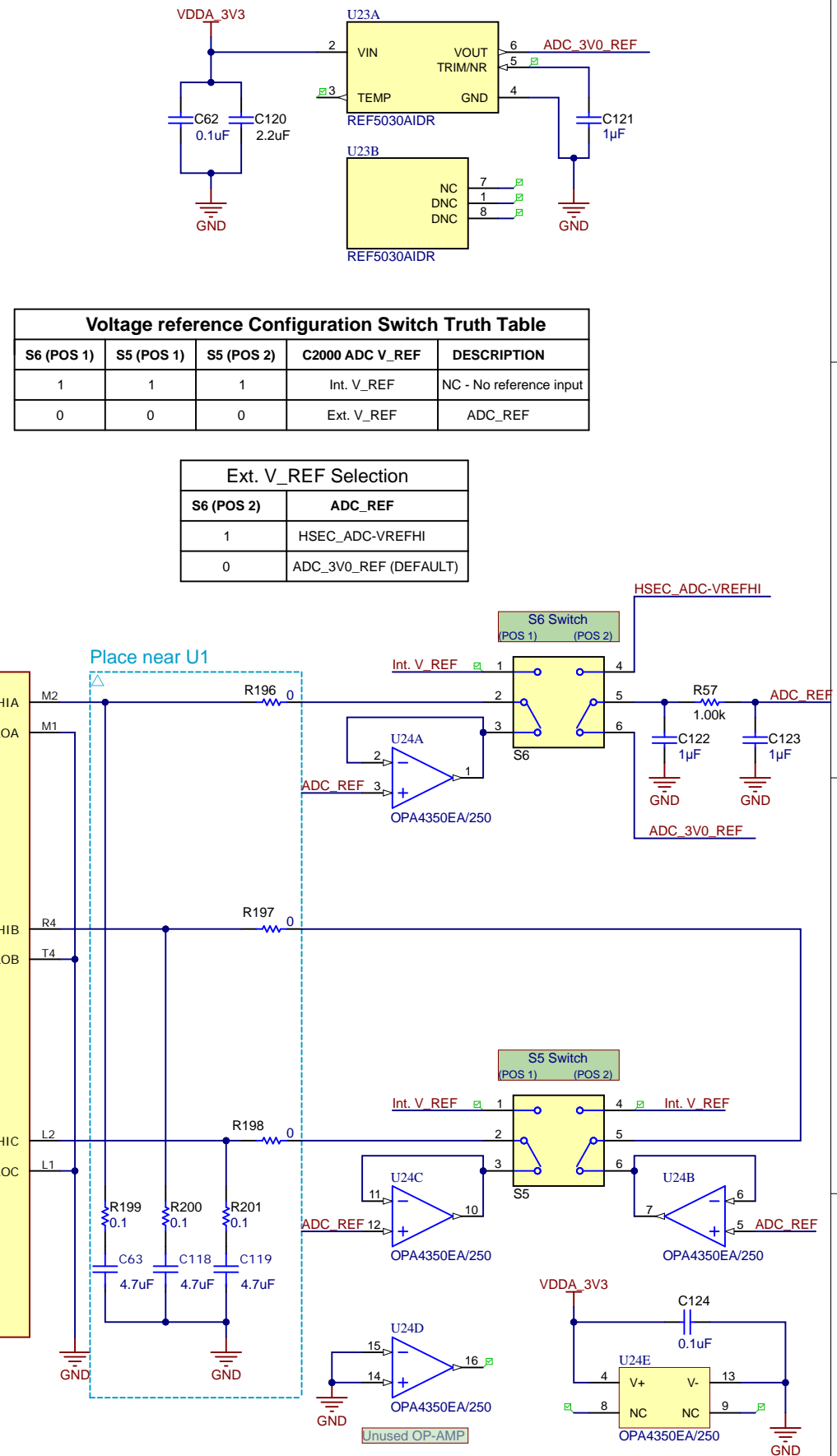


ADC\_A0A1\_P and ADC\_A0A1\_N make a differential pair using channels A0 and A1 respectively.

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").

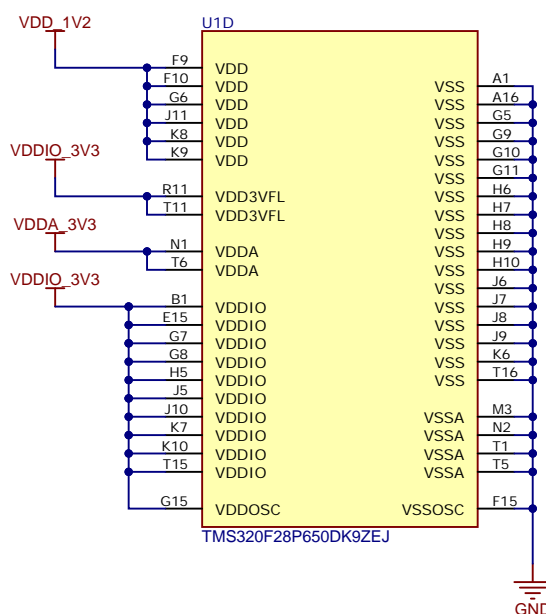
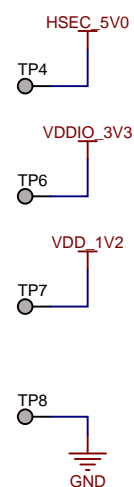
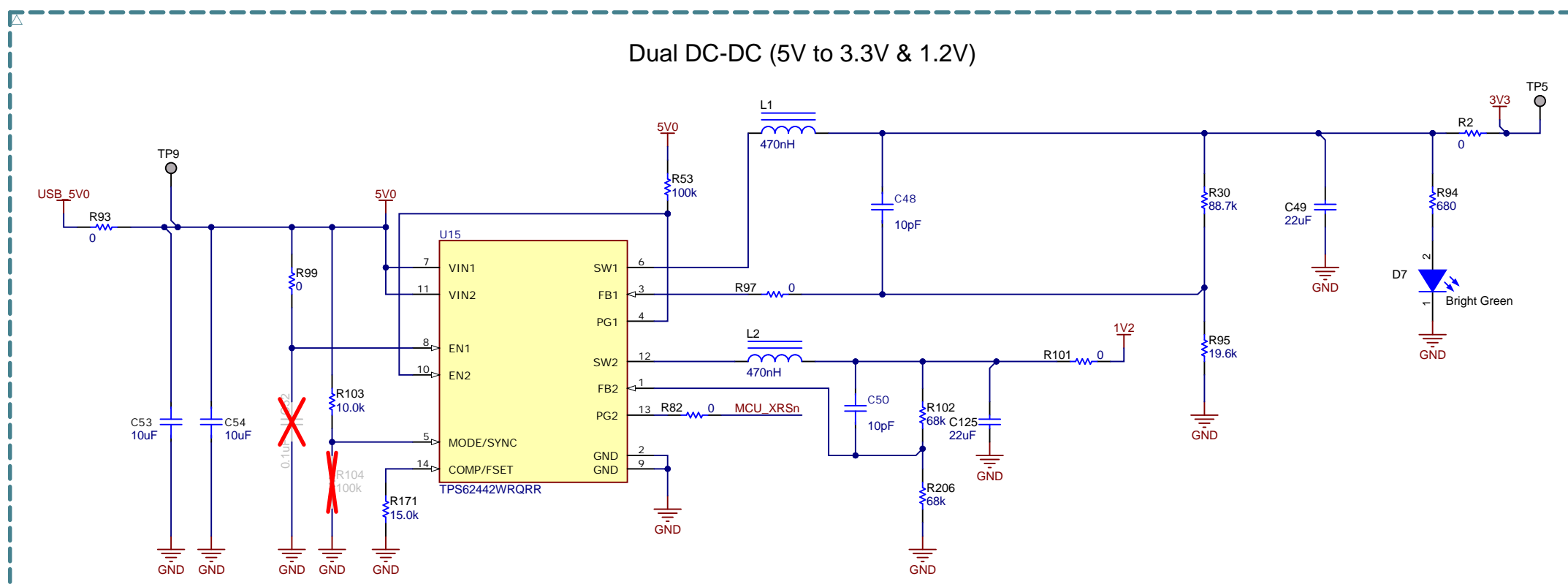
NOTE: C6 and C4 are not differential pairs

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.

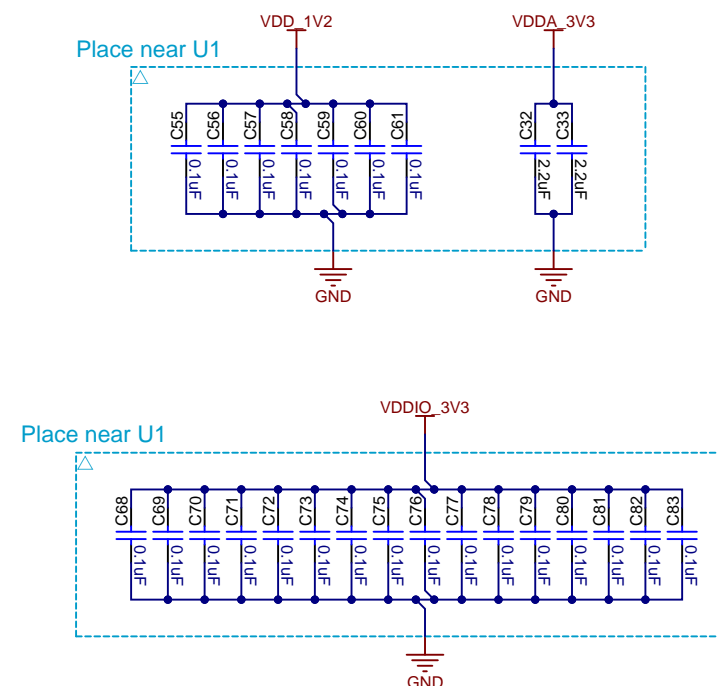


| Voltage reference Configuration Switch Truth Table |            |            |                 |                         |
|--|------------|------------|-----------------|-------------------------|
| S6 (POS 1)   | S5 (POS 1) | S5 (POS 2) | C2000 ADC V_REF | DESCRIPTION             |
| 1  | 1     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

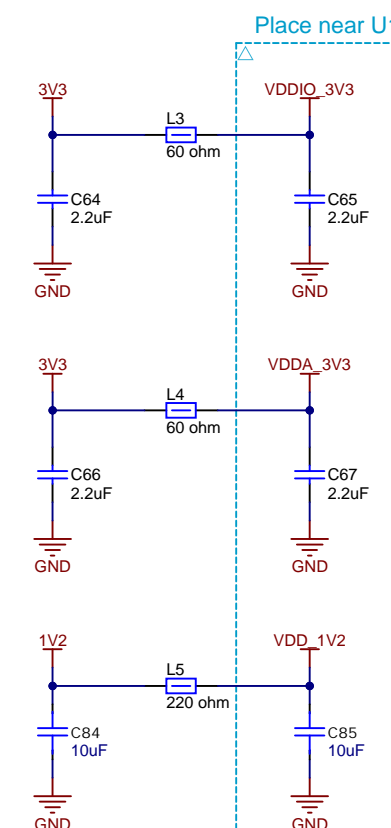
| Ext. V_REF Selection |                       |
|----------------------|-----------------------|
| S6 (POS 2)           | ADC_REF               |
| 1                    | HSEC_ADC-VREFHI       |
| 0                    | ADC_3V0_REF (DEFAULT) |



### Decoupling Capacitors



### Ferrite Beads

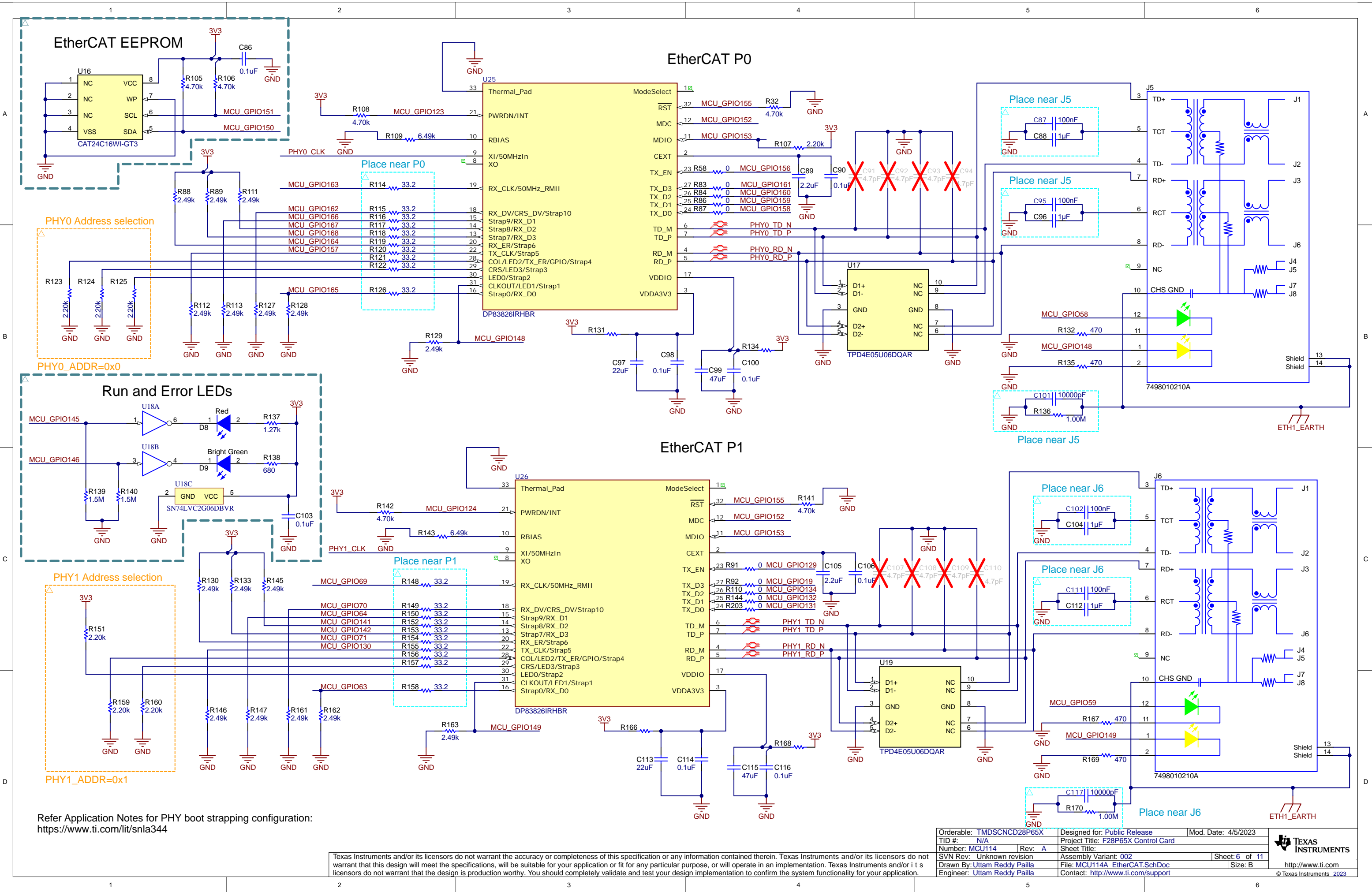


### NOTES:

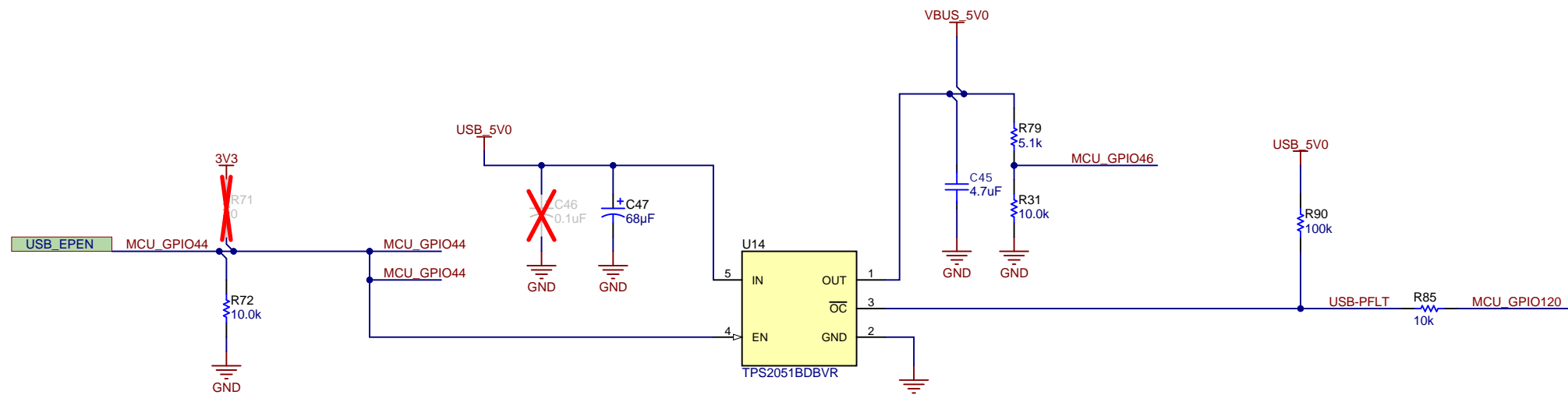
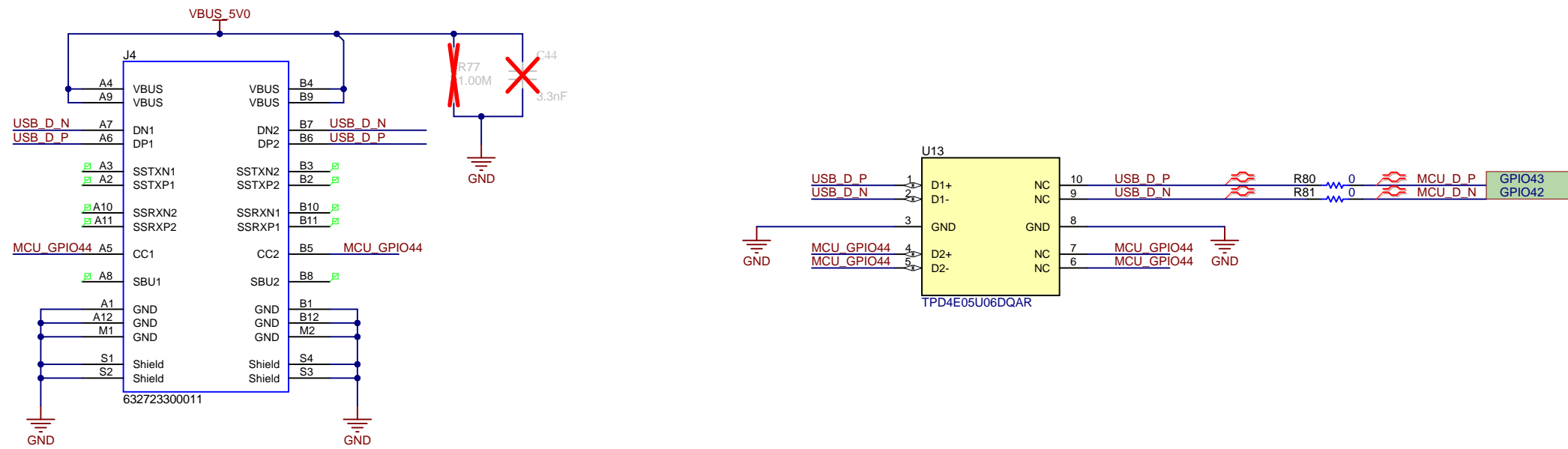
- 1) TPS62442 Dual DC-DC provides an output current of 2A/2A or 3A/1A, this amount of current capacity should not be necessary for certain applications using F28P65x. This is just necessary for the control card design
- 2) Alternative part: TPS62441 Dual DC-DC provides an output current of 1A/1A
- 3) 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: 4/14/2023 |
| TID #: N/A                  | Project Title: F28P65X Control Card |                      |
| Number: MCU114              | Rev: A                              | Sheet Title:         |
| SVN Rev: Unknown revision   | Assembly Variant: 002               | Sheet 5 of 11        |
| Drawn By: Uttam Reddy Paila | File: MCU114A_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

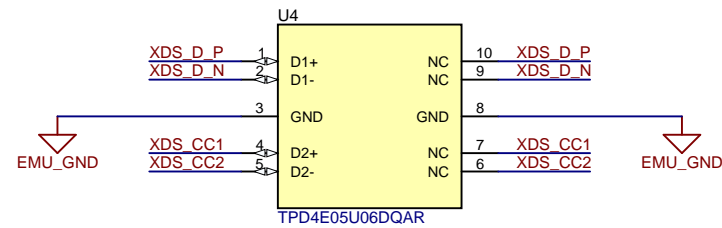
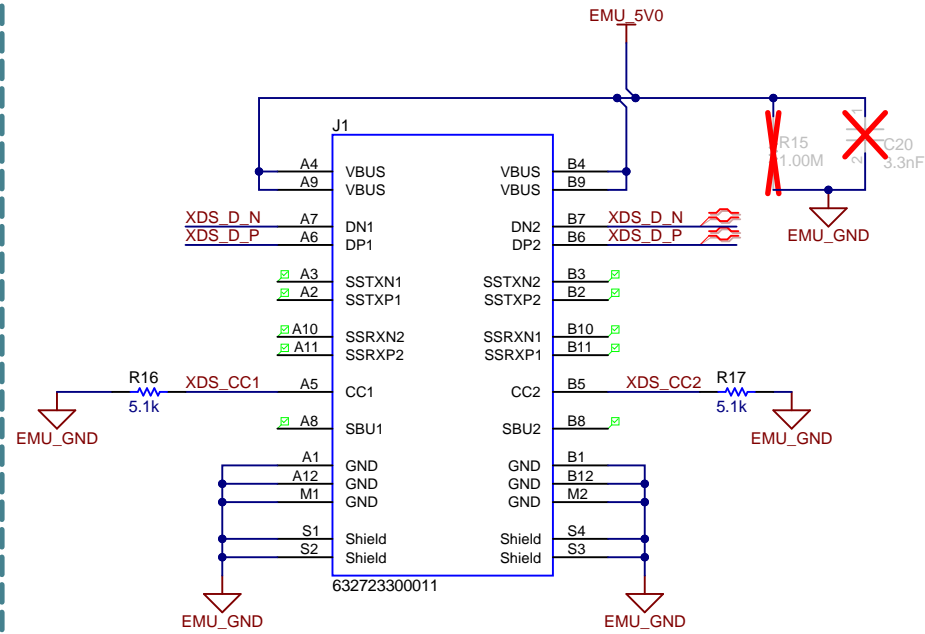
| MCU_GPIO44 STATUS | DESCRIPTION                               | USB_MODE              |
|-------------------|---|-----------------------|
| 1 (HIGH)          | UB_CC1 & USB_CC2 are pulled up            | Host mode             |
| 0 (LOW)           | UB_CC1 & USB_CC2 are strongly pulled down | Device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

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

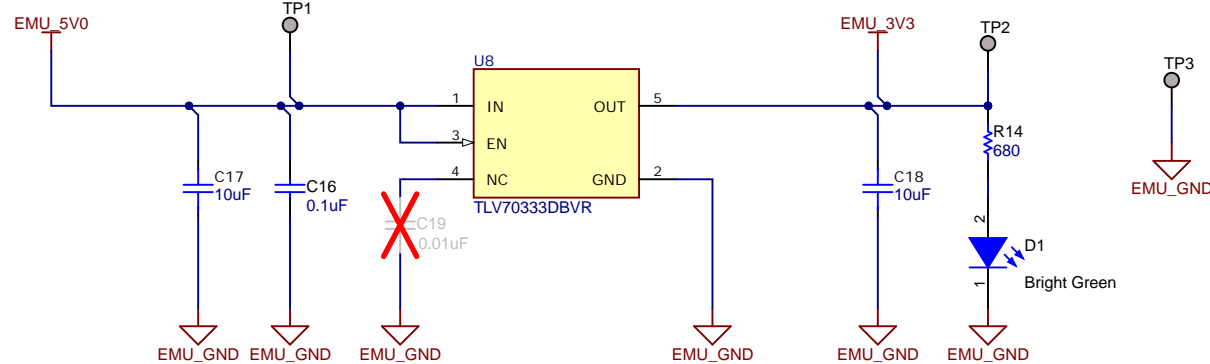
In this controlCARD, a standard GPIO is used to detect changes to these signals.

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.

## USB- Type C Connector - XDS110

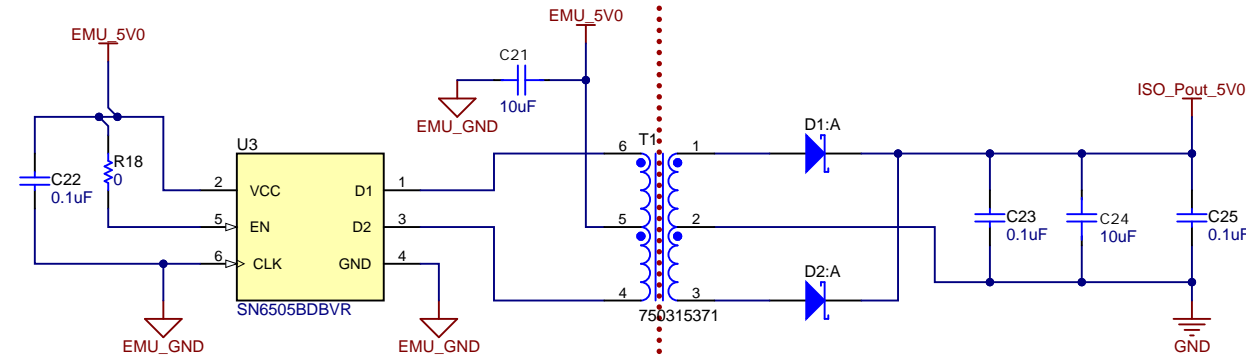


## LDO\_5V0\_3V3



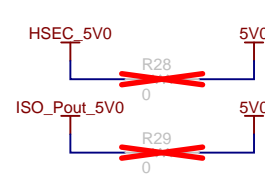
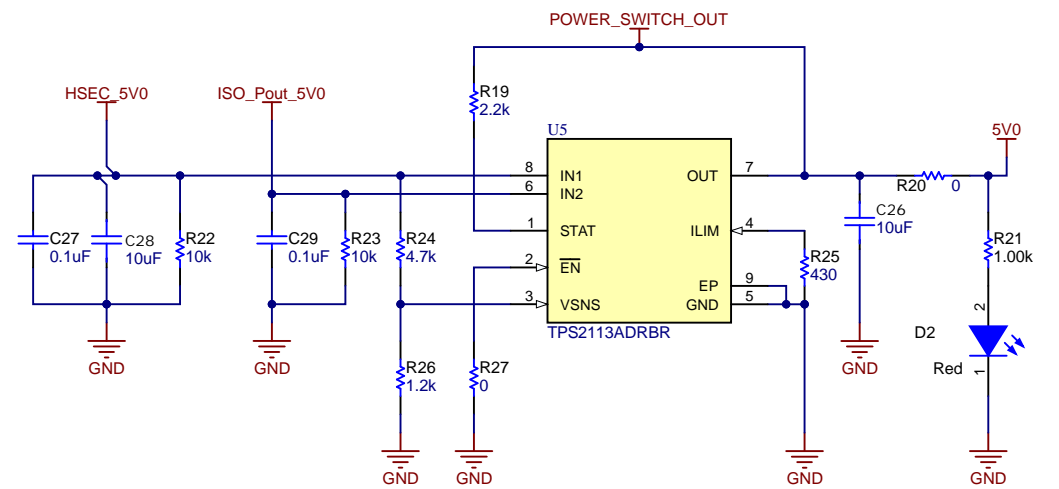
## (Cold Side)

## USB Isolated Power



## (Hot Side)

## Power Selection Switch



### Switch Truth Table

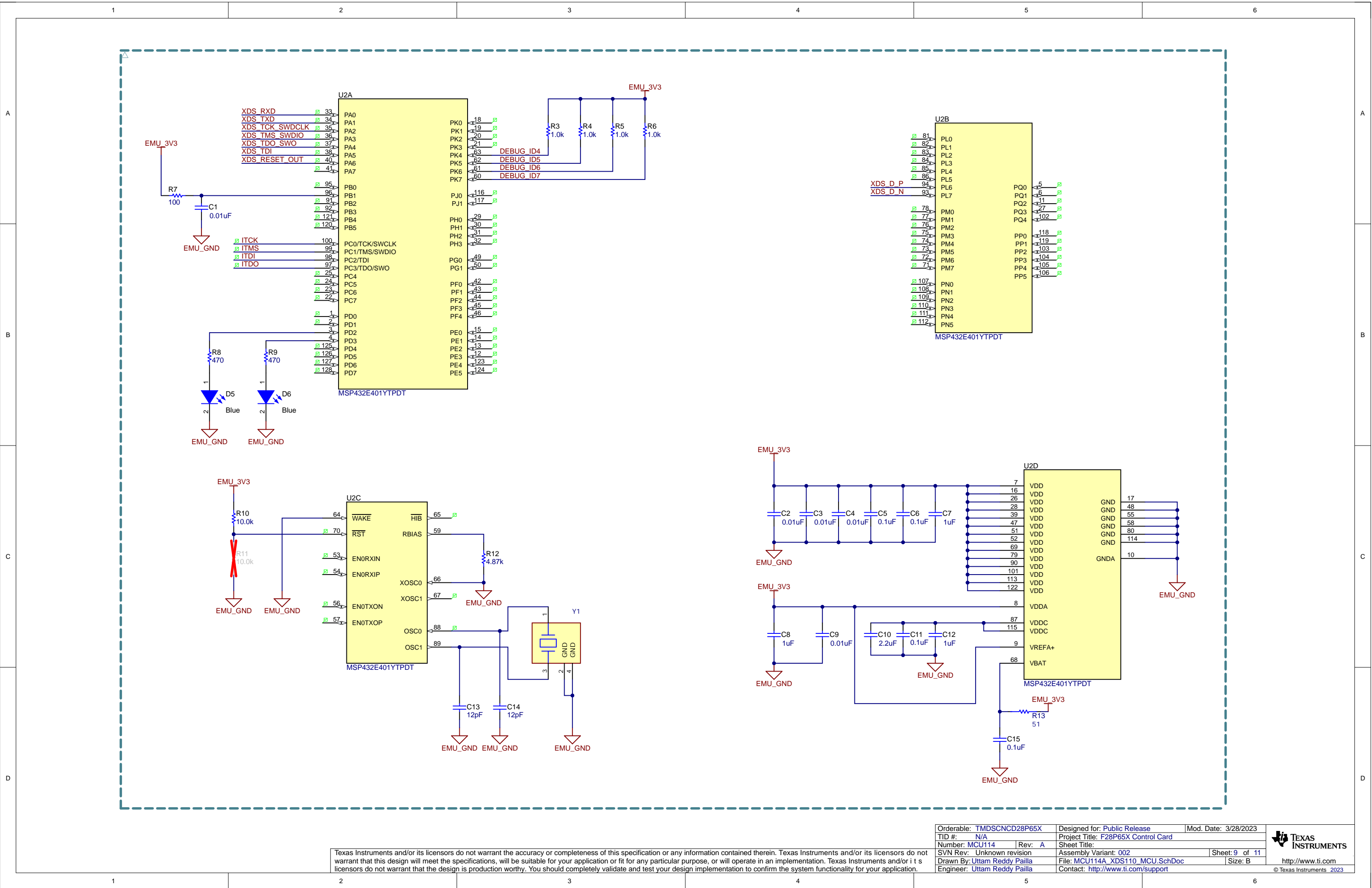
| HSEC_5V0 > 4V | ISO_Pout_5V0 > HSEC_5V0 | POWER_SWITCH_OUT |
|---------------|-------------------------|------------------|
| Yes           | X                       | HSEC_5V0         |
| No            | No                      | HSEC_5V0         |
| No            | Yes                     | ISO_Pout_5V0     |

NOTE: 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







FID1 FID2 FID3 FID4 FID5 FID6

PCB Number: MCU114  
PCB Rev: A



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: <b>TMDSCNCD28P65X</b>   | Designed for: <b>Public Release</b>  | Mod. Date: 5/15/2023          |  <b>TEXAS<br/>INSTRUMENTS</b><br><br><a href="http://www.ti.com">http://www.ti.com</a><br>© Texas Instruments 2023 |
| TID #: <b>N/A</b>                  | Project Title: <b>F28P65X Control Card</b>                                 |                               |   |
| Number: <b>MCU114</b>              | Rev: <b>A</b>  | Sheet Title:                  |   |
| SVN Rev: Unknown revision          | Assembly Variant: <b>002</b>   | Sheet: <b>11</b> of <b>11</b> |   |
| Drawn By: <b>Uttam Reddy Paila</b> | File: <b>MCU114A_EVM_Hardware_SchDoc</b>                                   | Size: B                       |   |
| Engineer: <b>Uttam Reddy Paila</b> | Contact: <a href="http://www.ti.com/support">http://www.ti.com/support</a> |                               |   |



TEXAS  
INSTRUMENTS