Sheet: Power Distribution
File: PowerDist.sch
+5V
+3.3V
GND

Sheet: CAN
File: CAN.sch
CAN_TX
CAN_RX
CAN1_TX
CAN1_RX

Sheet: Contactor Driver
File: Contactor.sch
CONTACTOR_EN
CONTACTOR_CHECK
PB0
PB1

Sheet: EEPROM
File: EEPROM.sch
SCL
SDA
I2C3_SCL
I2C3_SDA

Sheet: Sensor Boards Interface
File: SensorBrdInterface.sch
VT: Voltage/Temperature
I: Current (Amperes)
VT_CLK
VT_MOSI
VT_MISO
VT_CS
I_CLK
I_MOSI
I_MISO
I_CS
SPI1_CLK
SPI1_MOSI
SPI1_MISO
PD2
SPI3_CLK
SPI3_MOSI
SPI3_MISO
PA15

Sheet: Error Light
File: ErrorLight.sch
FAULT

Sheet: USB
File: USB.sch
UART_RX
UART_TX
USART3_TX
USART3_RX

Sheet: LEDs
File: LEDs.sch
PC[0..5]
PA[4..7]

Sheet: Fan Board Interface
File: FanBrdInterface.sch
PWM1
PWM2
PWM3
PWM4
TIM3_CH1
TIM3_CH2
TIM12_CH1
TIM12_CH2

Sheet: Bluetooth
File: Bluetooth.sch
UART_RX
UART_TX
UART2_TX
UART2_RX

Isolated +5V and +3.3V.
Use GND as local gnd for all board electronic components.
Connect GNDPWR when using +12V.

Important note, UART must have these connections:
STM RX to IC TX
STM TX to IC RX

MH1 M.3
MH2 M.3
MH3 M.3
MH4 M.3

The crystal and caps have to be as close to the uC as possible and usually no traces should go underneath these components or connections. Exceptions are possible with boards with more than 2 layers though...

U1
STM32F413RHTx
NRST
BOOT0
VCAP_1
PWR_FLAG
C3 4.7u
OSC_IN
OSC_OUT
8M
Y1
C1 12p
C2 12p
PD2
PC0
PC1
PC2
PC3
PC4
PC[0..5]
USART3_RX
TIM3_CH1
TIM3_CH2
I2C3_SDA
SPI3_CLK
SPI3_MISO
SPI3_MOSI
PA[4..7]
UART2_TX
UART2_RX
PA4
PA5
PA6
PA7
I2C3_SCL
PA9
PA10
PA11
PA12
SWDIO
SWCLK
PA15
PB0
PB1
SPI1_CLK
SPI1_MISO
SPI1_MOSI
CAN1_RX
CAN1_TX
USART3_TX
FAULT
TIM12_CH1
TIM12_CH2

Bypass Capacitors

Place these capacitors as close to mcu as possible for correct operation.
VDD/VSS
C4 0.1u
C6 0.1u
C8 0.1u
C10 0.1u
C11 4.7u

VDDA/VSSA (VREF+/VREF−)
C5 0.1u
C7 1u

C9 0.1u
SW1 B3SL-1002P

SWD J5
SWCLK
SWDIO
Programming Pins.

J1 GPIO Analyzer
PA9
PA10
PA11
PA12

J2 Volt/Temp SPI Analyzer
SPI1_CLK
SPI1_MISO
SPI1_MOSI

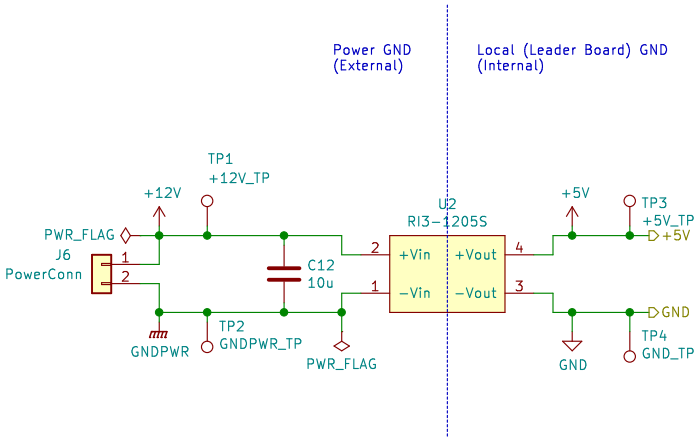
J3 Current SPI Analyzer
SPI3_CLK
SPI3_MISO
SPI3_MOSI

J4 CAN Analyzer
CAN1_RX
CAN1_TX

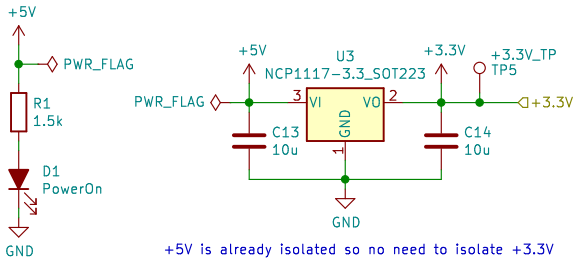
Graphics/Logos
Dr. Hallock
UTSVT Logo

Sheet: /
File: BPS-LeaderPCB.sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. kicad (5.1.6)-1
Id: 1/11

ISOLATED



Isolated DC-DC Converter to step down +12V power to an isolated +5V. The input gnd (Power GND) is different from the output gnd (Local GND)

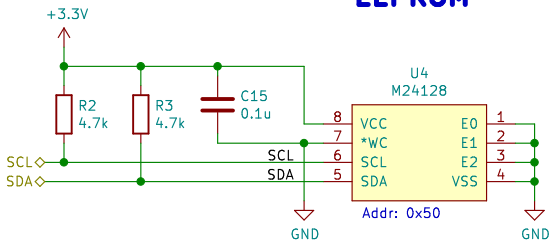


+5V is already isolated so no need to isolate +3.3V

Linear Regulator to step down +5V to +3.3V. An isolated converter was not used for the +3.3V line because of price and space. May need to change this to DC-DC converter if we really want to make the BPS more energy efficient.

Sheet: /Power Distribution/		
File: PowerDist.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 2/11

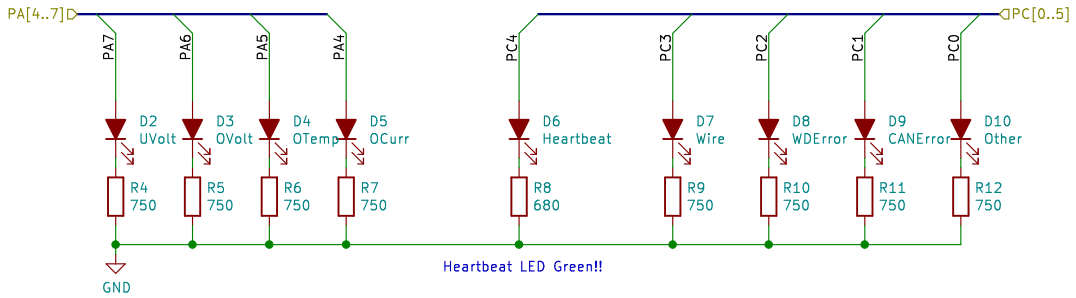
EEPROM



Sheet: /EEPROM/		
File: EEPROM.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 3/11

Status LEDs

Green LEDs good Red LEDs fault



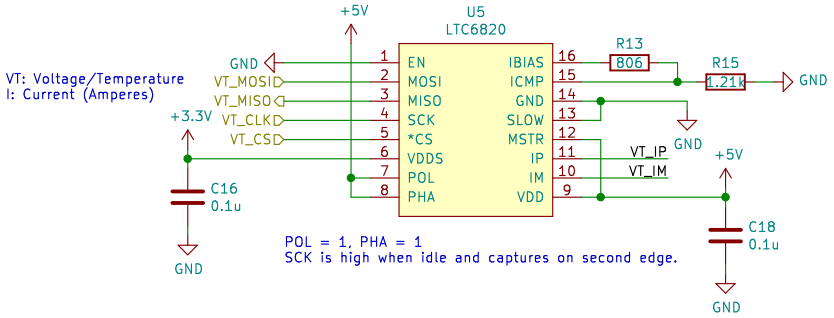
Sheet: /LEDs/		
File: LEDs.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 4/11

Isolated SPI

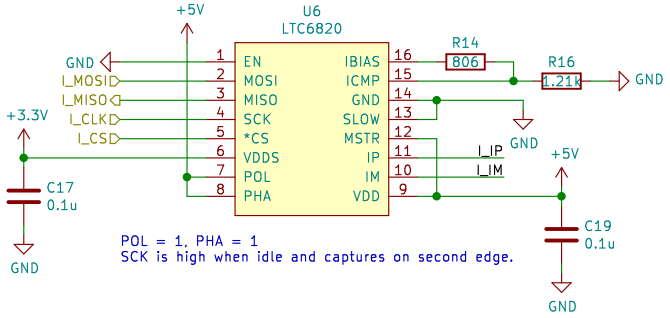
If the wires lengths are short and you want to save more power, change IBIAS resistor to be 2.8k. Look in LTC6820 datasheet for more information on calculating these BIAS resistors.

4-wire SPI to 2-wire Isolated SPI Converter ICs

Voltage/Temperature Brd

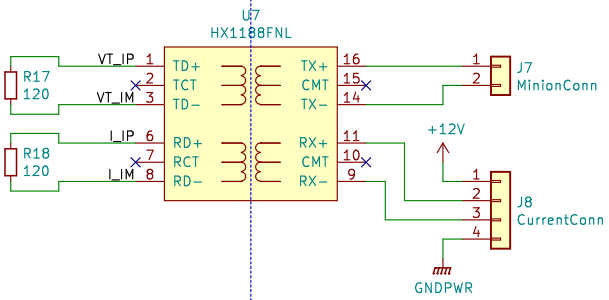


Amperes Current Brd



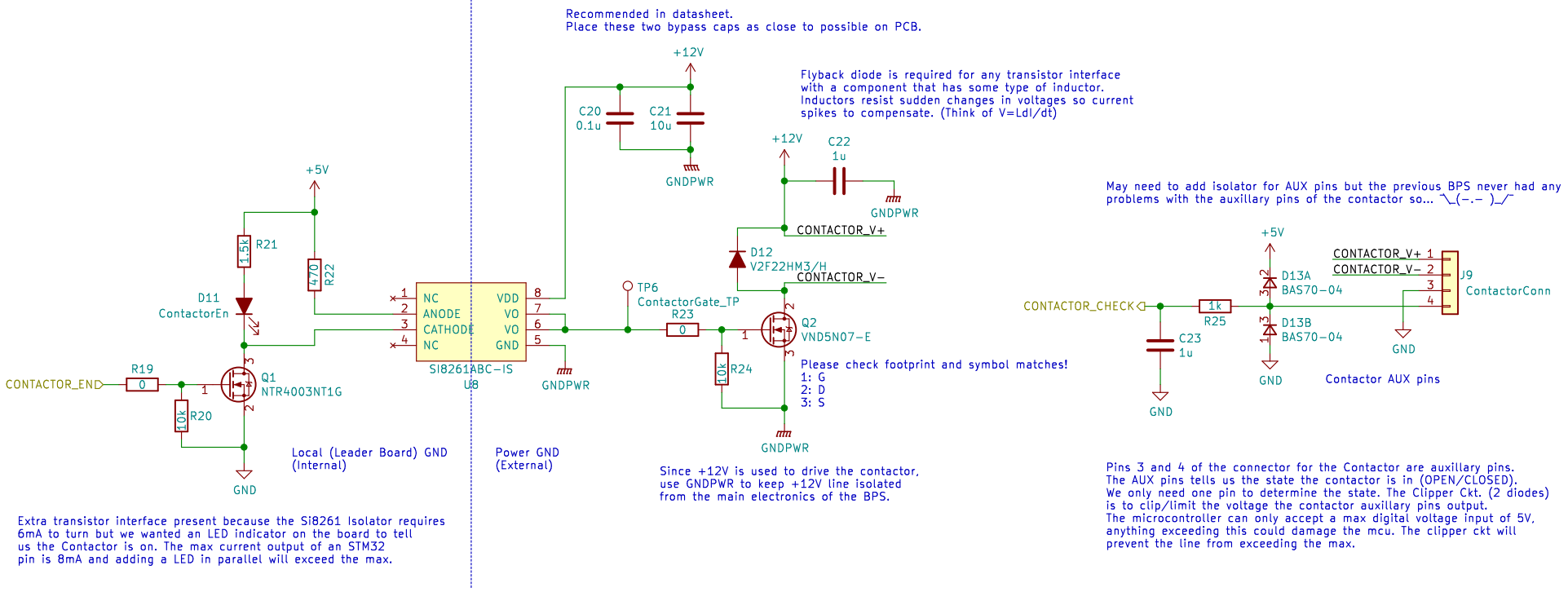
ISOLATED

Connectors



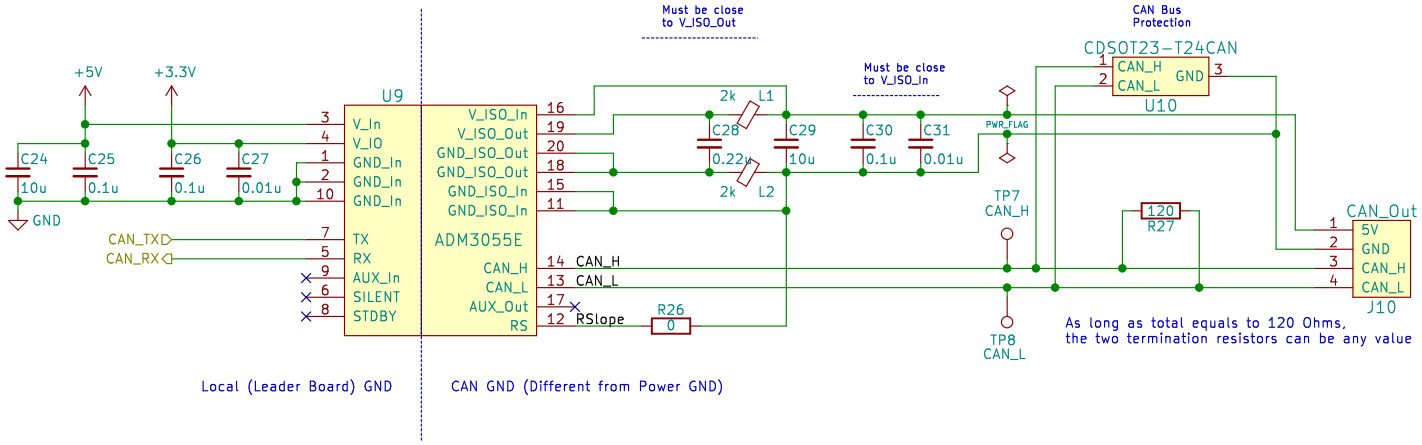
Sheet: /Sensor Boards Interface/ File: SensorBrdInterface.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 5/11

ISOLATED



Sheet: /Contactor Driver/		
File: Contactor.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 6/11

ISOLATED

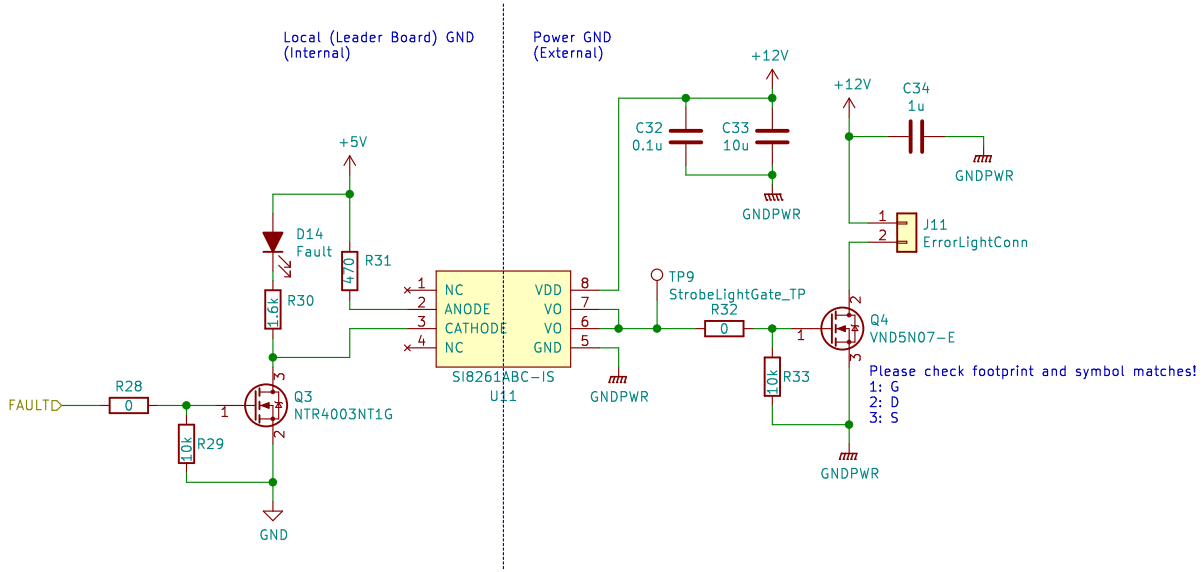


Isolated CAN transceiver. This connects to the main electrical system's CAN bus. Look in datasheet for more information about this page.

Sheet: /CAN/		
File: CAN.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 7/11

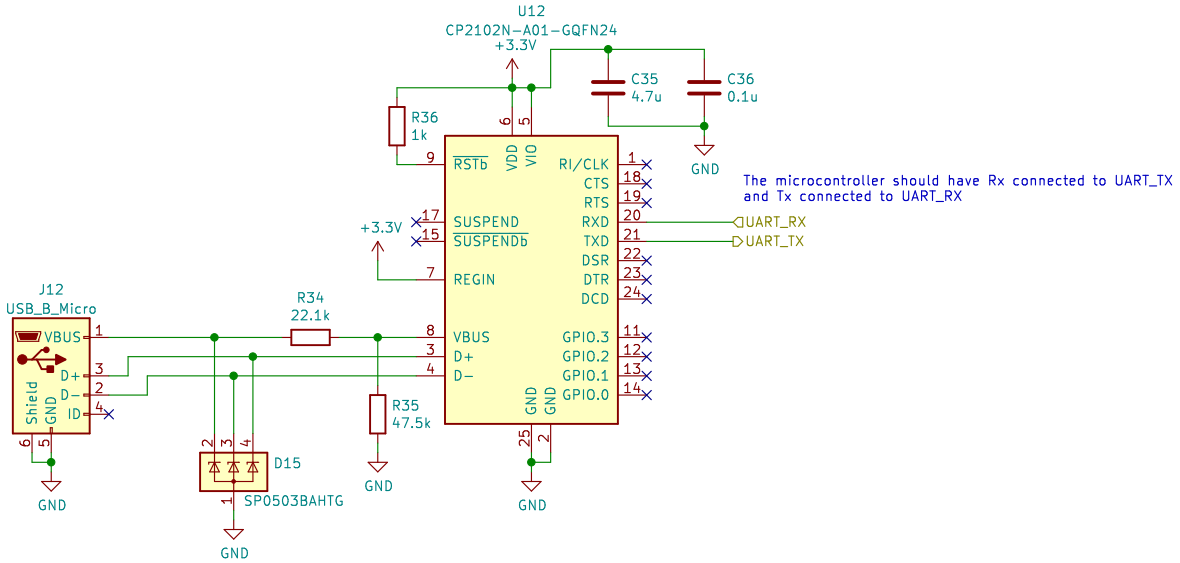
Error Light

ISOLATED



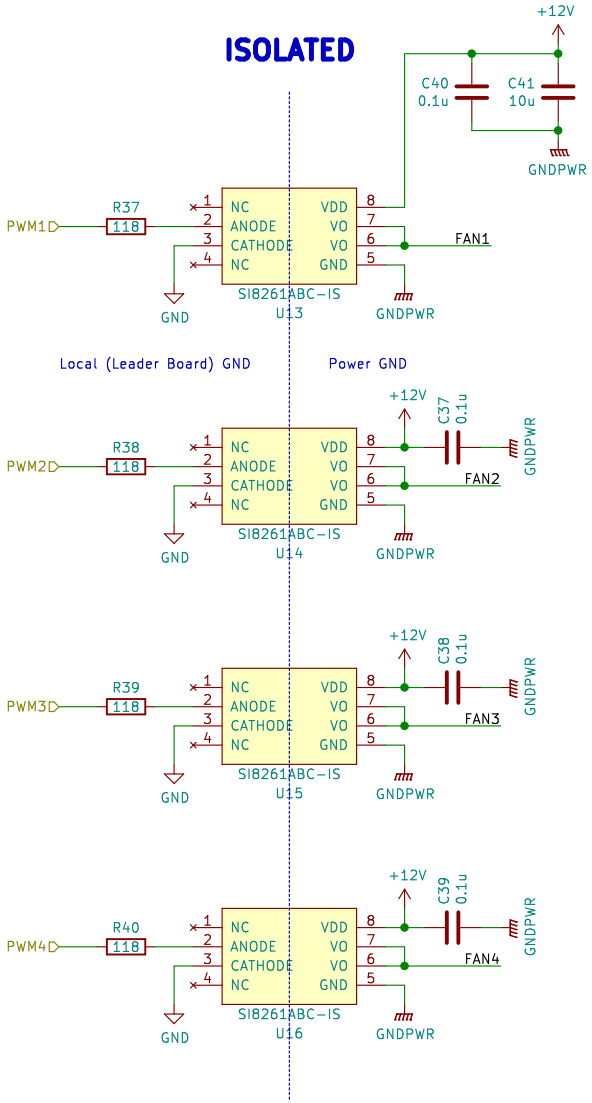
Extra transistor interface present because the Si8261 Isolator requires 6mA to turn but we wanted an LED indicator on the board to tell us the Contactor is on. The max current output of an STM32 pin is 8mA and adding a LED in parallel will exceed the max.

Sheet: /Error Light/ File: ErrorLight.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 8/11

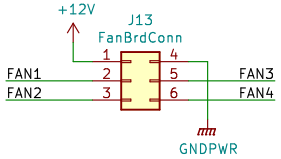


Sheet: /USB/		
File: USB.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 9/11

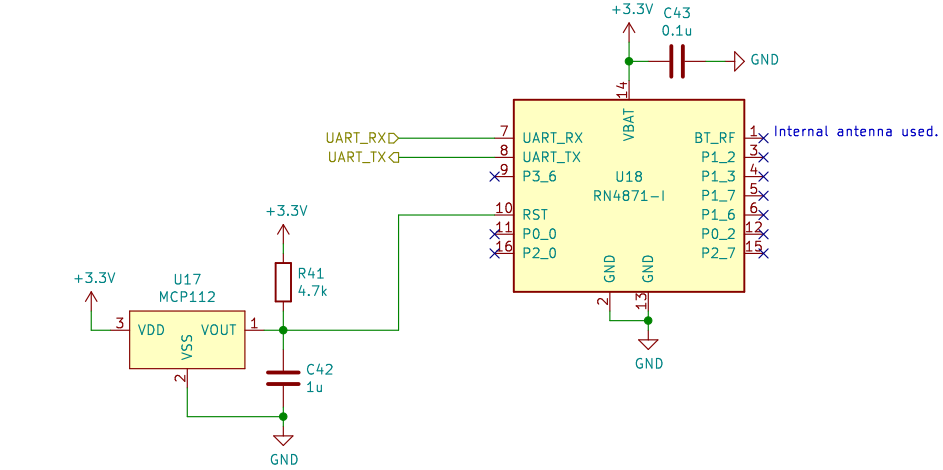
Recommended in datasheet.
Place these two bypass caps as close to possible on PCB.



All pins on this connector are isolated from the rest of the local components on this leader board.



Sheet: /Fan Board Interface/ File: FanBrdInterface.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 10/11



Reset Circuitry. This component prevents brownouts.
As a note, the STM32 already has brownout prevention circuitry present internally so no need for this on the STM32.

Sheet: /Bluetooth/ File: Bluetooth.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (5.1.6)-1		Id: 11/11