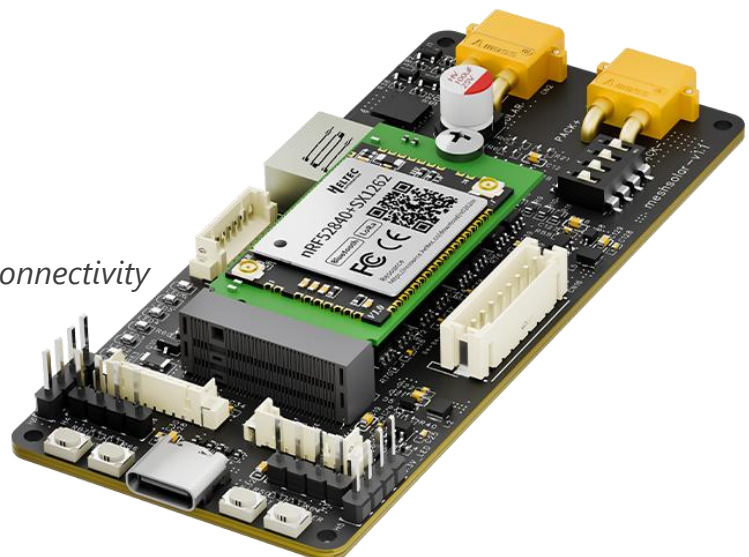




MeshSolar

Li-ion BMS Dev Board

Solar Charging + BLE + LoRa Connectivity



Document Version

Version	Time	Description	Remark
Rev. 1.0	2025-6-16	Preliminary version	Richard

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1 Description

1.1 Overview

MeshSolar is an integrated power management and communication solution designed for outdoor low-power devices, consisting of a BMS Power Management Board and an MCU Communication Control Mainboard. The system features solar MPPT charging, multi-protocol fast charging (supporting USB PD3.0 and 18–25V DC input), intelligent battery management (compatible with 1 – 4 cells/battery packs, with overcharge/over-discharge/short-circuit/over-temperature protection and balanced charging), and dual-mode Bluetooth + LoRa wireless communication (LoRa range up to 10 km with 21 ± 1 dBm transmit power).

With its low-power design, extensive hardware expansion interfaces (supporting displays, GPS, and general-purpose I/O), and seamless compatibility with the HT-N5262M module (nRF52480 + SX1262), MeshSolar is ideal for high-power or long-term stable power supply applications such as solar-powered systems and remote monitoring. It also fully supports the Meshtastic ecosystem.

1.2 Features

- **Battery Management:**
 - Supports 1-4 battery configurations (single-cell or battery packs)
 - Features comprehensive protection including overcharge/over-discharge/short-circuit/over-temperature safeguards
 - Enables balanced charging for optimal battery performance
- **Advanced Charging Capabilities:**
 - Multi-mode charging options: 18~25V Solar MPPT charging, USB PD3.0 fast charging, 18~25V external DC charging
 - Web-based configuration for charging/discharging parameters
- **Power Monitoring & Control:**



- Continuous power monitoring via software interface
- LED battery level indication
- One-touch output shutdown function
- **Connectivity & Expansion:**
 - Dual-mode wireless communication: Bluetooth connectivity, LoRa long-range communication (up to 10km range at $21\pm 1\text{dBm}$)
 - M.2 MCU application mainboard interface
 - Expansion interfaces for displays, GPS, and general-purpose I/O
- **Performance & Compatibility:**
 - Excellent low-power performance
 - Full compatibility with HT-N5262M (nRF52480 + SX1262)
 - Seamless integration with Meshtastic ecosystem

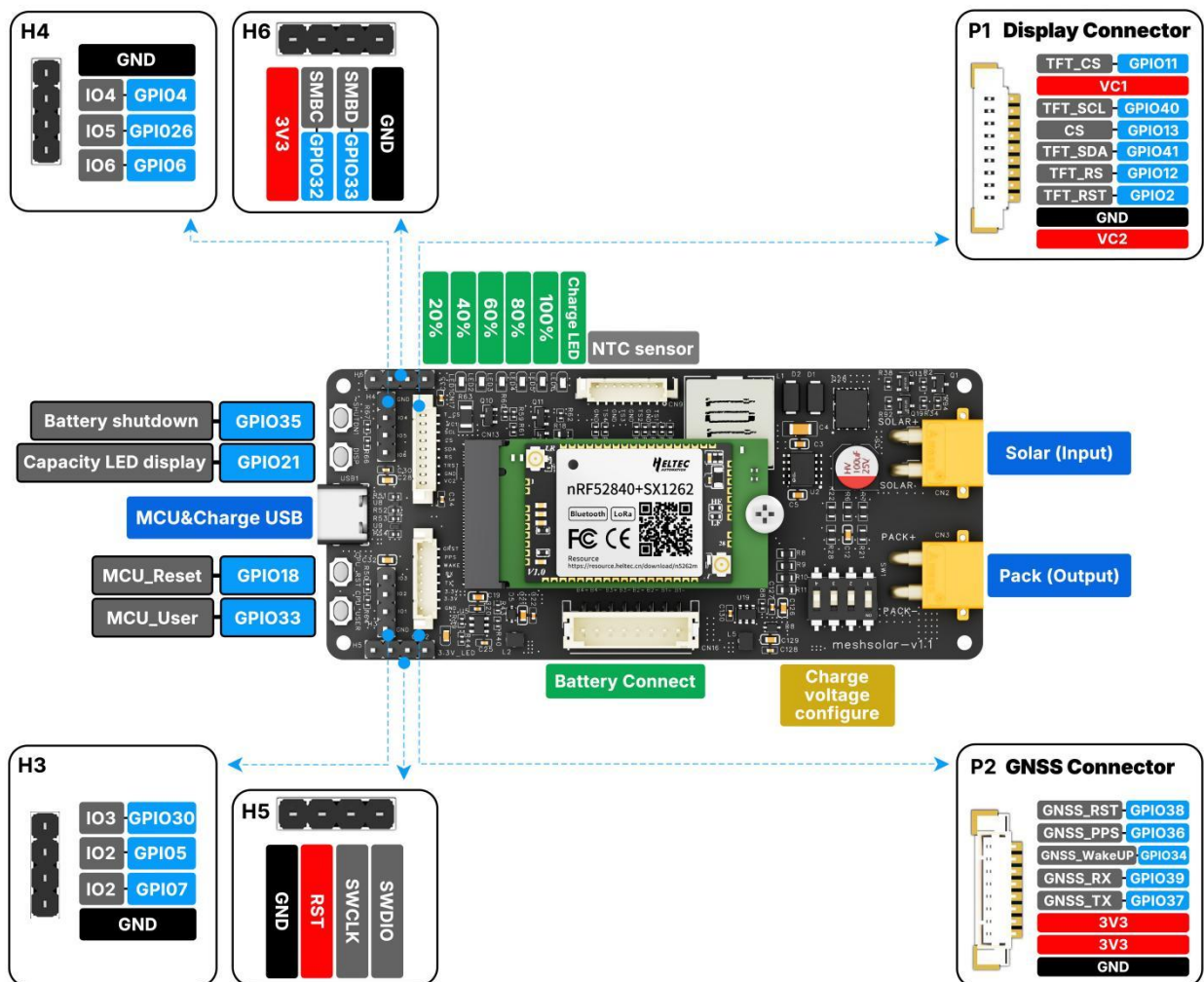
1.3 Typical Applications

- Environmental Monitoring Systems
- Smart Agriculture & Livestock Farming
- Asset Management and Tracking
- Outdoor Emergency Solutions
- Solar Street Lighting Systems
- Industrial Infrastructure Monitoring
- Open-source projects like **Meshtastic**

2 Pin Definition

2.1 BMS board pins:

For more details, please refer to the schematic link: **MeshSolar Schematic**



Button

Name	Description
SHUTDN1	Battery shutdown, GPIO35
DISP	Capacity LED display, GPIO21

<https://heltec.org>



CPU_RST	MCU reset, GPIO18
CPU_USER	MCU user, GPIO33

H3

Name	Description
IO3	GPIO30
IO2	GPIO5
IO1	GPIO7
GND	Ground

H4

Name	Description
GND	Ground
IO4	GPIO4
IO5	GPIO26
IO6	GPIO6

H5

Name	Description
GND	Ground
RST	MCU reset
SWCLK	SWCLK
SWDIO	SWDIO

P1

Name	Description
T_CS	TFT_CS, GPIO11



VC1	3V3
SCL	TFT_SCL, GPIO40
CS	CS, GPIO13
SDA	TFT_SDA, GPIO40
RS	TFT_RS, GPIO12
TRST	TFT_RST, GPIO2
GND	Ground
VC2	3V3

P2

Name	Description
GRST	GNSS_RST, GPIO38
PPS	GNSS_PPS, GPIO36
WAKI	GNSS_Wake_Up, GPIO34
RX	GNSS_RX, GPIO39
TX	GNSS_TX, GPIO37
3.3V	3V3
3.3V	3V3
GND	Ground

2.2 HT-N5262M MCU Pins

SPI, I2C, UART, QPSI, I2S, PDM, QDEC, PWM: All GPIOs can be configured as these function, but pin conflicts must be avoided (the same pin cannot be used for multiple peripherals simultaneously). For more information, please refer to the [HT-N5262M Schematic](#).



3 Specifications

3.1 General Specification

Table3.1: General specification

Parameters	Description
BMS chip	BQ4050, CN3795
Main Control Module	HT-N5262M(nRF52840+SX1262)
PCB Storage Condition	-30~80℃ , 90%RH(No condensing)
Number of Managed Battery Cells	1~4 cells
Input Voltage	18~25V(Learn More)
Battery charging current	≤1.5A
Solar & Pack Interface	XT30 Female
Battery Cell Interface	PH2.0-8P
Battery Pack Thermistor Interface	HC1.25-8P
MCU Control Board Interface	PCIe M.2
MCU Board 3.3V Supply Current	800mA
Expansion Interface	Screen: HC1.25-9P, GNSS: HC1.25-8P
USB Expansion Interface	USB Type C
Dimensions	43*97*11mm
Weight	



3.2 Main Control Module Specification

Table3.2: Main Control Module specification

Parameters	Description
MCU	nRF52840 (BLE)
LoRa Chip	SX1262 (LoRa)
Memory	1M ROM; 256kB SRAM
Bluetooth	Bluetooth 5, Bluetooth mesh, BLE.
Operating temperature	-40~85℃
Operating Humidity	90%(No condensing)
Power Supply	3.3V
Power Consumption	Table3.3
Hardware Resource	3*SPI, 2*I2C, 2*UART, 4*PWM, QPSI, I2S, PDM, QDEC, Etc.
Interface	2*IPEX1.0(antenna), M.2
Dimensions	30*20*3.2 mm



4 Electrical Characteristics

4.1 Battery Parameters

Table5.1: Battery parameters

Parameter	Specification	Remarks
Number of Cells	1~4 cells	Configurable
Cell Type	Lithium-ion, lithium polymer, lithium iron phosphate	The required hardware version varies depending on the battery type.
Charging Voltage	4.2V/Cell 3.6V/Cell	Depends on the battery type
Charging Method	Constant Current (CC) Constant Voltage (CV)	CC followed by CV
Charge Current	Max 1.5A	
Discharge Current	Max 2A	

4.2 Voltage Input

The Solar/DC input supports both solar panel and DC power sources, with a requirement that the **Voc**(open-circuit voltage) must exceed 18V not exceed 25V. The USB-C port only enables charging functionality when it detects a PD3.0 protocol with a 20V input voltage; a 5V input is solely for powering the MCU.

Parameter	Voc Min	Vmp	Voc Max	Unit
Solar(Voc)	18	18	25	V
DC	18		25	V
USB-C(PD) ^①		20		V

① The USB-C port will only charge the battery when it detects the PD 3.0 protocol and the voltage reaches 20V.



USB-C(MCU)	4.5	5	5.5	V
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4.3 Pack Output

The battery pack's output voltage is equal to the sum of the series-connected batteries' voltages.

Number of Batteries	Min	Max	Unit
1	2.5	4.2	V
2	5	8.4	
3	7.5	12.6	
4	10	16.8	

4.4 Protection and Balancing

Some "Configurable" parameters can be configured via the software or web page provided by Heltec. Please contact your battery supplier to avoid exceeding relevant values and causing permanent damage to your battery.

Function		Value	Description
Balancing Voltage		4.2V	Single cell reaches 4.2V
Balancing Mode			Resistive balancing
Balancing Current		100mA	Passive balancing
Overcharge Protection		4.3V	Stop charging, allow discharge, recovery threshold: 4.1V
Over-discharge Protection		2.5V	Stop discharge, allow charging, recovery threshold: 2.7V
Overcurrent	Charging	2A	Auto-recovery after 10S disconnection
	Discharging	2A	Auto-recovery after 10S disconnection
Battery Overtemperature		60°C	Charge/discharge termination (Configurable)



Battery Undertemperature	-10°C	Charge/discharge termination (Configurable)
Switch Overtemperature	80°C	Charge/discharge termination (Configurable)
Undervoltage	2.5V	Discharge termination (Configurable)

5 LoRa RF Characteristics

5.1 RF module power consumption

The test data comes from the standalone test results of the HT-N5262M, using the sample code from the official [Heltec nRF5240 library](#).

Table5.1: Transmit power

Mode	Condition	470MHz	868MHz	915MHz
LoRa_TX	5dBm		83mA	93mA
	10dBm		108mA	122mA
	15dBm		136mA	151mA
	20dBm		157mA	164mA
BT	UART	93mA		
	Scan	132mA		
Sleep		8uA		

5.2 Transmit Power

Table5.2: Transmit power

Operating frequency band	Maximum power value/[dBm]
470~510	21 ± 1
863~870	21 ± 1



902~928

21 ± 1

5.3 Receiving Sensitivity

The following table gives typically sensitivity level.

Table5.3: Receiving sensitivity

Signal Bandwidth/[KHz]	Spreading Factor	Sensitivity/[dBm]
125	SF12	-135
125	SF10	-130
125	SF7	-124

5.4 Operation Frequencies

HT-N5262M supports LoRaWAN frequency channels and models corresponding table.

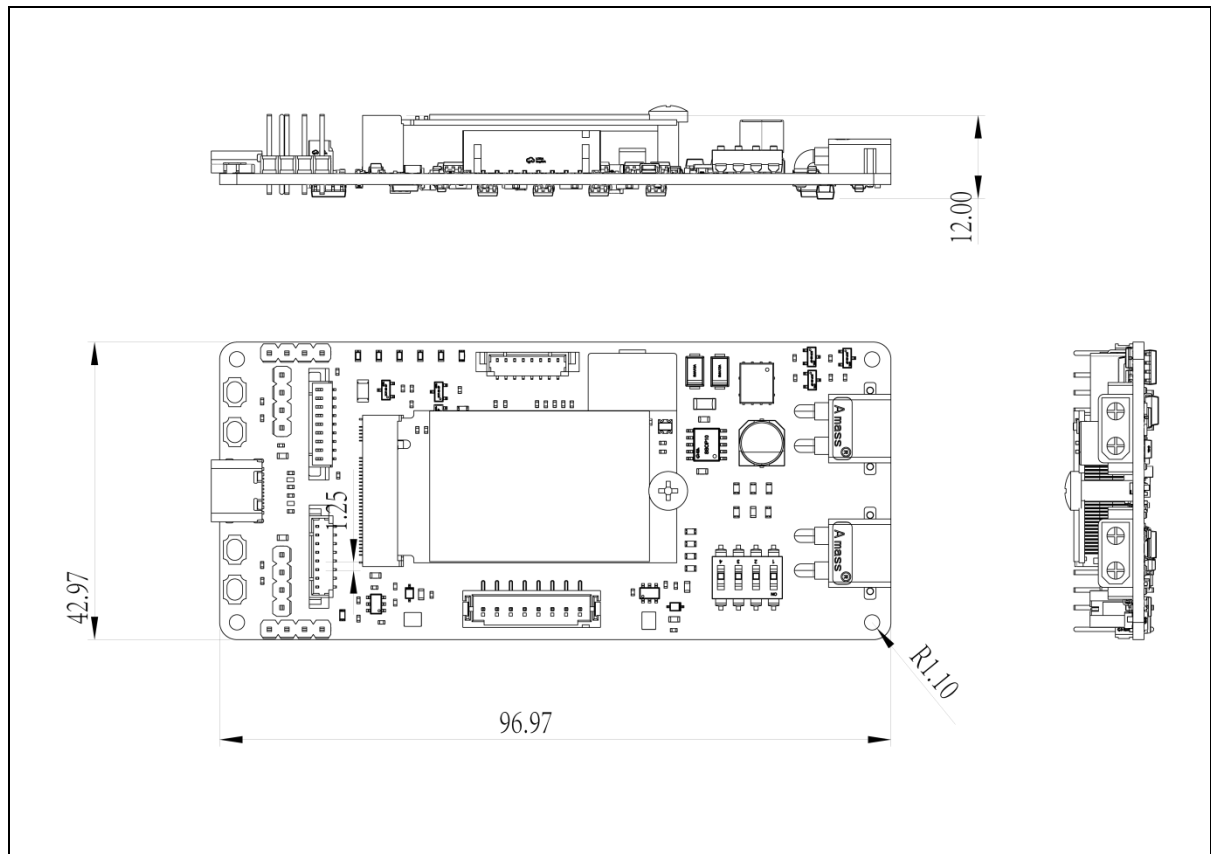
Table5.4: Operation Frequencies

Region	Frequency (MHz)	Model
EU433	433.175~434.665	HT-N5262M-LF
CN470	470~510	HT-N5262M-LF
IN868	865~867	HT-N5262M-HF
EU868	863~870	HT-N5262M-HF
US915	902~928	HT-N5262M-HF
AU915	915~928	HT-N5262M-HF
KR920	920~923	HT-N5262M-HF
AS923	920~925	HT-N5262M-HF



5 Physical Dimensions

For more model details, please refer to this link:[listing_directory](#)
[/download/MeshSolar/demension](#)



6 Resource

6.1 [BMS Board Schematic](#)

6.2 [HT-N5262M Schematic](#)

6.3 [Resource Station](#)

6.4 [Heltec nRF52840 Framework](#)

7 Heltec Contact Information

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