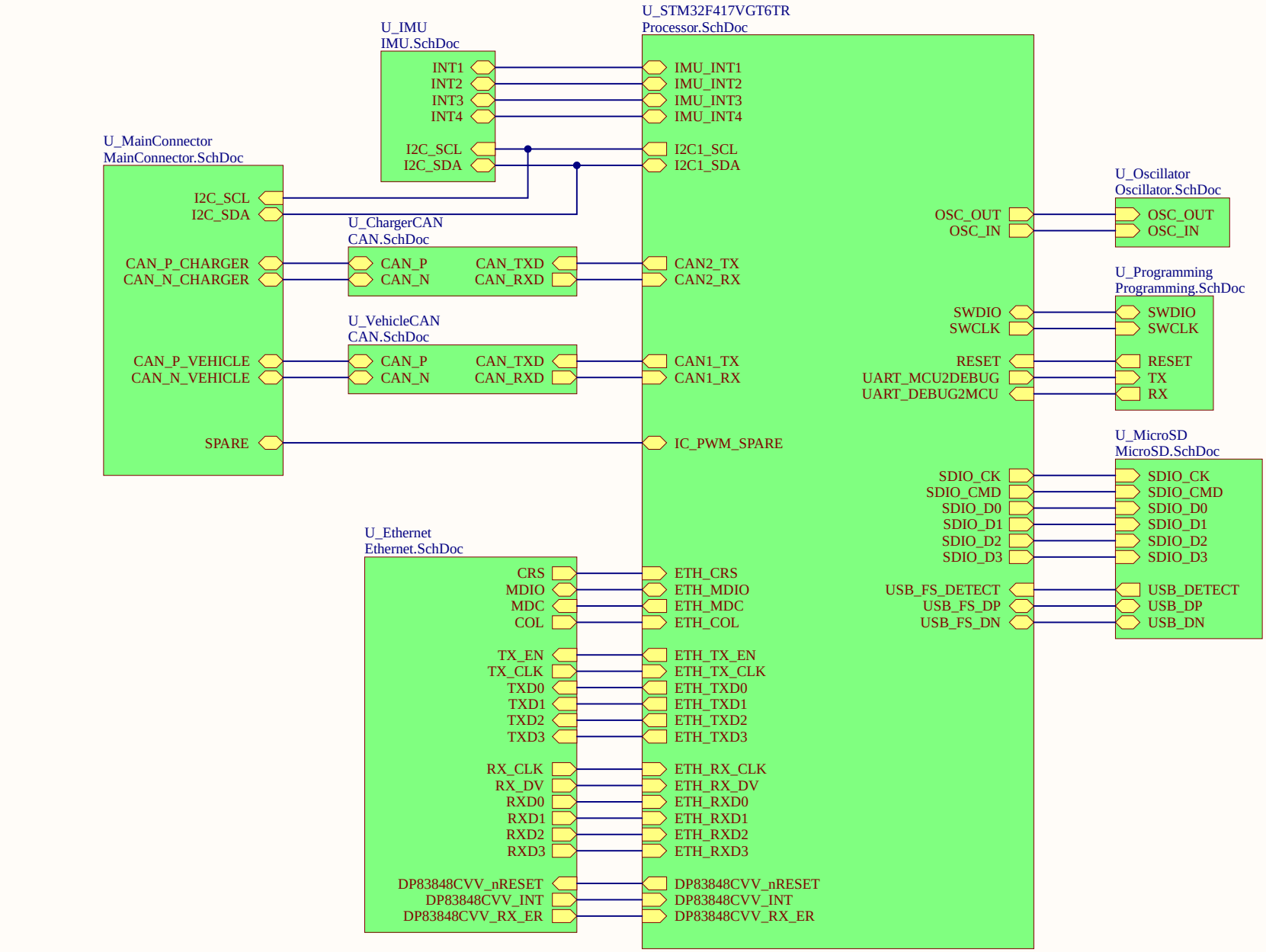
U_IMU
IMU.SchDoc
INT1
INT2
INT3
INT4
I2C_SCL
I2C_SDA
U_STM32F417VGT6TR
Processor.SchDoc
IMU_INT1
IMU_INT2
IMU_INT3
IMU_INT4
I2C1_SCL
I2C1_SDA
U_MainConnector
MainConnector.SchDoc
I2C_SCL
I2C_SDA
CAN_P_CHARGER
CAN_N_CHARGER
CAN_P_VEHICLE
CAN_N_VEHICLE
SPARE
U_ChargerCAN
CAN.SchDoc
CAN_P
CAN_N
CAN_TXD
CAN_RXD
CAN2_TX
CAN2_RX
U_VehicleCAN
CAN.SchDoc
CAN_P
CAN_N
CAN_TXD
CAN_RXD
CAN1_TX
CAN1_RX
IC_PWM_SPARE
U_Oscillator
Oscillator.SchDoc
OSC_OUT
OSC_IN
U_Programming
Programming.SchDoc
SWDIO
SWCLK
RESET
TX
RX
SWDIO
SWCLK
RESET
UART_MCU2DEBUG
UART_DEBUG2MCU
U_MicroSD
MicroSD.SchDoc
SDIO_CK
SDIO_CMD
SDIO_D0
SDIO_D1
SDIO_D2
SDIO_D3
USB_DETECT
USB_DP
USB_DN
SDIO_CK
SDIO_CMD
SDIO_D0
SDIO_D1
SDIO_D2
SDIO_D3
USB_FS_DETECT
USB_FS_DP
USB_FS_DN
U_Ethernet
Ethernet.SchDoc
CRS
MDIO
MDC
COL
TX_EN
TX_CLK
TXD0
TXD1
TXD2
TXD3
RX_CLK
RX_DV
RXD0
RXD1
RXD2
RXD3
DP83848CVV_nRESET
DP83848CVV_INT
DP83848CVV_RX_ER
ETH_CRS
ETH_MDIO
ETH_MDC
ETH_COL
ETH_TX_EN
ETH_TX_CLK
ETH_TXD0
ETH_TXD1
ETH_TXD2
ETH_TXD3
ETH_RX_CLK
ETH_RX_DV
ETH_RXD0
ETH_RXD1
ETH_RXD2
ETH_RXD3
DP83848CVV_nRESET
DP83848CVV_INT
DP83848CVV_RX_ER
U_POWER
Power.SchDoc
Title
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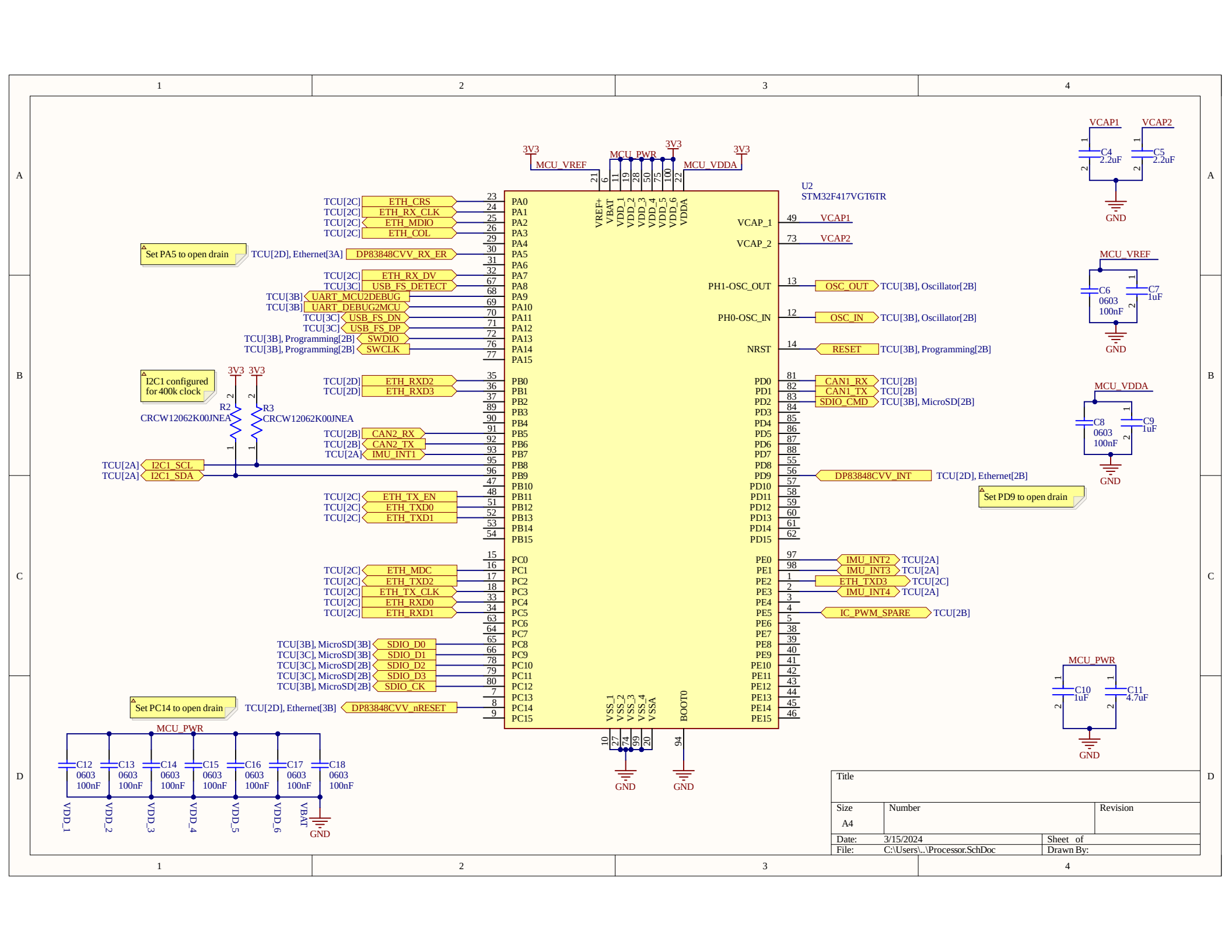
Date:
3/15/2024
Sheet of
File:
C:\Users\..\TCU.SchDoc
Drawn By:


U2
STM32F417VGT6TR
3V3
MCU_VREF
MCU_PWR
MCU_VDDA
VCAP1
VCAP2
GND
Set PA5 to open drain
Set PC14 to open drain
Set PD9 to open drain
I2C1 configured for 400k clock
R2
CRCW12062K00JNEA
R3
CRCW12062K00JNEA
TCU[2C] ETH_CRS
TCU[2C] ETH_RX_CLK
TCU[2C] ETH_MDIO
TCU[2C] ETH_COL
TCU[2D], Ethernet[3A] DP83848CVV_RX_ER
TCU[2C] ETH_RX_DV
TCU[3C] USB_FS_DETECT
TCU[3B] UART_MCU2DEBUG
TCU[3B] UART_DEBUG2MCU
TCU[3C] USB_FS_DN
TCU[3C] USB_FS_DP
TCU[3B], Programming[2B] SWDIO
TCU[3B], Programming[2B] SWCLK
TCU[2D] ETH_RXD2
TCU[2D] ETH_RXD3
TCU[2B] CAN2_RX
TCU[2B] CAN2_TX
TCU[2A] IMU_INT1
TCU[2A] I2C1_SCL
TCU[2A] I2C1_SDA
TCU[2C] ETH_TX_EN
TCU[2C] ETH_TXD0
TCU[2C] ETH_TXD1
TCU[2C] ETH_MDC
TCU[2C] ETH_TXD2
TCU[2C] ETH_TX_CLK
TCU[2C] ETH_RXD0
TCU[2C] ETH_RXD1
TCU[3B], MicroSD[3B] SDIO_D0
TCU[3C], MicroSD[3B] SDIO_D1
TCU[3C], MicroSD[2B] SDIO_D2
TCU[3C], MicroSD[2B] SDIO_D3
TCU[3B], MicroSD[2B] SDIO_CK
TCU[2D], Ethernet[3B] DP83848CVV_nRESET
OSC_OUT TCU[3B], Oscillator[2B]
OSC_IN TCU[3B], Oscillator[2B]
RESET TCU[3B], Programming[2B]
CAN1_RX TCU[2B]
CAN1_TX TCU[2B]
SDIO_CMD TCU[3B], MicroSD[2B]
DP83848CVV_INT TCU[2D], Ethernet[2B]
IMU_INT2 TCU[2A]
IMU_INT3 TCU[2A]
ETH_TXD3 TCU[2C]
IMU_INT4 TCU[2A]
IC_PWM_SPARE TCU[2B]
C4 2.2uF
C5 2.2uF
C6 0603 100nF
C7 1uF
C8 0603 100nF
C9 1uF
C10 1uF
C11 4.7uF
C12 0603 100nF
C13 0603 100nF
C14 0603 100nF
C15 0603 100nF
C16 0603 100nF
C17 0603 100nF
C18 0603 100nF
VDD_1
VDD_2
VDD_3
VDD_4
VDD_5
VDD_6
VBAT
Title
Size A4
Number
Revision
Date: 3/15/2024
File: C:\Users\..\Processor.SchDoc
Sheet of
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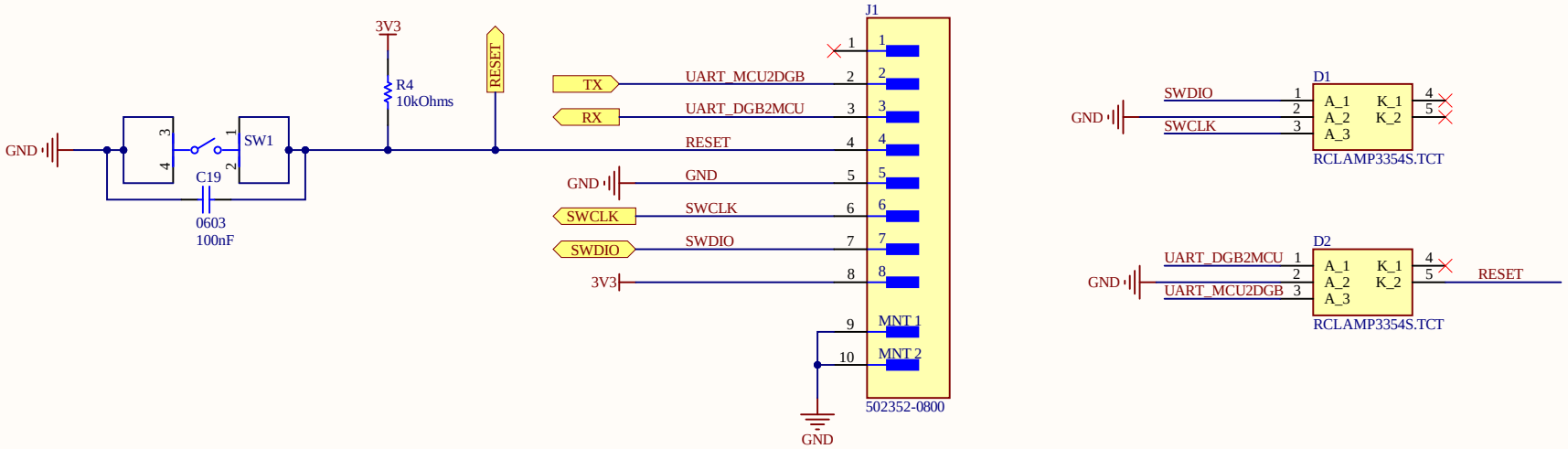

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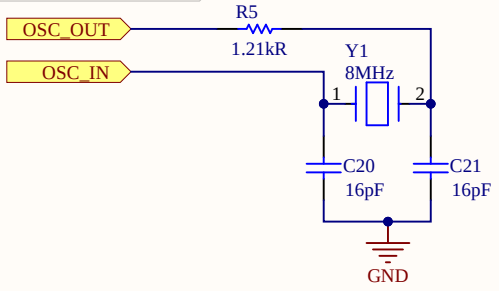
Oscillator external resistor must be selected to limit power dissipation to < 100uW. Value selected based value used for existing F7 boards but should be verified experimentally but a general equation in AN2867 is given in section 3.5.3 as:
R_EXT = 1/(2*pi*F_osc*C_L2)
R_EXT = 1/(2*pi*(8*10^6)*(16*10^-12))
R_EXT = 1243



See ST AN2867 Rev 19 and datasheet section 5.3.8 External clock source characteristics for details. MCU datasheet recommends a 10pF estimate for pararsitic capacitance. This is a Pierce Oscillator (variant of Colpitts Oscillator). R_Ext is used to limit inverter output current. See Figure 5 in AN2867.
From AN2867 Section 3.3 with C_L1 = C_L2 and C_L as 18pF:
C_L1 = 2*(C_L - C_s)
C_L1 = 16pF

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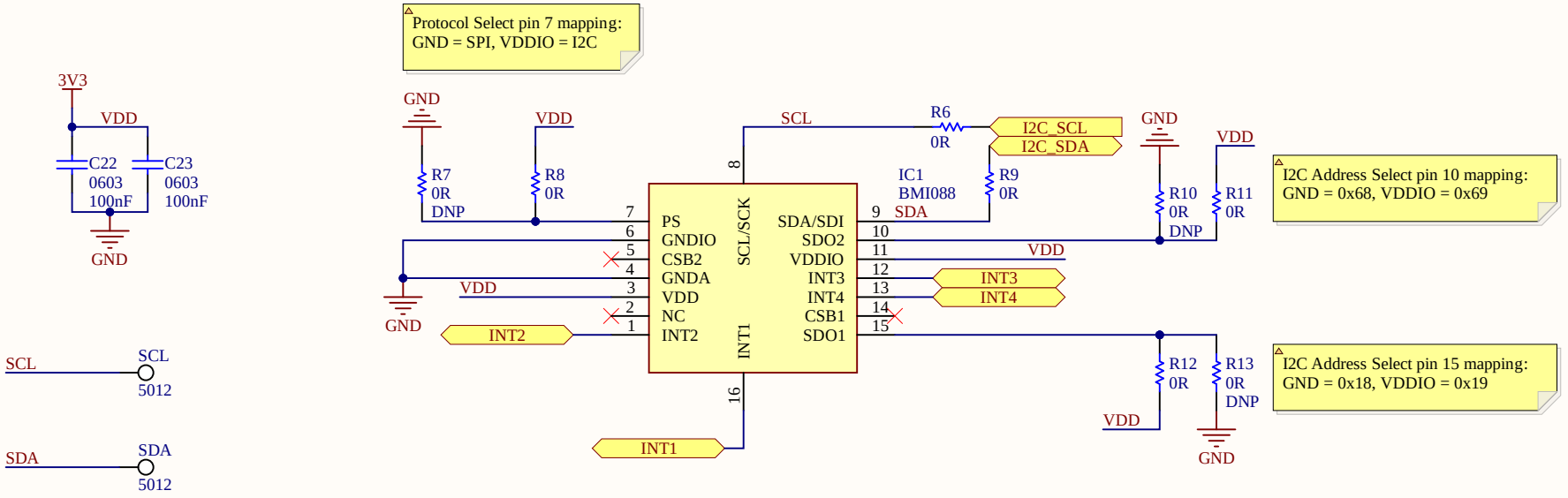
I2C Settings:
Clock Speed: 400k
Gyro I2C Address: 0x69
Accelerometer I2C Address: 0x19



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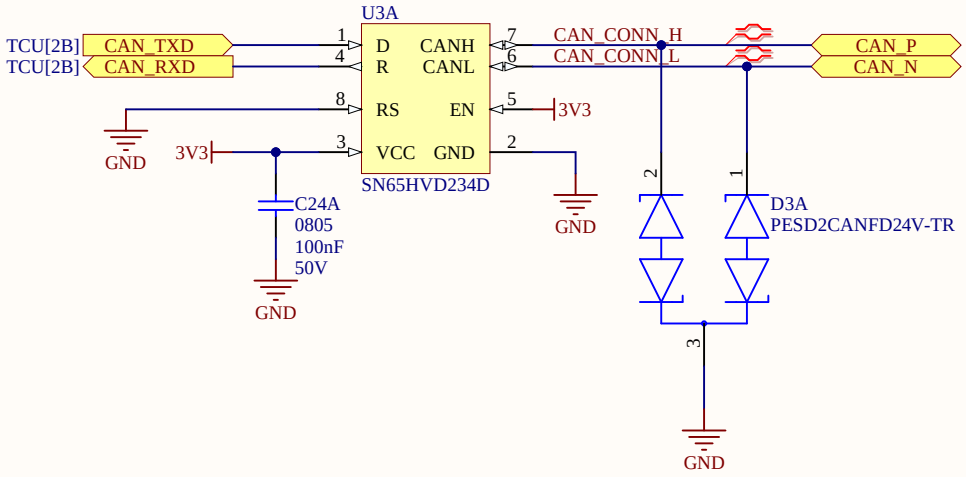

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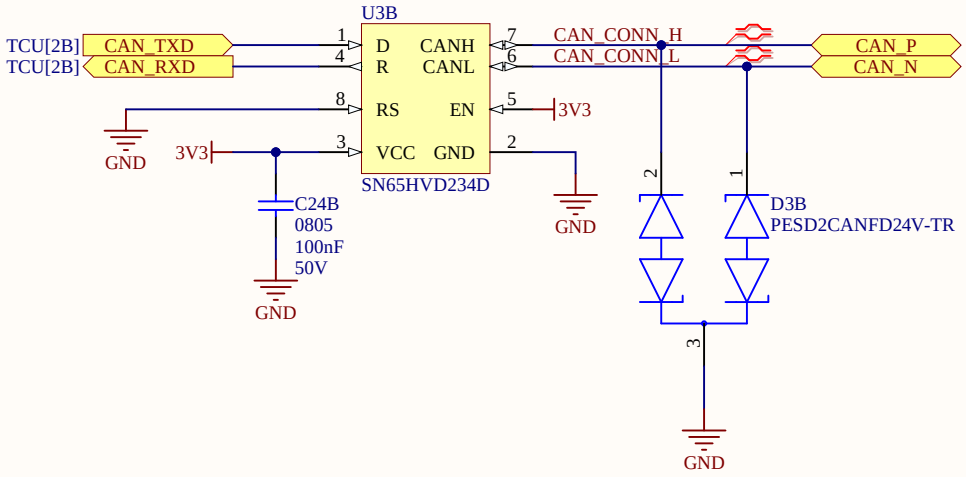

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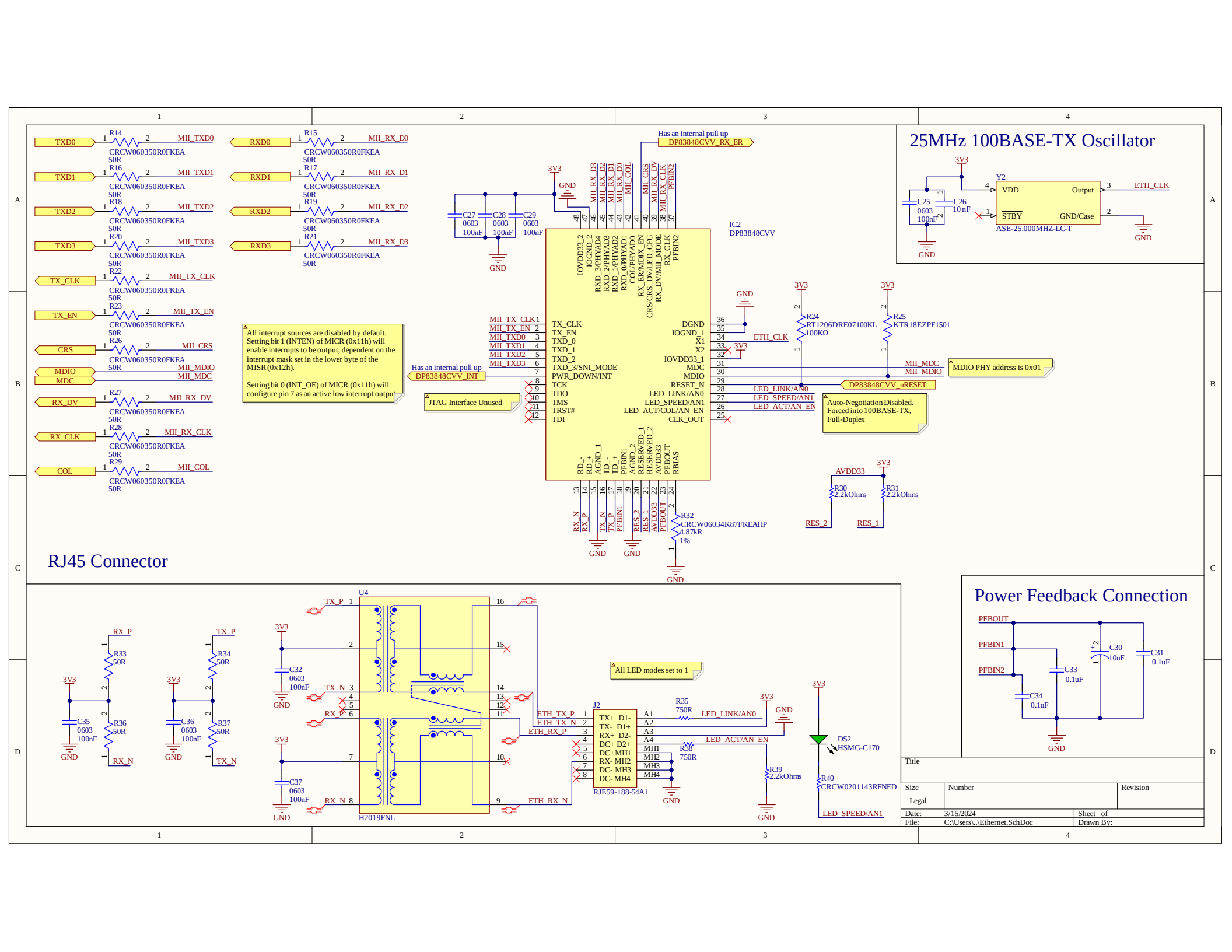
25MHz 100BASE-TX Oscillator
RJ45 Connector
Power Feedback Connection
IC2
DP83848CVV
Y2
ASE-25.000MHZ-LC-T
U4
H2019FNL
J2
RJE59-188-54A1
DS2
HSMG-C170
All interrupt sources are disabled by default. Setting bit 1 (INTEN) of MICR (0x11h) will enable interrupts to be output, dependent on the interrupt mask set in the lower byte of the MISR (0x12h).
Setting bit 0 (INT_OE) of MICR (0x11h) will configure pin 7 as an active low interrupt output
JTAG Interface Unused
MDIO PHY address is 0x01
Auto-Negotiation Disabled. Forced into 100BASE-TX, Full-Duplex
All LED modes set to 1
Has an internal pull up
DP83848CVV_RX_ER
DP83848CVV_INT
DP83848CVV_nRESET
Title
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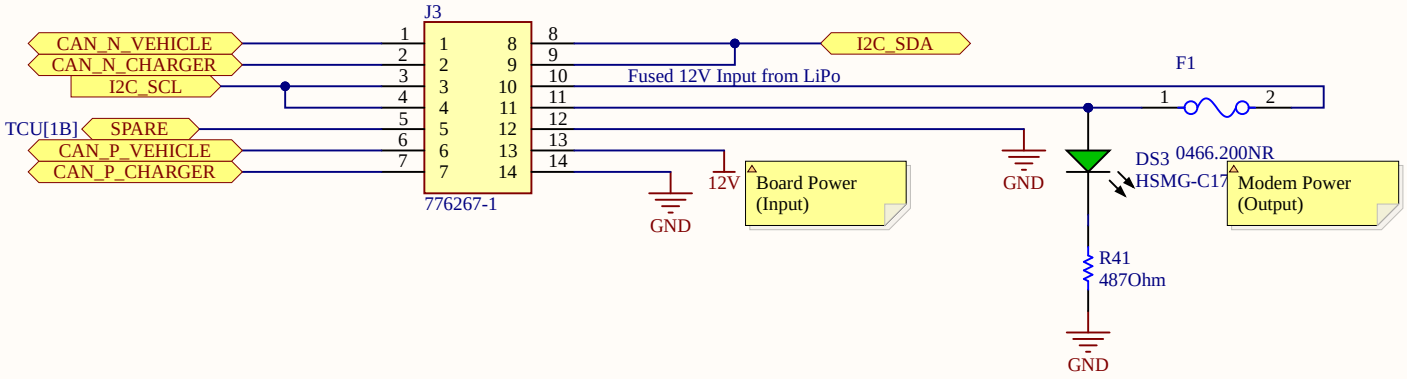
Main Connector



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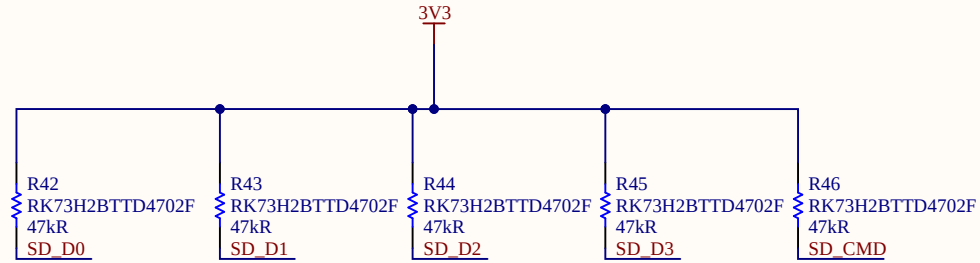
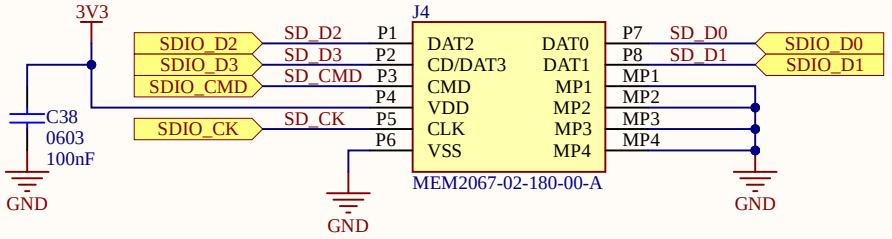
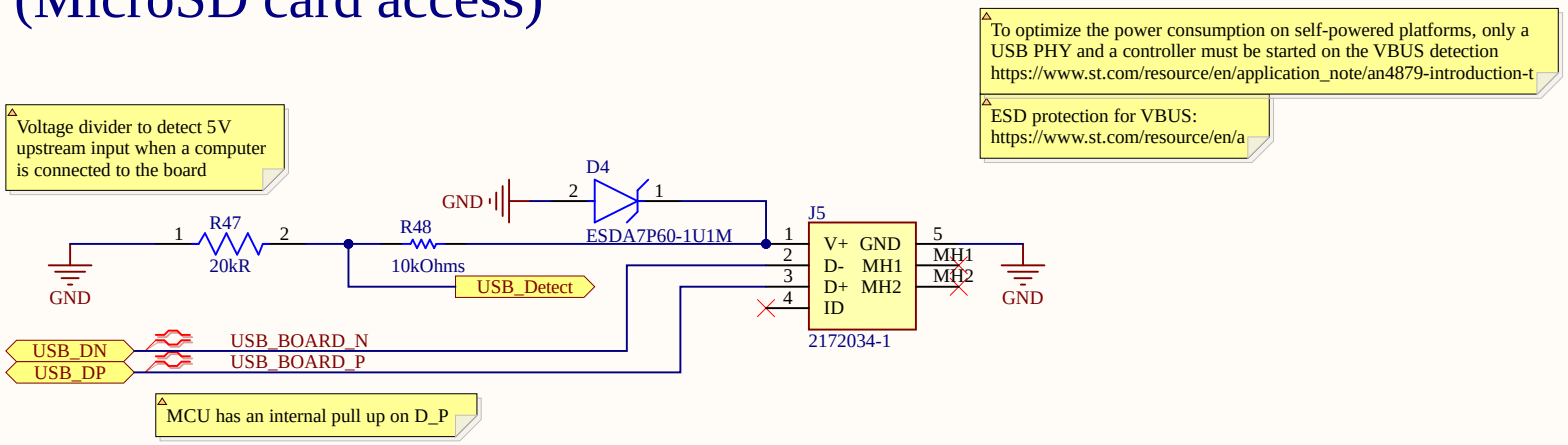
MicroSD (logging)





MiniUSB-B (MicroSD card access)



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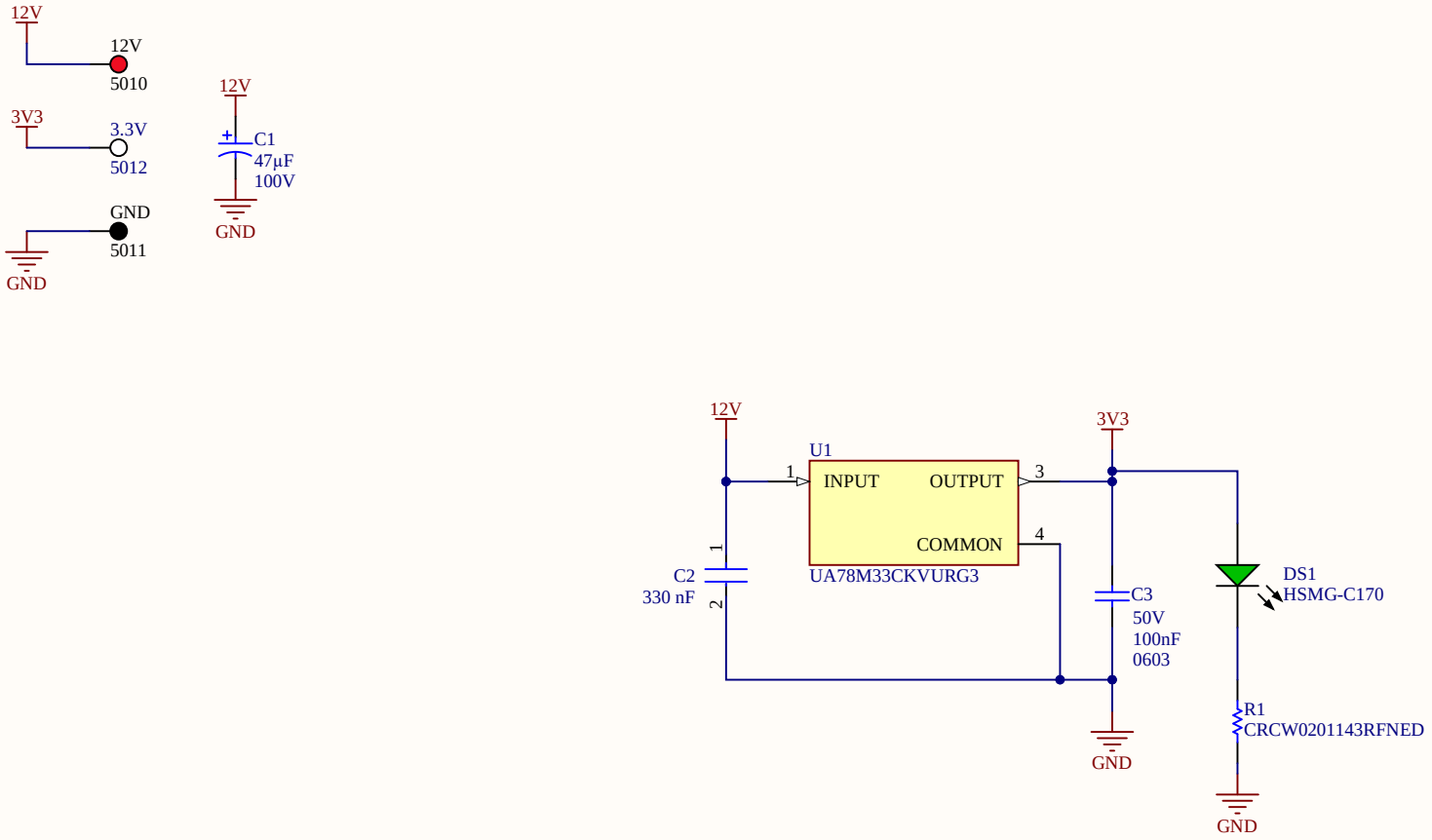

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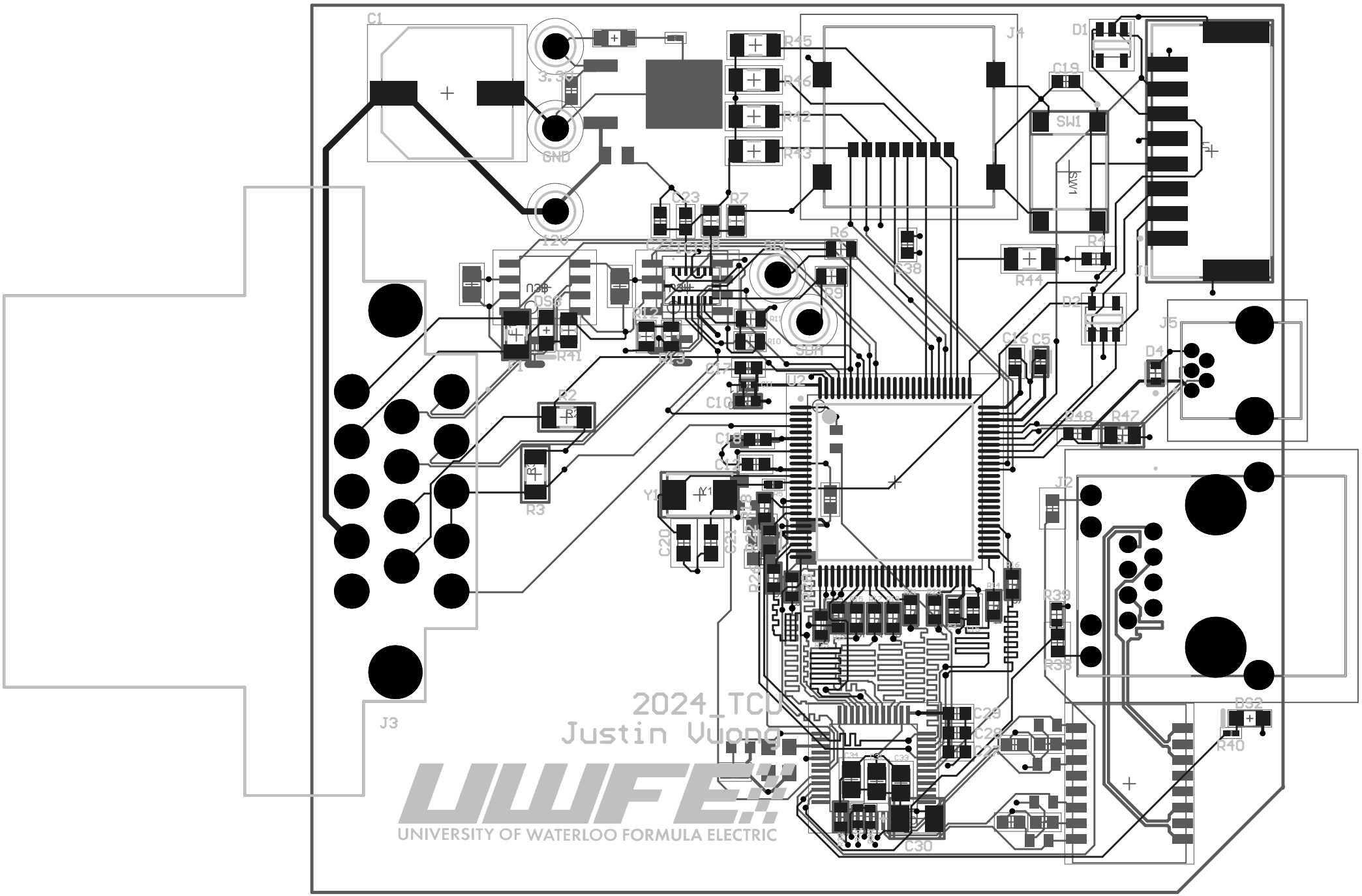
2024_TCU
Justin Vuong
UWFE
UNIVERSITY OF WATERLOO FORMULA ELECTRIC