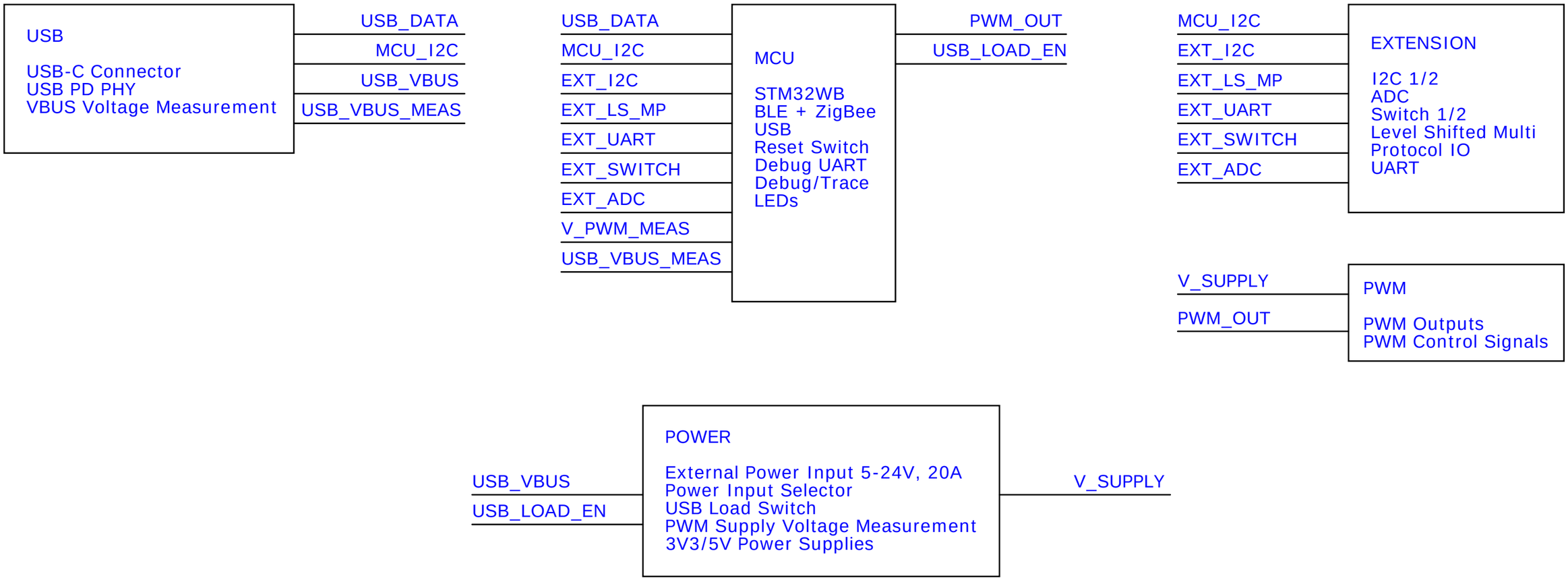
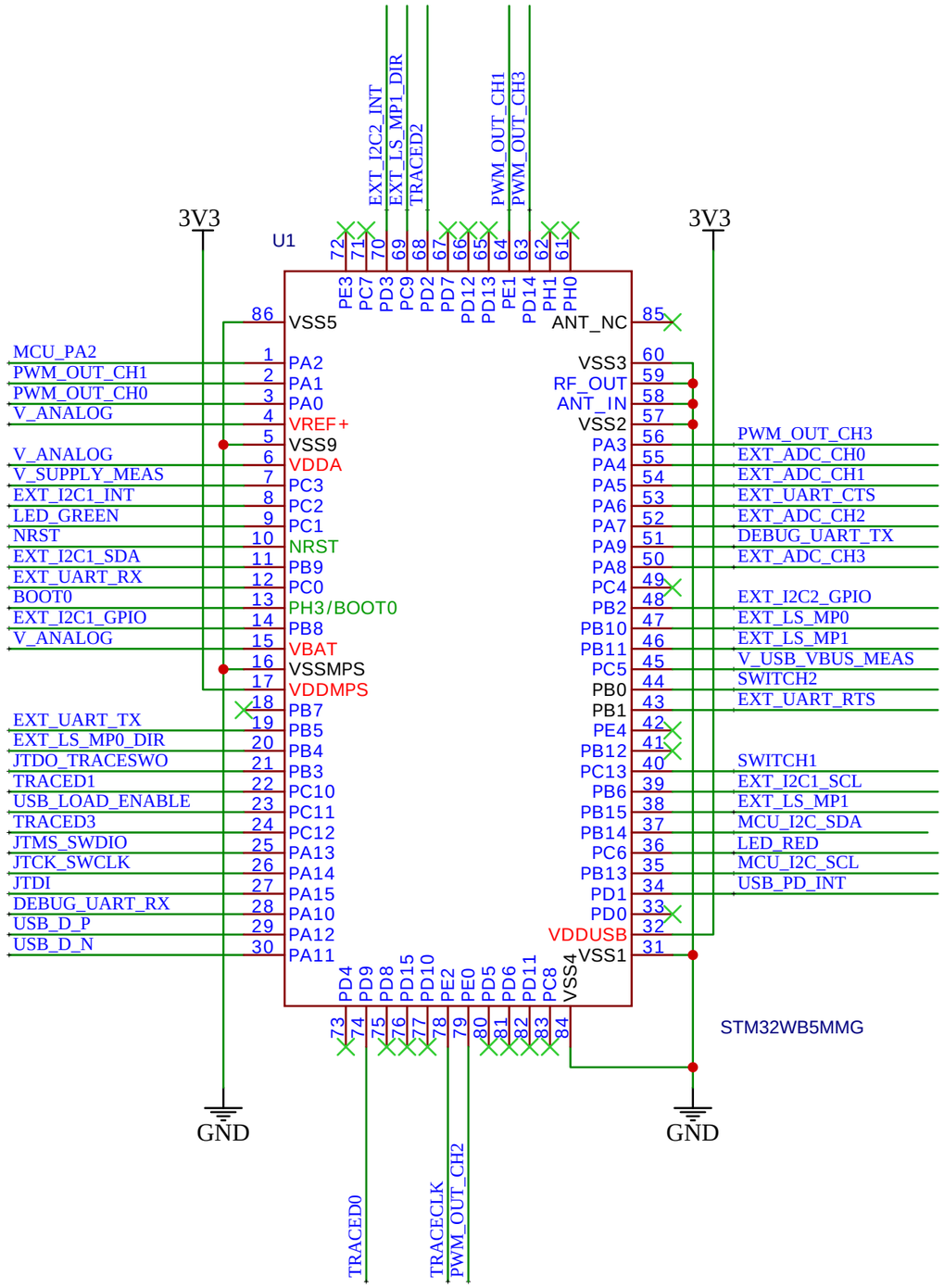
WiPoSense = Wireless Connectivity + Power (USB PD + PWM Outputs) + Sensor Connectivity

Requirements
USB-C PD up to 100W
Alternate power input (5-24V 20A)
Switched power outputs (4ch 5-24V 5A)
BLE/ZigBee connectivity
Total board power dissipation below 2W



TITLE: Overview		REV: 1.0
	Company:	Sheet: 1/8
	Date:	Drawn By: raitraak



EXTI GPIO Interrupt Map

0 - SWITCH2
1 - USB_PD_INT
2 - EXT_I2C1_INT
3 - EXT_I2C2_INT
4
5-9(6) - EXT_UART_CTS
10-15(13) - SWITCH1

Default Peripheral Mapping

DEBUG_UART - USART1
EXT_UART - LPUART1
USB_PD_I2C/EXT_I2C1 - I2C3
EXT_I2C1 - I2C1
EXT_LS_MP - SPI2, LPUART1

PWM outputs with alternates

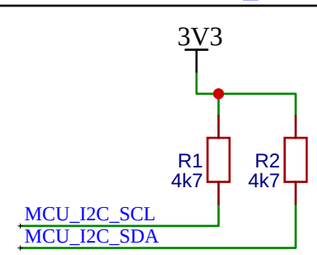
PWM outputs are provided with alternate pins to allow usage with different hardware timers. Note: Unused alternate pin must be configured as input.

PWM_OUT_CH0: PA0
PWM_OUT_CH1: PA1, PE1
PWM_OUT_CH2: PA2, PE0
PWM_OUT_CH3: PA3, PD14

EXT_LS Pins with alternate

EXT_LS_MP0: PB10
EXT_LS_MP1: PB15, PB11

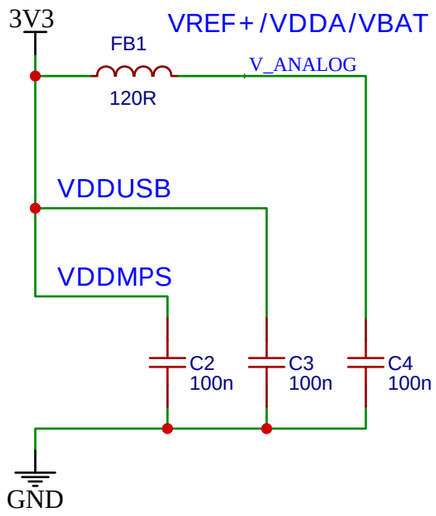
Shared I2C Pins USB_PD and I2C2



TITLE: MCU		REV: 1.0
	Company:	Sheet: 2/8
	Date:	Drawn By: raitraak

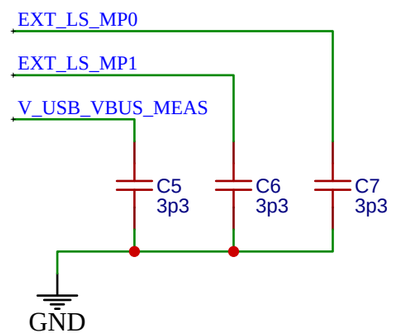
MCU Module Power

Filtering capacitors on power supply pins and components for the SMPS are already integrated into the module. Add only a single capacitor per power domain.



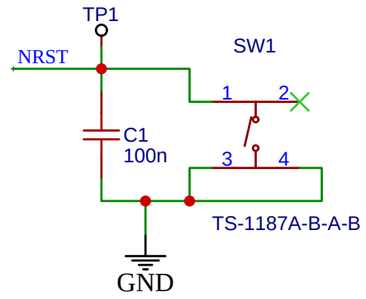
Sensitive Pin Decoupling

Pins PB10, PB11 and PC5 are sensitive and need a decoupling capacitor.



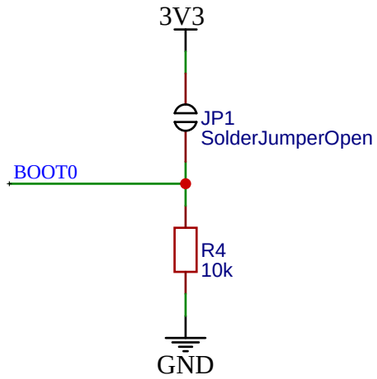
Reset Switch

MCU has internal ~40k pull-up.



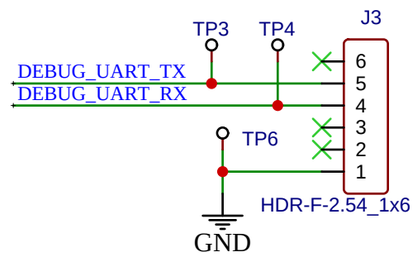
Boot Mode Select

Short to enable ROM bootloader

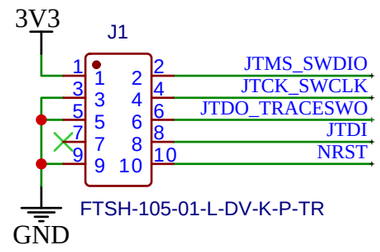


DEBUG_UART - FTDI Connector

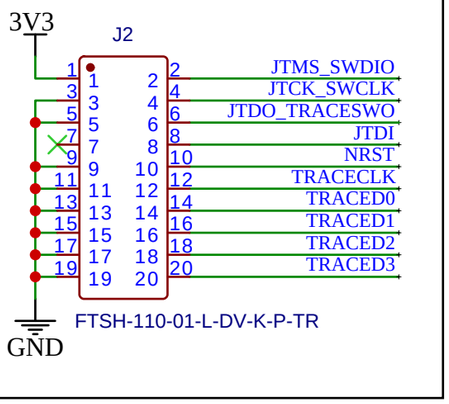
Also used for ROM bootloader communication.



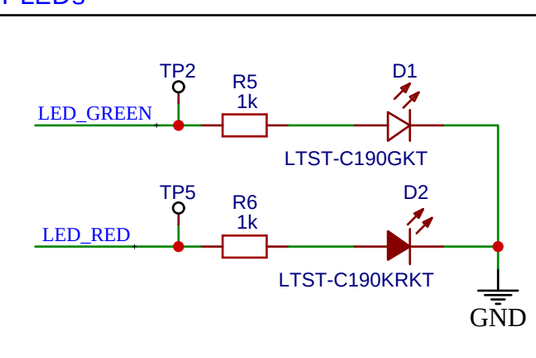
Cortex Debug connector



Cortex Debug+ETM connector

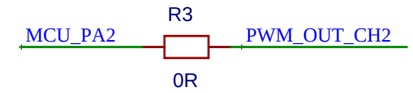


UI LEDs



PA2 Disconnect Option

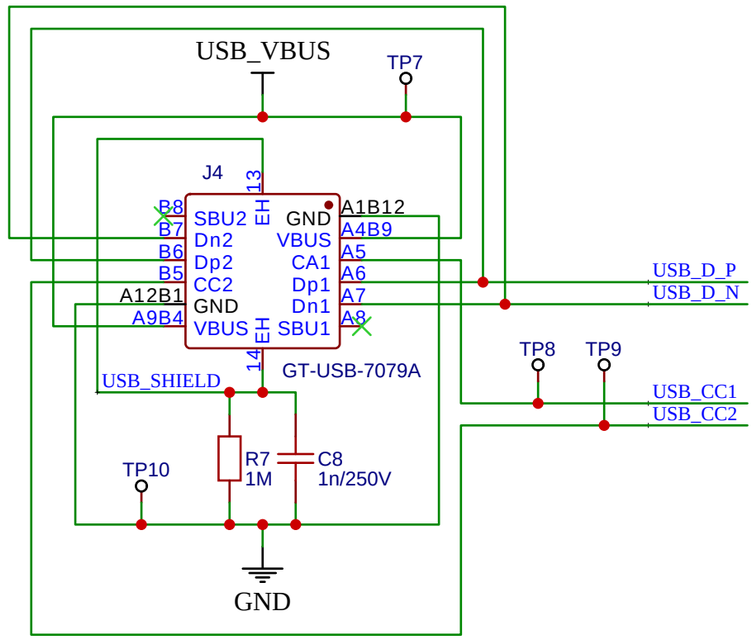
ES0394-Rev14-2.2.16 WLCSP100 PA2 signal transitions disturbs the LSE clock. The PA2 port may not be usable at the same time as LSE is used.



TITLE: MCU Support		REV: 1.0
	Company:	Sheet: 3/8
	Date:	Drawn By: raitraak

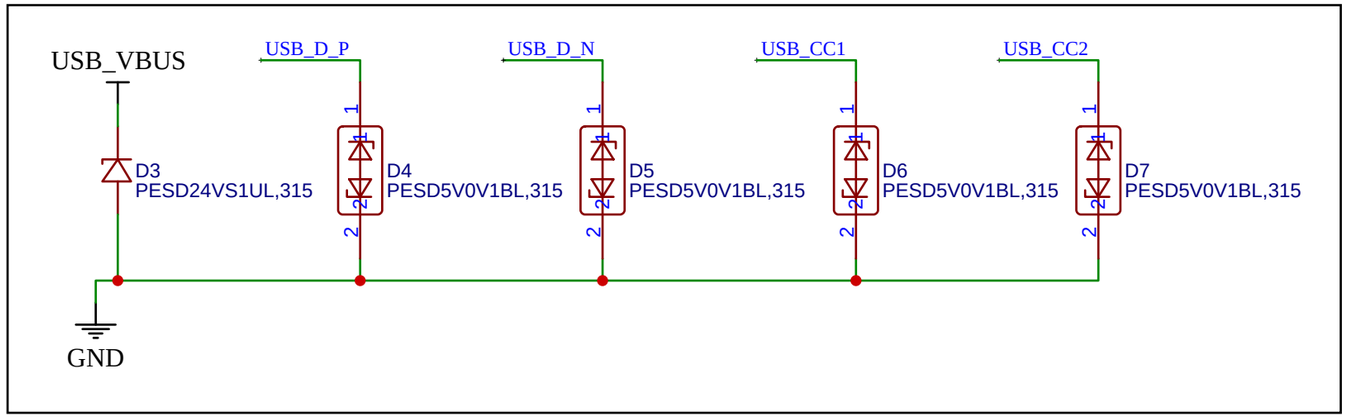
USB-C Connector

Max. 20V/5A

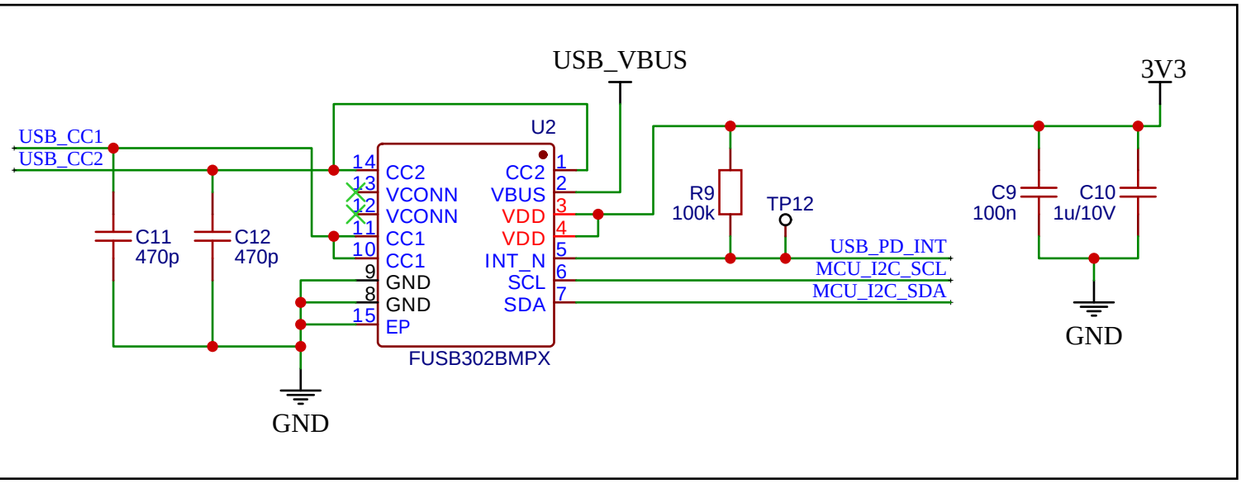


Notes:
Diff Pair 90ohm for data lines.
STM32WB55xx: No external termination series resistors are required on USB_DP (D+) and USB_DM (D-); the matching impedance is already included in the embedded driver.

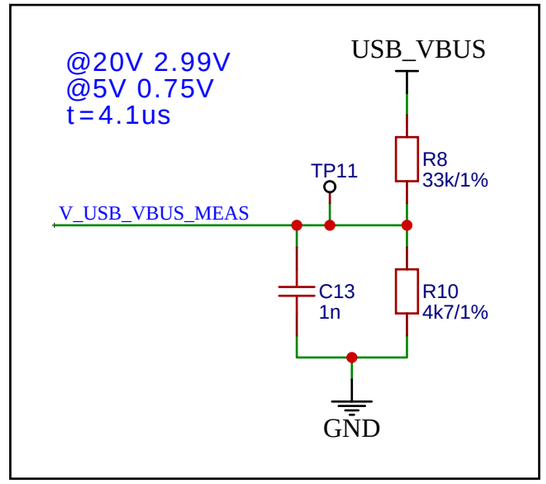
USB ESD Protection



USB PD PHY

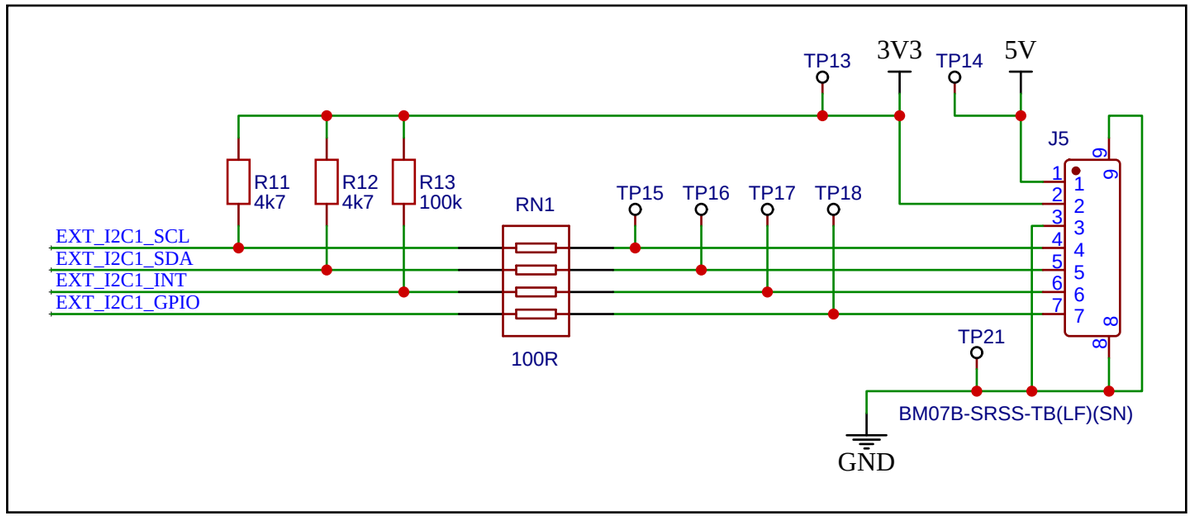


USB VBUS Voltage Measurement

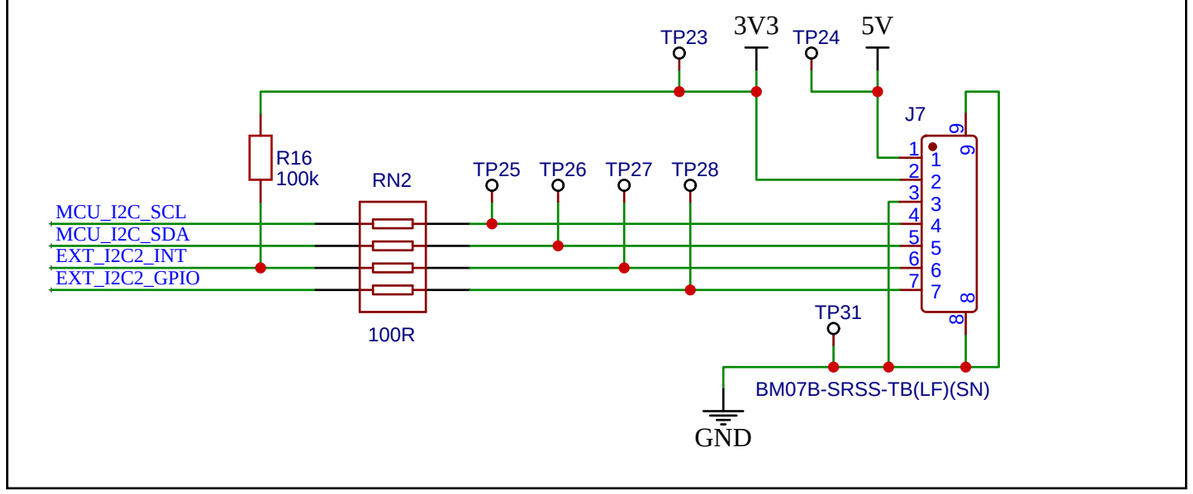


TITLE: USB		REV: 1.0
	Company:	Sheet: 4/8
	Date:	Drawn By: raitraak

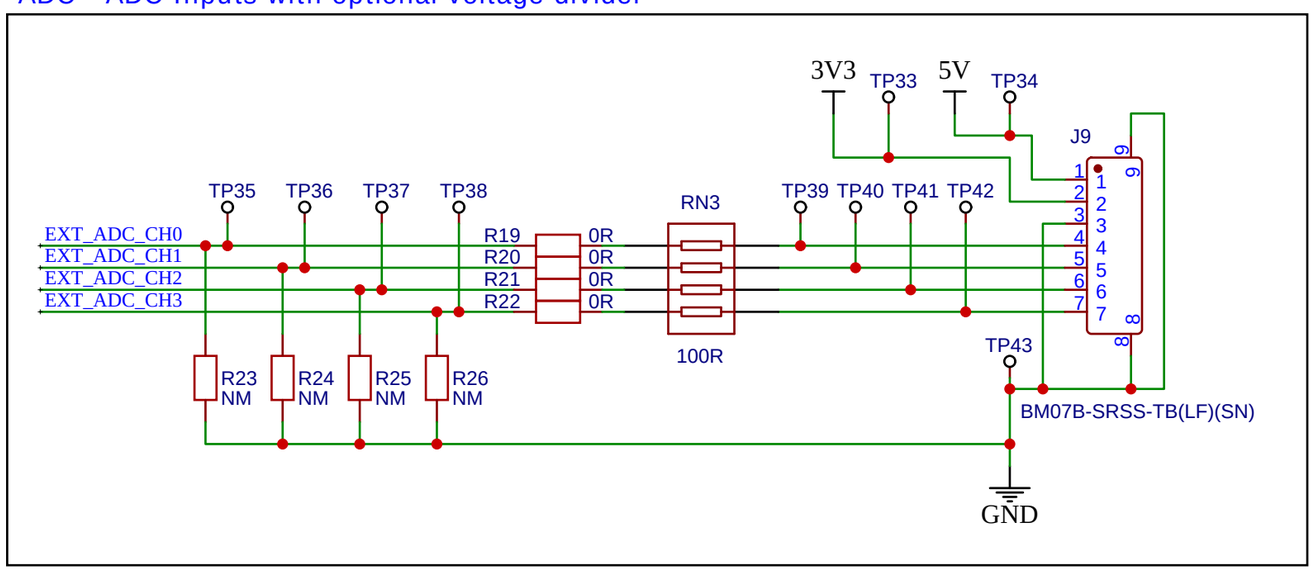
I2C1



I2C2

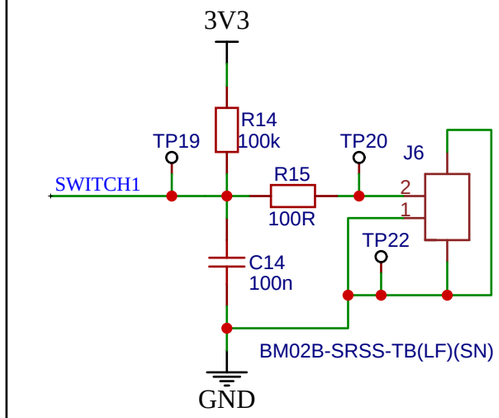


ADC - ADC Inputs with optional voltage divider

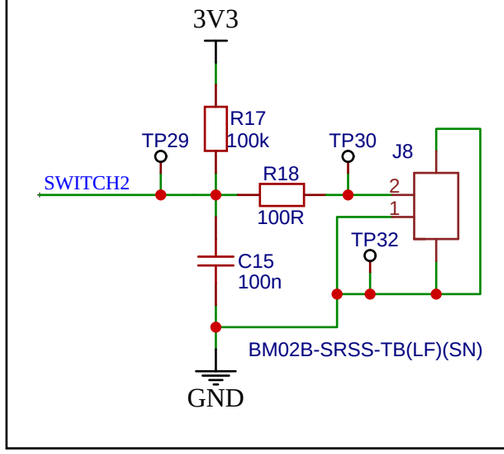


SWITCH1 - Debounced Switch Input

SWITCH1 can be used to wake the CPU from Shutdown (WKUP2)



SWITCH2 - Debounced Switch Input

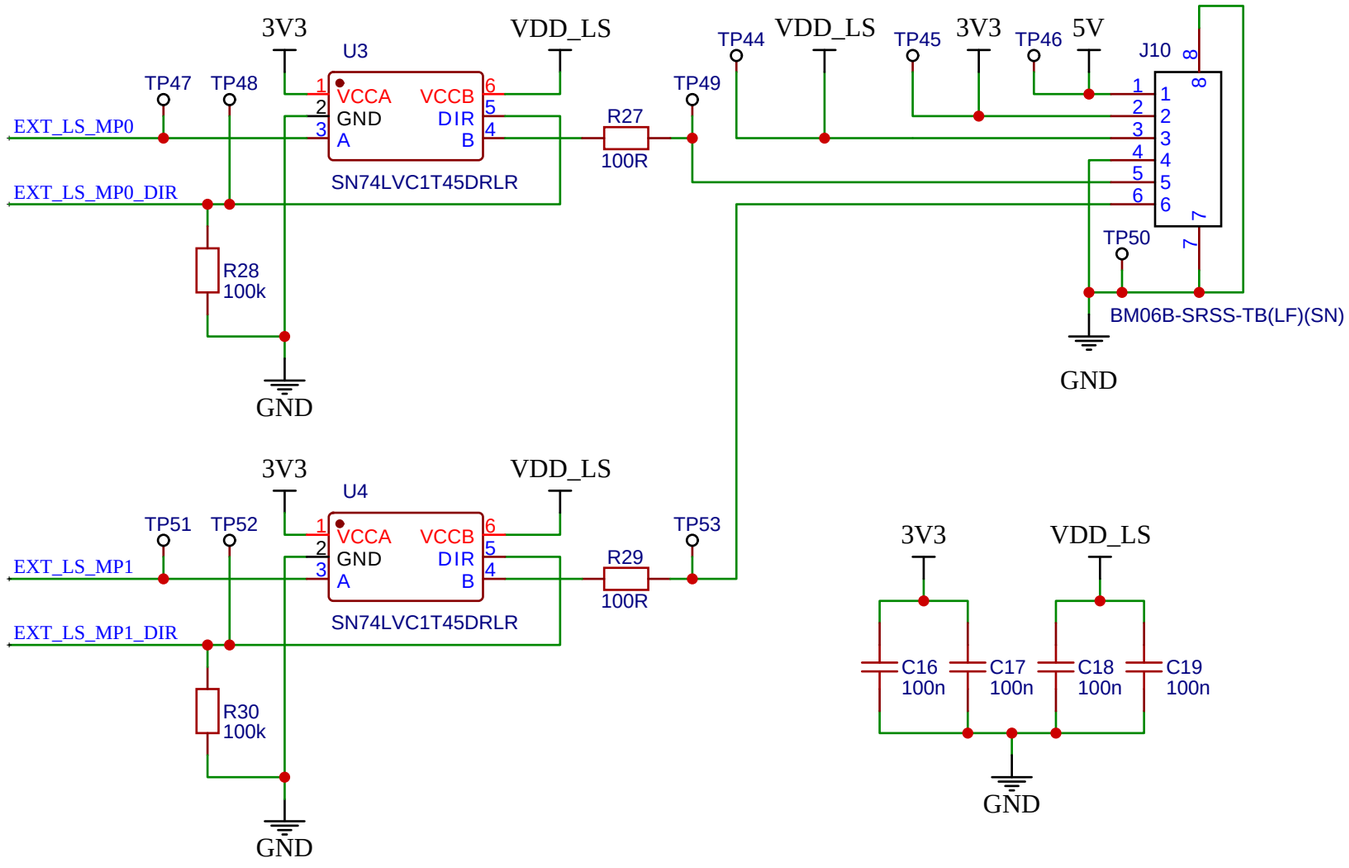


Notes:
All 7-pin extension connectors use the same supply pin layout to prevent any HW failures from connecting to the wrong header.

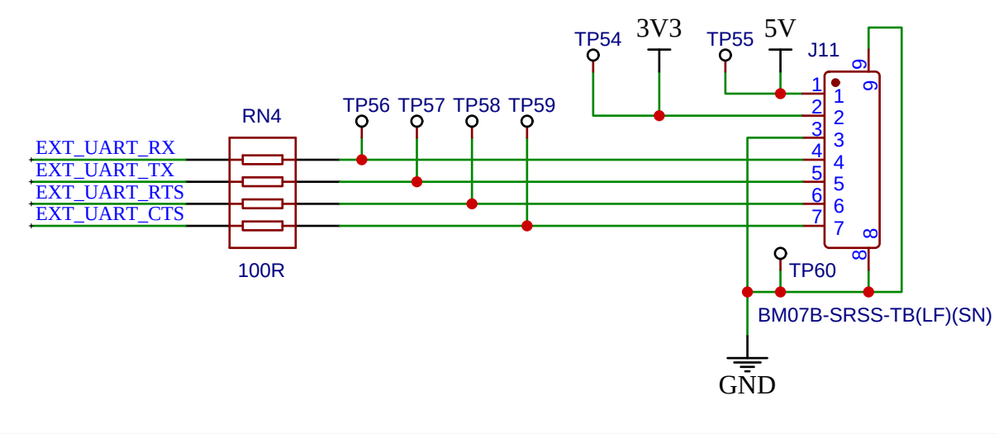
TITLE: Extension 1		REV: 1.0
	Company:	Sheet: 5/8
	Date:	Drawn By: raitraak

LS-MP - Level Shifted Multi Protocol IO

For flexibility the VDD_LS is provided externally. VDD_LS: 1.8-5V.
SN74LVC1T45 has a VCC isolation feature which allows B side to be unpowered.
Use 6-pin connector due to different supply pin layout compared to other connectors.
Direction defaults to input.
DIR High: Output
DIR Low: Input



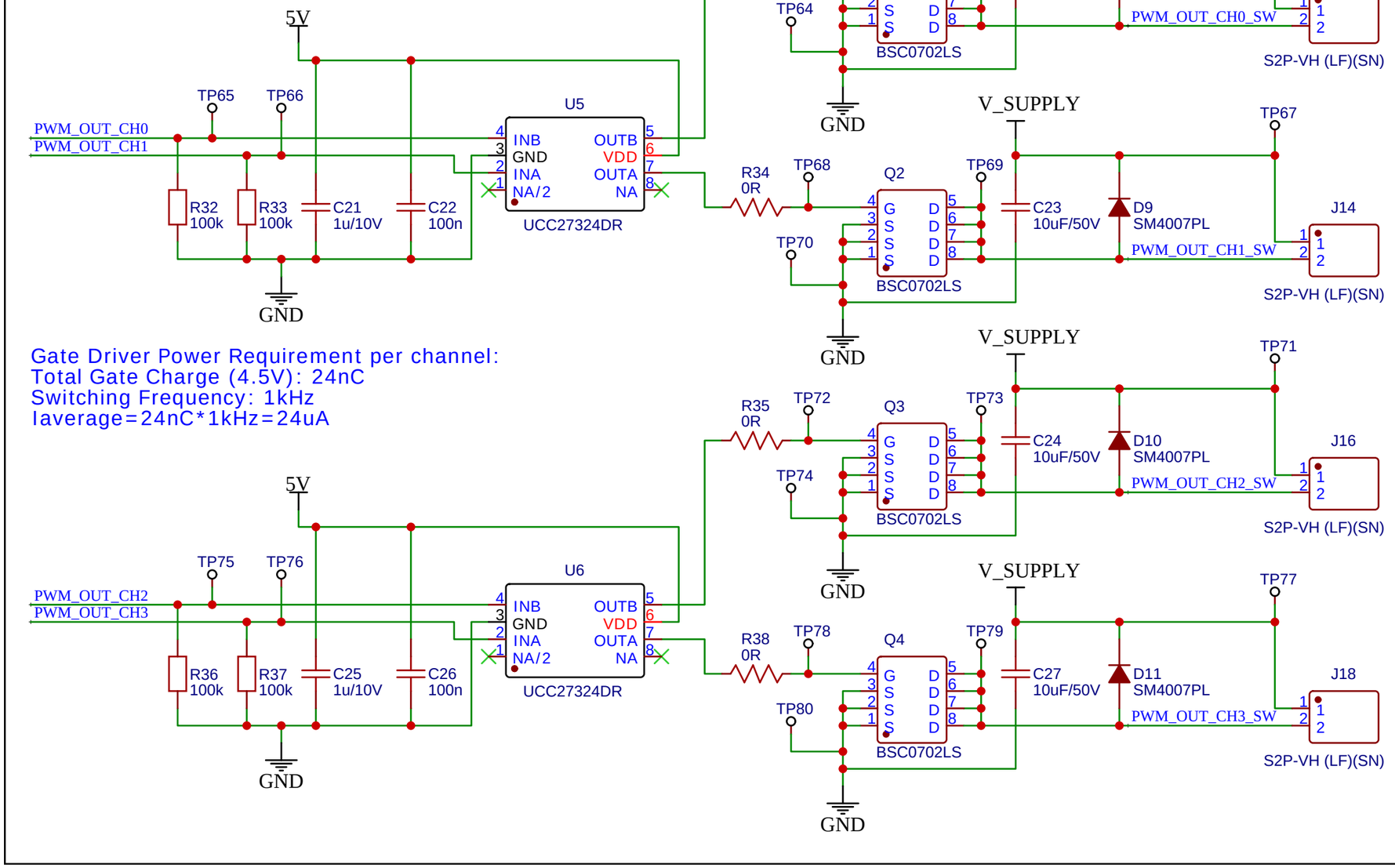
UART



TITLE: Extension 2		REV: 1.0
	Company:	Sheet: 6/8
	Date:	Drawn By: raitraak

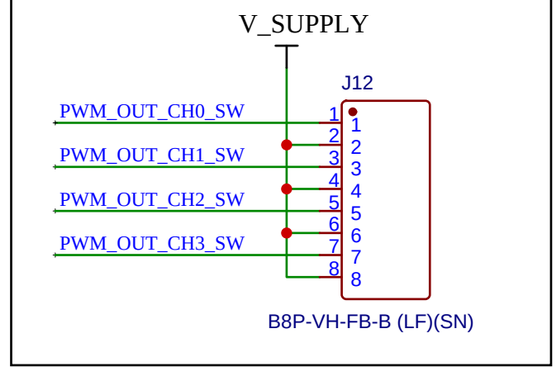
PWM Outputs 5-24V, 5A, 1kHz

Power dissipation of the PWM transistors:
Rds_on_max(4.5VGS) 3.9mOhm.
Per channel: 0.1W.
Total 0.4W.
Switching losses @1kHz are negligible.

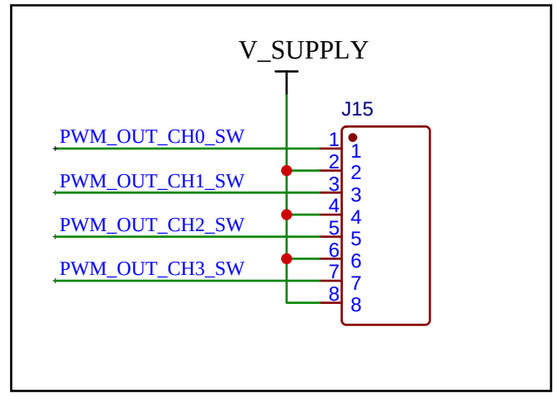


Gate Driver Power Requirement per channel:
Total Gate Charge (4.5V): 24nC
Switching Frequency: 1kHz
Iaverage=24nC*1kHz=24uA

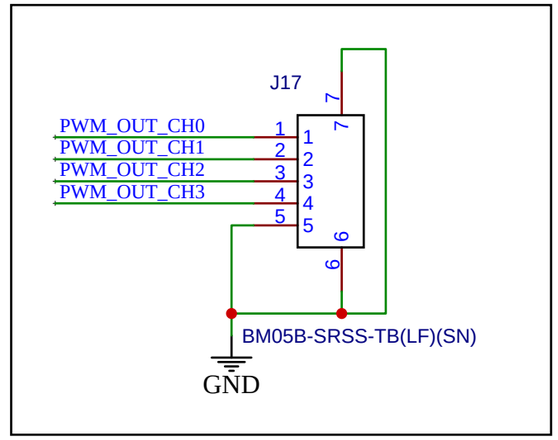
Alternate footprint for 8-way connector



Alternate footprint for solder pads



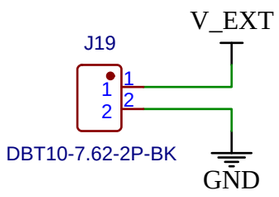
PWM Control Signals



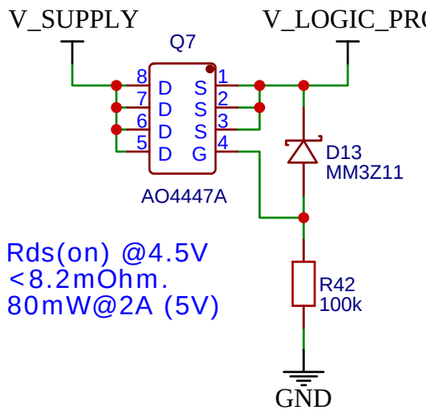
TITLE: PWM		REV: 1.0
	Company:	Sheet: 7/8
	Date:	Drawn By: raitraak

External Power Input 5-24V, 20A

Double sided access screw terminal to allow adding external electrolytic capacitor for PWM supply filtering.

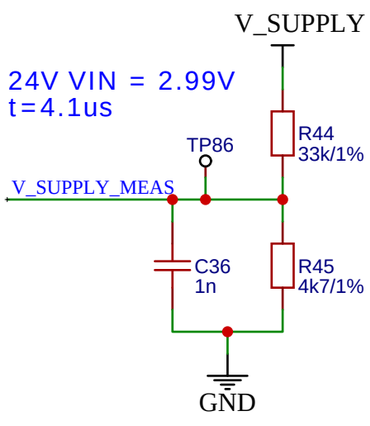


Logic supply reverse voltage protection

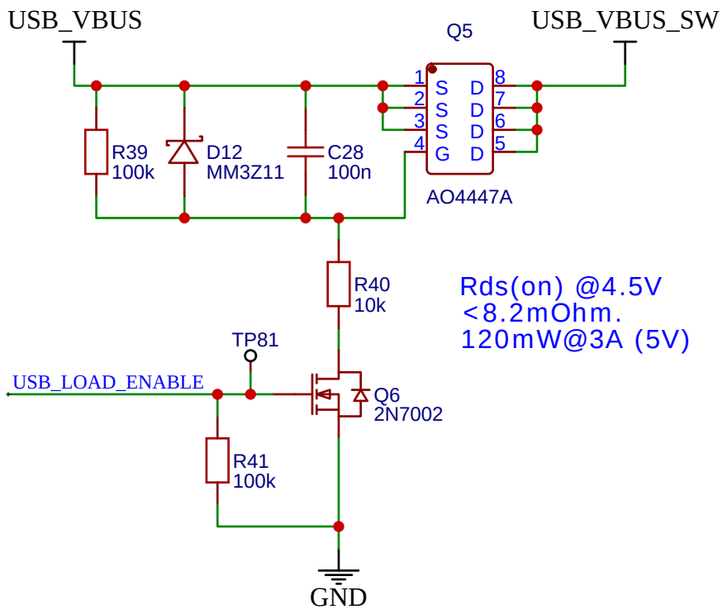


Rds(on) @4.5V
<8.2mOhm.
80mW@2A (5V)

Supply Voltage Measurement



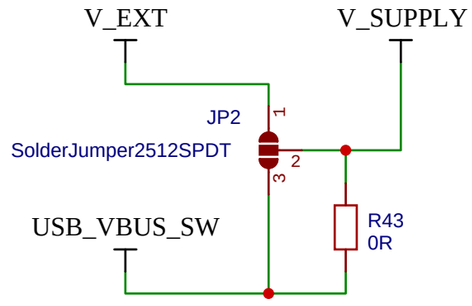
USB Load Switch



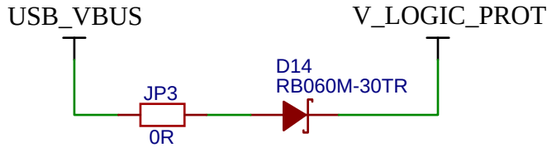
Rds(on) @4.5V
<8.2mOhm.
120mW@3A (5V)

Power Input Selector and VBUS feedthrough

V_EXT/USB_VBUS. Default: USB_VBUS.
SPDT solution with a movable jumper resistor to avoid connecting both supplies.



Electronic solution would add unnecessary complexity, cost and heat dissipation.

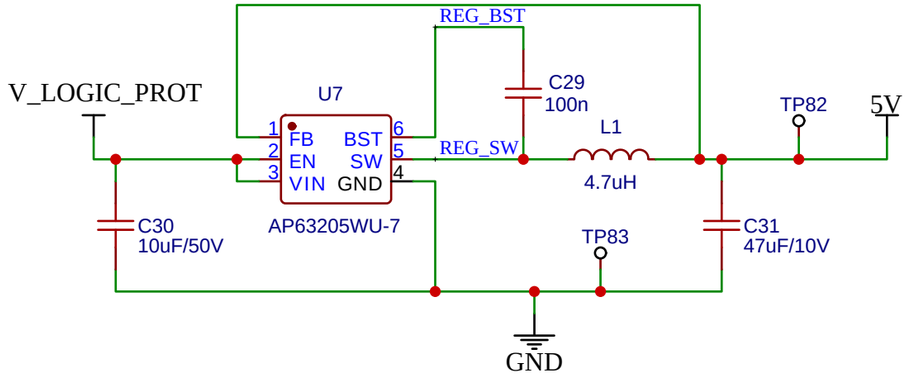


To completely isloate VUSB from V_EXT remove JP3.

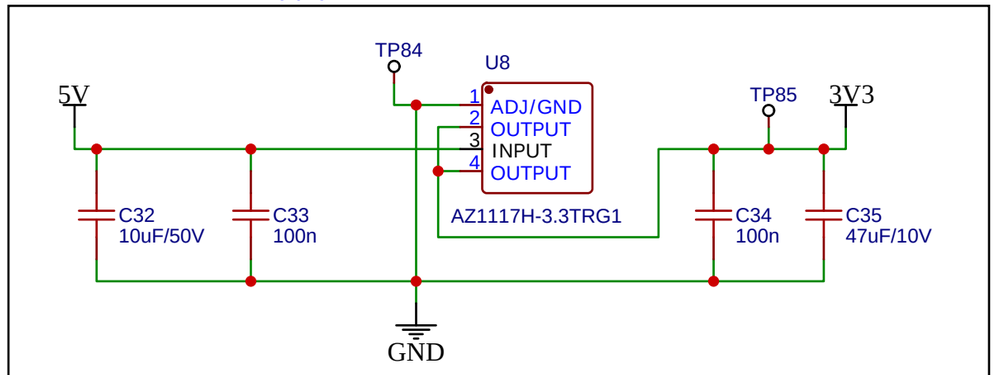
5V/2A Power Supply

Lmin = (Vout * (Vin - Vout)) / (Vin * Ir * fSW) = 3.6uH
Vout = 5V
Vin = 24V
Ir = 2A * 50% = 1A
fSW = 1.1MHz

I_L_Peak = I_Load + Ir / 2 = 2.5A
I_Load=2A
Ir=1A



3V3/0.5A Power Supply



TITLE: Power		REV: 1.0
	Company:	Sheet: 8/8
	Date:	Drawn By: raitraak