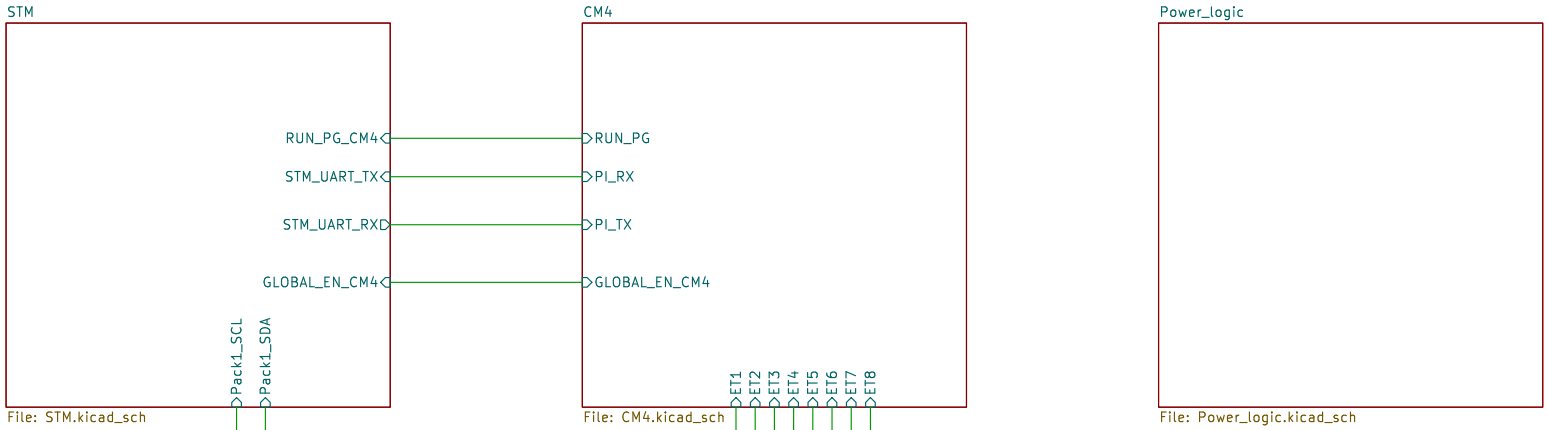


We should consider that we NEVER want the CM4 to power the unpowered STM over the TX pin. Found a neat part for that: https://www.mouser.ch/ProductDetail/Texas-Instruments/SN74LVC1G126DBVR?qs=pajglaoyDUi3T2WgNNfd3w%3D%3D

connections:
Pin 5: VCC -> CM4_3V3

Pin 2: A -> CM4 TX (PLTX)

Pin 4: Y -> STM_UART_RX

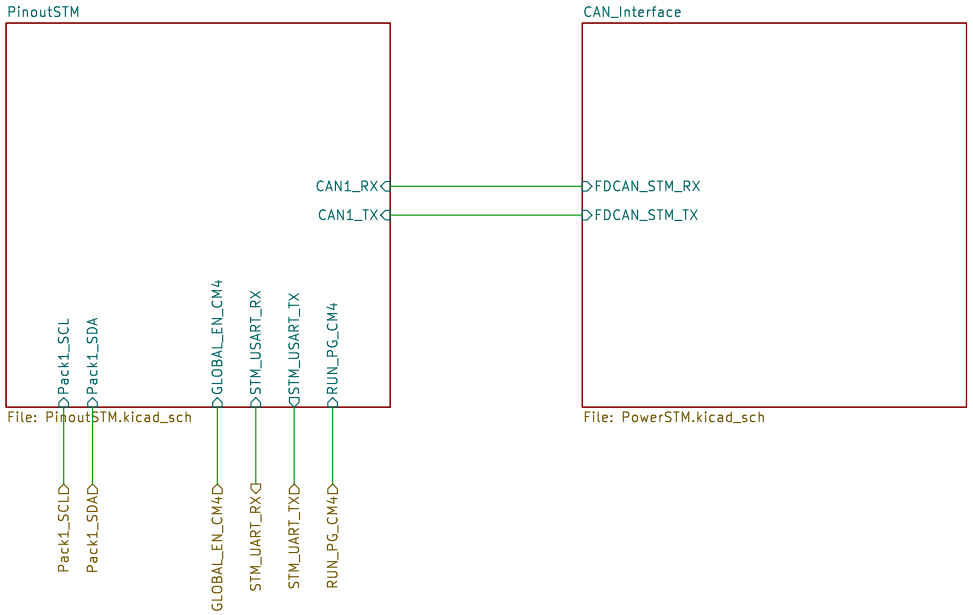
Pin 1: OE -> STM_IN_3.3V

Pin 3: GND

0.1uF decoupling cap VCC-GND

220 Ohm series at Y (to STM). (current limiting)

Title:		
Sheet: /		Rev:
Author:		
Date:	Size: A4	Id: 1/20
File: nautilus_mainboard.kicad_sch		



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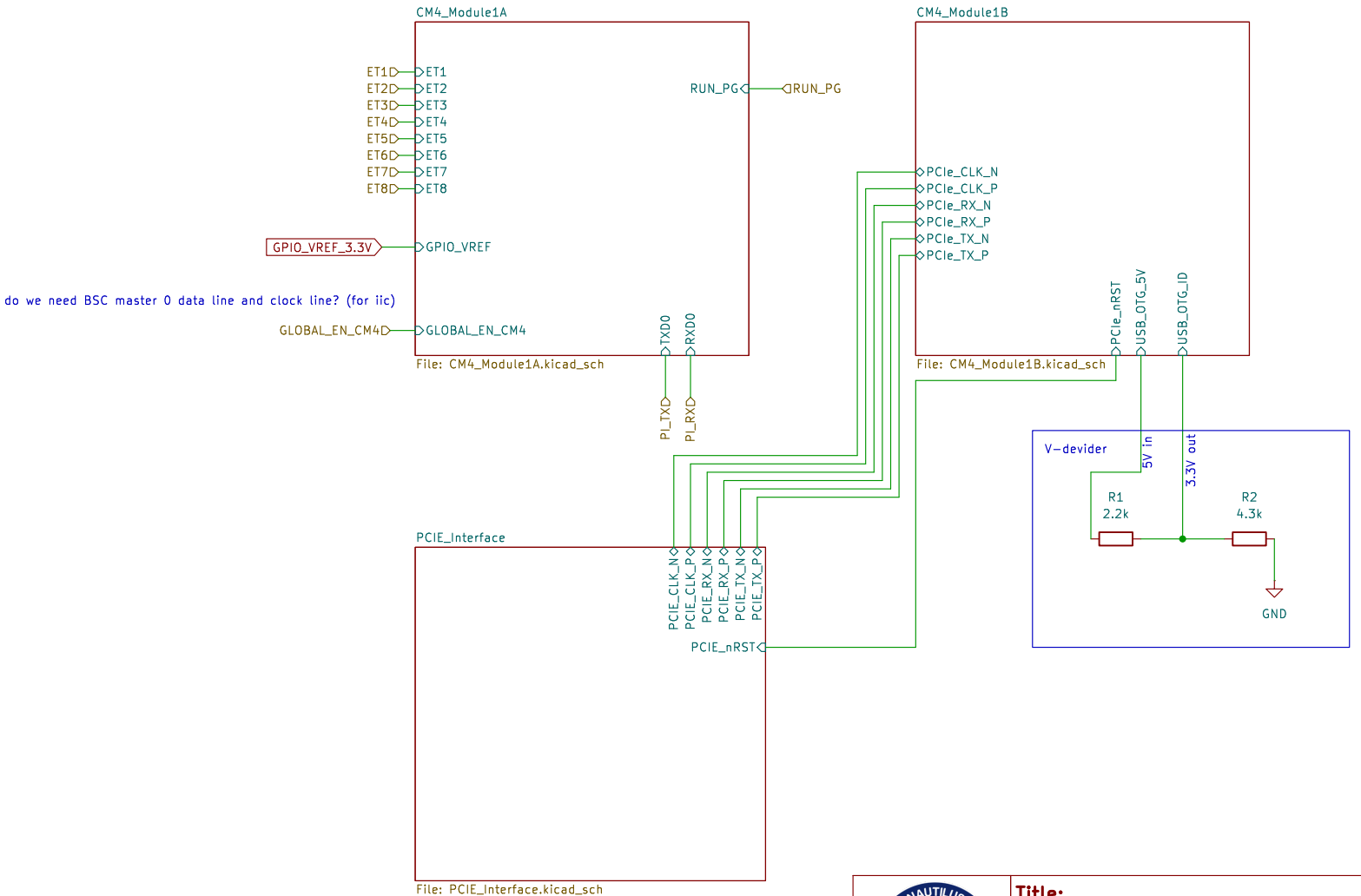
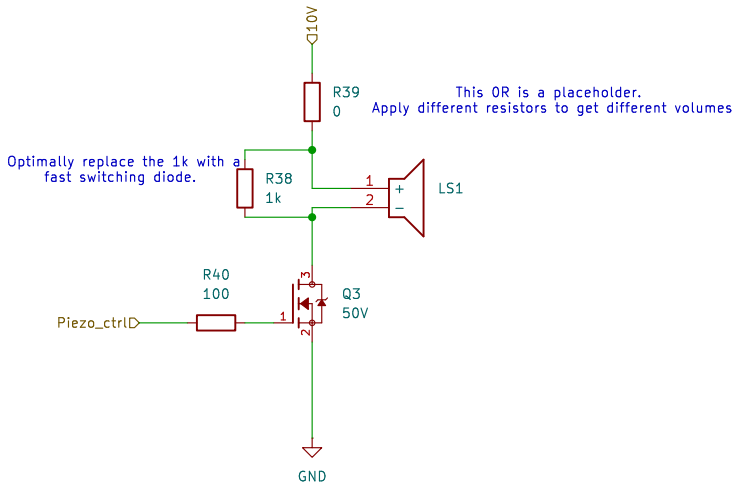
Author:		
Date:	Size: A4	Id: 2/20
File: STM.kicad_sch		



Title:

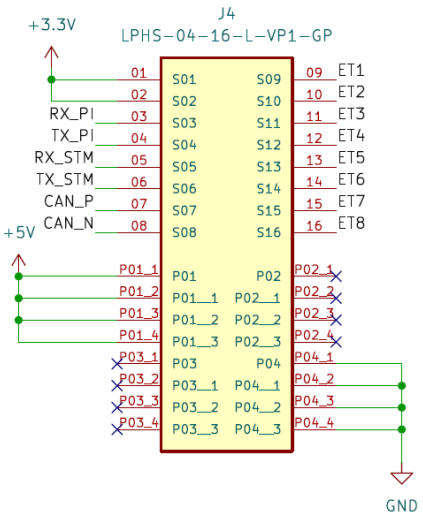
Sheet: /CM4/		Rev:
Author:		
Date:	Size: A4	Id: 3/20
File: CM4.kicad_sch		

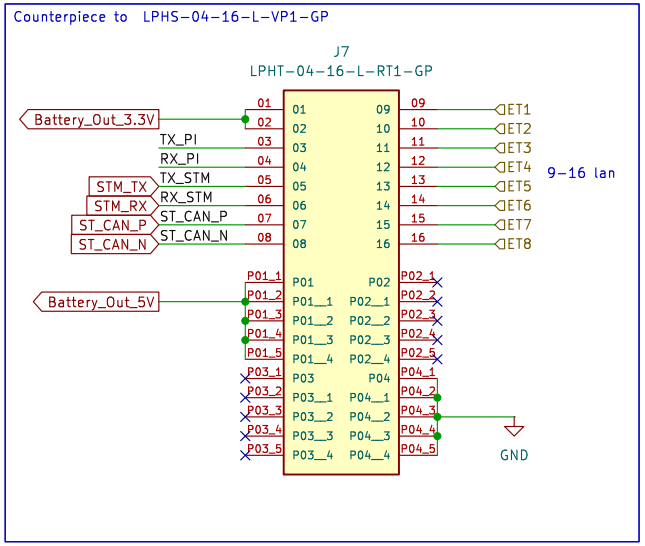
Not in the PCB yet as we dont know if we actually need it.



Title:			
Sheet: /Piezzo/			Rev:
Author:			
Date:	Size: A4		Id: 4/20
File: Piezzo.kicad_sch			

Mainboard

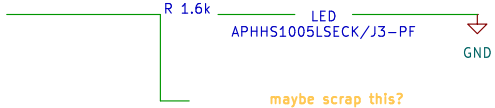




Title:			
Sheet: /LPHS-connector/			Rev:
Author:			
Date:	Size: A4		Id: 14/20
File: LPHT-connector.kicad_sch			

Simple Voltage Setup:

if there is a battery connected,
the LED will light up and you should
not plug in your USB cable/STM connector.

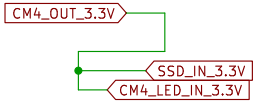


maybe scrap this?

Unconditional Power routes:

Whenever the CM4 runs, also run the LED signals AND the SSD voltage. all "core" tasks tied to the CM4.

If I forgot something please let me know.

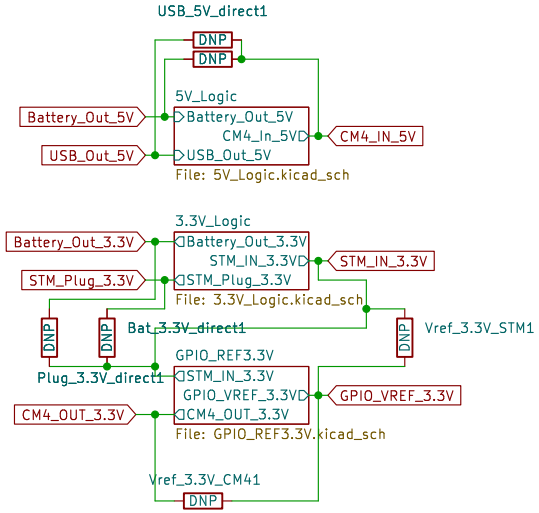


Lan only if plugged in (battery)

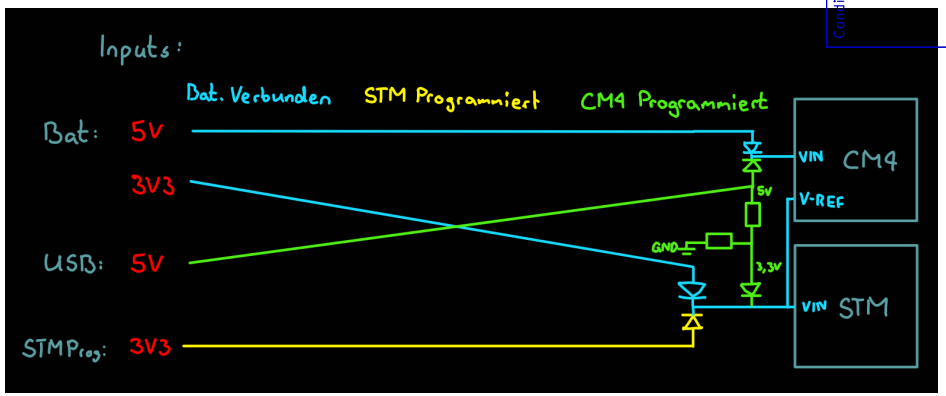
If STM has power, power the gyro and accelerometer

some rules:
USB wont power the STM32.
STM_Plug wont power the CM4
The GPIO_VREF of the CM4 needs to be STM32's 3.3V
The Lan Vin is only powered when running on Battery
Battery preferrably powers everything.

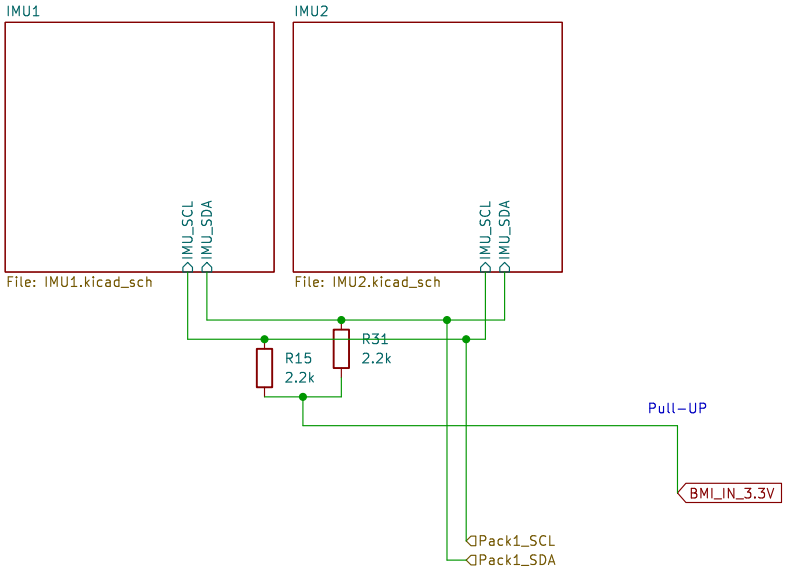
Conditional Power routes:



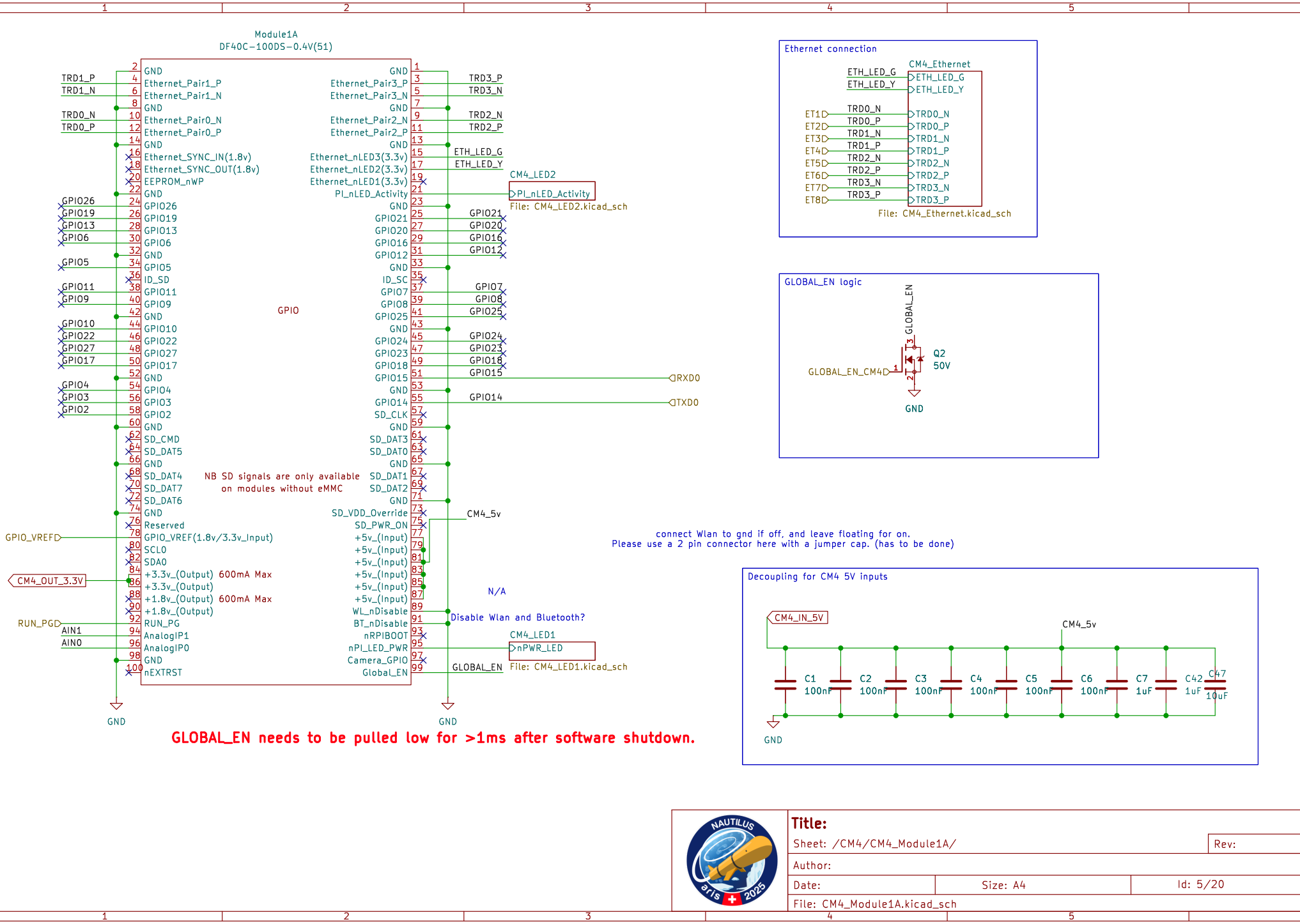
Wont work... diodes are not perfect...



Title:		
Sheet: /Power_logic/		Rev:
Author:		
Date:	Size: A4	Id: 14/20
File: Power_logic.kicad_sch		



Title:		
Sheet: /IMU/		Rev:
Author:		
Date:	Size: A4	Id: 18/20
File: IMU.kicad_sch		


Module1A
DF40C-100DS-0.4V(51)
GPIO
NB SD signals are only available on modules without eMMC
GND
GND
TRD1_P
TRD1_N
TRD0_N
TRD0_P
GPIO26
GPIO19
GPIO13
GPIO6
GPIO5
GPIO11
GPIO9
GPIO10
GPIO22
GPIO27
GPIO17
GPIO4
GPIO3
GPIO2
GPIO_VREF
CM4_OUT_3.3V
RUN_PG
AIN1
AIN0
TRD3_P
TRD3_N
TRD2_N
TRD2_P
ETH_LED_G
ETH_LED_Y
CM4_LED2
PI_nLED_Activity
File: CM4_LED2.kicad_sch
GPIO21
GPIO20
GPIO16
GPIO12
GPIO7
GPIO8
GPIO25
GPIO24
GPIO23
GPIO18
GPIO15
GPIO14
RXD0
TXD0
CM4_5v
N/A
Disable Wlan and Bluetooth?
CM4_LED1
nPWR_LED
File: CM4_LED1.kicad_sch
GLOBAL_EN
Ethernet connection
CM4_Ethernet
ET1
ET2
ET3
ET4
ET5
ET6
ET7
ET8
File: CM4_Ethernet.kicad_sch
GLOBAL_EN logic
GLOBAL_EN_CM4
Q2
50V
connect Wlan to gnd if off, and leave floating for on.
Please use a 2 pin connector here with a jumper cap. (has to be done)
Decoupling for CM4 5V inputs
CM4_IN_5V
C1 100nF
C2 100nF
C3 100nF
C4 100nF
C5 100nF
C6 100nF
C7 1uF
C42 1uF
C47 10uF
GLOBAL_EN needs to be pulled low for >1ms after software shutdown.
Title:
Sheet: /CM4/CM4_Module1A/
Rev:
Author:
Date:
Size: A4
Id: 5/20
File: CM4_Module1A.kicad_sch

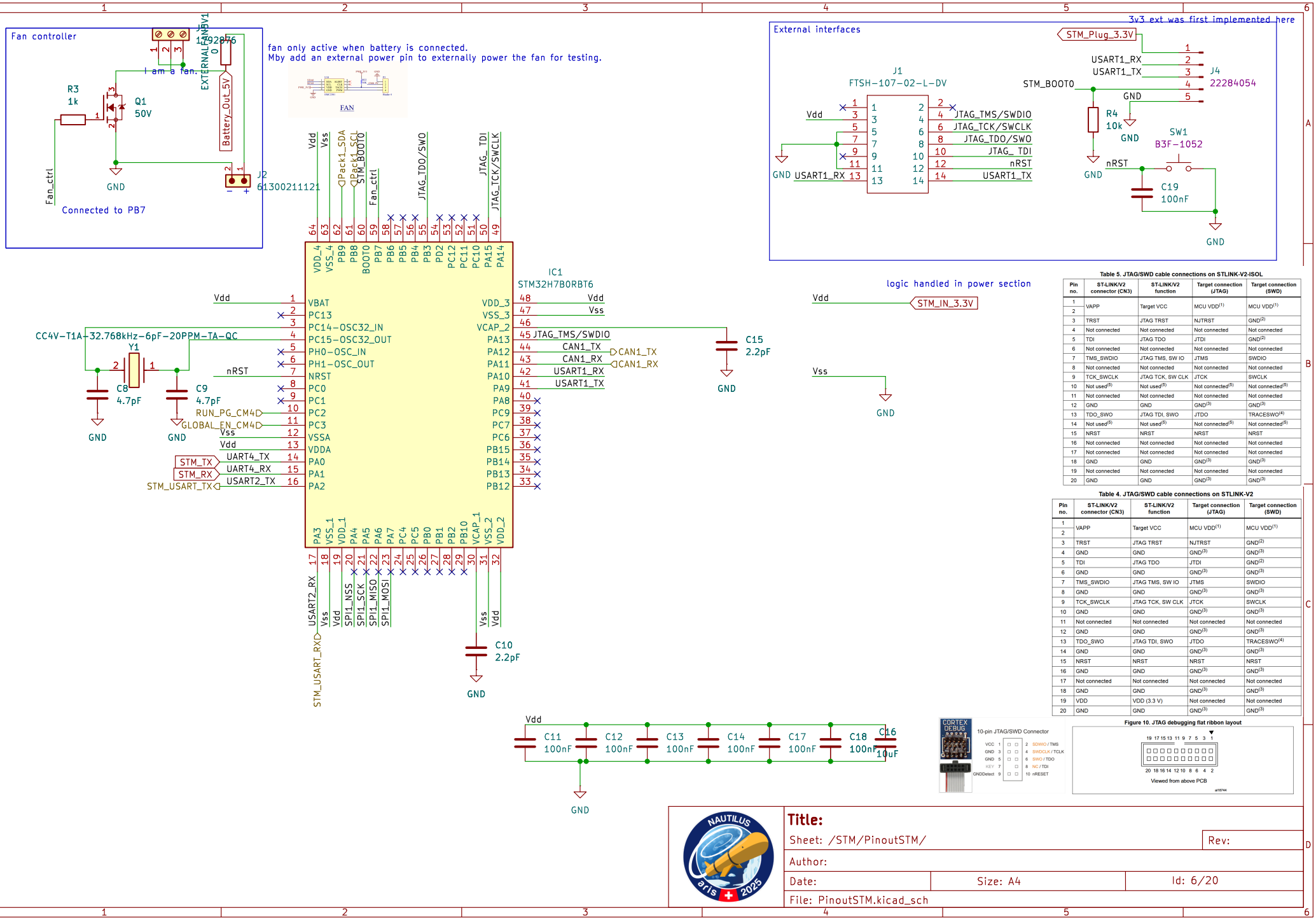


Table 5. JTAG/SWD cable connections on STLINK-V2-ISOL

Pin no.	ST-LINK/V2 connector (CN3)	ST-LINK/V2 function	Target connection (JTAG)	Target connection (SWD)
1	VAPP	Target VCC	MCU VDD[1]	MCU VDD[1]
2				
3	TRST	JTAG TRST	NJTRST	GND[2]
4	Not connected	Not connected	Not connected	Not connected
5	TDI	JTAG TDO	JTDI	GND[2]
6	Not connected	Not connected	Not connected	Not connected
7	TMS_SWDIO	JTAG TMS, SW IO	JTMS	SWDIO
8	Not connected	Not connected	Not connected	Not connected
9	TCK_SWCLK	JTAG TCK, SW CLK	JTCK	SWCLK
10	Not used[5]	Not used[5]	Not connected[5]	Not connected[5]
11	Not connected	Not connected	Not connected	Not connected
12	GND	GND	GND[3]	GND[3]
13	TDO_SWO	JTAG TDI, SWO	JTDO	TRACESWO[4]
14	Not used[5]	Not used[5]	Not connected[5]	Not connected[5]
15	NRST	NRST	NRST	NRST
16	Not connected	Not connected	Not connected	Not connected
17	Not connected	Not connected	Not connected	Not connected
18	GND	GND	GND[3]	GND[3]
19	Not connected	Not connected	Not connected	Not connected
20	GND	GND	GND[3]	GND[3]

Table 4. JTAG/SWD cable connections on STLINK-V2

Pin no.	ST-LINK/V2 connector (CN3)	ST-LINK/V2 function	Target connection (JTAG)	Target connection (SWD)
1				
2	VAPP	Target VCC	MCU VDD[1]	MCU VDD[1]
3	TRST	JTAG TRST	NJTRST	GND[2]
4	GND	GND	GND[3]	GND[3]
5	TDI	JTAG TDO	JTDI	GND[2]
6	GND	GND	GND[3]	GND[3]
7	TMS_SWDIO	JTAG TMS, SW IO	JTMS	SWDIO
8	GND	GND	GND[3]	GND[3]
9	TCK_SWCLK	JTAG TCK, SW CLK	JTCK	SWCLK
10	GND	GND	GND[3]	GND[3]
11	Not connected	Not connected	Not connected	Not connected
12	GND	GND	GND[3]	GND[3]
13	TDO_SWO	JTAG TDI, SWO	JTDO	TRACESWO[4]
14	GND	GND	GND[3]	GND[3]
15	NRST	NRST	NRST	NRST
16	GND	GND	GND[3]	GND[3]
17	Not connected	Not connected	Not connected	Not connected
18	GND	GND	GND[3]	GND[3]
19	VDD	VDD (3.3 V)	Not connected	Not connected
20	GND	GND	GND[3]	GND[3]

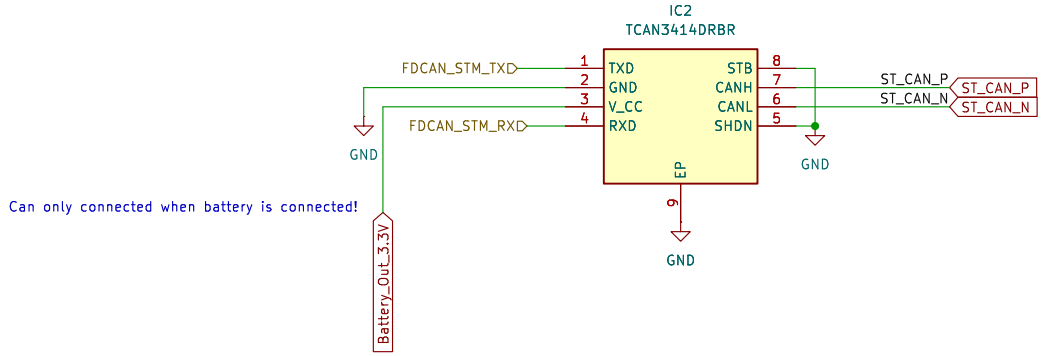
Title:

Sheet: /STM/PinoutSTM/ | Rev:

Author:

Date: | Size: A4 | Id: 6/20

File: PinoutSTM.kicad_sch



Title:

Sheet: /STM/CAN_Interface/		Rev:
Author:		
Date:	Size: A4	Id: 7/20
File: PowerSTM.kicad_sch		

Module1B
DF40C-100DS-0.4V(51)

Can be kept floating. if no usb is connected

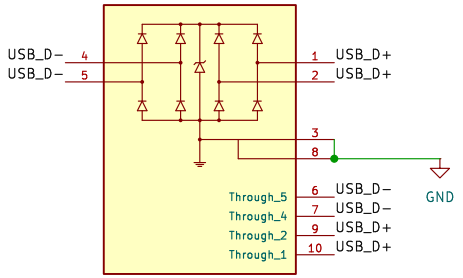
maybe RX and TX need to be switched

High Speed Serial

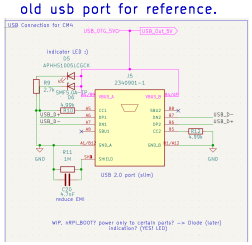
	102	PCIe_CLK_nREQ	USB_OTG_ID	101	USB_OTG_ID
	104	Reserved	USB2_N	103	USB_D-
	106	Reserved	USB2_P	105	USB_D+
	108	GND	GND	107	
PCIe_CLK_P	110	PCIe_CLK_P	PCIe_nRST	109	PCIe_nRST
PCIe_CLK_N	112	PCIe_CLK_N	VDAC_COMP	111	
	114	GND	GND	113	
PCIe_RX_P	116	PCIe_RX_P	CAM1_D0_N	115	
PCIe_RX_N	118	PCIe_RX_N	CAM1_D0_P	117	
	120	GND	GND	119	
PCIe_TX_P	122	PCIe_TX_P	CAM1_D1_N	121	
PCIe_TX_N	124	PCIe_TX_N	CAM1_D1_P	123	
	126	GND	GND	125	
	128	CAM0_D0_N	CAM1_C_N	127	
	130	CAM0_D0_P	CAM1_C_P	129	
	132	GND	GND	131	
	134	CAM0_D1_N	CAM1_D2_N	133	
	136	CAM0_D1_P	CAM1_D2_P	135	
	138	GND	GND	137	
	140	CAM0_C_N	CAM1_D3_N	139	
	142	CAM0_C_P	CAM1_D3_P	141	
	144	GND	HDMI1_HOTPLUG	143	
	146	HDMI1_TX2_P	HDMI1_SDA	145	
	148	HDMI1_TX2_N	HDMI1_SCL	147	
	150	GND	HDMI1_CEC	149	
	152	HDMI1_TX1_P	HDMI0_CEC	151	
	154	HDMI1_TX1_N	HDMI0_HOTPLUG	153	
	156	GND	GND	155	
	158	HDMI1_TX0_P	DSI0_D0_N	157	
	160	HDMI1_TX0_N	DSI0_D0_P	159	
	162	GND	GND	161	
	164	HDMI1_CLK_P	DSI0_D1_N	163	
	166	HDMI1_CLK_N	DSI0_D1_P	165	
	168	GND	GND	167	
	170	HDMI0_TX2_P	DSI0_C_N	169	
	172	HDMI0_TX2_N	DSI0_C_P	171	
	174	GND	GND	173	
	176	HDMI0_TX1_P	DSI1_D0_N	175	
	178	HDMI0_TX1_N	DSI1_D0_P	177	
	180	GND	GND	179	
	182	HDMI0_TX0_P	DSI1_D1_N	181	
	184	HDMI0_TX0_N	DSI1_D1_P	183	
	186	GND	GND	185	
	188	HDMI0_CLK_P	DSI1_C_N	187	
	190	HDMI0_CLK_N	DSI1_C_P	189	
	192	GND	GND	191	
	194	DSI1_D3_N	DSI1_D2_N	193	
	196	DSI1_D3_P	DSI1_D2_P	195	
	198	GND	GND	197	
	200	HDMI0_SCL	HDMI0_SDA	199	

GND GND

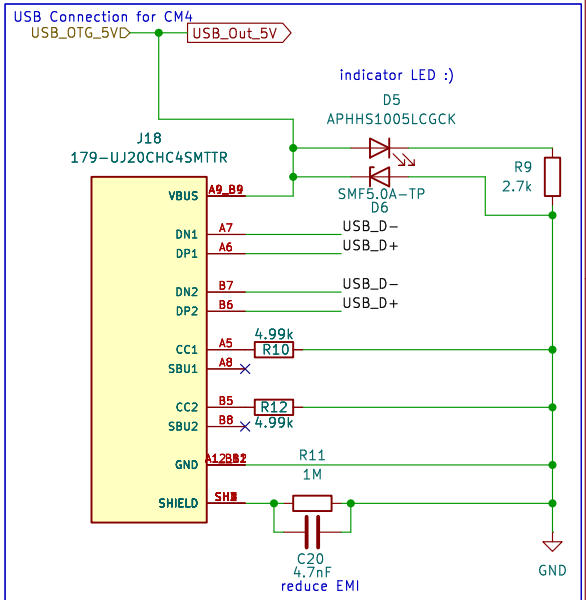
ESD/EMP protection for the USB
Super important to not differ lengths or curve a lot with D+ and D-.
Also should have same hole counts (vias) and same length.
TPD4EUSB30DQAR3



old usb port for reference.

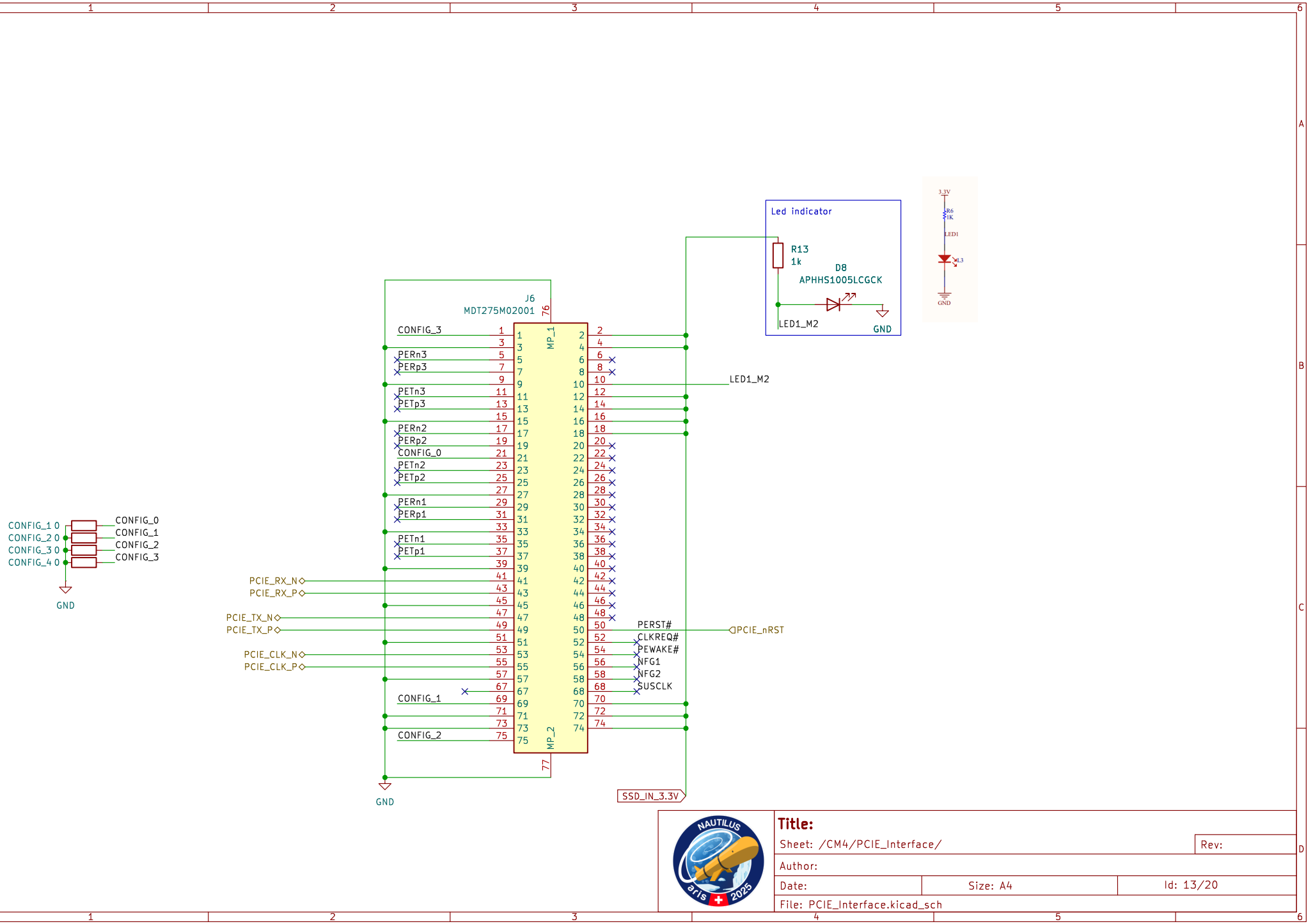


USB Connection for CM4

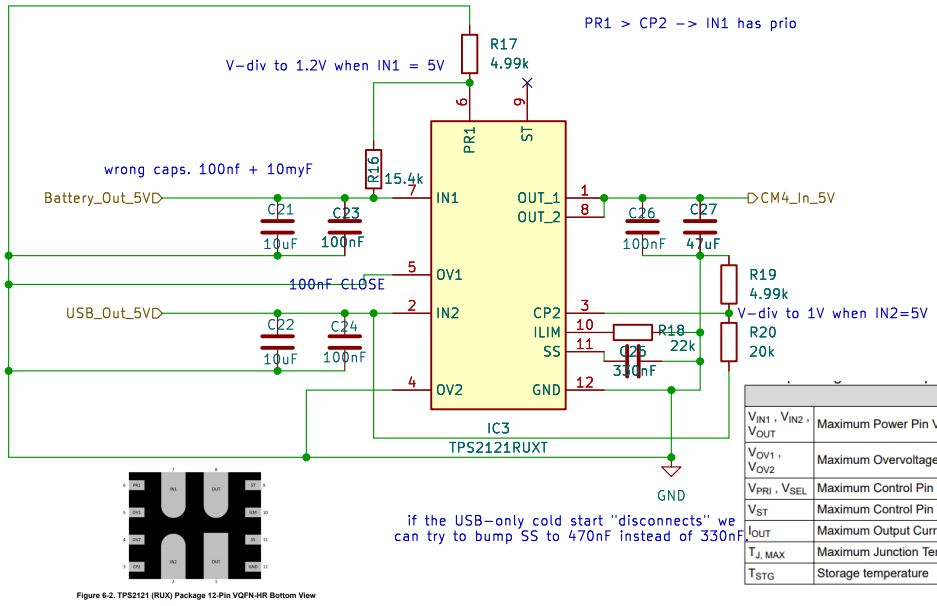


WIP, nRPI_BOOT? power only to certain parts? -> Diode (later)
indication? (YES! LED)

Title:		
Sheet: /CM4/CM4_Module1B/		Rev:
Author:		
Date:	Size: A4	Id: 11/20
File: CM4_Module1B.kicad_sch		


Led indicator
R13
1k
D8
APHHS1005LCGCK
LED1_M2
GND
J6
MDT275M02001
MP_1
MP_2
CONFIG_3
PERn3
PERp3
PETn3
PETp3
PERn2
PERp2
CONFIG_0
PETn2
PETp2
PERn1
PERp1
PETn1
PETp1
CONFIG_1
CONFIG_2
PCIE_RX_N
PCIE_RX_P
PCIE_TX_N
PCIE_TX_P
PCIE_CLK_N
PCIE_CLK_P
PERST#
CLKREQ#
PEWAKE#
NFG1
NFG2
SUSCLK
PCIE_nRST
SSD_IN_3.3V
CONFIG_1 0
CONFIG_2 0
CONFIG_3 0
CONFIG_4 0
CONFIG_0
CONFIG_1
CONFIG_2
CONFIG_3
GND
Title:
Sheet: /CM4/PCIE_Interface/
Rev:
Author:
Date:
Size: A4
Id: 13/20
File: PCIE_Interface.kicad_sch

for questions about wiring etc please consult the datasheet...
https://www.ti.com/lit/ds/symlink/tps2120.pdf?ts=1761678178328



		Pins	MIN	MAX	UNIT
V_{IN1} , V_{IN2} , V_{OUT}	Maximum Power Pin Voltage	IN1, IN2, OUT	-0.3	24	V
V_{OV1} , V_{OV2}	Maximum Overvoltage Pin Voltage	OV1, OV2	-0.3	6	V
V_{PRI} , V_{SEL}	Maximum Control Pin Voltage	PRI, SEL	-0.3	6	V
V_{ST}	Maximum Control Pin Voltage	ST	-0.3	6	V
I_{OUT}	Maximum Output Current	OUT	Internally Limited		
$T_{J, MAX}$	Maximum Junction Temperature		Internally Limited		
T_{STG}	Storage temperature		-65	150	°C

Figure 6-2. TPS2121 (RUX) Package 12-Pin VQFN-HR Bottom View

Pin Functions

PIN			I/O	DESCRIPTION
NAME	TPS2120 WCSP	TPS2121 VQFN-HR		
IN1	B1, B2, C1	7	I	Power Input for Source 1
IN2	B3, B4, C4	2	I	Power Input for Source 2
OUT	C2, C3, D1, D2, D3, D4	1, 8	I	Power Output
ST	E1	9	O	Status output indicating which channel is selected. Connect to GND if not required.
ILIM	E2	10	O	Output Current Limiting for both channels.
SS	E3	11	O	Adjusts Input Setting Delay Time and Output Soft Start Time
GND	E4	12	—	Device Ground
PR1	A1	6	I	Enables Priority Operation. Connect to IN1 to set switchover voltage. Connect to GND if not required.
OV1	A2	5	I	Active Low Enable Supervisor for IN1 Overvoltage Protection. Connect to GND if not required.
OV2	A3	4	I	Active Low Enable Supervisor for IN2 Overvoltage Protection. Connect to GND if not required.
SEL	A4	—	I	Active low Enable for IN1. Allows GPIO to override priority operation and manually select IN2. TPS2120 only.
CP2	—	3	I	Enables Comparator Operation and is compared to PR1 to set switchover voltage. Connect to GND if not required. TPS2121 only.

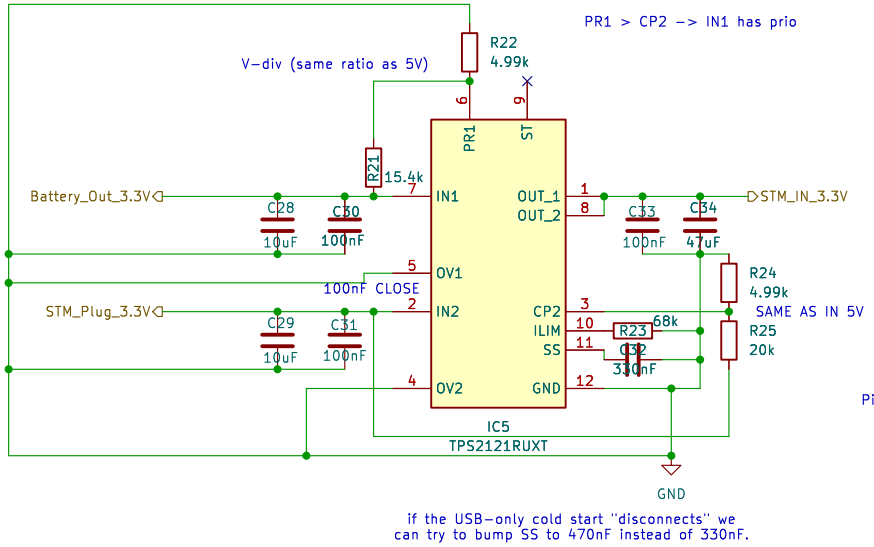
Title:

Sheet: /Power_logic/5V_Logic/ | Rev:

Author:

Date: | Size: A4 | Id: 15/20

File: 5V_Logic.kicad_sch



Pin 10: 68k leads to about 1.72A (should be enough for STM)

[R] = [kOhm]	22 kΩ → ~4.55 A
65.2 / R^0.861	39 kΩ → ~2.78 A
	50 kΩ → ~2.25 A
	56 kΩ → ~2.04 A
	68 kΩ → ~1.72 A
	100 kΩ → ~1.24 A

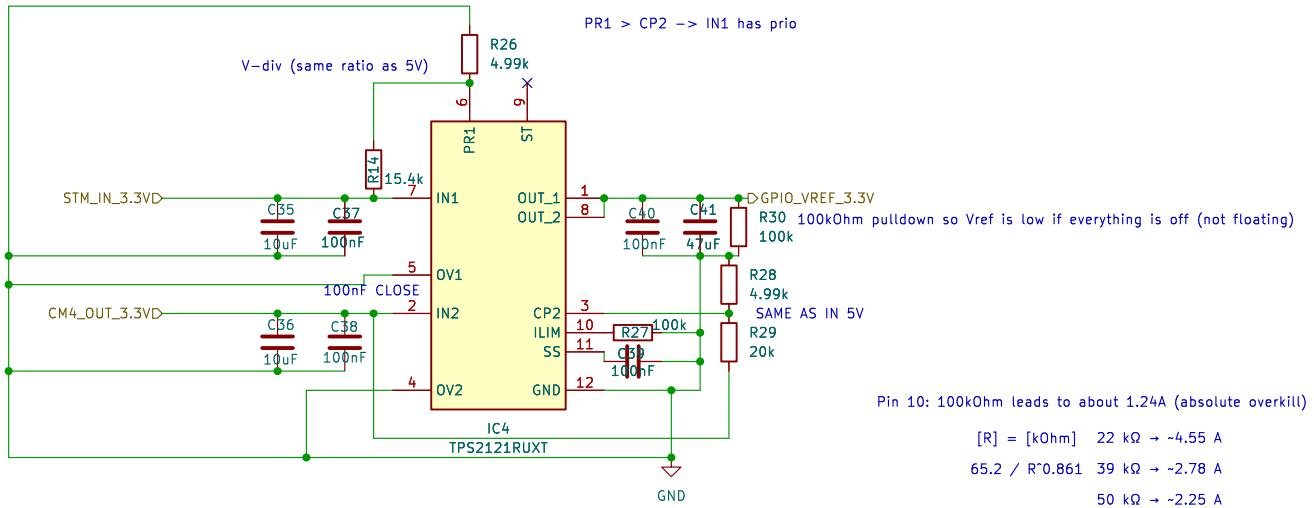
Title:

Sheet: /Power_logic/3.3V_Logic/ | Rev:

Author:

Date: | Size: A4 | Id: 16/20

File: 3.3V_Logic.kicad_sch

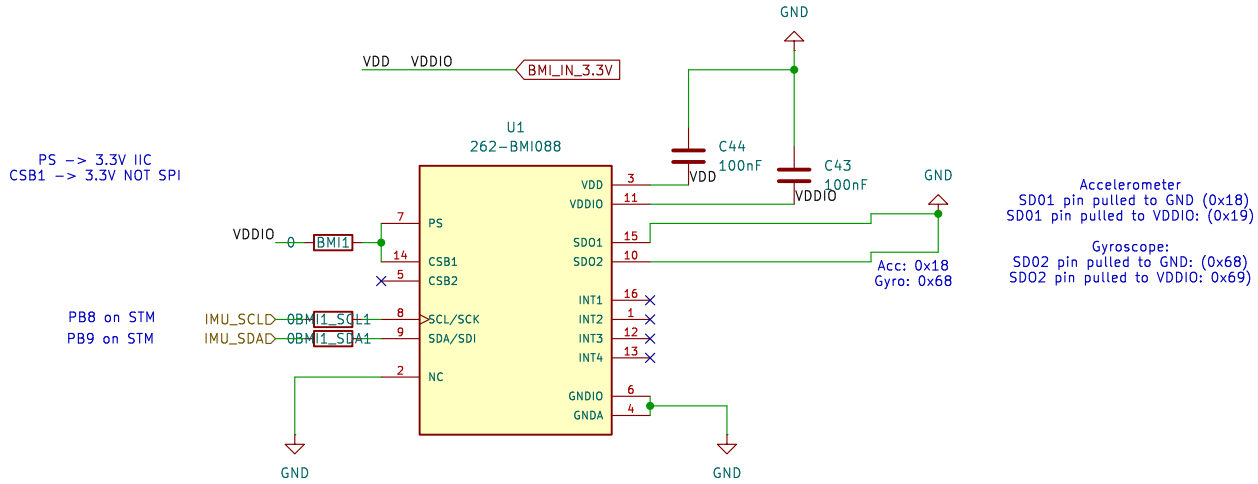


Pin 10: 100kOhm leads to about 1.24A (absolute overkill)

[R] = [kOhm]	22 kΩ → ~4.55 A
65.2 / R^0.861	39 kΩ → ~2.78 A
	50 kΩ → ~2.25 A
	56 kΩ → ~2.04 A
	68 kΩ → ~1.72 A
	100 kΩ → ~1.24 A

Pin SS (11): 100nF soft start cap more than enoug as virtually no load at all at vref

Title:		
Sheet: /Power_logic/GPIO_REF3.3V/		Rev:
Author:		
Date:	Size: A4	Id: 17/20
File: GPIO_REF3.3V.kicad_sch		



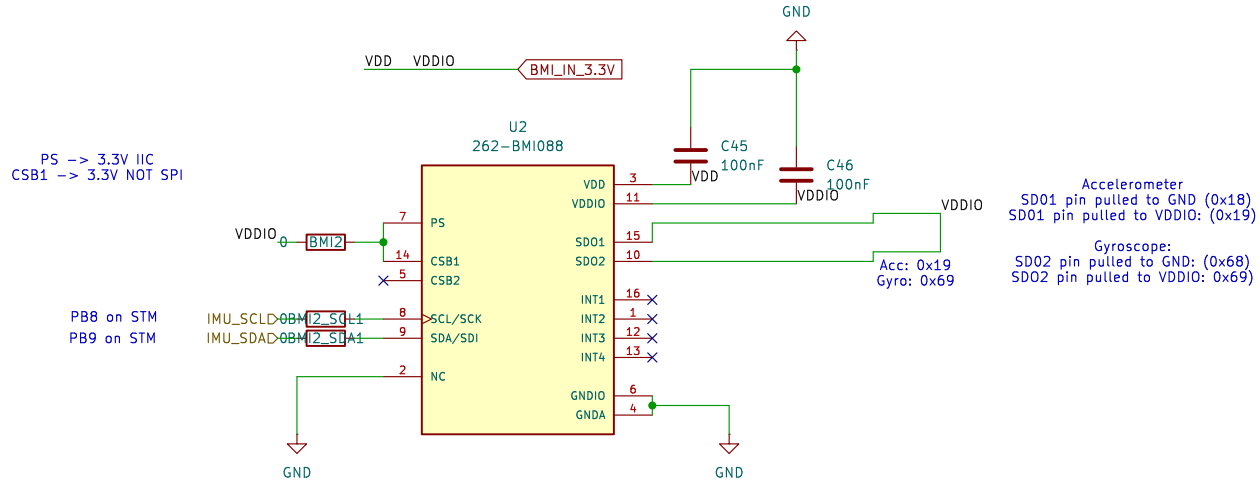
Title:

Sheet: /IMU/IMU1/ | Rev:

Author:

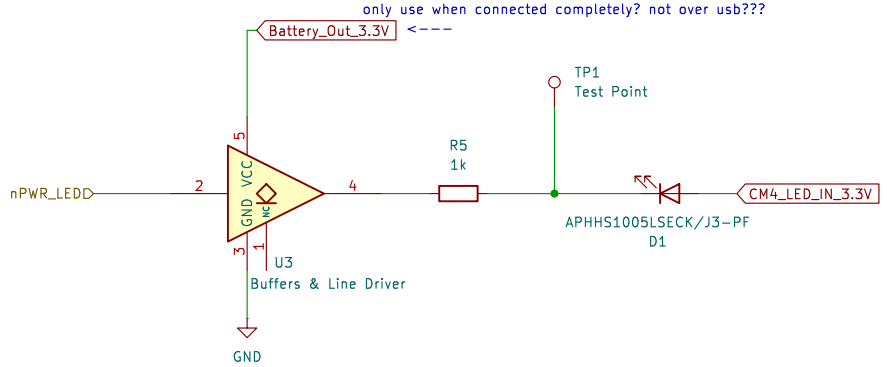
Date: | Size: A4 | Id: 19/20

File: IMU1.kicad_sch



Title:		
Sheet: /IMU/IMU2/		Rev:
Author:		
Date:	Size: A4	Id: 20/20
File: IMU2.kicad_sch		

Directly copied from the official CM4 io board (indicator LED for 3.3v)
issue: will that logic work if I use USB vin only?
then I would in theory compare internal voltage with internal voltage... so probably not...
only use when connected completely? not over usb???



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Author:		
Date:	Size: A4	Id: 8/20
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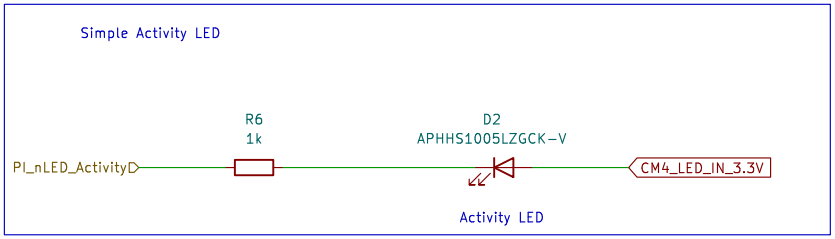

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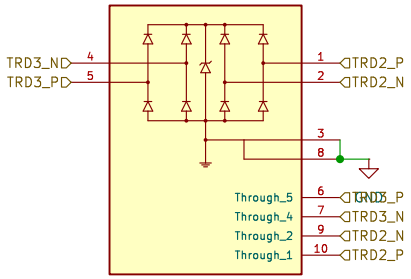
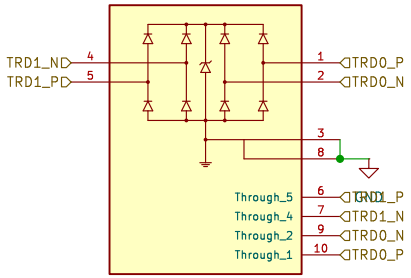
POE Protection

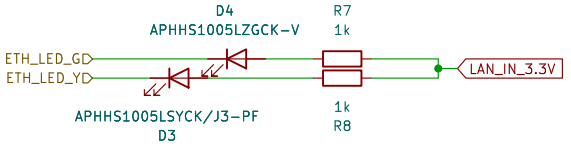
TPD4EUSB30DQAR1



TPD4EUSB30DQAR2



Optimal: Green: 325 Ohm (3.3−2.65)/0.002
Optimal: Yellow: 725 Ohm (3.3−1.85)/0.002



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Author:		
Date:	Size: A4	Id: 10/20
File: CM4_Ethernet.kicad_sch		