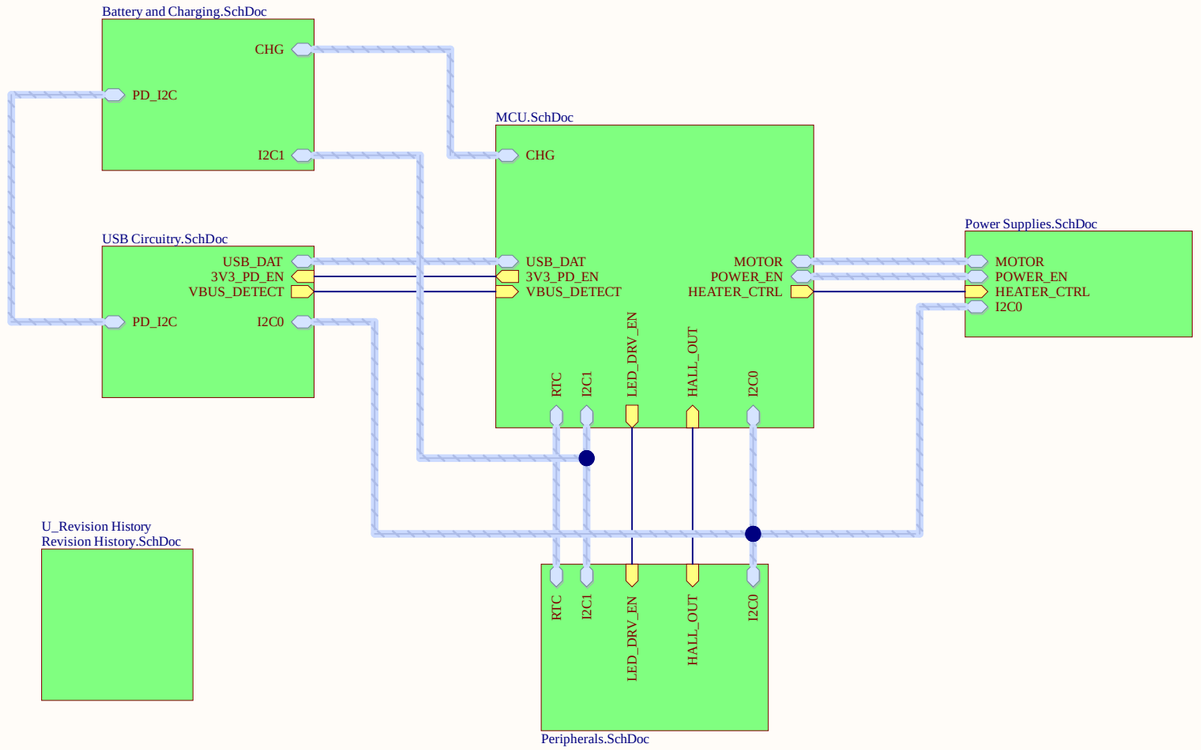
REVISION	DESCRIPTION	DATE	APPROVED

Contents

Block Diagram



Testpoint Circle Table

Ref. Des.	Net	Schematic Sheet	Description
TP1	P1.12	2	MCU spare
TP2	P1.13	2	MCU spare
TP3	P1.14	2	MCU spare
TP4	P1.15	2	MCU spare
TP5	GND	2	GND clip
TP6	SD_D0	3	SD over SPI, MISO
TP7	SD_D3	3	SD over SPI, CS
TP8	SD_CMD	3	SD CMD line
TP9	SD_CLK	3	SD over SPI, CLK
TP10	SD_CD_N	3	SD CD line
TP11	MS_PGOOD	6	Motor supply, "power good" signal
TP12	I2C0_SCL	2	I2C bus 0, clock
TP13	I2C0_SDA	2	I2C bus 0, data
TP14	I2C1_SCL	2	I2C bus 1, clock
TP15	I2C1_SDA	2	I2C bus 1, data
TP16	VBAT	5	Battery pack voltage
TP17	HEATER_PWR	6	Heater buck supply, output voltage
TP18	HEATER_CTRL	6	PWM signal throttling current through heater board
TP19	3V3	6	System/logic 3.3V supply output
TP20	3V3_SW	6	Peripheral 3.3V supply rail
TP21	VCC_MOTOR	6	Motor supply output
TP22	MOTOR_FG	6	Motor speed output
TP23	MOTOR_PWM	6	Motor speed, MCU control signal
TP24	VBUS	4	USB connector VBUS voltage
TP25	5V	4	USB PHY supply voltage
TP26	GND	2	GND testpoint circle
TP27	3V3_PD	4	USB PD controller supply voltage
TP28	HALL_OUT	7	Hall effect sensor analog output
TP29	MOTOR_POWER_EN	6	Motor power supply, enable

I2C Address Table

Device	Ref. Des.	Base Addr.	Write Addr.	Read Addr.	Bus	Bus Master	Pullup Rail
USB PD Controller	U10	0x23	0x46	0x47	I2C0	nrf5240	3V3_SW
Temperature Sensor	J2	0x77	0xEE	0xEF	I2C0		
LED Driver	U14	0x64	0xC8	-	I2C0		
Fuel Gauge	U5	0x6C	0xD8	0xD9	I2C1	nrf5240	3V3
RTC	U3	0x51	0xA2	0xA3	I2C1		
EEPROM	U12	0x50	0xA0	0xA1	PD	PD Controller	PD_LDO_3V3
Battery Charger	U4	0x6B	0xD6	0xD7	PD		

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PROJECT: GHL NAATOS Sample Prep Main Board RevB ODIC.PrjPcb

TITLE: Title Page

SIZE	PROJECT ID	DWG NO.	REV
B	263-03	GHL-1-21002	B

FILE NAME: Title Page.SchDoc

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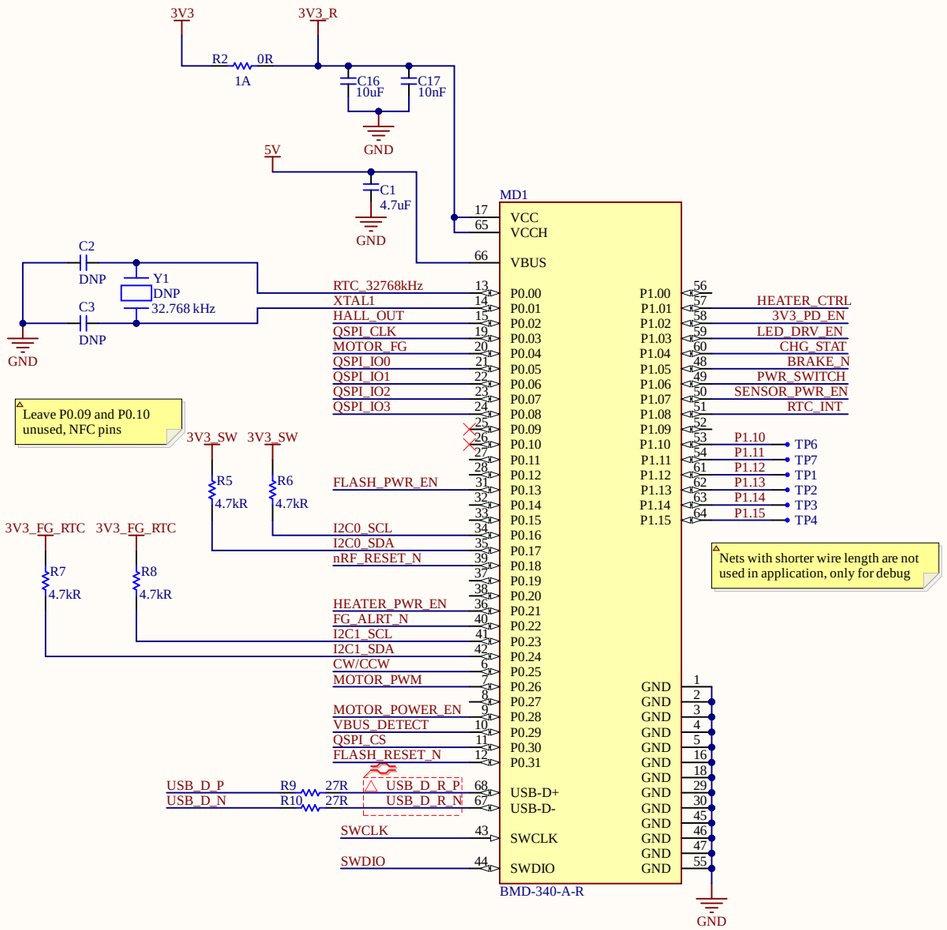
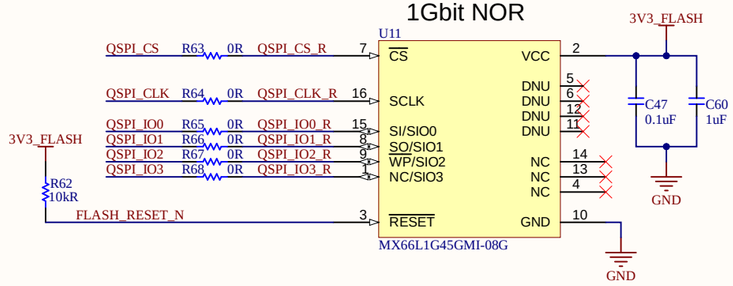
REVISION	DESCRIPTION	DATE	APPROVED

nRF52840 Module

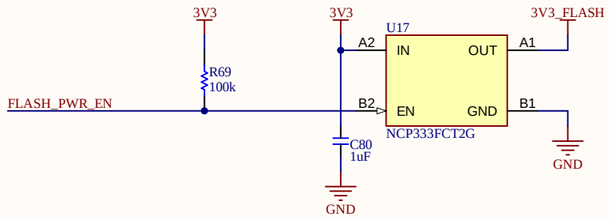


QSPI Flash

1Gbit NOR

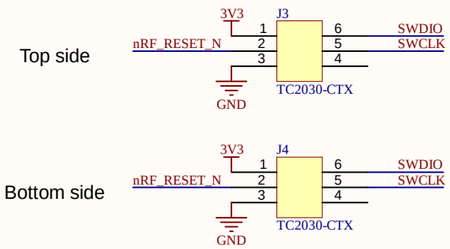


Flash Power

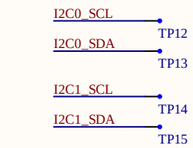


Programming and Debug

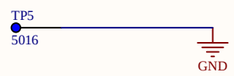
Programming Headers (TAG Connect)



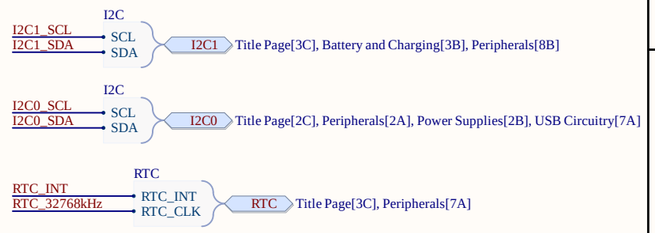
I2C Testpoints



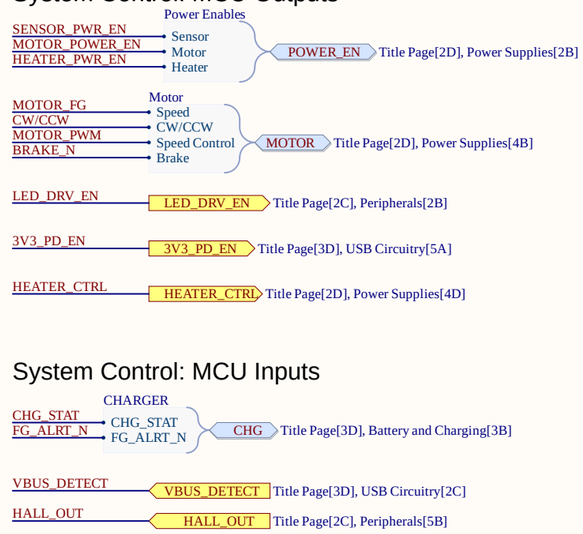
GND Clip



Inter-IC Busses

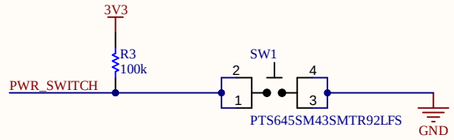


System Control: MCU Outputs



System Control: MCU Inputs

System On/Off Button



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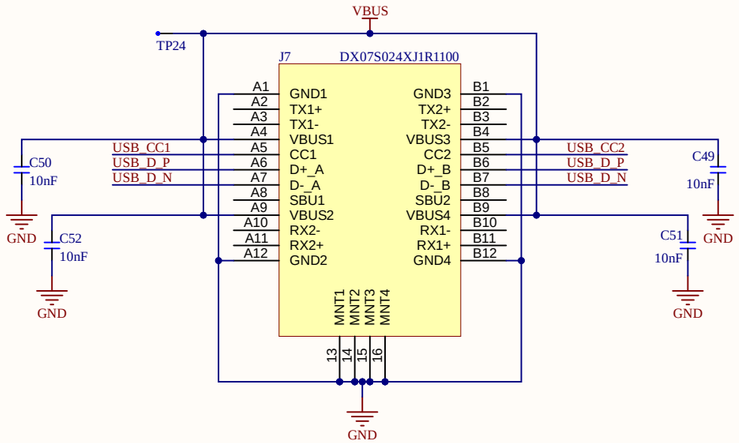
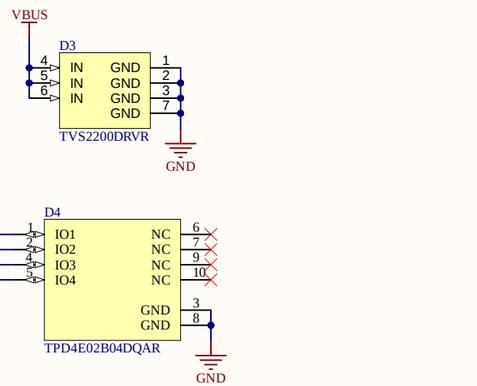
		TITLE	MCU
APPROVALS	DATE	SIZE: B	PROJECT ID: 263-03
DRAWN: DD	5/28/2025	DWG NO.: GHL-1-21002	REV: B
CHECKED: *		FILE NAME: MCU.SchDoc	SHEET 2 OF 7
APPROVED: *			

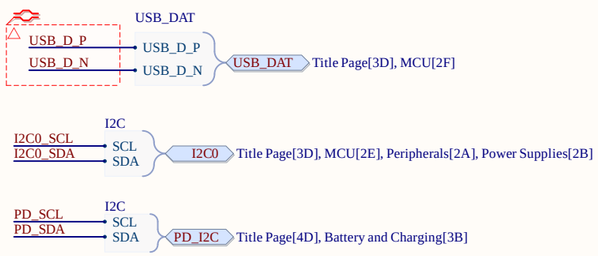
REVISION	DESCRIPTION	DATE	APPROVED

USB-C 2.0 Port

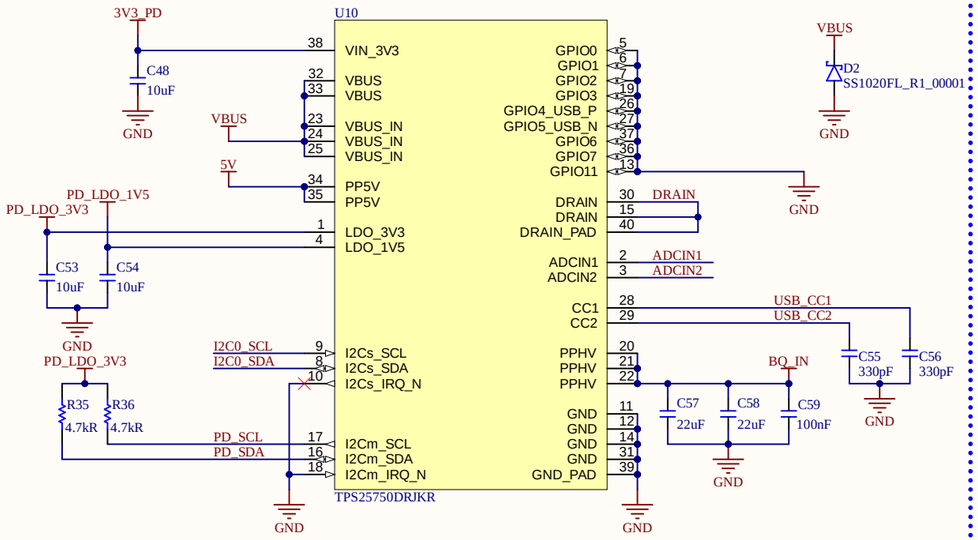


ESD Protection

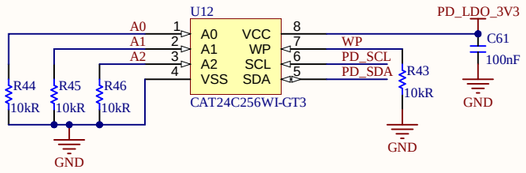




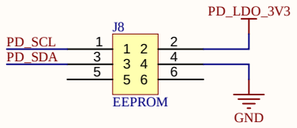
USB PD Controller



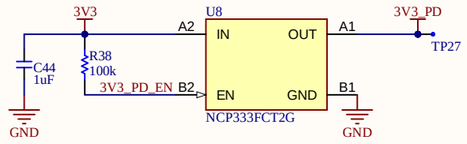
EEPROM



EEPROM Programming Header



PD Controller Load Switch

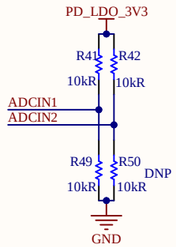


Title Page[3D], MCU[2D] 3V3_PD_EN 3V3_PD_EN

U8 : Enables MCU to switch off the PD controller. Switch defaulted to ON

Dead Batt. Config.

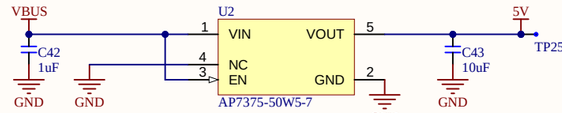
SafeMode, I2C Addr. Index #4



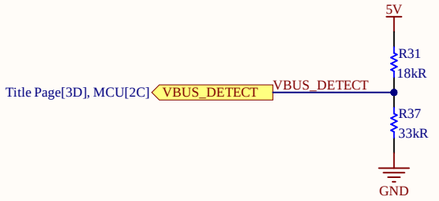
PD-Voltage Tolerant LDO for USB PHY Supply and USB Detect

USB PHY 5V LDO

5 - 45V Input Range



VBUS Detect Line



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PROJECT: GHL NAATOS Sample Prep Main Board RevB ODIC.PrjPcb

TITLE: USB Circuitry

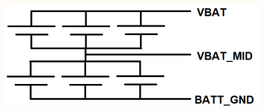
SIZE	PROJECT ID	DWG NO.	REV
B	263-03	GHL-1-21002	B

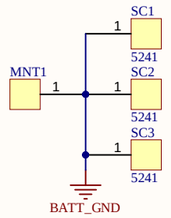
FILE NAME: USB Circuitry.SchDoc

SHEET 3 OF 7

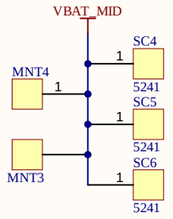
Battery Connectors

6x 21700 cells, 2s3p configuration, 30Ahr capacity

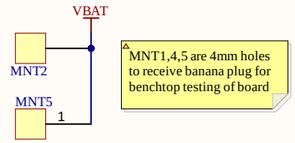




Battery pack ground

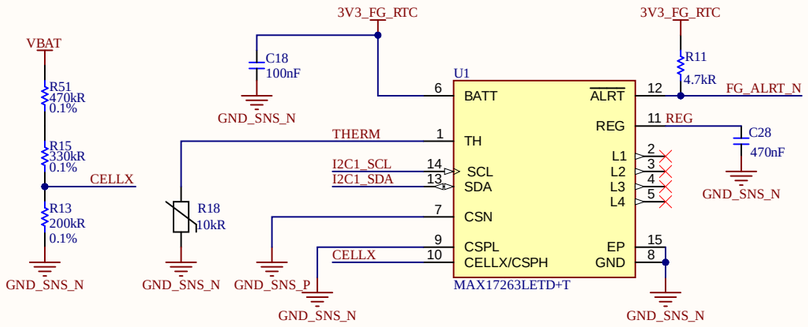


Node connecting the two series stacks of batteries



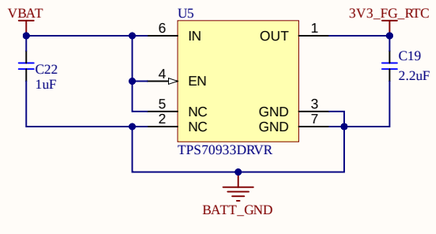
Battery pack positive

Battery Fuel Gauge



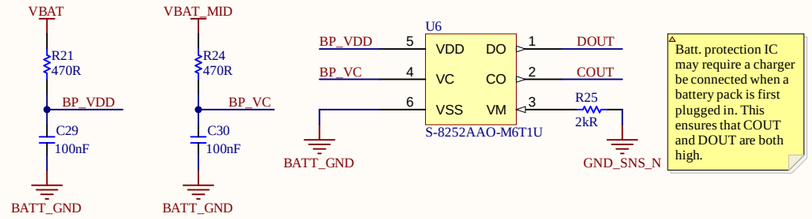
LDO for FG/RTC Power

200mA max output, 30V max input, 1uA Iq

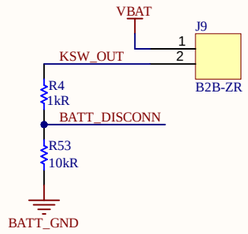


Battery Protection IC

VBAT UVLO: 2.5V, OVLO: 4.25V

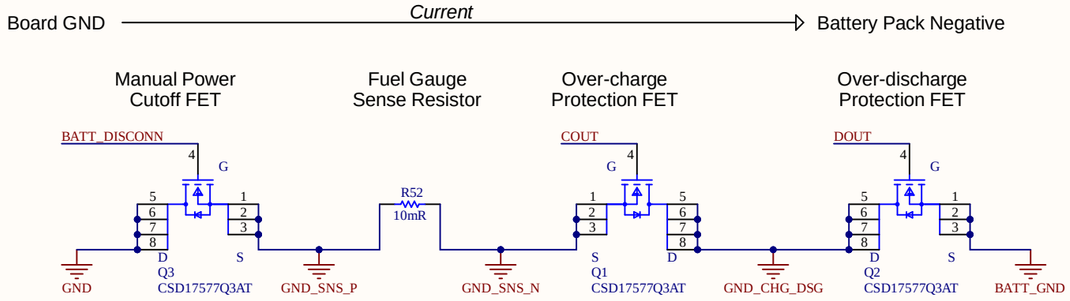


Ship-Mode/Kill Switch

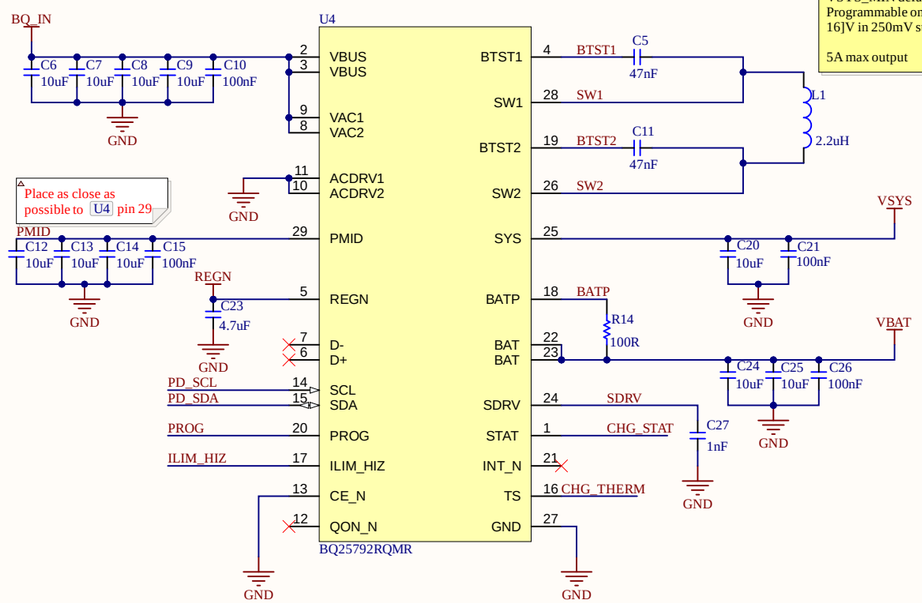


Kill switch open: battery discharge path interrupted at Q3

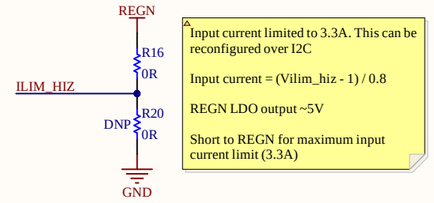
Kill switch closed: battery discharge path uninterrupted



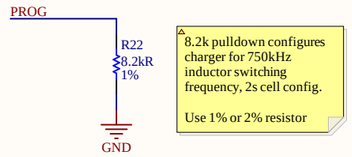
Battery Charger



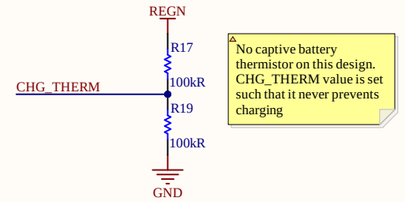
Input Current Set

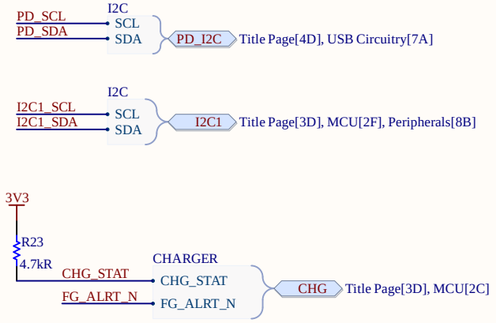


Switching Freq. Set



Batt. Thermistor





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PROJECT: GHL NAATOS Sample Prep Main Board RevB ODIC.PrjPcb

TITLE: Battery and Charging

SIZE	PROJECT ID	DWG NO.	REV
B	263-03	GHL-1-21002	B

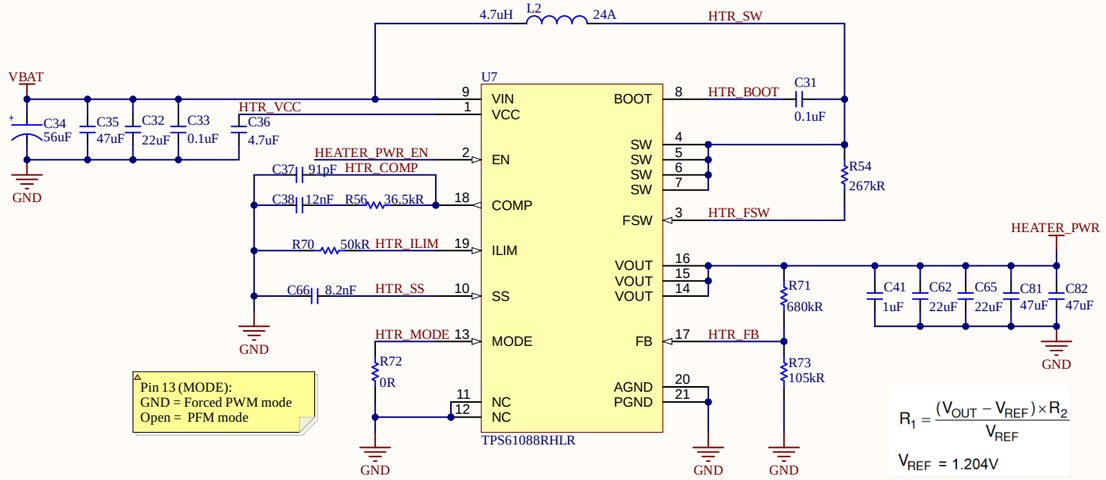
FILE NAME: Battery and Charging.SchDoc

SHEET 4 OF 7

REVISION	DESCRIPTION	DATE	APPROVED

Heater Boost Supply

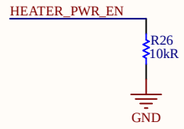
9V output, 5A max



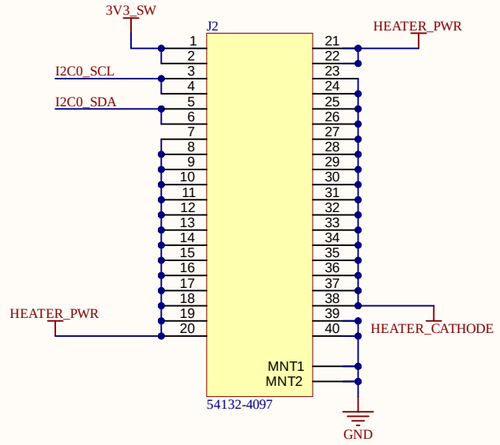
$$R_1 = \frac{(V_{OUT} - V_{REF}) \times R_2}{V_{REF}}$$

V_{REF} = 1.204V

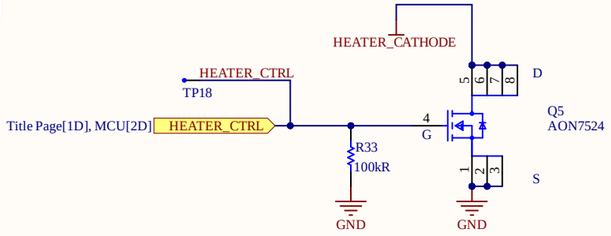
Heater Supply Enable



Heater Board FFC Connector

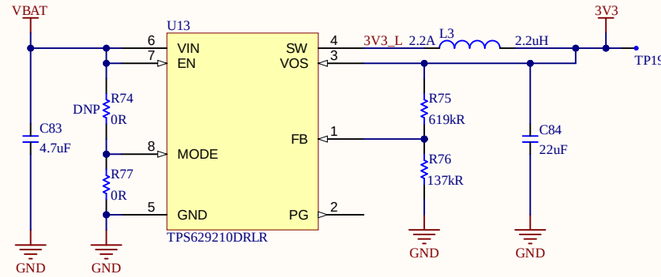


Heater Control FET



System/Logic Buck Supply

3.3V output, 1A max



Pin 8 (MODE) sets maximum switching frequency, internal vs. external feedback.

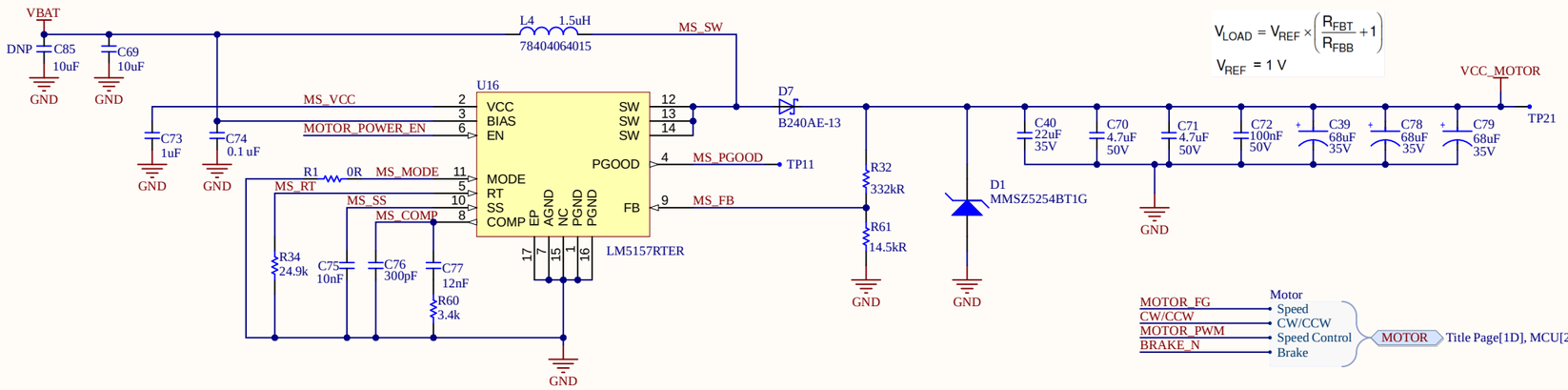
MODE connected to GND sets maximum switching frequency to 2.5 MHz (variable), and external feedback

$$R_1 = R_2 \times \left(\frac{VOUT}{VFB} - 1\right)$$

where VFB is 0.6 V.

Motor Boost Supply

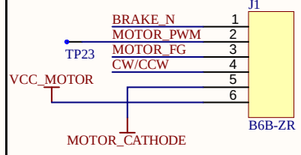
24V output



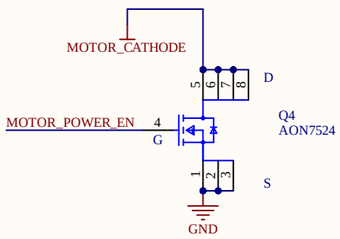
$$V_{LOAD} = V_{REF} \times \left(\frac{R_{FBT}}{R_{FBB}} + 1\right)$$

V_{REF} = 1 V

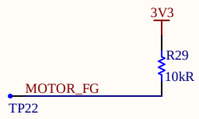
Motor Connector



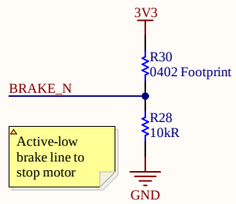
Motor Power Disconnect



Motor Speed Output

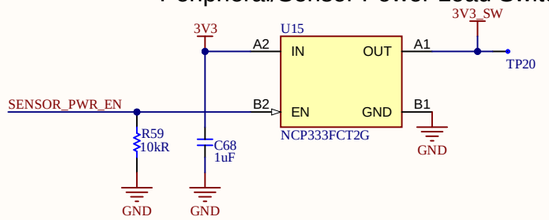


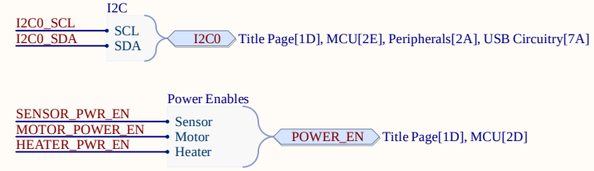
Motor Brake Mode



Motor Supply Enable

Peripheral/Sensor Power Load Switch



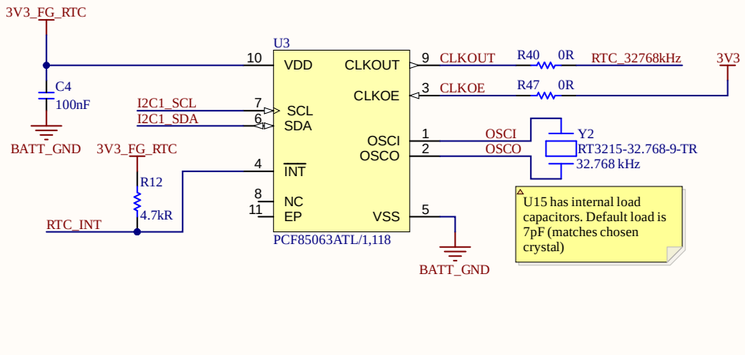


odic Engineered.	295 Foster St Suite 202 Littleton, MA 01460 www.odic.com	PROJECT	GHL NAATOS Sample Prep Main Board RevB ODIC.PrjPcb
		TITLE	Power Supplies
APPROVALS	DATE	SIZE / PROJECT ID / DWG NO. / REV	B / 263-03 / GHL-1-21002 / B
DRAWN: DD	5/28/2025	FILE NAME	Power Supplies.SchDoc
CHECKED: *		SHEET	5 OF 7
APPROVED: *			

REVISION	DESCRIPTION	DATE	APPROVED

RTC/Calendar

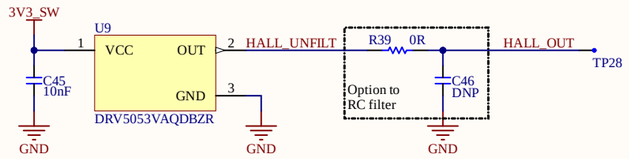
Input voltage range: 1.8-5.5V



I2C1_SCL
I2C1_SDA
I2C
SCL
SDA
I2C1
Title Page[3C], Battery and Charging[3B], MCU[2F]

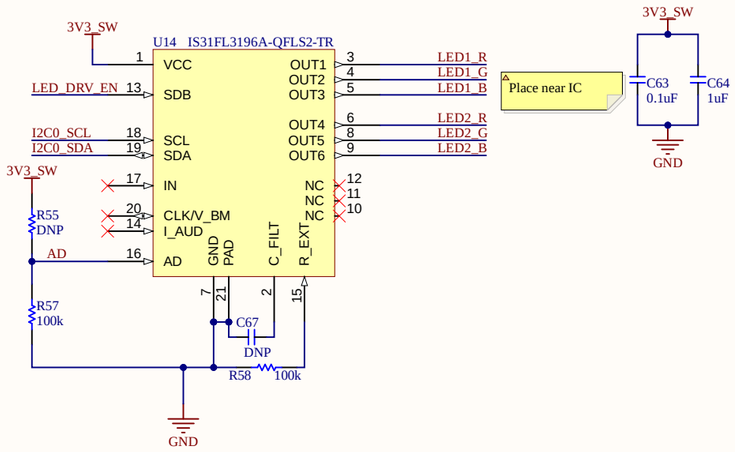
RTC_INT
RTC_32768kHz
RTC
RTC_INT
RTC_CLK
RTC
Title Page[3C], MCU[2E]

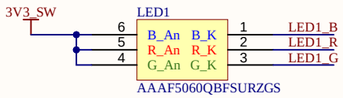
Hall Effect Sensor

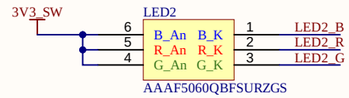


HALL_OUT
HALL_OUT
Title Page[2C], MCU[2C]

LED Driver







Title Page[2C], MCU[2D]
LED_DRV_EN
LED_DRV_EN
R48
10kR
GND

I2C0_SCL
I2C0_SDA
I2C
SCL
SDA
I2C0
Title Page[2C], MCU[2E], Power Supplies[2B], USB Circuitry[7A]

odic Engineered.
295 Foster St
Suite 202
Littleton, MA
01460
www.odic.com

APPROVALS	DATE
DRAWN: DD	5/28/2025
CHECKED: *	
APPROVED: *	

PROJECT: GHL NAATOS Sample Prep Main Board RevB ODIC.PrjPcb

TITLE: Peripherals

SIZE	PROJECT ID	DWG NO.	REV
B	263-03	GHL-1-21002	B

FILE NAME: Peripherals.SchDoc

SHEET 6 OF 7

REVISION	DESCRIPTION	DATE	APPROVED

REV			
A	DD	Initial Capture	5/2/2024
B	IEO	Batteries: Changed from 1s4p 18650 configuration to 2s3p 21700 configuration. Changed battery protection IC, fuel gauge. Added kill-switch. Added LDO to power RTC and fuel gauge when kill-switch is engaged. Heater: Reworked heater boost supply. Increased heater board FFC connector pin count from 20 to 40. Motor: Reworked motor circuit to use a new motor. Other: Removed SD card, added SPI NOR flash. Reworked USB detect circuitry. Added many testpoints. Minor tweaks to improve battery life.	10/3/2024

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APPROVALS	DATE
DRAWN: DD	5/28/2025
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APPROVED: *	

PROJECT: GHL NAATOS Sample Prep Main Board RevB ODIC.PrjPcb

TITLE: Revision History

SIZE	PROJECT ID	DWG NO.	REV
B	263-03	GHL-1-21002	B

FILE NAME: Revision History.SchDoc

SHEET 7 OF 7