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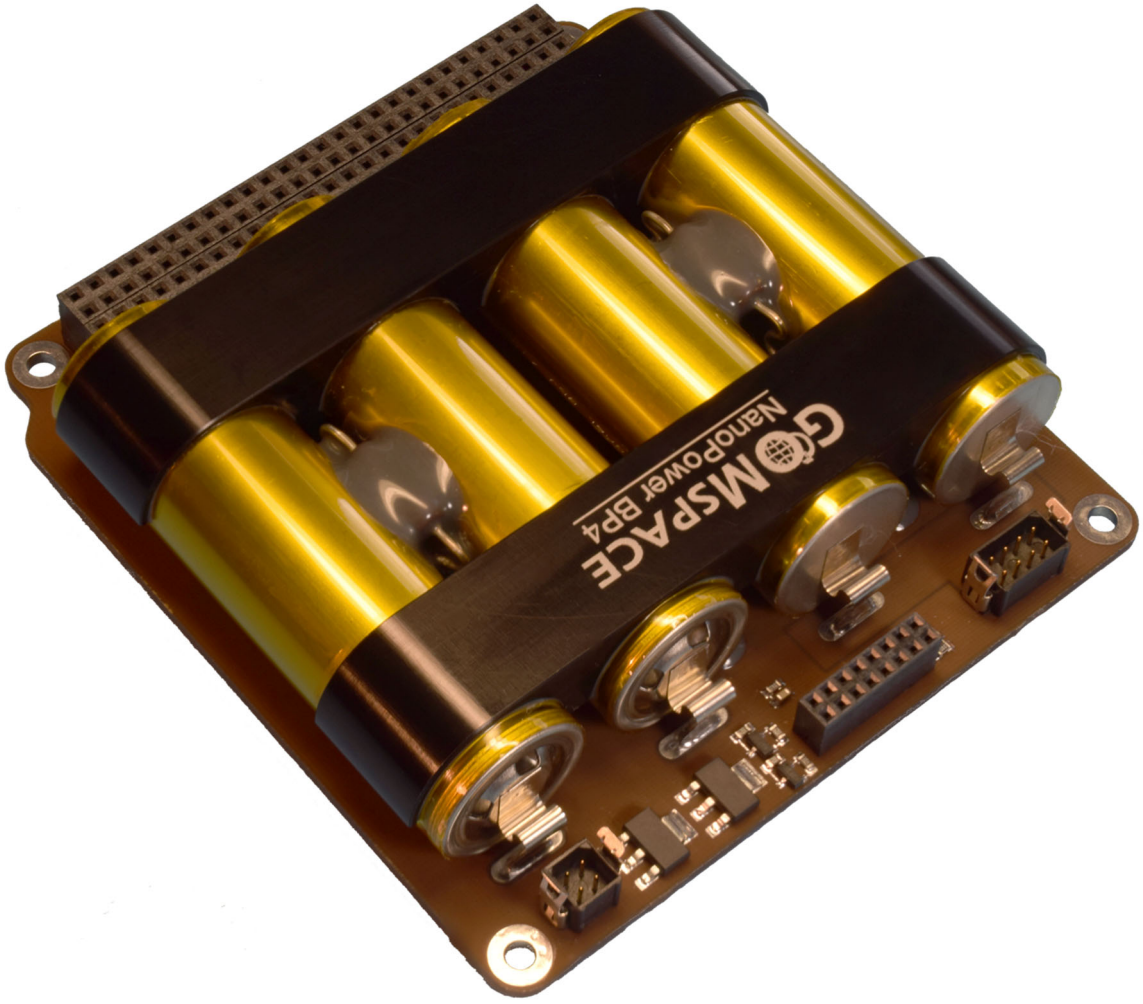

NanoPower
BP4 3000mA

Datasheet

High Capacity battery pack for nano-satellites featuring four Li-Ion cells

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Confidentiality Notice

1 Table of Contents

2 System Overview

NanoPower BP4 (BP4) is a battery pack tailored to fit in CubeSat satellites together with the GomSpace NanoPower EPS. It employs four lithium-ion cells and features a power switch, which can be used for control of high power consuming elements like antenna separation.

2.1 Highlighted Features

NanoPower BP4:

- Lithium-Ion battery pack for space applications
- Utilizes four 18650 series cells
- Available in two different voltage range configurations:
  - 6.0 – 8.4 V
  - 12.0 – 16.8 V
- Temperature sensors w. digital interface
- Heater
- Operational temperature: Depends on chosen battery cell
- Fits standard PC104
- Weight: 270 g
- PCB material: Glass/polyimide ESA ECSS-Q-ST-70-11-C
- IPC-A-610 Class 3 assembly

2.2 General Description

The BP4 comes in two different configurations:

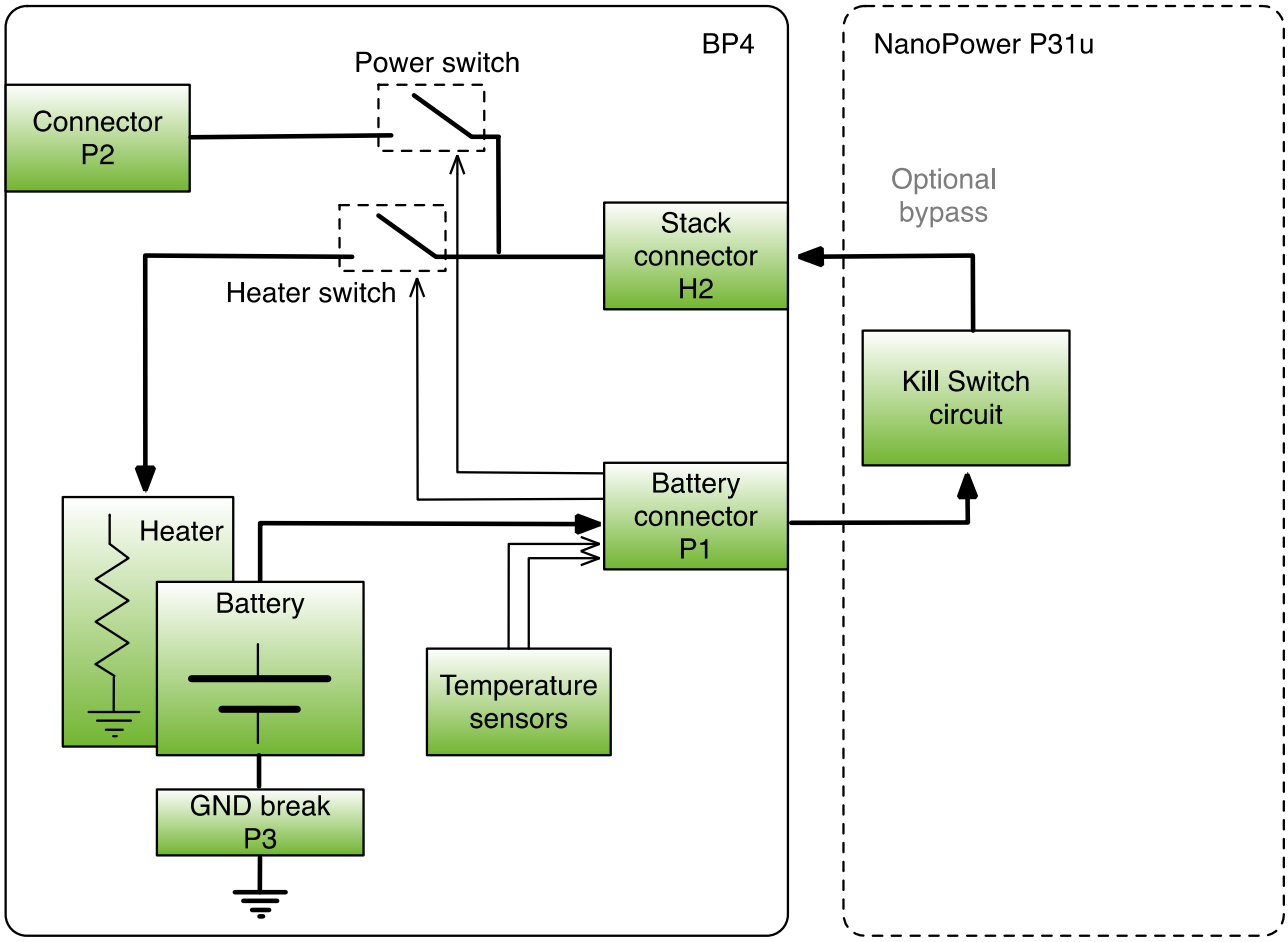
Configurations	Number of cells	3000 mAh cell (Nominal)
2P-2S	4	43 Wh 6 - 8.4 V 6.0 Ah
1P-4S	4	43 Wh 12 - 16.8 V 3.0 Ah

For information on battery specifications (temperatures, charge and discharge current etc), please see the GomSpace battery datasheet (gs-ds-battery).

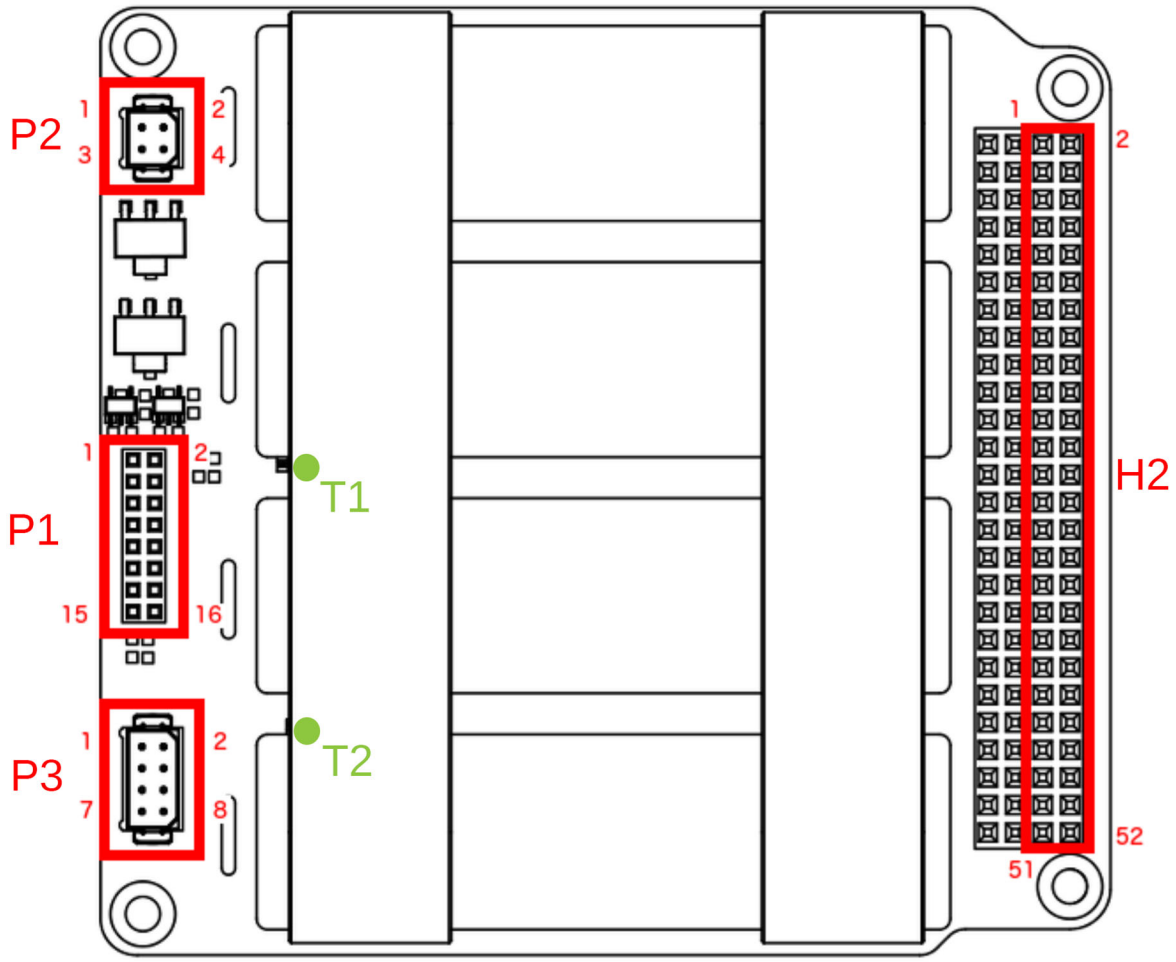
The batteries are attached to a PCB following the CubeSat Kit standard (modified PC-104 plus) and are re-packed with Kapton insulation and fitted to the board with Scotch-Weld 2216 epoxy. In addition, aluminum brackets are glued to the batteries and screwed to the PCB for added mechanical and thermal stability. The inter-cell connections are made with strips spot-welded to the cell terminals.

2.3 Block Diagram

The BP4 connects to the NanoPower P31u through a dedicated battery connector as well as through the stack connector.



3 Connector Pinout



- Temperature sensors – T1, T2

3.1 H2 – Stack Connector

Connector H2 is the stack connector.

Pin	Name	Dir.	Description
H2-29	GND	O	Power ground
H2-30	GND	O	Power ground
H2-32	GND	O	Power ground
H2-45	V_BAT	O	Battery voltage
H2-46	V_BAT	O	Battery voltage

3.2 P1 – Battery Connector

The battery cells are connected to a 16-pin dual row 2 mm pitch female header. This connector fits with the female external battery connector of the GomSpace NanoPower P31 with a Samtec TW-08-07-G-D-375-188 in between.

Pin	Name	Description	Pin	Name	Description
1	Vbat	Battery voltage connection	**2**	Vbat	Battery voltage connection
3	Vbat	Battery voltage connection	**4**	Vbat	Battery voltage connection
5	GND	Ground	**6**	GND	Ground
7	GND	Ground	**8**	GND	Ground
9	MISO	SPI MISO	**10**	MOSI	SPI MOSI
11	VCC	Supply voltage for temperature sensors	**12**	SCK	SPI SCK
13	CS1	Chip select for temperature sensor 1	**14**	SC2	Chip select for temperature sensor 2
15	PS	Active high power switch control (optional)	**16**	HS	Active high heater control

3.3 P2 - Power-switch Output

Harwin M80-8670405.

Pin	Name	Description
1	Vout	Power switch out
2	GND	Ground
3	Vout	Power switch out
4	GND	Ground

3.4 P3 - Ground-break Connector

Harwin M80-8670805.

Pin	Name	Description
1	GND	Ground
2	Bat GND	Battery negative terminal
3	GND	Ground
4	Bat GND	Battery negative terminal
5	GND	Ground
6	Bat GND	Battery negative terminal
7	GND	Ground
8	Bat GND	Battery negative terminal

4 Heater and Temperature Sensor

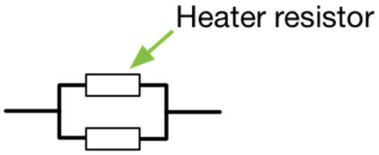
Lithium ion batteries cannot charge in low temperatures (see battery datasheet). Using a heater to maintain temperature above charging threshold is a software option. Software default mode is set to manual.

The heater is implemented as high side switches with drivers (with active high inputs) and are powered from the stack connector. If no stack connector, it is powered directly from the battery. (No current reading available).

Heater Characteristics:

Parameter	Condition	Min.	Typ.	Max.	Unit
Heater Element					
Heater resistance	2P-2S		22		Ω
	1P-4S		82		Ω
Heater power	2P-2S	3.5	6	7	W
	1P-4S	3.5	6	7	W

Heater resistor circuit setup is shown to the right.



BP4 temp sensor Texas Instruments TMP121.

Parameter	Min.	Typ.	Max.	Unit
Temperature Sensors				
- Range	-40		125	°C
- Accuracy	-2	1.5	2	°C

5 Power Switch

The power switch is implemented as high side switches with drivers (with active high inputs) and are powered from the stack connector. If no stack connector, it is powered directly from the battery. (No current reading available).
Power switch characteristics:

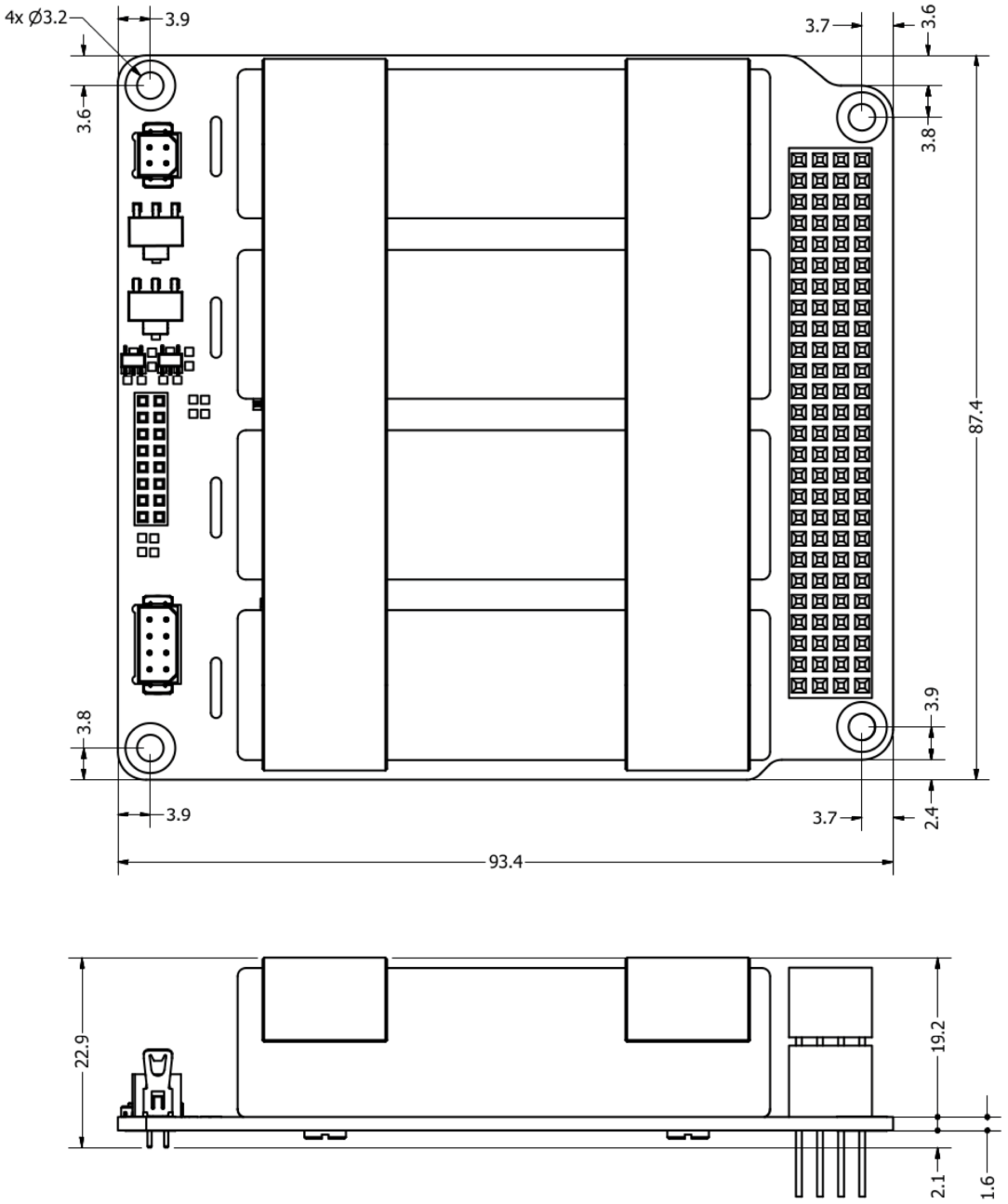
Parameter	Condition	Min.	Typ.	Max.	Unit
Power Switch					
Control voltage	Active high	1.5		6	V
Current	Continues		1	3.9	A

6 Physical Characteristics

Description	Value	Unit
Mass	258	g
Size	Fits PC104 94 x 84 x 23	 mm

7 Physical Dimensions

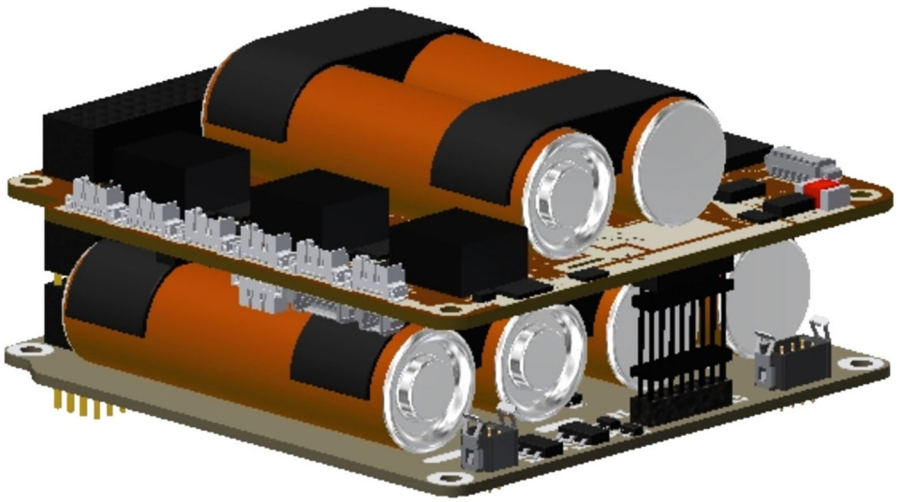
All dimensions in mm.



8 Configuration

The BP4 can be mated to the NanoPower P31u.

Shown below is the P31u on top and the BP4 below. Notice the stack connector between BP4 (P1) and P31u (P13) shown on the right.



Stacking height between the P31u and BP4 PCB is 23.5 mm.

9 BP4 Heater Power

In the BP4, the heater is supplied from the VBAT channel in the stack. When used with a NanoPower P31u this channel is always enabled. When used with the NanoPower P60 the VBAT stack power channel on the P60 Dock must be enabled.

10 Disclaimer

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