Battery Charging and Protection Series



5S 26650 Lithium-Ion Battery Charging, Protection and Balancing Board w MPPT – BCPB4 (PS-BC12113)

Overview:

BCPB4 is a highly reliable Lithium-Ion Battery Charging, Protection, and Balancing Board that operates with wide input range, 5-24V. This board able to charge the batteries from input voltages above, below, or equal to the output voltages. It is designed for 5 in series 26650 Lithium-Ion Battery which provides approximately 90-125Wh energy. The MPPT charging integrated feature supports a 15-24V power supply. BCPB4 is complemented with a visualized display of battery level indicators. To ensure the reliability of this board, it is equipped with full protection circuit; overcurrent, over-temperature, short circuit, and over/under voltage protection. The battery balancing IC allows constant battery voltage between 5 in series 26650 Lithium-Ion cells. It is designed for industrial application with verified MTBF for low-temperature increment under rigorous design.

Distributors:

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All BCPB Series are complied with RoHS and pre-tested with our power supply solution adheres to FCC and CE. FCC, CE, and RoHS certification will be provided per customer requests. The test reports for high and low temperature with 200 cycles of HASS Test will be provided once requested by customer through emails and this request is applicable for bulky purchases of MOV USD$10,000 or MOQ 500pcs only. RoHS 3 (EU

Ready for:

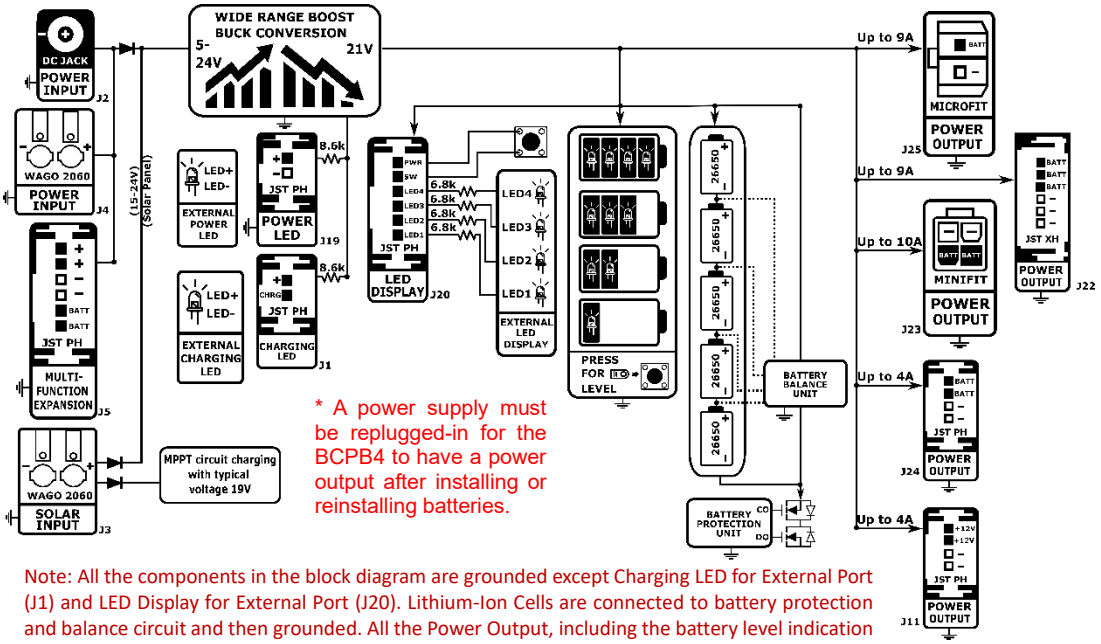
FC CE

Contact Info

- **Email:**
  info@wondom.com

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Block Diagram



Note: All the components in the block diagram are grounded except Charging LED for External Port (J1) and LED Display for External Port (J20). Lithium-Ion Cells are connected to battery protection and balance circuit and then grounded. All the Power Output, including the battery level indication module will be disconnected once the board goes into a protection mode. When the battery is fully charged, the voltage across the charging LED shunt resistor is approximately 28V and drops drastically to 0V when there is no power supplied to the board.

Applications:

- Industrial Applications
- DIY and IoT Purposes
- Power Bank for Router/ Drone/
- High Power Portable Speaker
- Time Lapse Camera

Key Features:

- 5-24V Wide Range Charging Voltage
- Large Battery Capacity with 5S 26650 Cells
- Battery Voltage Balancing
- Solar Charging Supported
- Multiple Output Ports
- Charge and Discharge at the Same Time
- LED Indicators for Battery Level
- Full Protection Circuit; Short Circuit, Over-temperature, Over/Under Voltage, Over-current, Over-charge and Over-discharge Protection

Notes:

1. Sure Electronics does not provide technical support for any behavior of connecting the board with power supply out of the recommended range. Any damage/problem arises due to this, will not be covered by the warranty.
2. Remove battery from the circuit board if it is not use for a long time.
3. For initial charging, it is normal for the board to take longer time to fully charge.
4. If the board goes into a protection mode or the battery has been re-installed, please recharge the board with DC Input Jack to reactivate.
5. Please check the battery polarity before installation. This board can be used with Lithium-Ion battery ONLY. Other batteries, including LiFePO4 is prohibited.
6. Please note, this board is prohibited to be connected in parallel or in series.

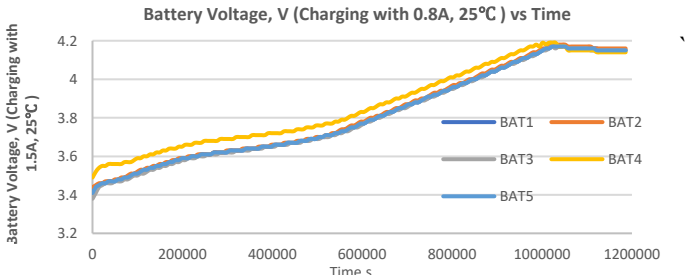
Electrical Specifications

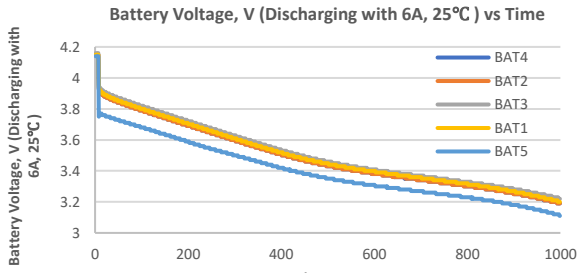
Specifications typical @ +25℃ unless otherwise noted. Specifications subject to change without notice.

Parameters	Conditions	Min.	Typ.	Max.	Units
Supply Voltage	Both wide input range, DC Jack (J1) and Wago 2060 (J2) through diode.	5.0	-	24.0	VDC
	Solar panel input, Wago 2060 through a diode (J5).	15.0	19.0	24.00	VDC
Supply Current	Supply current at wide input range, DC Jack (J1) & Wago 2060 (J2) are limited by boost circuit only, so typical current limitations are same.	0.75	2	2.5	A
Output Current	JST-PH (J24). Peak current 8A for 200ms.	-	4.0	4.0	A
	JST-PH (J11). Peak current 8A for 200ms.	-	4.0	4.0	A
	Molex Micro-Fit (J25). Peak current 12A for 200ms.	-		9.0	A
	JST-XH (J22). Peak current 12A for 200ms.	-	-	9.0	A
	Molex Mini-Fit (J23). Peak current 12A for 200ms.	-	-	10.0	A
Charge current	Pre-charge current (0-140mA) might take hours before going to constant current charge mode at 0.8A minimum charge current. The charging current decreases dramatically after reaching constant voltage mode. The maximum charge current can only be obtained if I_{in}: 2A, V_{in}: 5V are supplied to the board. Charge current decreases if lower input current and voltage applied to the board. Charge current can be controlled by 4 positions slide switch. See charging control at pin definitions section for further details on the charge current selection.	0.8 +15%	0.8 (by default setting)	0.8 +15%	A
Over-Current Protection	Do not connect the battery directly to the load, otherwise the overcurrent protection circuit cannot function properly. 16A peak current for 200ms.	6.0	10.0 (cont. and max.)		A
Battery Capacity	Use 5000mAh to get the typical value. Refer battery's user manual if you are using your own battery.	5000mAh 26650 Lithium-Ion Battery			
Overcharge Detection Voltage (per cell)	Once overcharge triggered, users are supposed to wait till voltage drops to over voltage release voltage and activate again for normal use.	4.19	4.24	4.29	V
Overcharge Release Voltage (per cell)		4.00	4.18	4.22	V
Over-Discharge Detection Voltage (per cell)	Power up this board through DC Jack (J1) or Wago 2060 (J2) to activate if the board goes into protection mode or for initial use.	2.72	2.80	2.88	V
Over-Discharge Release Voltage (per cell)		2.90	3.00	3.10	V
Operating Temperature	For wide operation range version, please contact us for solutions.	0	20	50	℃

Note: All parameters were tested with the GwInstek GDM-8341 multimeter. All charge and discharge curves are from Hioki LR8500 Data Loggers. For authorized distributors and OEM customers who need more detailed performance graphs and parameter settings, please send an inquiry e-mail to us. Raw test data and graphs from data analysis software will also be provided (Not available for retail customers).

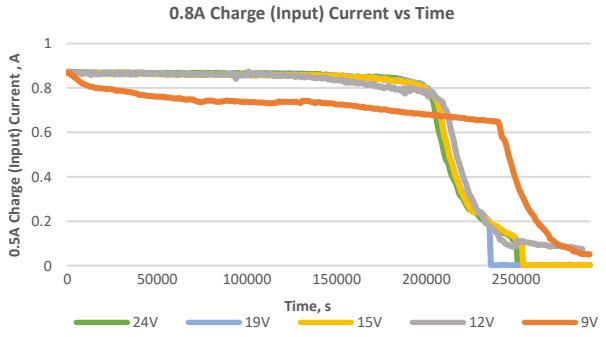
Charge and Discharge Curve

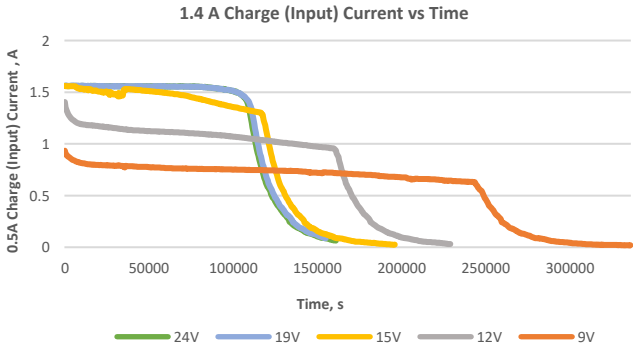




Note: The battery balancing circuit in this board allows the charge and discharge voltage across 5S 26650 Lithium-Ion Battery to be almost the same. Balancing is activated at the end of each charging cycle. OEM customers can require our raw test data of up to 200 charge/discharge test cycles to evaluate the battery performance and the balancing performance. Test curves are based on batteries used up for less than 200 charge/discharge cycles. Batteries used for more than 200 charge/discharge cycles will not absolutely be balanced during charging and discharging. Plus, the battery capacity might be less than the initial cycle.

Charge Characterization





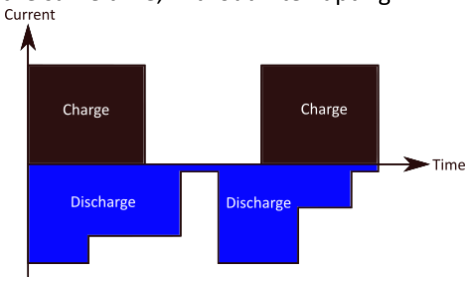
Self Discharge Rate

The self-discharge rate can be observed through the battery discharging rate. The battery discharge rate is independent of the circuit board discharging rate. Take reference from the battery datasheet for battery charging rate's details.

SELF DISCHARGE RATE	
Battery	5% -10% / MONTH
Battery Protection Circuit Standby Current Consumption	Typical 30 µA, Maximum 45 µA

DC-Uninterrupted Power Supply (UPS) Features

BCPB4 is designed as DC-Uninterrupted Power Supply (UPS). This unique feature allows this board to be charged and discharged at the same time, without interrupting.



Cable Selections

Use 24 AWG or 0.25 mm^2 only for JST-PH connectors while 22 AWG or 0.34 mm^2 only for JST-XH output connector. The cable's temperature might be a little bit high. Take reference from the table below to see the maximum current of JST-PH and JST-XH connectors can withstand at different temperature. It is suggested to use 18 AWG or 0.75mm^2 at Molex Micro-Fit and Molex Mini-Fit connectors while 20 AWG or 0.50mm^2 for Wago 2060 connector when connecting the board to the input ports. See Current Derating Reference Information Table and Current Rating Table for Micro-Fit and Mini-Fit respectively for future reference. 5.5/2.1mm or compatible plug is suggested for wide range DC Jack input. For industrial customers, we provide customized wire harness and 3D/2D wire diagram for your reference.

Note: Current de-rating's values are provided as guidelines, applicable for not exceeding 30°C temperatures rise ONLY.

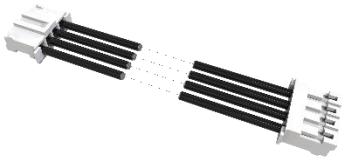
AWG	Conductor Cross Section (mm^2)	Suggested Metric (mm^2)	Number of 4-Pair Cables in Bundle					
			1			2-7		
			Temperature Rating (°C)					
			60	75	90	60	75	90
			Maximum Current (A) per Conductor					
26	0.129	0.14	1	1	1	1	1	1
24	0.205	0.25	2	2	2	1	1.4	1.6
22	0.326	0.34	3	3	3	1.4	1.8	2.1

Current Derating Reference Information for Molex Micro-Fit			
AWG	Suggested Metric (mm^2)	2-CKT	
		Wire to Wire	Wire to Board
18	0.75	7	8.5
20	0.5	6.5	7

Current Rating Wire to Wire and Wire to Board for Molex Mini-Fit Connector			
AWG	Suggested Metric (mm^2)	2-3 -CKT	4-6 -CKT
18	0.75	9	8
20	0.5	7	6

Standard Accessories

A dual header of PH 4-PIN cable and Micro-Fit 2-PIN cable will be provided as standard accessories. You can cut the PH 4-PIN cable into half as shown in the picture below to get 2 PH cables. LED battery display kit and L-bracket are optional accessories for BCPB4. You can use your own cable for other connectors or get the unprovided cable and optional accessories at our webstore.



a) JST-PH-4PIN



b) Micro-Fit-2PIN

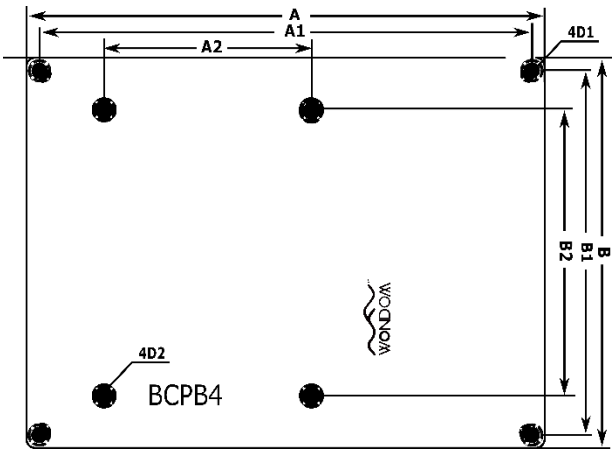
Bulk Order Information

For bulk purchases of more than 500 pieces, customers can email to request for special quotation at info@sure-electronics.com or info@wondom.com. 4K Resolutions Videos, Thermal Images, and STP Files are provided upon requests (Applicable only for system integrator with bulk purchase). STL Files, DWG Files, Product Videos, High Resolutions Product Pictures are open for download to retail customers. We will provide CE and FCC certificates upon request for the customized bulk purchase. Our product is EU REACH and RoHS 3 (EU 2015/863) compliant. Other necessary files (not included in the BCPB4 product module) shall be provided upon request from the system integrator, and bulk purchasers.

Item Provided	Bulk Purchases	Retail Purchases
STL Files	✓	✓
STP Files*	✓	✗
DWG Files	✓	✓
4K Resolutions Videos*	✓	✗
Product Videos (YouTube)	✓	✓
High Resolutions Product Pictures	✓	✓

Note:
All the *item(s) will be provided upon requests through email. Other items can be freely accessed and downloaded through our webstore or YouTube.

Dimensions

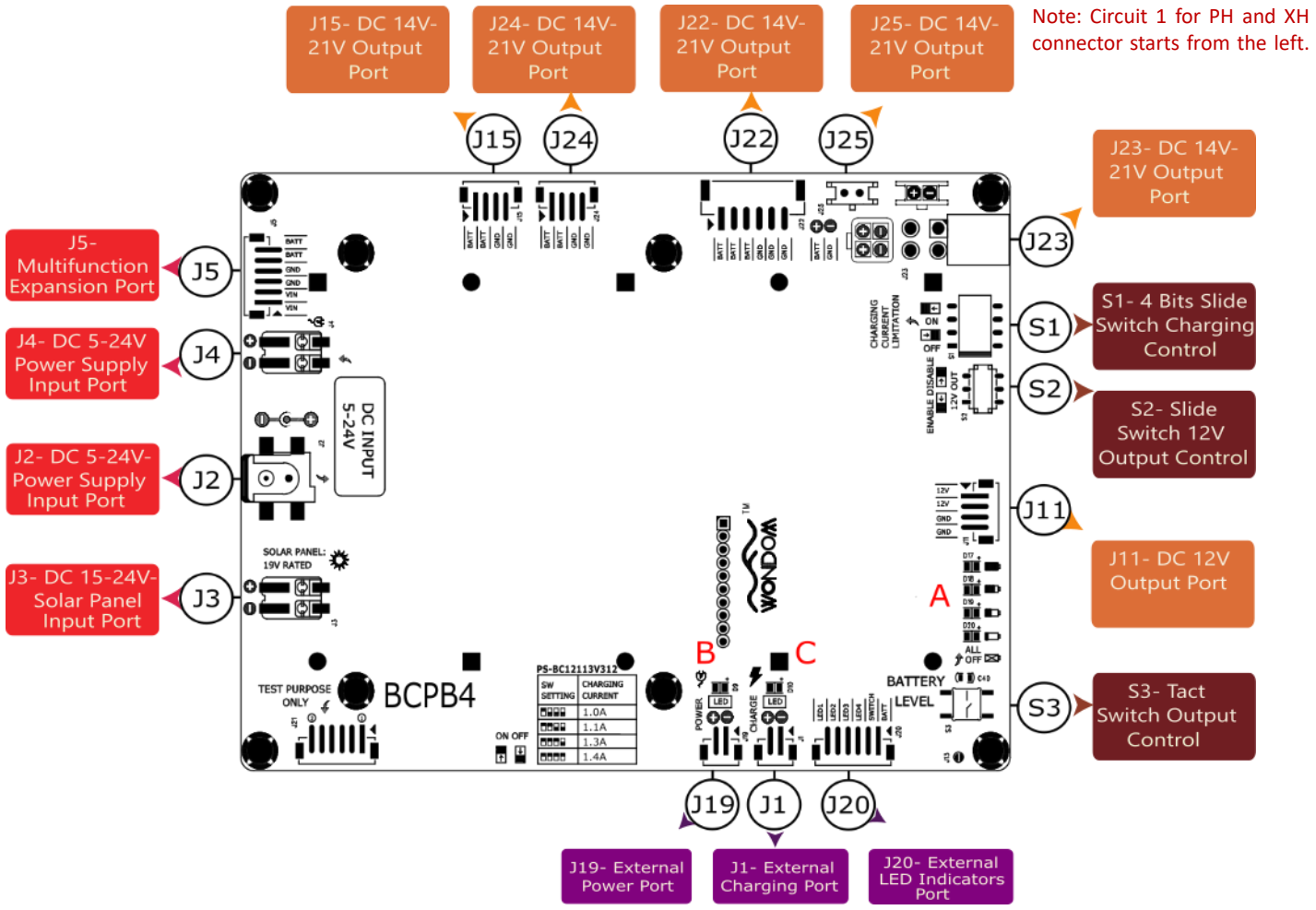


Dimensions	A (inch/mm)	A1 (inch/mm)	A2 (inch/mm)
	6.0/ 152.45.7	5.60/ 142.2	2.40/ 61.0
	B (inch/mm)	B1 (inch/mm)	B2 (inch/mm)
	4.50/ 114.3	4.10/ 104.1	3.30/ 83.8
	D1 (mm)	D2 (mm)	
	3.6 *Use 3 mm or #6-32 screw ONLY (not provided)	3.6 *Use 3 mm or #6-32 screw ONLY (not provided). Compatible with BCPB2 or 3.6"x2.7" board from Sure Electronic products.	

Notes:

- All dimensions are typical in inches/mm
- Tolerance x.xx = ±0.004''(±0.1mm)
- Battery holder's height: 0.85''/21.5 mm
- Board's height: 0.10'' /2.5 mm
- Maximum height of component's side: 0.43''/ 11.0 mm
- Total height: 1.38''/ 35.0 mm

Pin Definitions



Input Options:

- J2 DC Wide Input Range 5-24V, 5.5/2.1mm Jack
- J4 DC Wide Input Range 5-24V Wago 2060

Circuit	Definition
1	VIN
2	GND

- J3 DC 15-24V Solar Panel Input Wago 2060

Circuit	Definition
1	VIN
2	GND

Output Options:

• J22 DC 14V-21V JST XH-2.5mm 6-CKT

Circuit	Definition
1	BATT
2	BATT
3	BATT
4	GND
5	GND
6	GND

• J15, J24 DC 14V-21V JST PH-2mm 4-CKT

Circuit	Definition
1	BATT
2	BATT
3	GND
4	GND

• J25 DC 14V-21V Molex Micro-Fit 2-CKT

Circuit	Definition
1	BATT
2	GND

• J11 DC 12V JST PH-2mm 4-CKT

This port is designed to supply +12V to the port, board or any application that needs 12V; Eg: BCPB2 and BCPB5.

Circuit	Definition
1	BATT
2	BATT
3	GND
4	GND

• J23 DC 14V-21V Molex Mini-Fit 4-CKT

Circuit	Definition
1	BATT
2	BATT
3	GND
4	GND

External LED Indicators Port:

• J20 PH-2mm-6CKT

Circuit	Definition
1	POWER
2	SWITCH
3	LED4
4	LED3
5	LED2
6	LED1

LED Indicator for External Charging Port:

• J1 PH-2mm-2CKT

Circuit	Definition
1	LED+
2	LED-

LED Indicator for External Power Port:

• J19 PH-2mm-2CKT

Circuit	Definition
1	LED+
2	LED-

LED Indicators (Position A) for Battery Level Status:

• Four LED indicators for battery level status. Short press tact switch, S3 to check battery level

LED Indicators (Position B) for Charge:

Mode	Status
Charging	○
Fully Charged	×

○: ON ×: OFF

LED Indicators (Position C) for Power status:

Mode	Status
Power	○
No Power	×

○: ON ×: OFF

Charging Control: S1, 4 Bits Slide Switch

- S1 is used to set the 4 rated charge current. The current setting might vary 10% for absolute value and another 20% for incremental.
- Use a smaller charge current to protect your battery. It is recommended to use 1A for suggested 5000mAh battery kits for 5 hours minimum charge time.
- A higher charge current results in raising the battery's internal temperature because ions have finite mobility and are easily damaged when charging with a high current.
- Hence, it is encouraged to charge your board at a low charging current to prolong your battery life.

Number of Switch	Charge Current
0	0.8A
1	1.0A
2	1.1A
3	1.3A
4	1.4A

Output 5V Control:

• S2- 5V Slide Switch

Status	Function
ENABLE	Enable Discharging
DISABLE	Disable Discharging

Multifunction Expansion Port:

Only circuit 1 and 2 are designed for power input. See BCPB-CB and BCPB-UC User Manuals for detail explanation of this port.

• J5 PH-2mm-6-CKT

Circuit	Definition
1	VIN
2	VIN
3	GND
4	GND
5	BATT
6	BATT

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