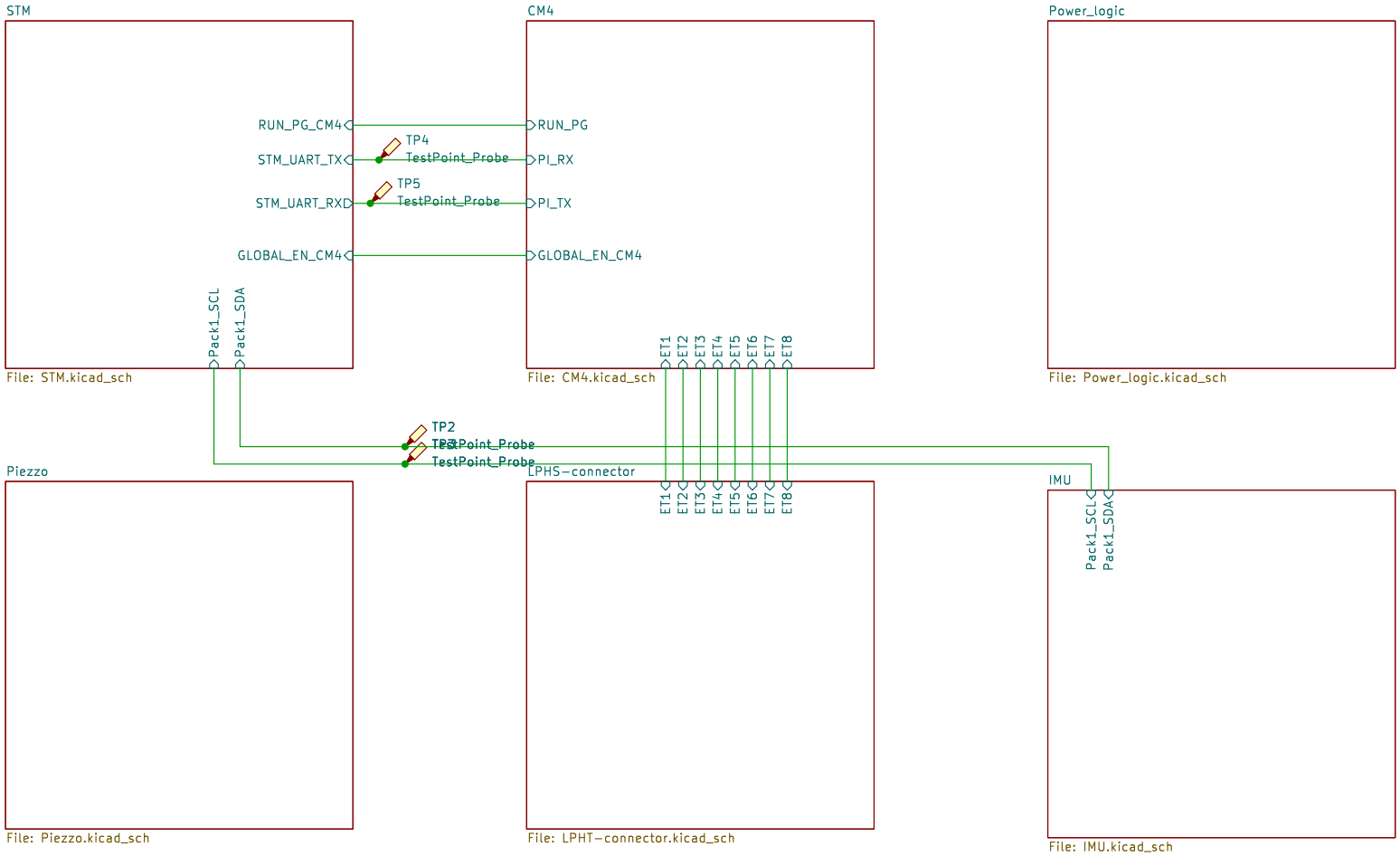


We should consider that we NEVER want the CM4 to power the unpowered STM over the TX pin. Found a neat part for that: https://www.mouser.ch/ProductDetail/Texas-Instruments/SN74LVC1G126DBVR?qs=pajglaoyDUi3T2WgNNfd3w%3D%3D

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

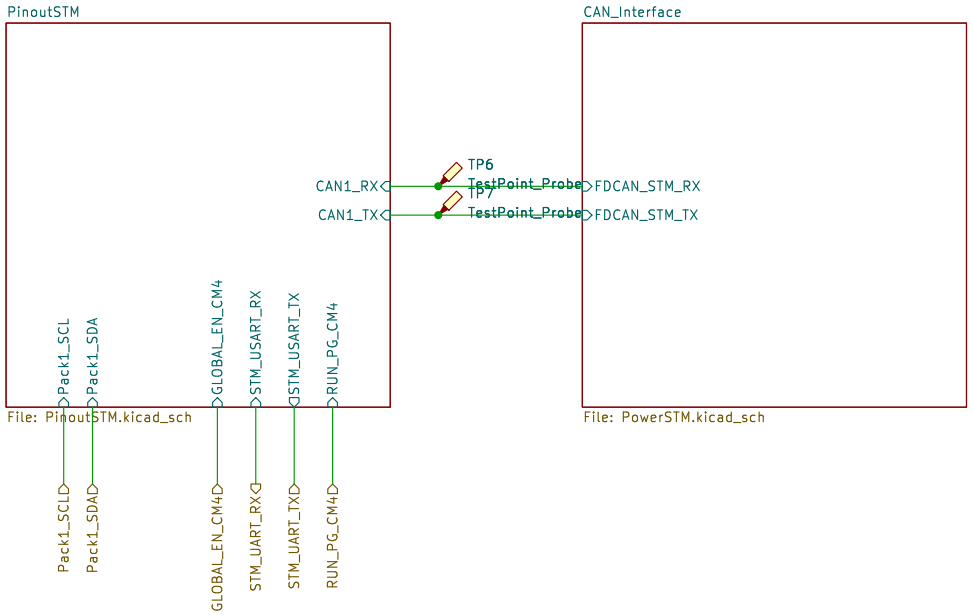
Pin 3: GND

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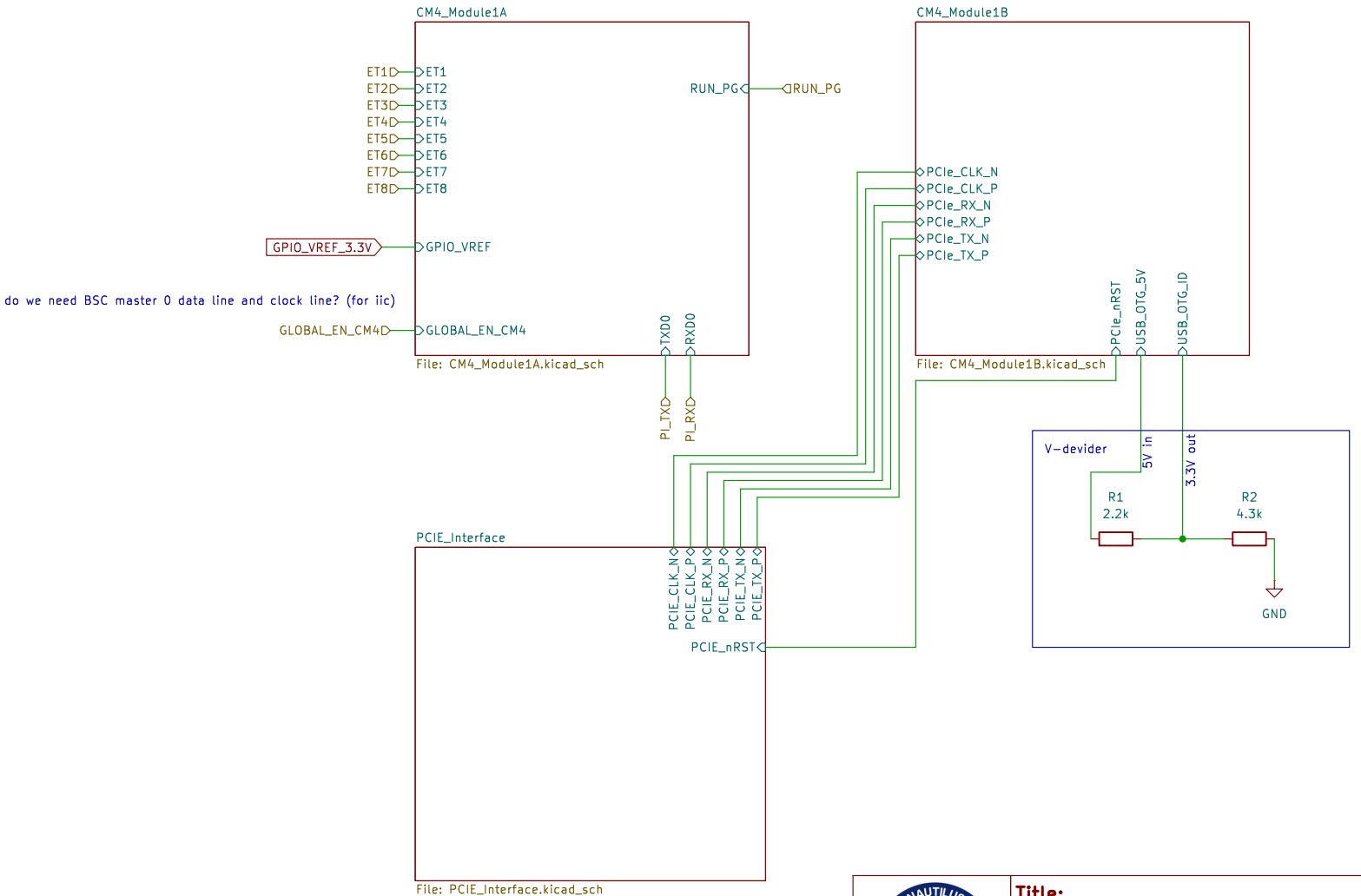
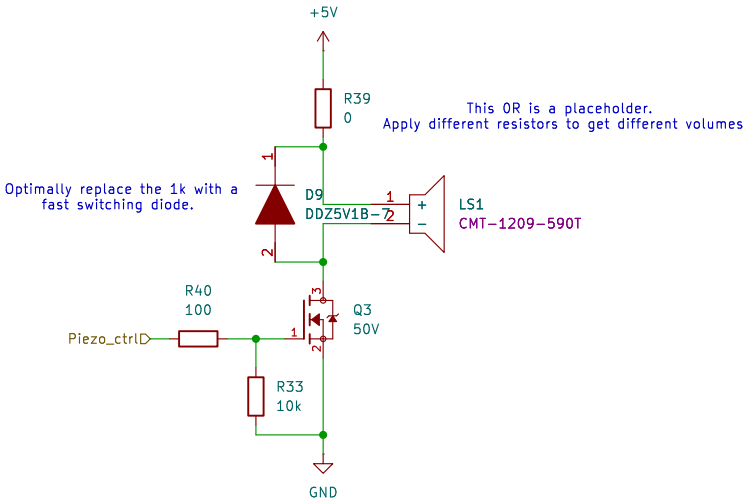
Sheet: /STM/		Rev:
Author:		
Date:	Size: A4	Id: 2/20
File: STM.kicad_sch		



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.



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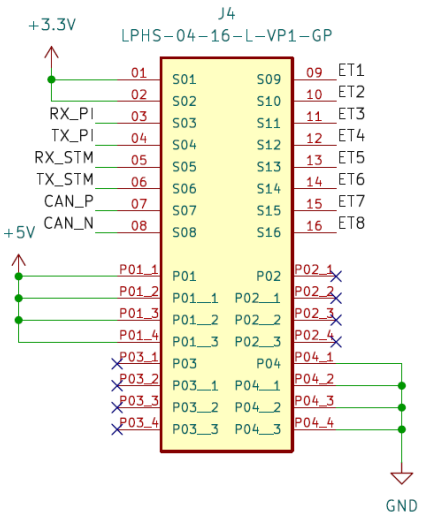
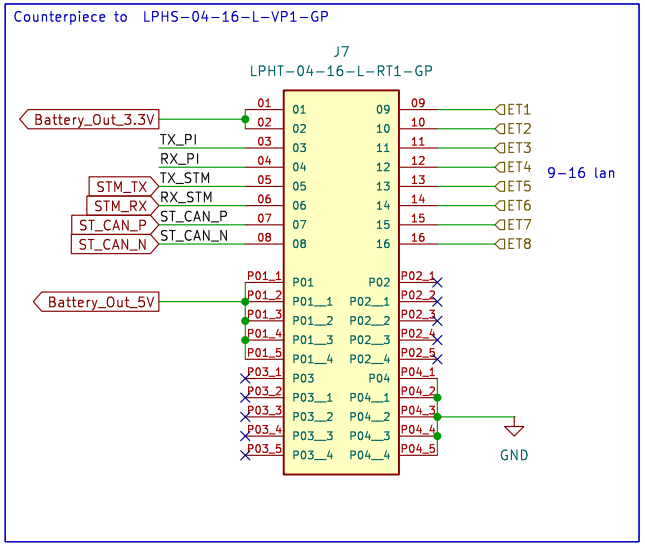
Sheet: /Piezzo/		Rev:
Author:		
Date:	Size: A4	Id: 4/20
File: Piezzo.kicad_sch		

Mainboard

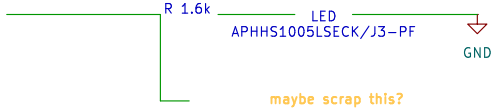




Title:			
Sheet: /LPHS-connector/			Rev:
Author:			
Date:	Size: A4		Id: 14/20
File: LPHT-connector.kicad_sch			

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.

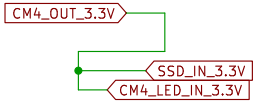


maybe scrap this?

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.

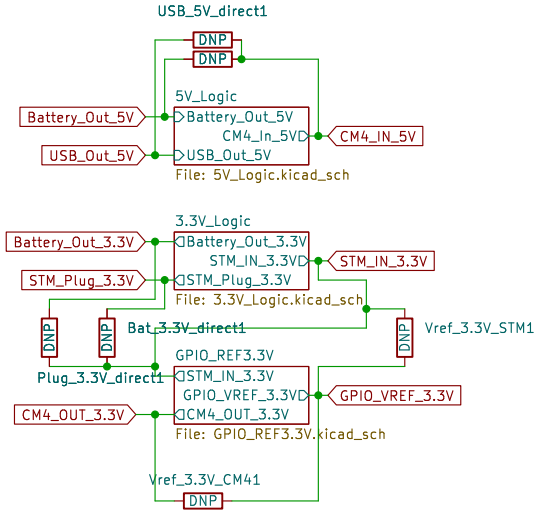


Lan only if plugged in (battery)

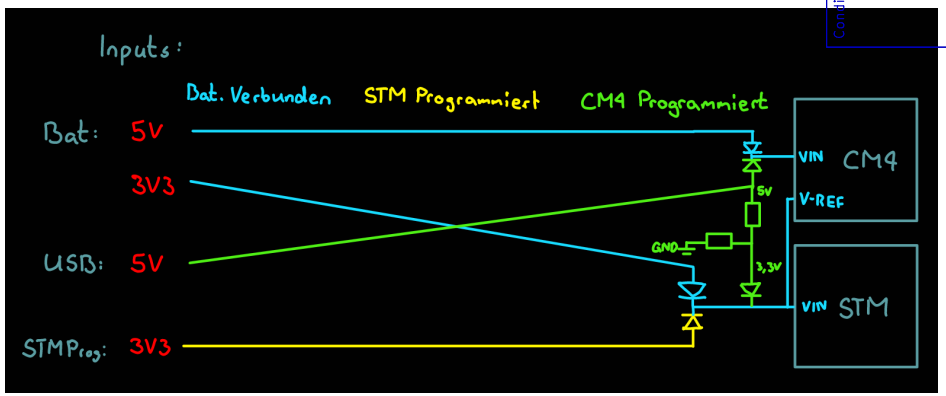
If STM has power, power the gyro and accelerometer

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...



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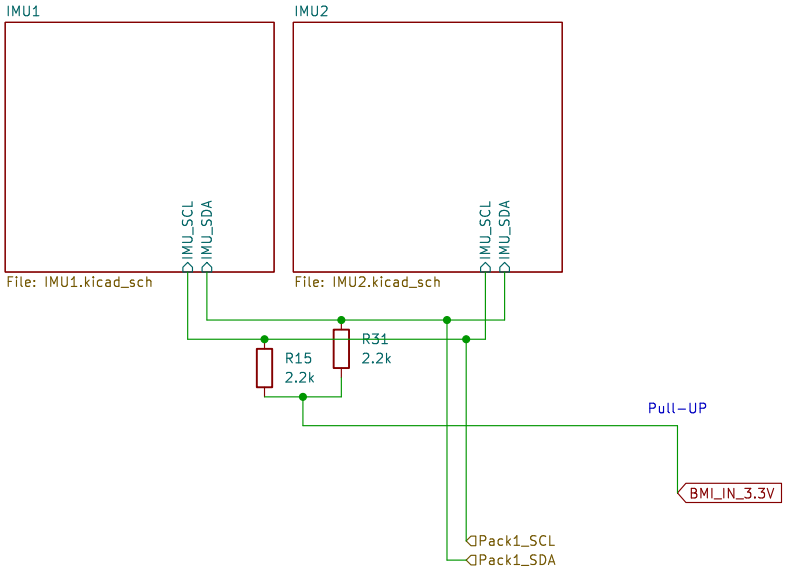
Author:		
Date:	Size: A4	Id: 14/20
File: Power_logic.kicad_sch		



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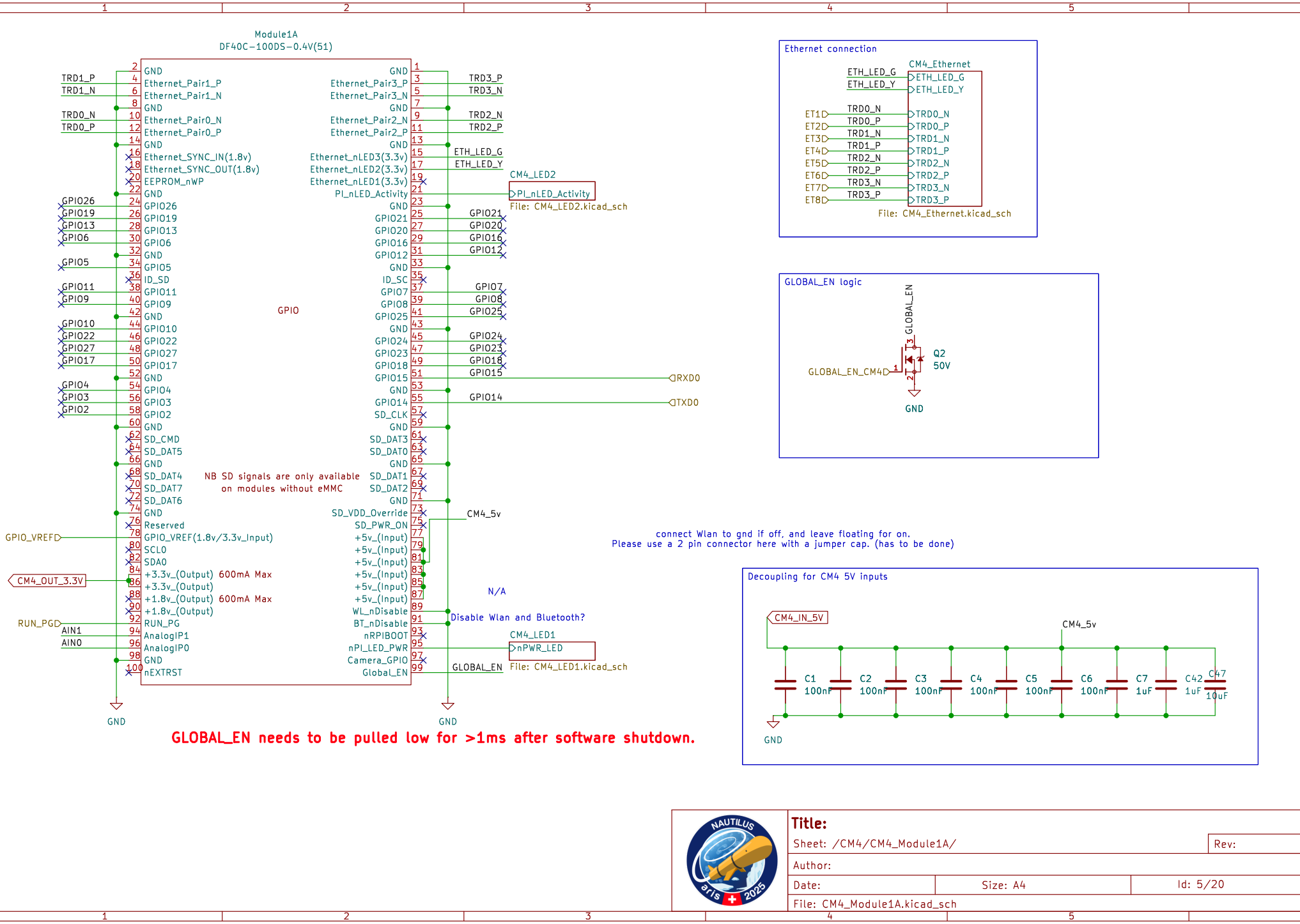
Author:		
Date:	Size: A4	Id: 18/20
File: IMU.kicad_sch		


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

EXTERNALFAN5V1

Fan controller

J5
1792876

I am a fan.

R3
1k

Q1
50V

Battery_Out_5V

Fan_ctrl

GND

Connected to PB7

J2
61300211121

fan only active when battery is connected.
Mby add an external power pin to externally power the fan for testing.

FAN

3v3 ext was first implemented here

External interfaces

J1
FTSH-107-02-L-DV

Vdd
GND
USART1_RX
JTAG_TMS/SWDIO
JTAG_TCK/SWCLK
JTAG_TDO/SWO
JTAG_ TDI
nRST
USART1_TX

STM_Plug_3.3V
USART1_RX
USART1_TX
STM_BOOT0
GND

J4
22284054

R4
10k

SW1
B3F-1052

nRST
C19
100nF

IC1
STM32H7B0RBT6

Vdd
Vss
Pack1_SDA
Pack1_SCL
STM_BOOT0
Fan_ctrl
JTAG_TDO/SWO
JTAG_ TDI
JTAG_TCK/SWCLK

VBAT
PC13
PC14-OSC32_IN
PC15-OSC32_OUT
PH0-OSC_IN
PH1-OSC_OUT
NRST
PC0
PC1
PC2
PC3
VSSA
VDDA
PA0
PA1
PA2

VDD_3
VSS_3
VCAP_2
PA13
PA12
PA11
PA10
PA9
PA8
PC9
PC7
PC6
PB15
PB14
PB13
PB12

PA3
VSS_1
VDD_1
PA4
PA5
PA6
PA7
PC4
PC5
PB0
PB1
PB2
PB10
VCAP_1
VSS_2
VDD_2

CC4V-T1A-32.768kHz-6pF-20PPM-TA-QC
Y1
C8
4.7pF
C9
4.7pF
RUN_PG_CM4
GLOBAL_EN_CM4
UART4_TX
UART4_RX
USART2_TX
STM_TX
STM_RX
STM_USART_TX
CAN1_TX
CAN1_RX
USART1_RX
USART1_TX
JTAG_TMS/SWDIO
C15
2.2pF
C10
2.2pF
USART2_RX
SPI1_NSS
SPI1_SCK
SPI1_MISO
SPI1_MOSI
STM_USART_RX

logic handled in power section
STM_IN_3.3V

C11 100nF
C12 100nF
C13 100nF
C14 100nF
C17 100nF
C18 100nF
C16 10uF

STDC14 for STLINK-V3MINI (STM32 JTAG/SWD and VCP)

Figure 11. CN5 STDC14 connector (Top view)

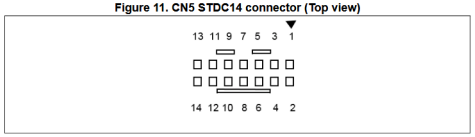


Table 4. CN5 STDC14 connector pinout

STDC14 Pin #	ARM10 Pin #	Pin description	Type
1	-	Reserved(1)	-
2	-	Reserved(1)	-
3	1	T_VCC(2)	I
4	2	T_JTMS/T_SWDIO	I/O
5	3	GND	S
6	4	T_JCLK/T_SWCLK	O
7	5	GND	S
8	6	T_JTDO/T_SWO(3)	I
9	7	T_JCLK	O
10	8	T_JTDI/NC(4)	O
11	9	GNDDetect	O
12	10	T_NRST	O
13	-	T_VCP_RX	O
14	-	T_VCP_TX	I

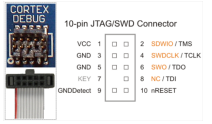
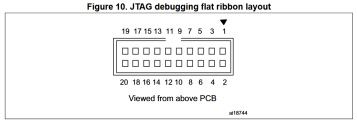


Figure 10. JTAG debugging flat ribbon layout



Title:

Sheet: /STM/PinoutSTM/

Rev:

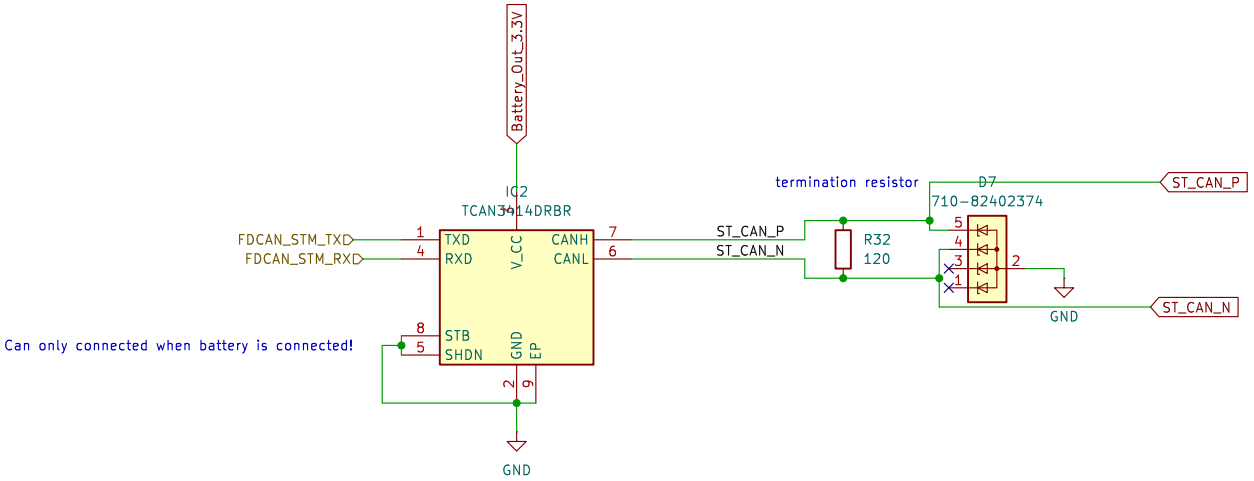
Author:

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)

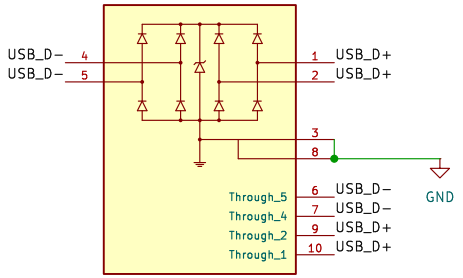
Can be kept floating. if no usb is connected

	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	
maybe RX and TX need to be switched	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	

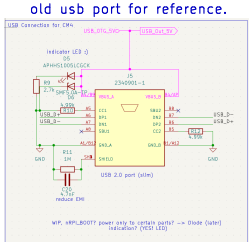
High Speed Serial

GND GND

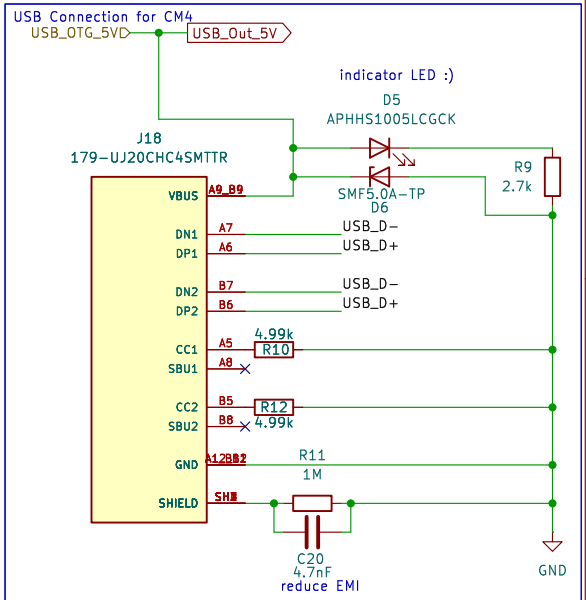
ESD/EMP protection for the USB
Super important to not differ lengths or curve a lot with D+ and D-.
Also should have same hole counts (vias) and same length.
TPD4EUSB30DQAR3



old usb port for reference.



USB Connection for CM4



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

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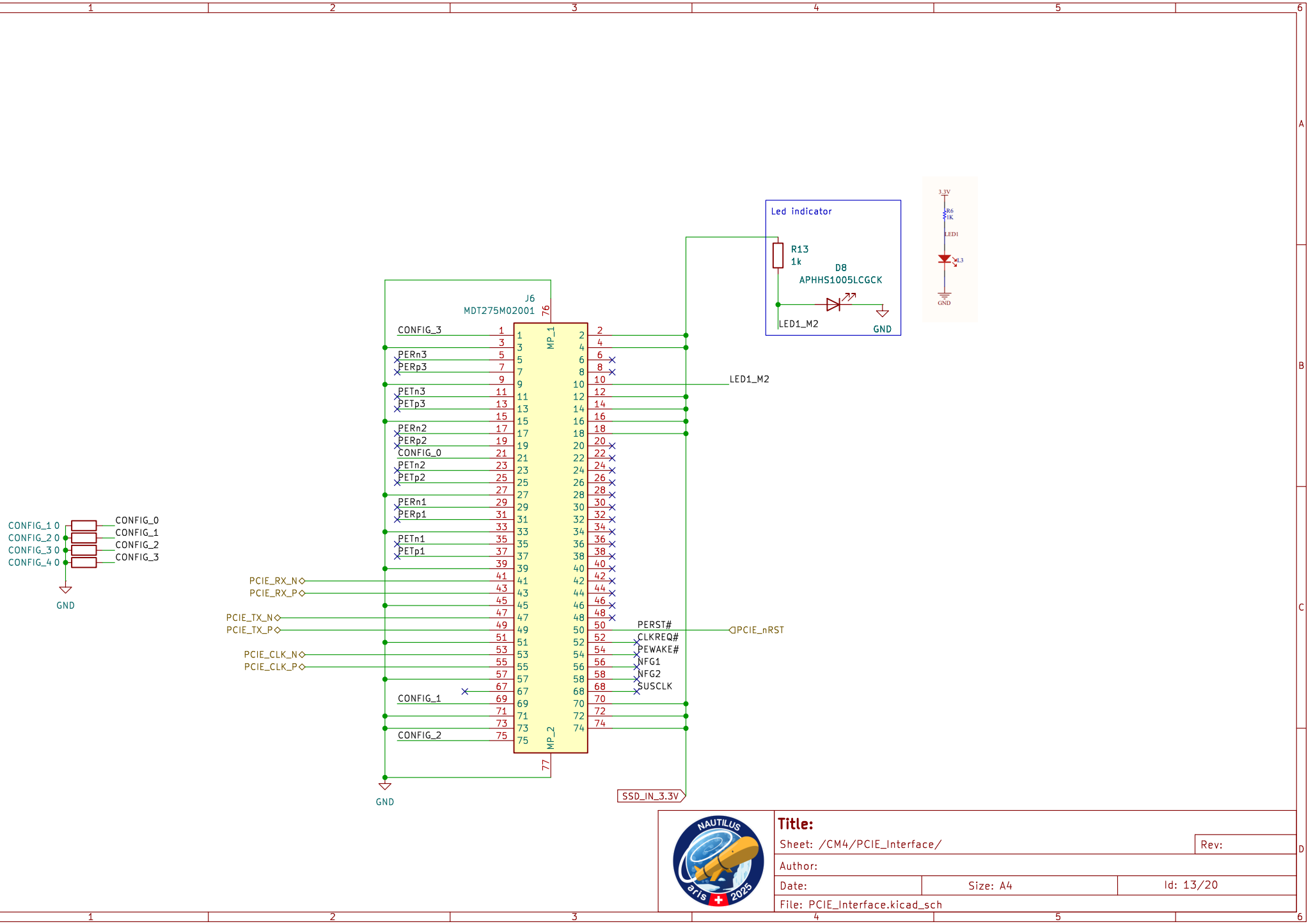
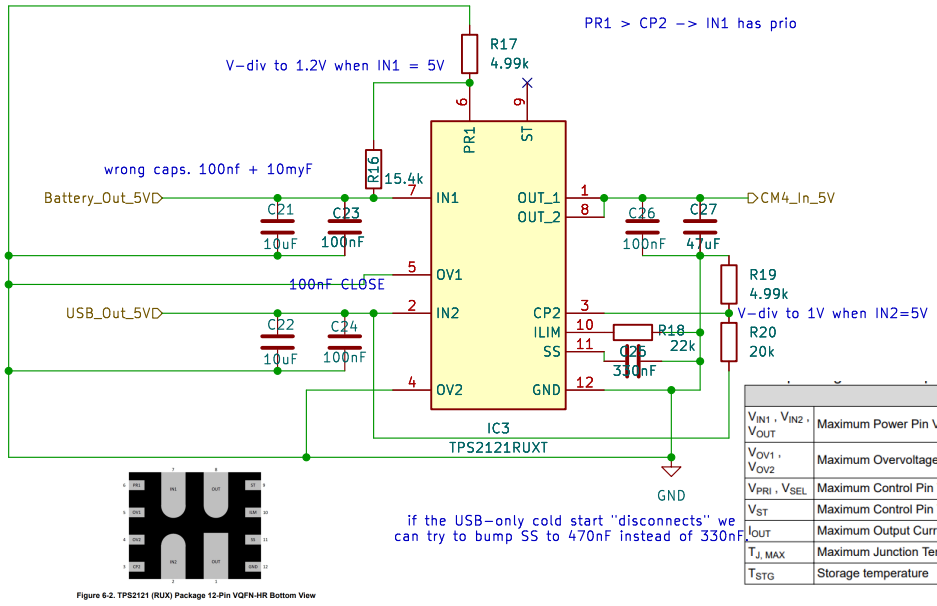
Author:		
Date:	Size: A4	Id: 11/20
File: CM4_Module1B.kicad_sch		


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.

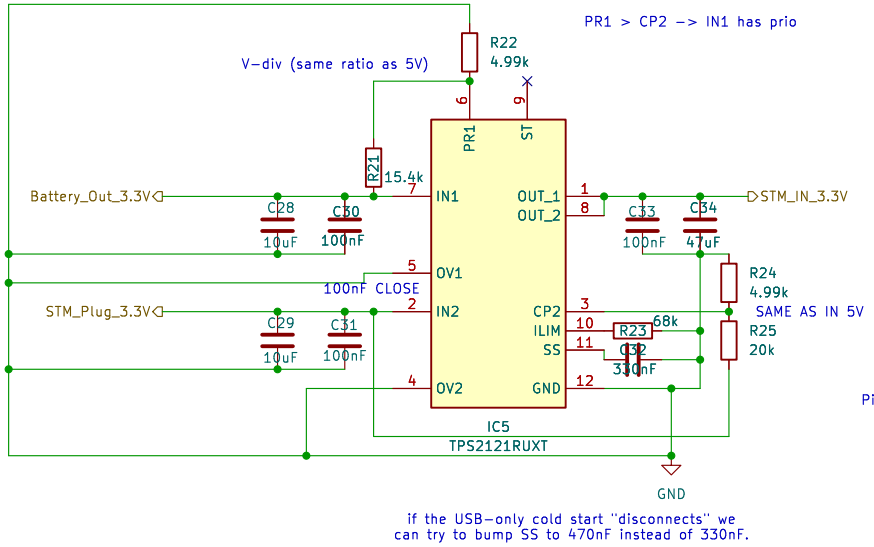
Title:

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

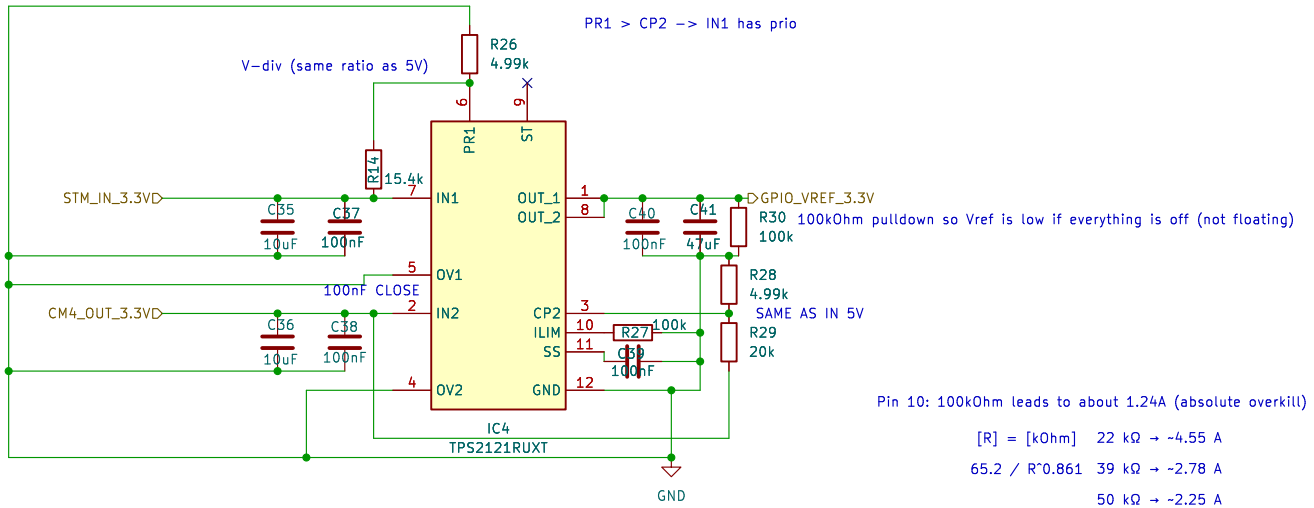
Title:

Sheet: /Power_logic/3.3V_Logic/ | Rev:

Author:

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

File: 3.3V_Logic.kicad_sch

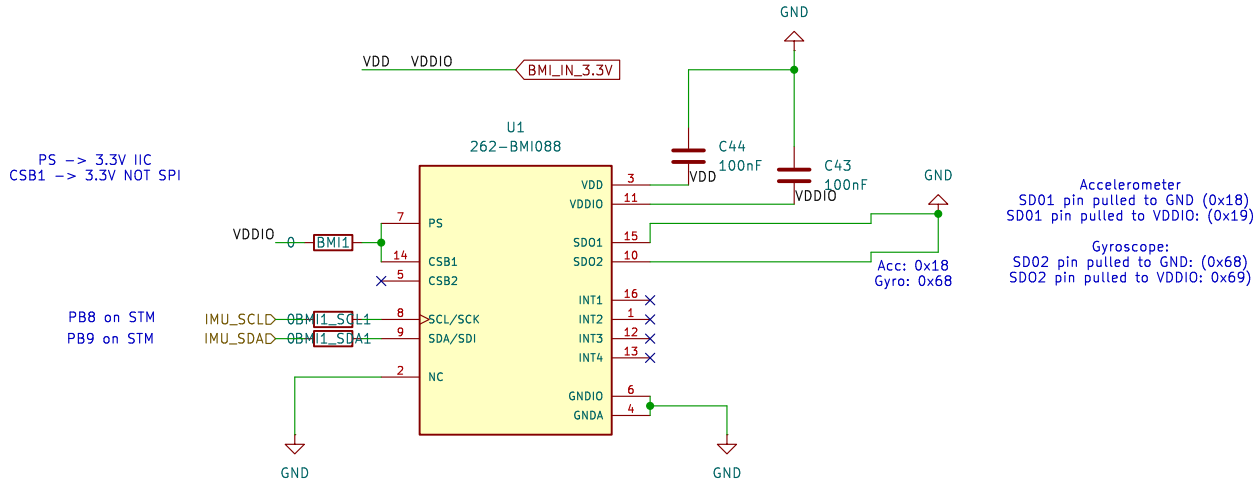


Pin 10: 100kOhm leads to about 1.24A (absolute overkill)

[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		



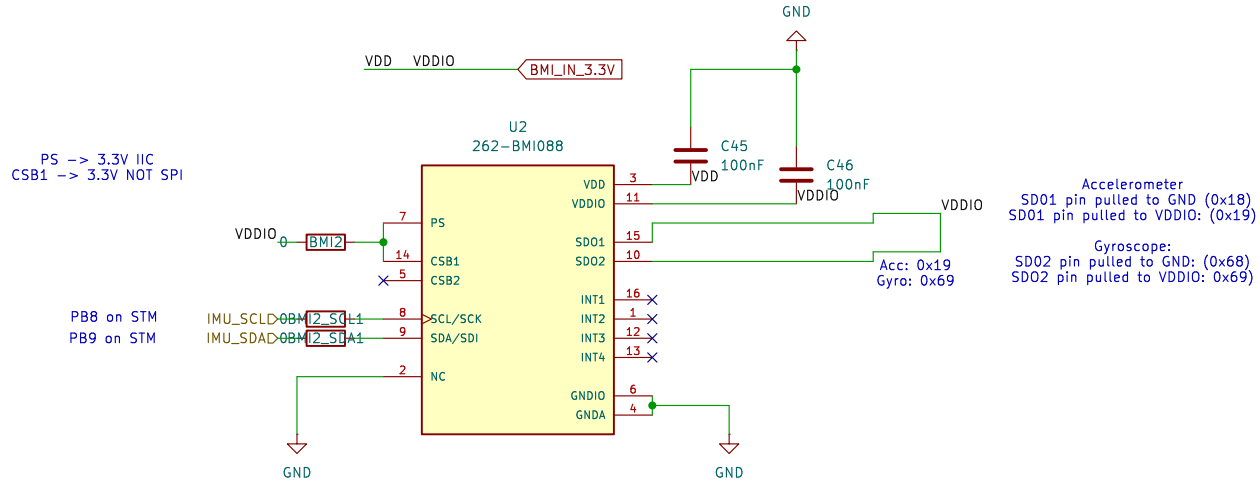
Title:

Sheet: /IMU/IMU1/ | Rev:

Author:

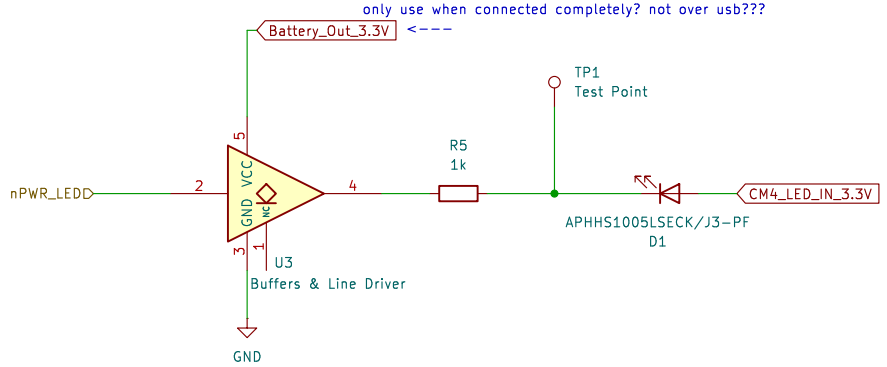
Date: | Size: A4 | Id: 19/20

File: IMU1.kicad_sch

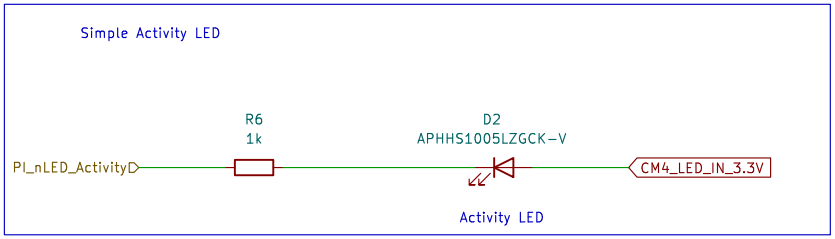


Title:		
Sheet: /IMU/IMU2/		Rev:
Author:		
Date:	Size: A4	Id: 20/20
File: IMU2.kicad_sch		

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???



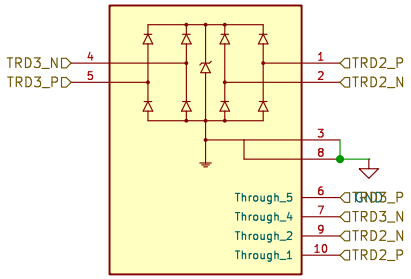
Title:		
Sheet: /CM4/CM4_Module1A/CM4_LED1/		Rev:
Author:		
Date:	Size: A4	Id: 8/20
File: CM4_LED1.kicad_sch		



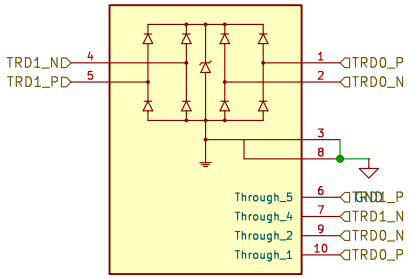
Title:		
Sheet: /CM4/CM4_Module1A/CM4_LED2/		Rev:
Author:		
Date:	Size: A4	Id: 9/20
File: CM4_LED2.kicad_sch		

POE Protection

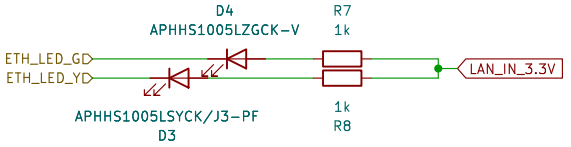
TPD4EUSB30DQAR1



TPD4EUSB30DQAR2



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



Title:		
Sheet: /CM4/CM4_Module1A/CM4_Ethernet/		Rev:
Author:		
Date:	Size: A4	Id: 10/20
File: CM4_Ethernet.kicad_sch		