

3. Product Specification

No	Item		Specification	Remarks
1	Nominal Voltage		46.8V	Standard voltage 3.6V/cell, 13 serial cells
	Typical Capacity		NCR18650GA: 13.8Ah	Cell for 13S4P 2.68A discharge (at 25 °C ± 2°C)
			INR18650-35E: 13.6Ah	
	Rated Capacity		NCR18650GA: 13.2Ah	
			INR18650-35E: 13.6Ah	
Minimum Capacity		13.4±1%Ah		
2	Communication Interface		CAN Bus	Baud Rate 250Kbps
3	Discharge and Charge Path		Same	
4	Discharge Voltage Range		33.8 ~ 54.6 V	
	Discharge Cut-off Voltage		Min Cell < 2.6V/Cell	Stops to discharge when any cell reaches 2.6V (at 25 °C ± 2°C)
	Nominal Continuous Discharge Current		-10 ~ 15 °C: 15A	Continuous Discharge Current: SOC from 100% to 0%
15 ~ 40 °C: 6A			Continuous Discharge Current: SOC from 100% to 0%	
5	Charge Voltage		54.6V (Constant Voltage)	Charge method: CC→CV
	Nominal Charge Current (CC Mode)		2A	Constant current
	Maximum Charge Current (for Charger Max)		3.5A	Constant current
6	Fully Charged Condition		Pack Voltage > 53.95V & Taper Current < 1A	Charger LED color: Red turn to Green
7	Power Consumption (@48V)	Operating Mode	< 10 mA	
		Shutdown Mode	< 20 uA	
8	Operating Temperature Range		Discharge: -10 ~ 40 °C Charge: 0 ~35 °C	This means Environment temp. Not means Battery temp.
	Storage Temperature Range		1. -20 to 50 °C (within 1 month) 2. -20 to 40 °C (within 3 months) 3. -20 to 20 °C (within 1 year)	Item 3: During storage, the battery must be recharged to 60%~100% every 3 months.

4. Protection Function

4.1 Recoverable Protection

Item	Set			Release / Troubleshooting	
	Condition	Time	Action	Condition	Action
CHG Over Temp	> 45°C	5s	Enter Shutdown mode	< 40°C	Ensure the temperature is below 40°C before trying to recharge the battery.
DSG Over Temp	> 65°C	5s	Enter Shutdown mode	< 60°C	Press the power button to turn on the battery.
CHG Under Temp	< 0°C	5s	Enter Shutdown mode	> 5°C	Ensure the temperature is above 5°C before trying to recharge the battery.
DSG Under Temp	< -20°C	5s	Enter Shutdown mode	> -10°C	Press the power button to turn on the battery.
CHG Over Current	>6A	5s	Enter Shutdown mode	< 4A	Unplug the charger and plug it back in to charge again.
DSG Over Current	>30A	5s	Enter Shutdown mode	< 20A	Press the power button to turn on the battery.
Cell Over Voltage	Any > 4.23V	5s	Enter Shutdown mode	< 3.95V	Please disconnect the charger, then press the power button to turn on the battery.
Cell Under Voltage	Any < 2.6V	5s	Enter Shutdown mode	> 3.2V	The battery needs to be charged.
MOS Over Temp	> 90°C	5s	Enter Shutdown mode	< 60°C	Press the power button to turn on the battery.
short-circuit	>100A	500uS	Enter Shutdown mode	Check if the battery output is short circuit. Try to turn on the Battery Pack by charger or SW Pin after removal of the short circuit.	

4.2 Permanent Failure Protection

No	Item	Condition	Level	Action
1	2 nd Over Voltage Protection by MCU	Set	Max Cell > 4.35 V/Cell	Fuse Blow
		Delay	5 Sec	
2	2 nd Under Voltage Protection by MCU	Set	Min Cell < 1.7 V/Cell	Fuse Blow
		Delay	5 Sec	
3	Cell Imbalance Protection	Set	Cell ΔV > 0.5V & Any Cell > 3.7V	Fuse Blow
		Delay	5 Sec	
4	C/D MOSFET Fail	Set	C/D MOSFET OFF & Current > 500mA	Fuse Blow
		Delay	5 Sec	

5. Special Function

The battery pack has some special functions, which could satisfy some special application of customer.

1. To enter and exit shipping mode:

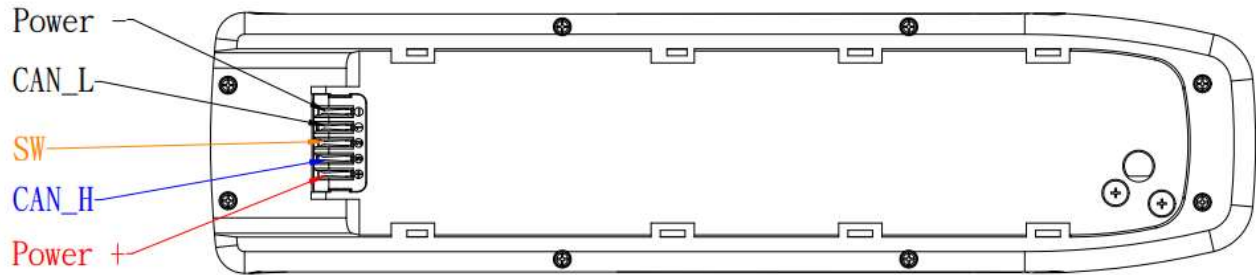
When shipping mode command is sent, the Battery Pack will enter shipping mode. In shipping mode, lower its power consumption to prevent battery drain.

We program the battery pack in the factory into shipping mode. When the customer gets it, they need to bring it out of shipping mode by plugging in the charger.

2. If there are communication problems or no communications present on the CAN Bus for 5 minutes, the battery pack will automatically shut down the output.
3. When a short circuit occurs, the output voltage drops to 0V and the battery will enter shutdown mode to prevent damage.
4. While the charger is connected, the battery cannot turn off via HMI command.
5. If a protection event occurs during charging, the battery pack will automatically shut down.

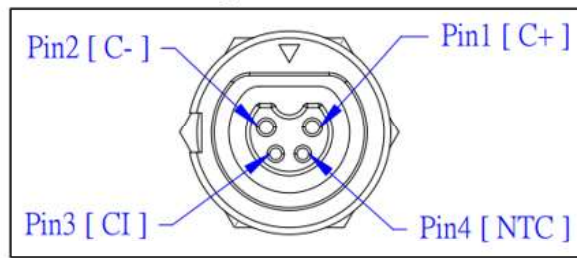
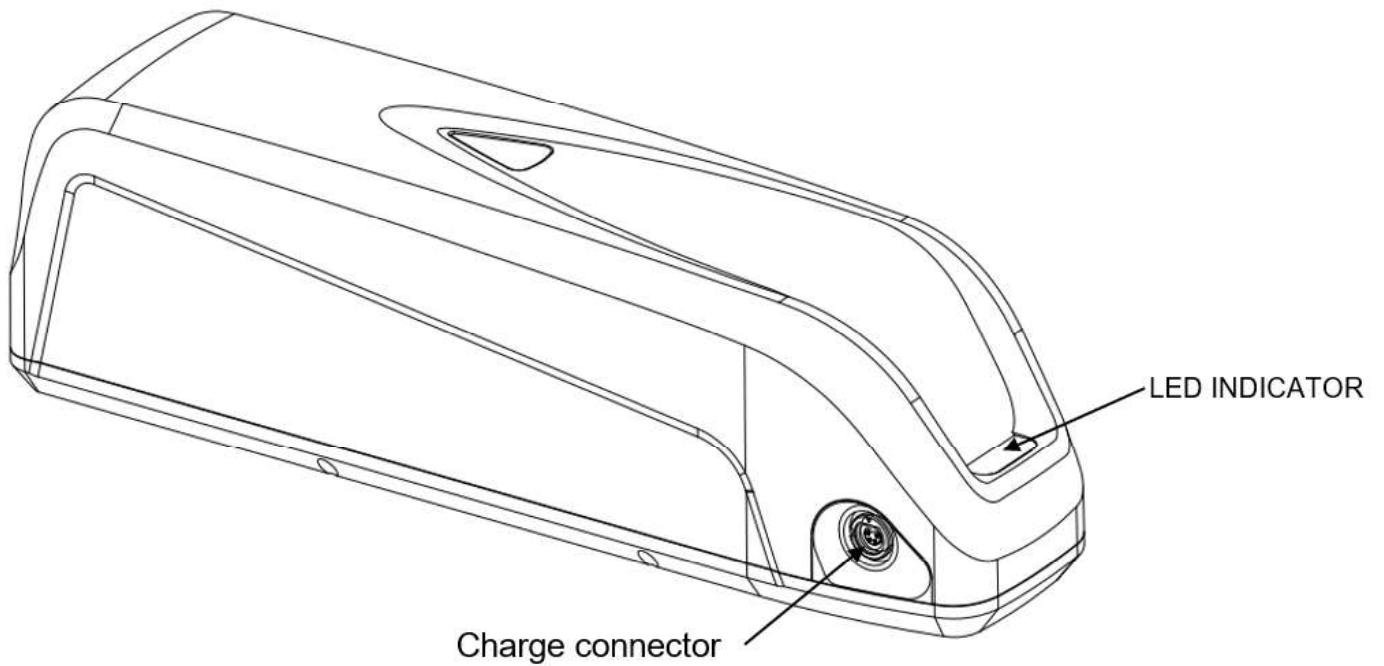
6. Connector Definition

6.1 Discharge connector



Discharge connector		
PIN	COLOR	PIN FUNCTION
-	BLACK	P-
1	WHITE	CAN_L
2	ORANGE	SW (POWER ON)
3	BLUE	CAN_H
+	RED	P+

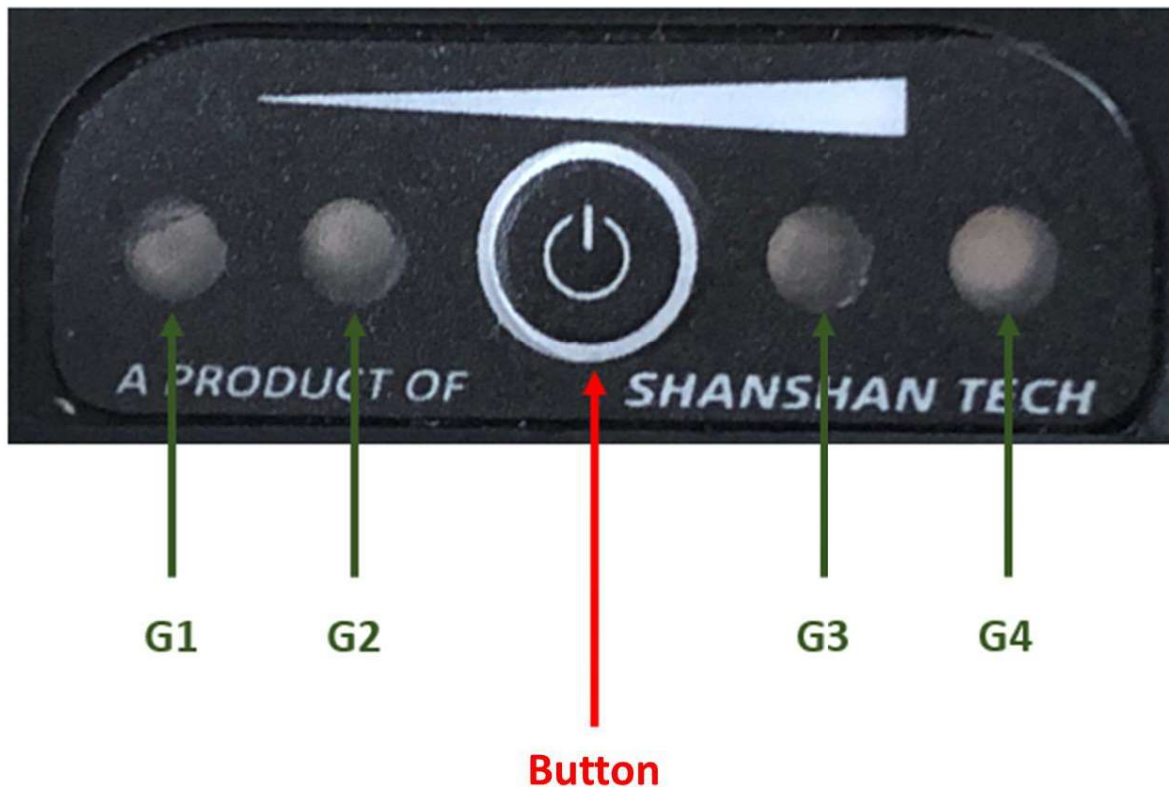
6.2 Charge connector



Charge connector	
Pin	Function
1	C+
2	C-
3	CI
4	NTC

7. LED/Button/Turn On/Shutdown Behavior

7.1 LED and Button Position



Note: The button is only for LED display, not the power button.

7.2 Battery Level Indication

Fast press the button

Press the button less than 1 second when power on.

Battery Capacity LED Indication	Remaining Battery Capacity
LED G1 G2 G3 G4 Static Light ●●●●	91~100%
LED G1 G2 G3 Static Light ●●●○	51~90%
LED G1 G2 Static Light ●●○○	11~50%
LED G1 Static Light ●○○○	0~10%

● → Light

○ → Not Light

7.3 Charge Level Indication

During charging-in-progress LED G keeps blinking once per every second.

Battery Capacity LED Indication	Remaining Battery Capacity
LED G1 G2 G3 G4 Static Light ●●●☆	91~100%
LED G1 G2 G3 Static Light ●●☆○	51~90%
LED G1 G2 Static Light ●☆○○	11~50%
LED G1 Blinking ☆○○○	0~10%

☆ → **Blink**

● → **Light**

○ → **Not Light**

7.4 Turn-On the Battery Pack

Pull low SW Pin (Discharge Connector) more than 3 second.

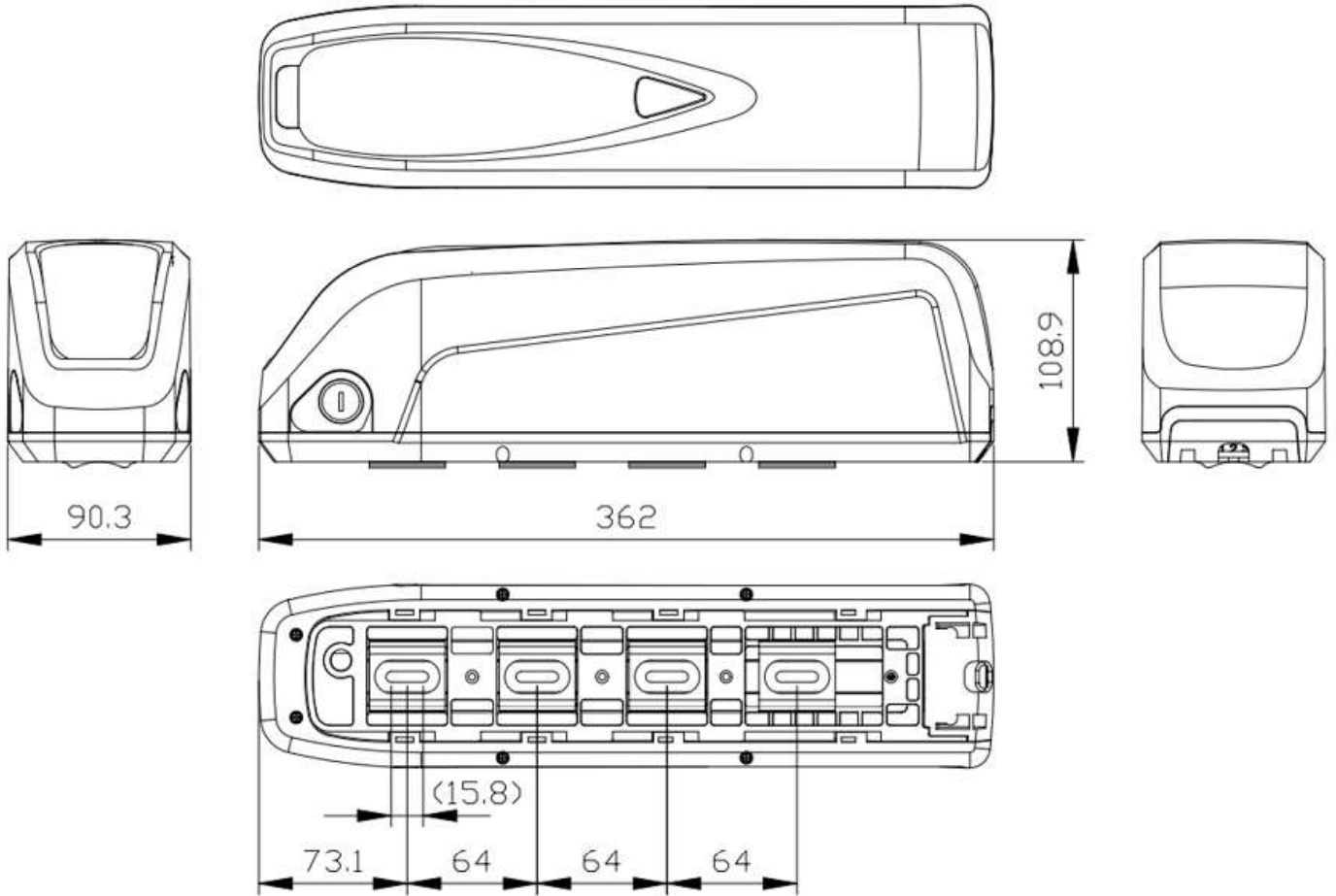
Turn on the lights in the order of G1G2G3G4.

7.5 Shutdown the Battery Pack

The battery must be shut down using the CAN command (Refer to Can bus protocol).

Turn on the lights first, then turn off the lights in the order of G4G3G2G1.

8. Battery Pack Outline



9. Warning Letter

9.1 For Manufacturer

The following represents a typical, but non-exhaustive, list of good advice to be provided by the manufacturer of secondary cells and batteries to equipment manufacturers and battery assemblers.

- a. Do not dismantle, open or shred cells. Batteries should be dismantled only by trained personnel. Multi-cell battery cases should be designed so that they can be opened only with the aid of a tool.
- b. Compartments should be designed to prevent easy access to the batteries by young children.
- c. Do not short-circuit a cell or battery. Do not store cells or batteries haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by conductive materials.
- d. Do not remove a cell or battery from its original packaging until required for use.
- e. Do not expose cells or batteries to heat or fire. Avoid storage in direct sunlight.
- f. Do not subject cells or batteries to mechanical shock.
- g. In the event of a cell leaking, do not allow the liquid to come into contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.
- h. Equipment should be designed to prohibit the incorrect insertion of cells or batteries and should have clear polarity marks. Always observe the polarity marks on the cell, battery and equipment and ensure correct use.
- i. Do not mix cells of different manufacture, capacity, size or type within a battery.
- j. Seek medical advice immediately if a cell or battery has been swallowed.
- k. Consult the cell or battery manufacturer on the maximum number of cells which may be assembled in a battery and on the safest way in which cells may be connected.
- l. A dedicated charger should be provided for each equipment. Complete charging instructions should be provided for all secondary cells and batteries offered for sale.
- m. Keep cells and batteries clean and dry.
- n. Wipe the cell or battery terminals with a clean dry cloth if they become dirty.
- o. Secondary cells and batteries need to be charged before use. Always refer to the cell or battery manufacturer's instructions and use the correct charging procedure.
- p. Do not maintain secondary cells and batteries on charge when not in use.
- q. After extended periods of storage, it may be necessary to charge and discharge the cells or batteries several times to obtain maximum performance.
- r. Retain the original cell and battery literature for future reference.
- s. When disposing of secondary cells or batteries, keep cells or batteries of different electrochemical systems separate from each other.

9.2 For End-Users

The following represents a typical, but non-exhaustive, list of good advice to be provided by the equipment manufacturer to the end-user.

- a. Do not dismantle, open or shred secondary cells or batteries.
- b. Keep batteries out of the reach of children. Battery usage by children should be supervised. Especially keep small batteries out of reach of small children.
- c. Seek medical advice immediately if a cell or a battery has been swallowed.
- d. Do not expose cells or batteries to heat or fire. Avoid storage in direct sunlight.
- e. Do not short-circuit a cell or a battery. Do not store cells or batteries haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.
- f. Do not remove a cell or battery from its original packaging until required for use.
- g. Do not subject cells or batteries to mechanical shock.
- h. In the event of a cell leaking, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.
- i. Do not use any charger other than that specifically provided for use with the equipment.
- j. Observe the plus (+) and minus (–) marks on the cell, battery and equipment and ensure correct use.
- k. Do not use any cell or battery which is not designed for use with the equipment.
- l. Do not mix cells of different manufacture, capacity, size or type within a device.
- m. Always purchase the battery recommended by the device manufacturer for the equipment.
- n. Keep cells and batteries clean and dry.
- o. Wipe the cell or battery terminals with a clean dry cloth if they become dirty.
- p. Secondary cells and batteries need to be charged before use. Always use the correct charger and refer to the manufacturer's instructions or equipment manual for proper charging instructions.
- q. Do not leave a battery on prolonged charge when not in use.
- r. After extended periods of storage, it may be necessary to charge and discharge the cells or batteries several times to obtain maximum performance.
- s. Retain the original product literature for future reference.
- t. Use the cell or battery only in the application for which it was intended.
- u. When possible, remove the battery from the equipment when not in use.
- v. Dispose of properly.