

NanoPower MSP

Datasheet

Modular solar panel with integrated coarse sun sensor and temperature sensor.

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2 Overview

The NanoPower MSP is a modular designed solar panel system to be used on 6U-12U sized nano-satellites. The solar panels are mounted on aluminium plates, which also function as radiation shielding for the internal satellite components. Temperature and coarse sun sensors are mounted next to the solar panels.

The modular design ensures that besides antennas and sensors the satellite can be fully covered with solar panels for optimize energy production.

The back of the aluminium plate has connectors to the power supply and the data bus.

The MSP system is designed to fit on the GomSpace 6U structure, however they also fit on structures from other vendors – for more information contact GomSpace.

The MSP is designed to fit with several other GomSpace products:

- NanoCom ANT-6F
- NanoStructure 6U
- NanoUtil AR6
- NanoUtil MSP-FPP

2.1 Highlighted Features

- 30% solar panel efficiency
- Up to 1.15 W per cell in LEO
- AzurSpace 3G30A space qualified triple junction solar cell assemblies
- CMG 100 cover glass 100 μm
- 30.18 cm^2 effective solar cell area.
- Coarse sun sensor
- External and internal temperature sensors
- Internal temperature -40°C to $+85^\circ\text{C}$
- External temperature -55°C to $+175^\circ\text{C}$

3 Warnings



Handling

This product uses advanced solar cells that are fragile. Do not touch solar cells.

Only handle solar panels without touching solar cells
or their tabs

Never place anything on solar cells!

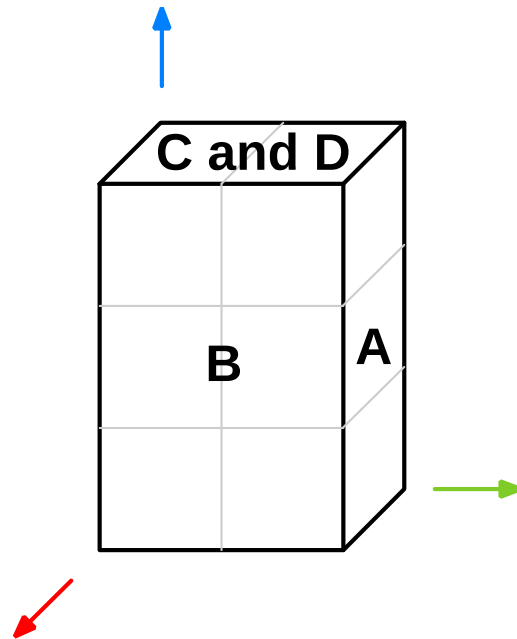


ESD

This product uses semiconductors that can be damaged by electrostatic discharge (ESD). When handling, care must be taken so that the devices are not damaged. Use appropriate precautions.

4 Definitions of Satellite Sides

The different sides of the satellite are referred to as illustrated in the drawing below.



The C side is the standard side (similar to A) with only a choice of solar panels. D is if the GomSpace NanoCom ANT-6F is mounted.

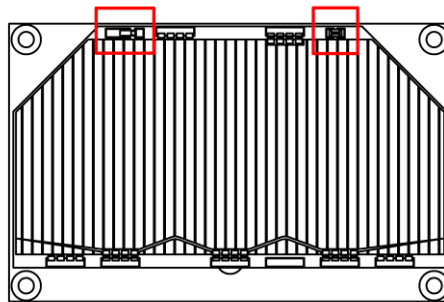
5 Description of the Modular System

5.1 General

The A, C and D modules consists of a 1.5 mm aluminium plate. The B side is a 2.5 mm aluminium plate with 1.5 mm recess. Each module has one temperature sensor and one coarse sun sensor. The inward facing side holds two connectors, one for EPS and one for the GomSpace Sensor Bus (GSSB).

5.2 External Sensors

Next to the top solar cell on each unit, there is a temperature sensor and a coarse sun sensor. The sensors are connected to the GSSB PCB on the back, view chapter 6. View the illustration below. Coarse sun sensor on the left and the temperature sensor on the right.



On the B side, there is a pair in the top left and bottom right corner.

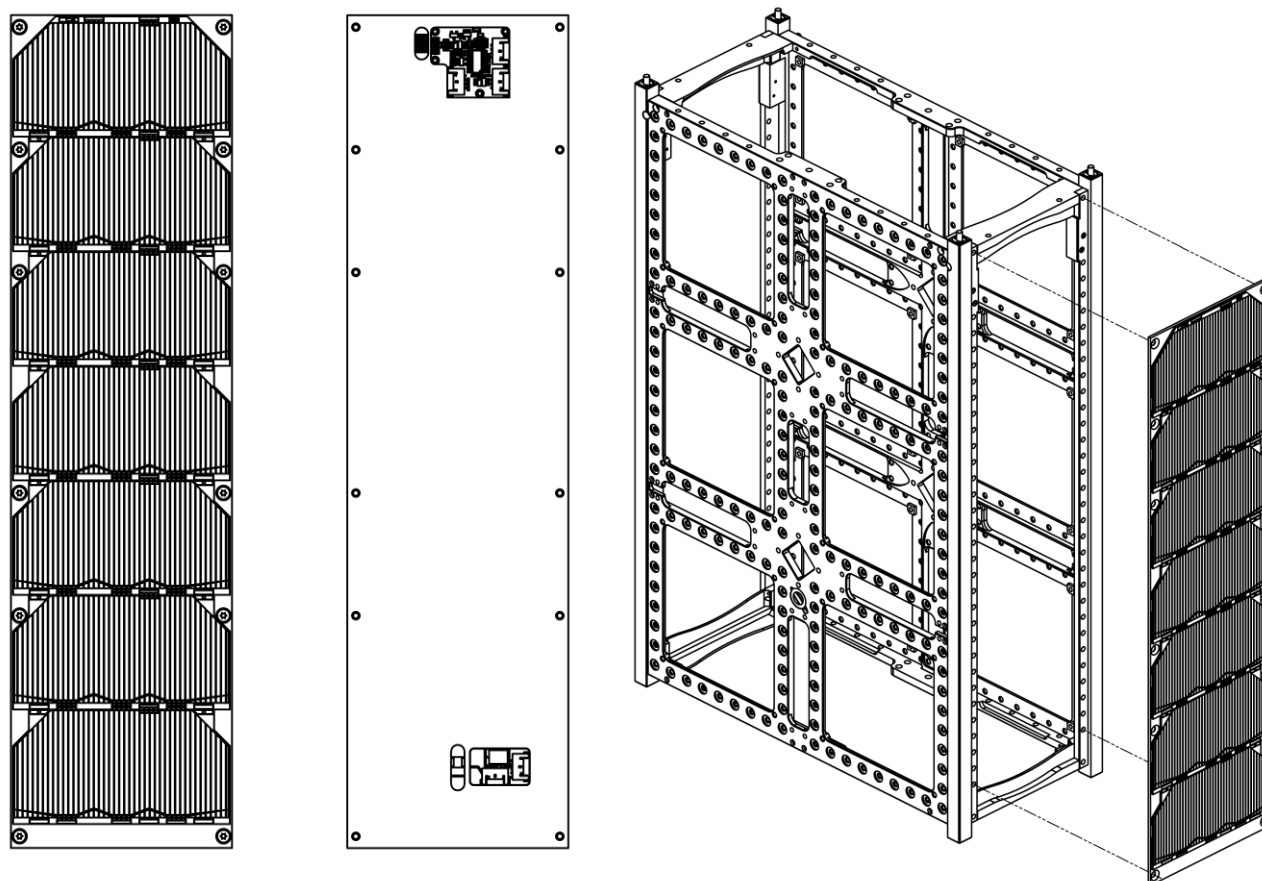
5.3 Internal Sensors

The internal temperature sensor is located in the MCU on the GSSB module. View chapter 6.

5.4 A Side

An A side plate module can contain from one to seven solar cells. Each module has a connector to the EPS and a connector to GSSB. The solar panels are connected in one serial string in each module.

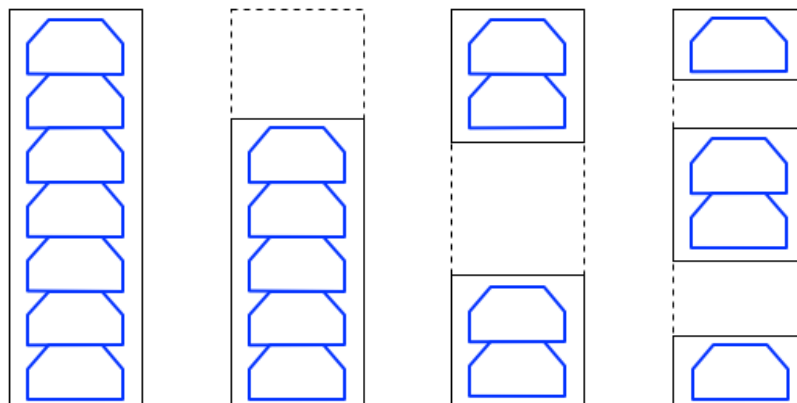
Below is shown a drawing of a 7-cell unit, front and back. And a drawing to illustrate mounting on a 6U structure.



On each module, mounting holes are placed at the top and bottom, and otherwise where it can fit the NanoStructure 6U holes.

Several smaller modules can be fitted on one side, e.g. if an antenna is required to be placed in the middle area then modules can be placed above and below it.

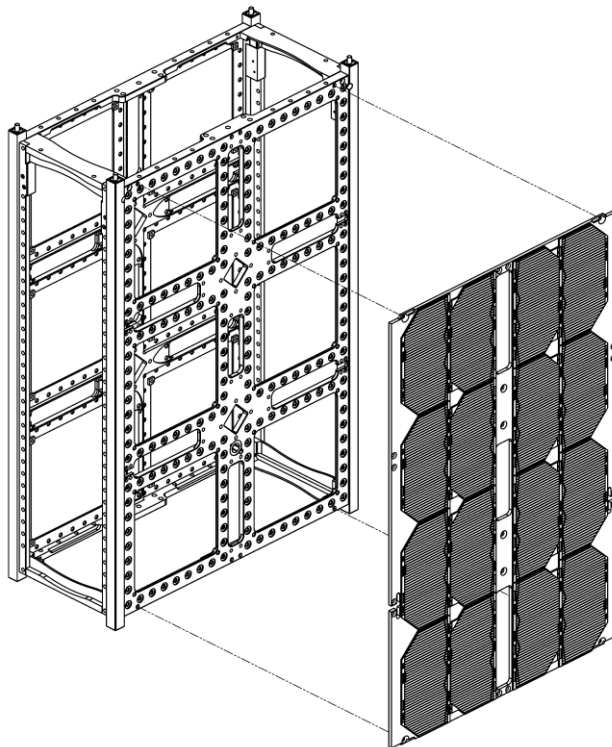
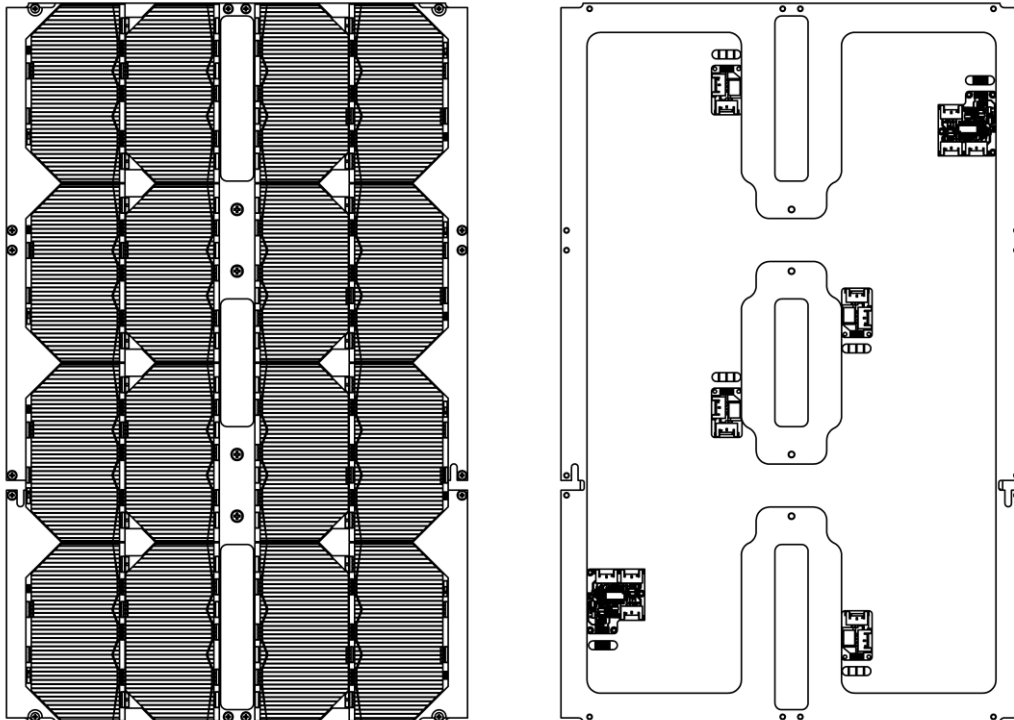
Examples of setups:



5.5 B Side

The B side is one plate covering the entire side, mounted with 16 solar panels. Down the middle are three cut outs for external sensors, such as Fine Sun Sensors. The solar panels can be connected as either a 4 serial strings / 4 parallel or an 8 serial / 2 parallel string.

Below is shown the front and back. And a drawing to illustrate mounting on a 6U structure.



The B-8-2 panel is built as the B-4-4 and configured to B-8-2 with a harness.

5.5.1 Central covering plates

Down the middle of the B side there are three rectangular cut out. Two kinds of covering plates are made to fit here:

- 1.5 mm aluminium covering plate
- 1.5 mm aluminium plate with a sunk slot where a GomSpace NanoSense Fine Sun Sensor (FSS) can fit.

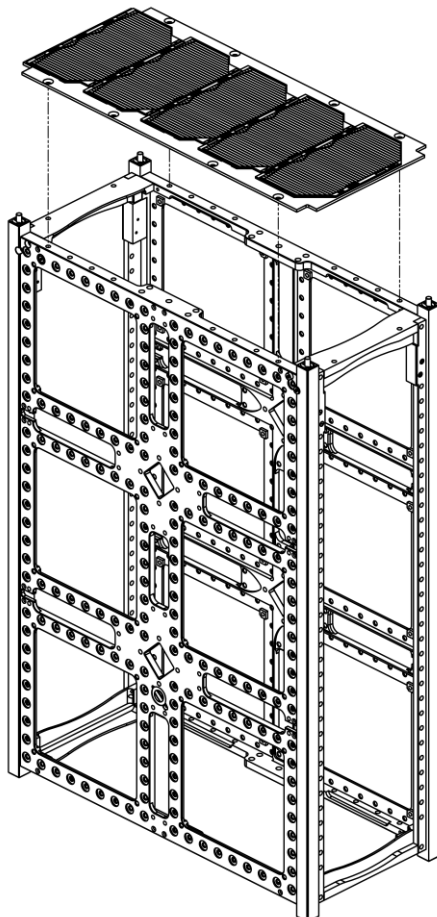
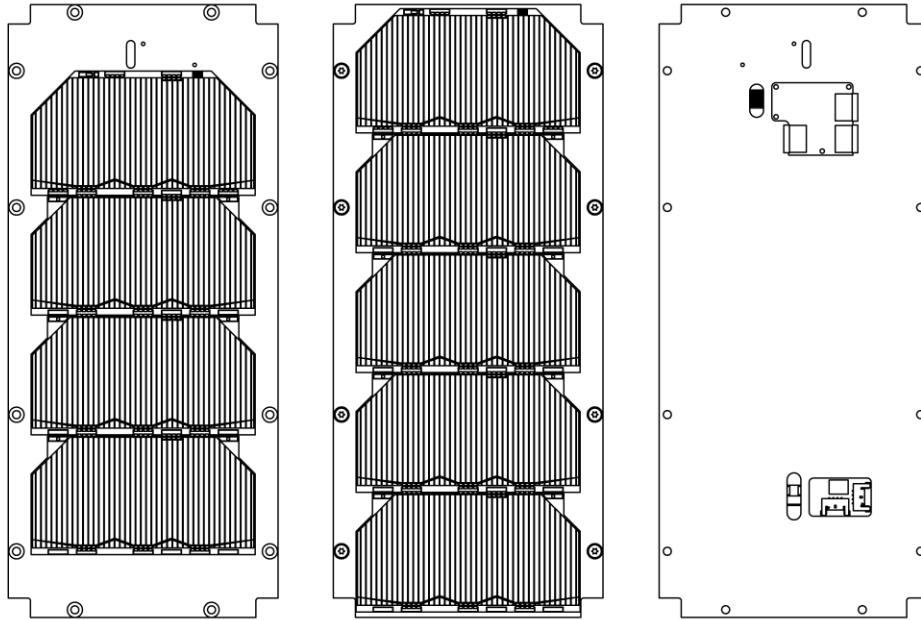


A set of three of each plate is delivered with the B side.

5.6 C Side

On the C side there are two options. A five solar cell version and a four solar cell version where there is room for e.g. a NanoSense Fine Sun Sensor.

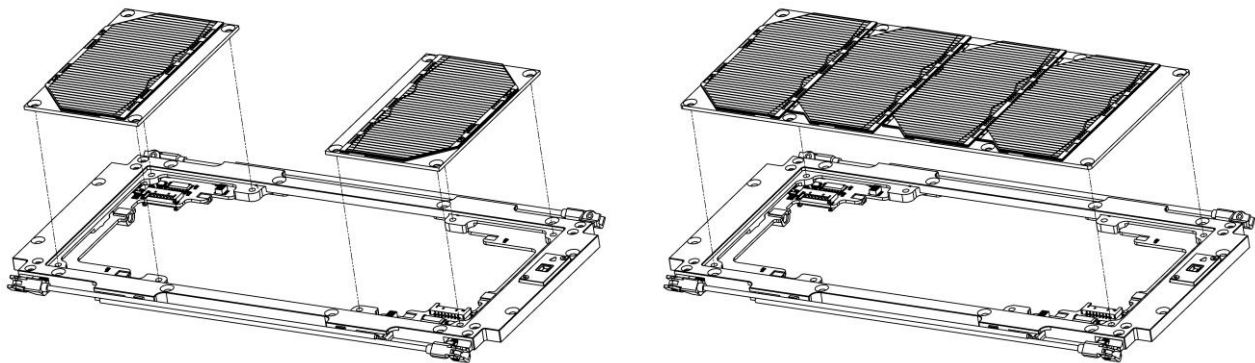
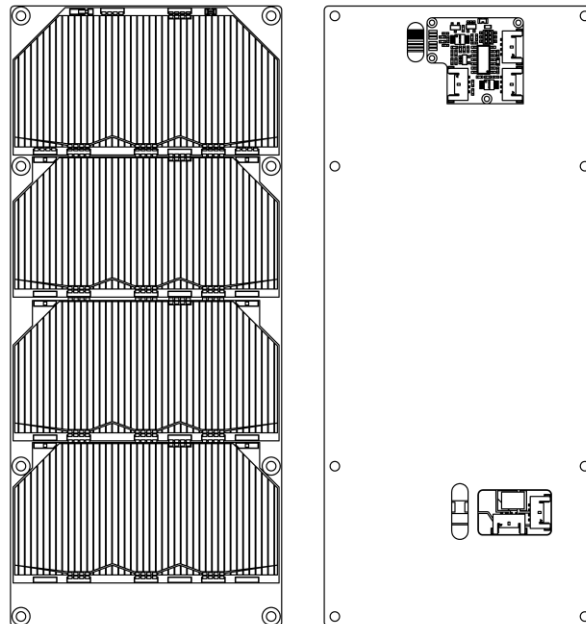
Below is shown the front of the 4 cell and 5 cell version and the back. And a drawing to illustrate mounting on a 6U structure.



5.7 D Side

If the satellite is equipped with a GomSpace NanoCom ANT-6F consult the datasheet and option to order. Below is shown an example with 4 cells. Notice the corners are different from C. It can be mounted with either two modules with one solar cells each, or with one module with four solar cells.

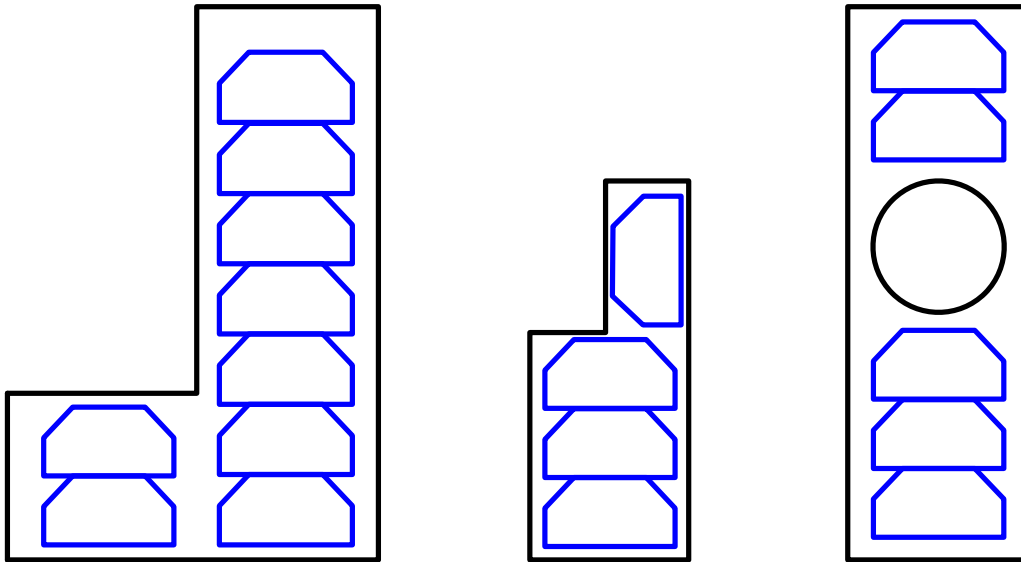
Below is shown the front and back of a 4 cell version. And a drawing to illustrate mounting on a NanoCom ANT-6F.



The two 1 cell MSP are the same as the A side 1 cell, and is ordered as that.

5.8 Custom Side

In some cases, a custom panel is preferred. The solar panels, connectors and sensors must be the same as used in this document. Both module shape and string layout can be chosen.



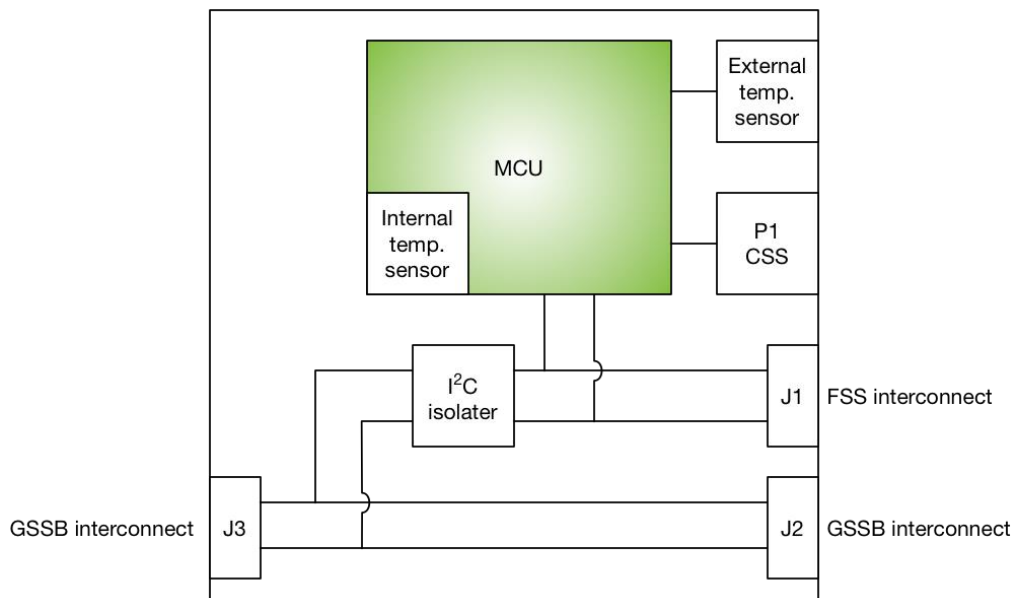
Provide drawings with the plate outline, solar panel placement, PCB placements, cut outs, screw holes, etc. Note down information regarding parallel/serial setup.

Contact GomSpace for a price quote.

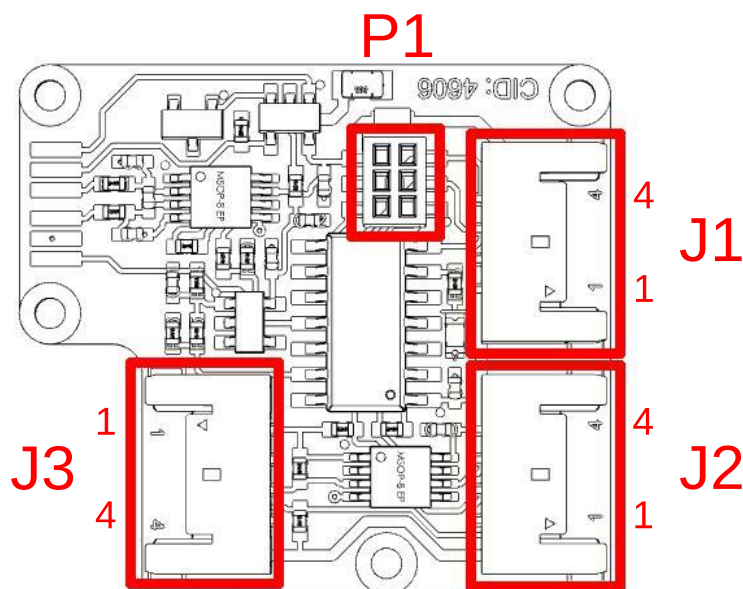
6 Connector Pinout

6.1 Connect to GSSB

The GSSB modules includes a temperature sensor, connector for the Fine Sun Sensor and connection to the GSSB bus. The MCU and the connection to the FSS is isolated from the GSSB bus, view the block diagram below. The temperature sensor and the course sun sensor on the solar panel is read out through the GSSB module.



6.1.1 Connector Location



On the top left are the interface connectors to the front sensors, these are pre-soldered.

6.1.2 J1 – Fine Sun Sensor

Molex Pico-Lock 1.50 mm pitch, right angle, 504050-0491.

Pin	Description
1	GSSB_VCC
2	GND
3	SDA
4	SCL

6.1.3 J2 – GSSB IN

Molex Pico-Lock 1.50 mm pitch, right angle, 504050-0491.

The pins on connector J2 and J3 are connected back to back. This is to avoid split harness and the sensor bus can be routed through the GSSB module.

Pin	Description
1	GND
2	GSSB_SCL
3	GSSB_SDA
4	GSSB_VCC

6.1.4 J3 – GSSB OUT

Molex Pico-Lock 1.50 mm pitch, right angle, 504050-0491.

The pins on connector J2 and J3 are connected back to back. This is to avoid split harness and the sensor bus can be routed through the GSSB module.

Pin	Description
1	GSSB_VCC
2	GSSB_SDA
3	GSSB_SCL
4	GND

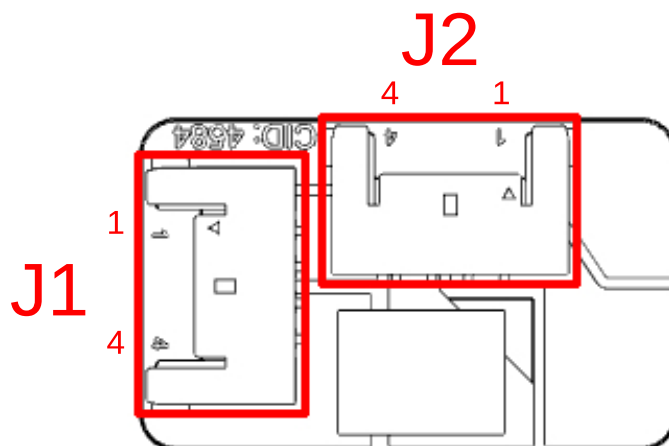
6.1.5 P1 – GomSpace Debug

Samtec CLP-103-02-G-D-BE

This connector is used for internal programming of the PCB.

6.2 Connect to EPS

6.2.1 Connector Location



6.2.2 J1 – Parallel Connector 1

Molex Pico-Lock 1.50 mm pitch, right angle, 504050-0491.

Used to connect two parallel solar strings through one common EPS connection J2.
Only to be used for strings with a common sun view field.

Pin	Description
1	Cathode
2	Cathode
3	Anode
4	Anode

6.2.3 J2 – EPS Connector 2

Molex Pico-Lock 1.50 mm pitch, right angle, 504050-0491.

This connector has a diode in series between the solar cell Anode and the pins 3 and 4 on J2

Pin	Description
1	Cathode
2	Cathode
3	Anode (blocking diode)
4	Anode (blocking diode)

7 Absolute Maximum Ratings

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the MSP. Exposure to absolute maximum rating conditions for extended periods may affect the reliability.

Symbol	Description	Min.	Max.	Unit
T_{ext}	Temperature on the solar panel	-55	+175	°C
T_{int}	Electronics operating temperature	-40	+85	°C
GSSB_VCC		3.1	3.5	V

8 Electrical Characteristics

Parameter	Condition	Min	Typ.	Max	Unit
Single Solar Panel	Full sunlight in LEO				
• Voltage	Optimal voltage	2.32		2.42	V
• Current	Current at optimal voltage	490		508	mA
• Power	Maximum power	1135		1200	mW
• Efficiency		29.8	30	30.2	%
GSSB_VCC			3.3		V
GSSB_I_idle			2.6		mA
Course Sun Sensor	Short current at 1367 W/m ²		930		μA
• Current			1.85	3.5	°
• Cosine error					
Temperature Sensor External		-75		+175	°C
• Range				3.5	%
• Resolution					
Temperature Sensor Internal		-40		85	°C
• Range		-10		10	%
• Resolution					

9 Physical Characteristics

Module plates are made of AL5005-H14 (clear anodization)

Values are of modules with filled solar panels

Name	Configuration	Plate Size [mm]	Weight
MSP-A-1-1	Single	51.7 x 82.6 x 1.5	32
MSP-A-2-1	2 in series	100.5 x 82.6 x 1.5	60
MSP-A-3-1	3 in series	146.3 x 82.6 x 1.5	86
MSP-A-4-1	4 in series	182.9 x 82.6 x 1.5	109
MSP-A-5-1	5 in series	228.7 x 82.6 x 1.5	135
MSP-A-6-1	6 in series	274.5x 82.6 x 1.5	162
MSP-A-7-1*	7 in series	326.5 x 82.6 x 1.5	190
MSP-B-4-4	4 serial, 4 parallel	326.5 x 209.0 x 2.5	438+harness
MSP-B-8-2	8 serial 2 parallel	326.5 x 209.0 x 2.5	438+harness
MSP-C-4-1	4 in series	221.5 x 97.5 x 1.5	132
MSP-C-5-1	5 in series	221.5 x 97.5 x 1.5	132
MSP-D-4-1	4 in series	189.0 x 82.6 x 1.5	112

* Note that if the seven solar cell version is chosen, a few cm of extra aluminium plate is added, so the plate covers the entire side.

9.1 Covering Plates

The covering plates with sunk holes are made of AL5005, and has a chromital TCP surface treatment. The other covering plates are made of AL5005-H14 clear anodization.

Description	Value	Unit
Mass (short)	4.4	g
Mass (long)	5.3	g
Mass (long with sunk slot)	4.7	g
Size (short)	57.0 x 14.0 x 1.5	mm
Size (long)	74.0 x 14.0 x 1.5	mm
Size (long with sunk slot)	74.0 x 14.0 x 5.5 (1.5)	mm

10 Disclaimer

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