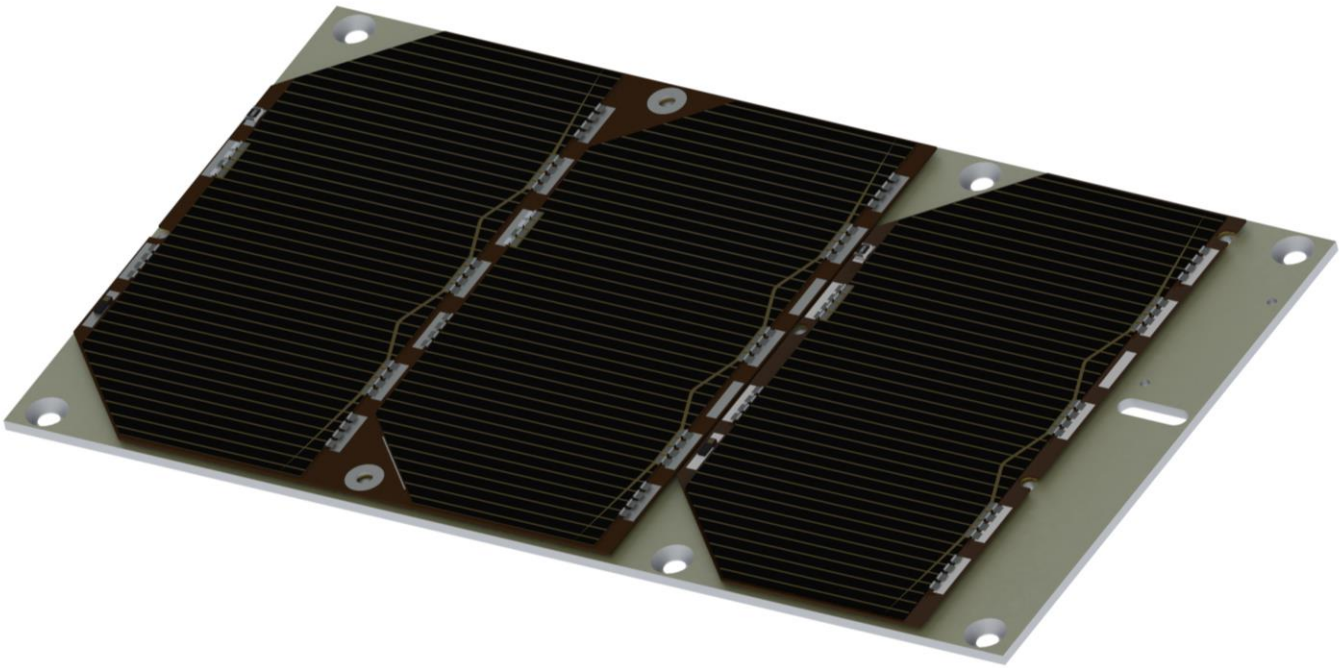

NanoPower
MSP

Datasheet

Modular Solar Panel with integrated sun sensor and temperature sensor.

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Product name: NanoPower MSP

Document No.: 1016340

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Approved by: PHK.

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Confidentiality Notice

1 Table of Contents

2 Overview

The NanoPower MSP is a modular designed solar panel system designed to be used on Gomspace satellites. The product consists of two primary building blocks: a *single cell* PCB and a *dual cell* PCB with solar cells. The two PCBs can be combined in many different combinations covering a wide range of solar panels options for a CubeSat; also, CubeSats not designed by Gomspace. The unique modular design ensures that besides antennas and sensors, the satellite can be fully covered with solar panels to optimize energy production.

The MSP system is designed to fit on the GomSpace standard 6U and 12U structures – see Table 2-1 here below, however they may also fit on structures from other vendors.

Structure	MSP A-1-1	MSP A-2-1	MSP A-3-1	MSP A-4-1	MSP A-5-1	MSP A-6-1	MSP A-7-1	MSP B-4-1	MSP B-4-4	MSP B-8-2	MSP C-4-1	MSP D-4-1	DSP 135 deg	DSP 135 deg reversed	DSP 90 deg
6U X	x	x	x	x	x	x	x						x	x	x
6U Y								x	x	x					
6U Z	x*										x	x*			
12U X		x**						x	x	x					
12U Y								x	x	x					
12U Z											x***				

* When mounted together with NanoCom ANT-6F.
**Requires the topXadaptor bracket.
*** Only at the Z+ end.

Table 2-1: Compatibility Table

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

- NanoCom ANT-6F
- NanoUtil AR6
- NanoUtil MSP-FPP
- NanoSense FSS

Power system compatible:

- P31U
- P60
- P80

2.1 Highlighted Features

General:

- Dual Cell Module.
- Single Cell Module.
- Coarse sun sensor, a detector for if in shadow or illuminated.
- Temperature sensors:
  - Internal temperature sensor range is -40°C to +85°C.
  - External temperature sensor range is -55°C to +175°C.

Solar cells:

- Two solar cell variants to mitigate lead time:
  - AzurSpace 3G30A Triple Junction Solar Cell GaInP/GaAs/Ge on Ge.
  - CESI CTJ-LC Triple Junction Solar Cells InGaP/GaAs/Ge.
- Space qualified triple junction solar cell assemblies.
- 30 cm^2 effective area per solar cell.
- 28-30% solar panel efficiency.
- Up to 1.2 W per cell in LEO.
- Cover glass included.

3 Handling 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 MSP Variant Definitions

The GomSpace CubeSat is made of several cubes each with 10 cm sides arranged as defined below. The sides of the satellite are referred to as illustrated in the drawing below.

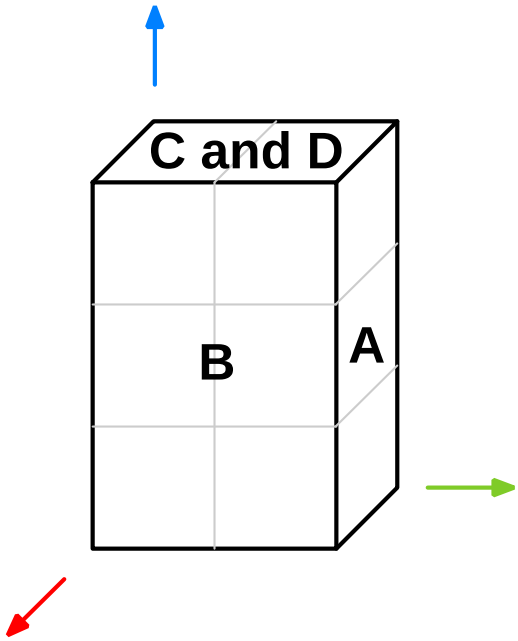

Figure 4-1: Satellite sides definition

The satellite sides can be covered with solar cells to collect as much energy as possible. The payload in the satellite traditionally requires as much energy as possible to achieve best performance.

The naming of a Modular Solar Panel uses following logic:

MSP <*mounting side*> - <*number of cells per string*> - <*number of strings*>

I.e., MSP **A**-x-x refers to a module developed for A side for mounting, primary. Remark, small MSP A modules can also in special situations be placed on side C/D.

The naming of the modules is also telling the module's connection.
The solar cells can be combined in many different combinations, serial or parallel and combinations of these.
The current available cell combinations are for 6 U and 12 U satellites:

MSP-A-1-1, 1 solar cell and one output.
MSP-A-2-1, 2 solar cells are combined in series into 1 output.
MSP-A-3-1, 3 solar cells are combined in series into 1 output.
MSP-A-4-1, 4 solar cells are combined in series into 1 output.
MSP A-5-1, 5 solar cells are combined in series into 1 output.
MSP-A-6-1, 6 solar cells are combined in series into 1 output.
MSP-A-7-1, 7 solar cells are combined in series into 1 output.

MSP-B-4-1, 4 solar cells are combined in series into 1 output.
MSP-B-4-4, 16 solar cells are combined into 4 outputs (each with 4 cells connected in series).
MSP-B-8-2, 16 solar cells are combined into 2 outputs (each with 8 cells connected in series).

MSP-C-4-1, 4 solar cells are combined in series into 1 output.

MSP-D-4-1, 4 solar cells are combined in series into 1 output.

For other combinations please contact GomSpace.

5 Description of the Modular Solar Panel (MSP) System

5.1 General

The modules for sides A, C and D are built on an aluminium plate of thickness 1.5 mm as base.
The B side variants are based on a backplate of thickness is 3.0 mm due to the large size. On the B side, weight is reduced by removing material where possible to a thickness of 1.5 mm.
Each Solar Cell module has one temperature sensor and one coarse sun sensor.
The solar cells can be arranged in serial or parallel which will require the use of interface boards, S2C for serial, and P2C for parallel connections. Serial combinations are default.
S2C exists in two variants, one with a blocking diode and one without. All serial connected strings must use the S2C with the blocking diode as the last S2C in the string to close the loop and having blocking function if connected in parallel with other series strings. For more information of serial wiring – see chapter 6.3.1.

The backside holds the connections to the electronic power supply EPS, to the S2C and/or P2C interface boards, and the Gomspace Sensor System Bus MSP-GSSB module.

The MSP comes with all required interface boards and wiring.

The amount of energy that can be harvested from the modules is up to 1.2 W per cell, depending on type of solar cell, temperature, and alignment toward the sun.

5.2 External Sensors

On the sun facing side, each solar cell module has a temperature sensor for external and a coarse sun sensor – see Figure 5-1.

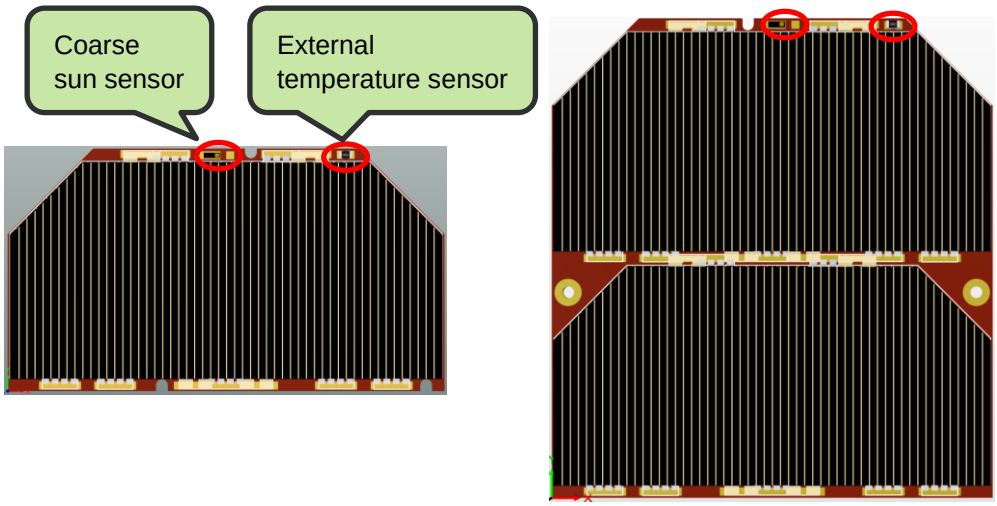

Figure 5-1: Single Cell and Dual Cell modules.

The sun sensor on the left and the temperature sensor on the right encircled in red.
The sensor pair are connected to a GSSB module on the back, see more in chapter 6.2.
Normally only one or two sensor pairs are used per satellite side with solar panels.

As an example, the MSP-B-4-4 version use two sensor pairs on the same side, one in the bottom left corner and one in top right corner – see Figure 5-2. Two MSP-GSSB modules are thus used.

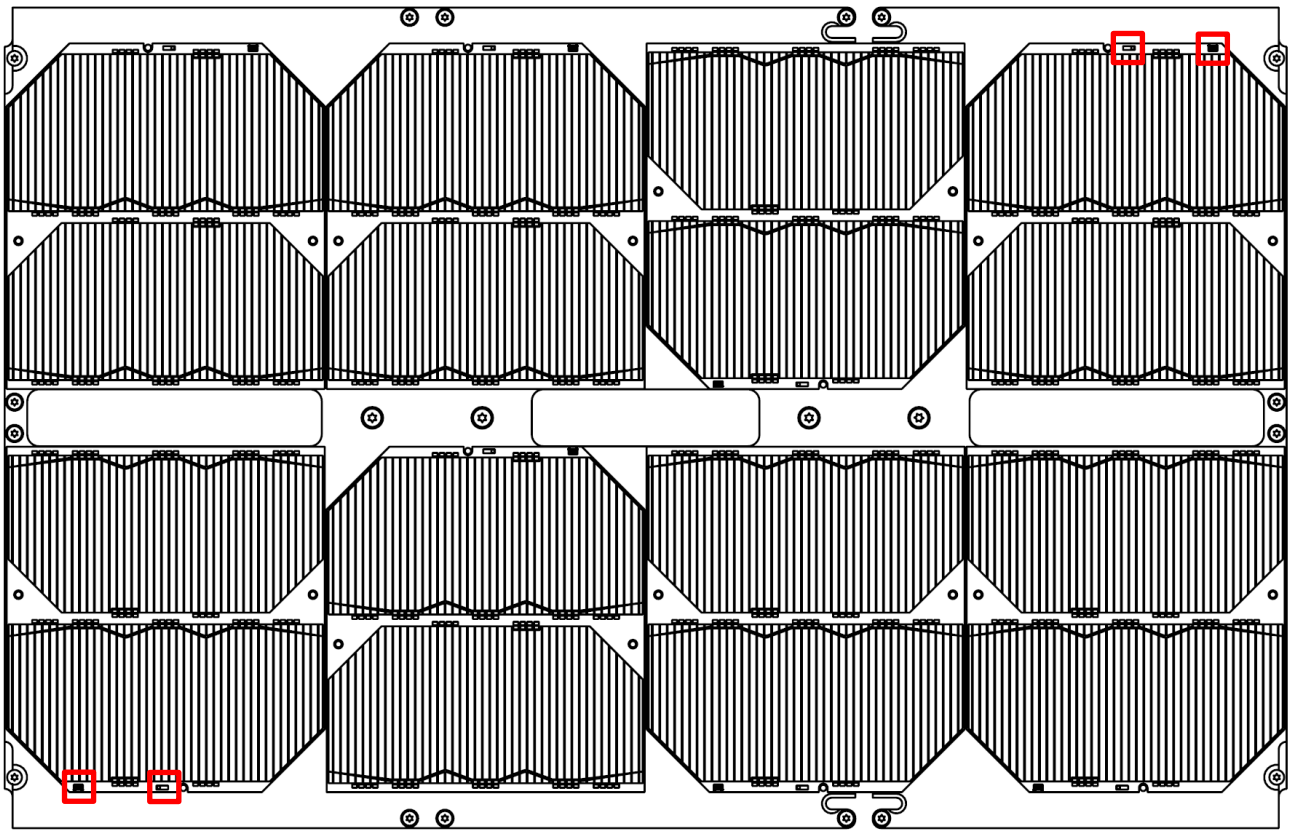

Figure 5-2: The MSP-B-4-4 version.

Other MSP-B-X-X versions will have minimum one temperature sensor and one coarse sun sensor like MSP B-4-1 – see Figure 5-3.

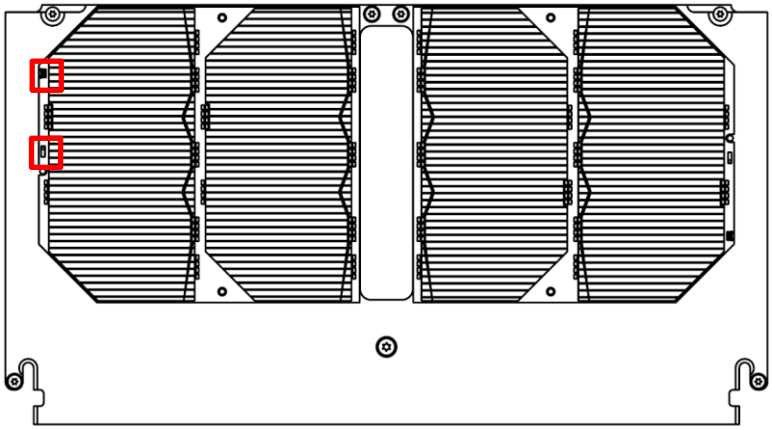

Figure 5-3: The MSP B-4-1 version.

5.3 Internal Sensors

The internal temperature sensor is integrated into the microprocessor of the GSSB module – see chapter 6.2.

5.4 A Side

An A side MSP can contain from one to seven solar cells. Each solar cell module has a connector for wiring to the EPS via interface boards and a connector for wiring to the GSSB. The solar panels are connected in one serial string on each module.
The S2C boards connect to the solar cell module from the satellite internal side and are used to connect solar panels in a series string. The first S2C in the string is wired to the EPS, and the last S2C includes a blocking diode ensuring that one string performing poorly does not load other strings connected in parallel performing normally. Se more about the serial string in chapter 6.3.1.
Mounting holes are placed at the top and bottom of all MSP A variants, and additional mounting holes are found along the length direction (the number of holes depends on the variant).

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 places above and below it.

Examples of setups on A side of a 6 U or 12 U satellite – see Figure 5-4:

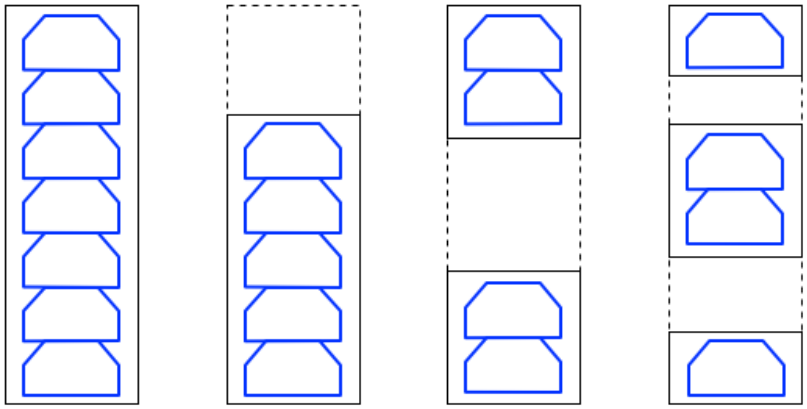

Figure 5-4: A side solar panel options for a 6 U and 12 U.

With reduced solar cell modules, the number of S2C boards are also reduced.

5.4.1 MSP A-7-1 MK2 (111275)

Below is shown a drawing of the MSP A-7-1, a 7 cells unit, front and back – see Figure 5-5 left – and a drawing to illustrate mounting on a 6U structure – see Figure 5-5 right.

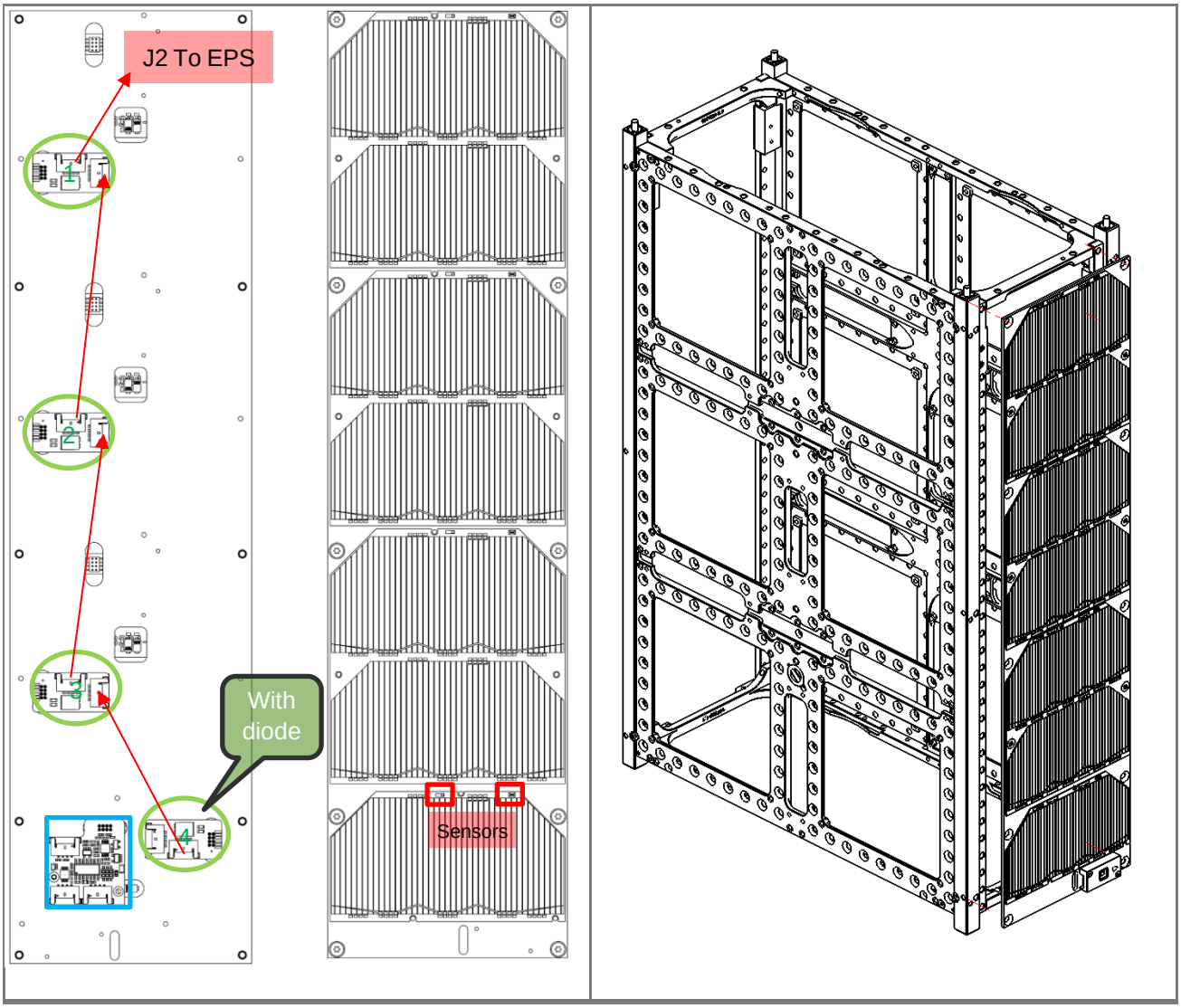

Figure 5-5: A side using the MSP A-7-1 with three dual cells modules and one single cell module.

4 pcs S2C boards encircled in green are used, one per solar cell module.
Wiring is indicated in red – note the last S2C in the string (which has one connection only) includes a blocking diode and the first S2C is wired to the EPS.
One MSP-GSSB module is used – see the blue rectangle.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.4.2 MSP A-6-1 MK2 (111281)

The MSP A-6-1 use 3 dual cells giving 6 solar cells arranged in series using 3 pcs S2C boards (green); and has a coarse sun sensor and an external temperature sensor (red) via an MSP-GSSB board (blue) – see Figure 5-6.

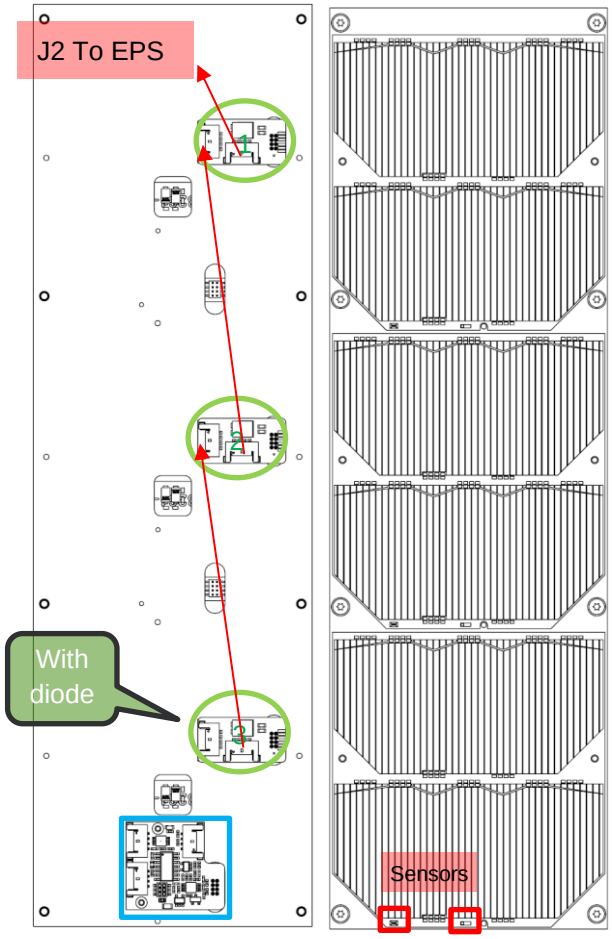

Figure 5-6: The MSP A-6-1 Module.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.4.3 MSP A-5-1 MK2 (111280)

The MSP A-5-1 use 2 dual cell modules and 1 single cell module giving 5 solar cells arranged in series using 3 pcs S2C boards (green); and has a coarse sun sensor and an external temperature sensor (red) via an MSP-GSSB board (blue) – see Figure 5-7.

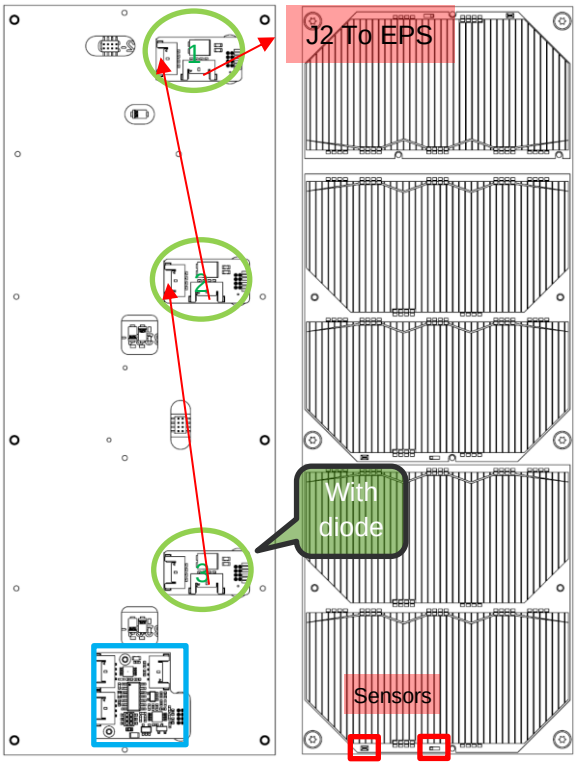

Figure 5-7: The MSP A-5-1 Module.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.4.4 MSP A-4-1 MK2 (111285)

The MSP A-4-1 use 2 dual cell modules giving 4 solar cells arranged in series using 2 pcs S2C boards (green); and has a coarse sun sensor and an external temperature sensor (red) via an MSP-GSSB board (blue) – see Figure 5-8.

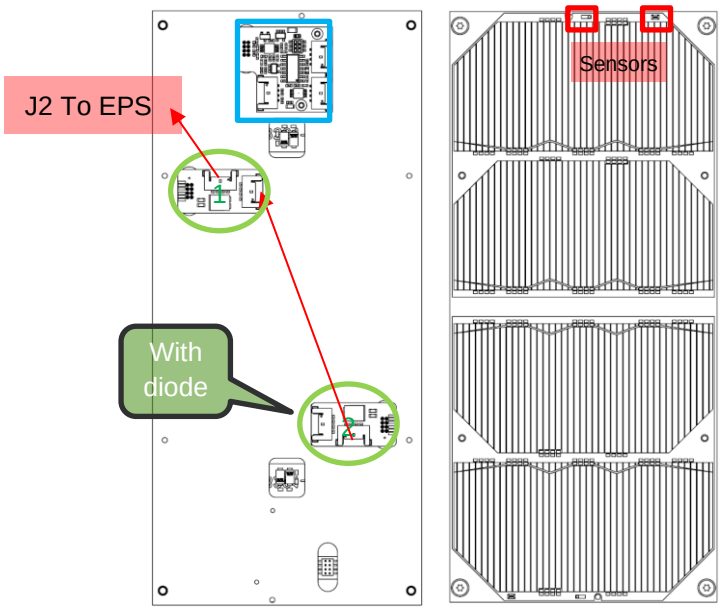

Figure 5-8: The MSP A-4-1 Module.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.4.5 MSP A-3-1 MK2 (111279)

The MSP A-3-1 use one dual cell module and one single cell module giving 3 solar cells arranged in series using 2 pcs S2C boards (green); and has a coarse sun sensor and an external temperature sensor (red) via an MSP-GSSB board (blue) – see Figure 5-9.

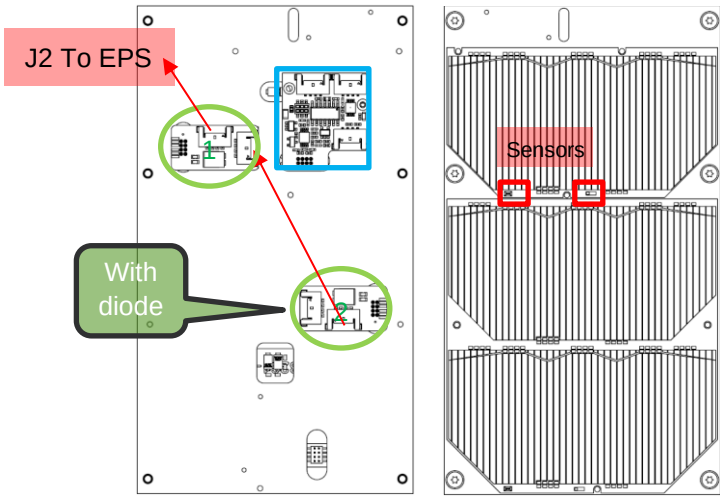

Figure 5-9: The MSP A-3-1 Module.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.4.6 MSP A-2-1 MK2 (111278)

The MSP A-2-1 use one dual cell module giving 2 solar cells arranged in series using 1 pcs S2C boards (green) and has a coarse sun sensor (red) and an external temperature sensor via an MSP-GSSB board (blue) – see Figure 5-10.

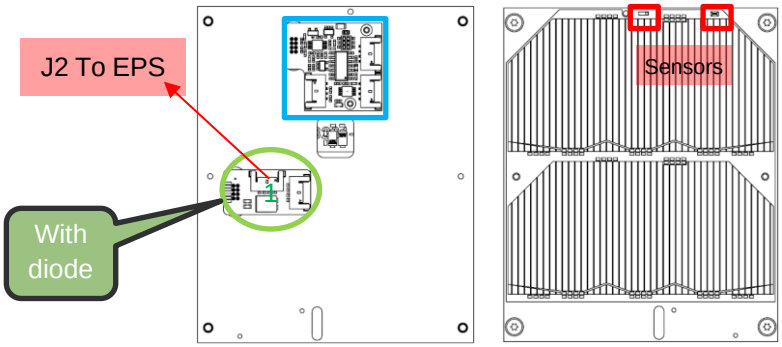

Figure 5-10: The MSP A-2-1 Module.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.4.7 MSP A-1-1 MK2 (111290)

The MSP A-2-1 use one dual cell module giving 2 solar cells arranged in series using 1 pcs S2C boards (green) and has a coarse sun sensor (red) and an external temperature sensor via an MSP-GSSB board (blue) – see Figure 5-11.

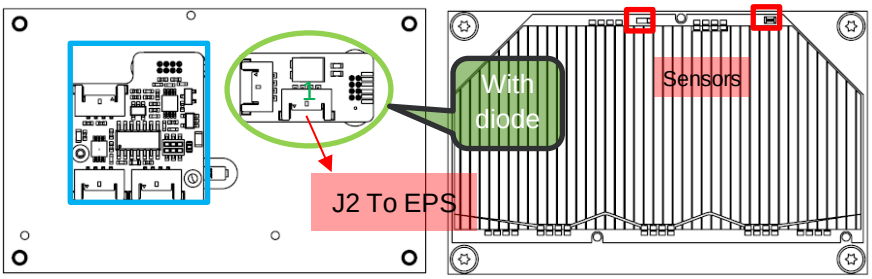

Figure 5-11: MSP A-1-1.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.5 B Side

The B side is one plate covering the entire B side with 16 solar panels – see Figure 5-12.

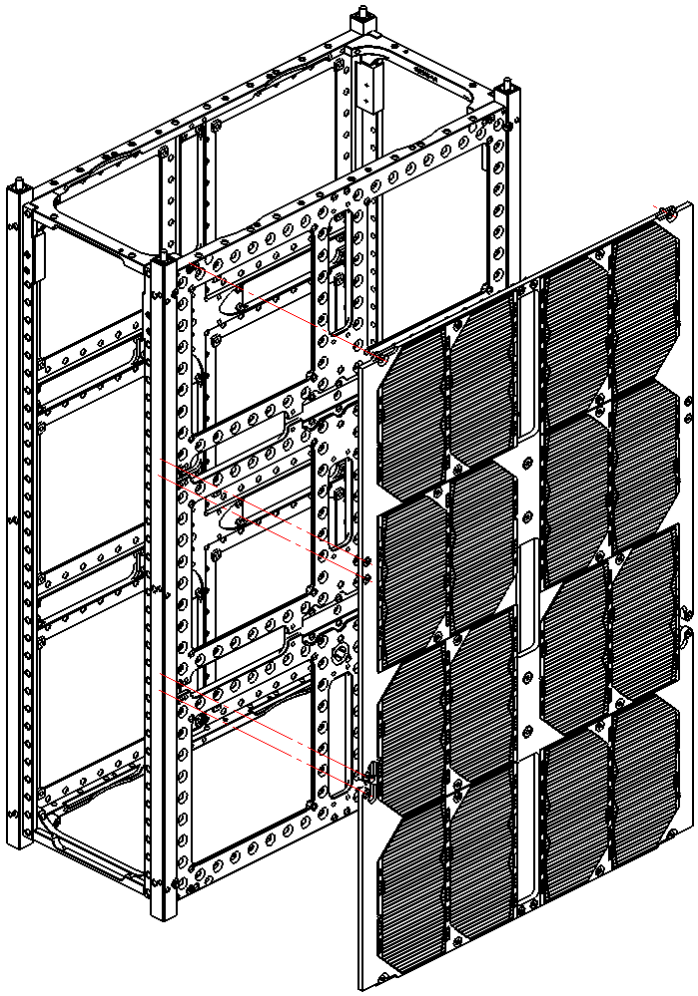

Figure 5-12: 6 U with the B side Solar Panel.

Down the middle are three cut outs for external sensors, such as the Fine Sun Sensor.
The solar panels can be connected as either a 4 serial strings / 4 parallel or an 8 serial / 2 parallel string.

5.5.1 MSP B-4-4 MK2 (111282)

The MSP B-4-4 has 4 outputs, each 2 x Dual Cell Modules (4 solar cells total) arranged in series using one S2C board per Dual Cell Module. In total 8 dual cell modules and 8 x S2C board are used. 4 of the S2C boards are with blocking diode – see Figure 5-13.

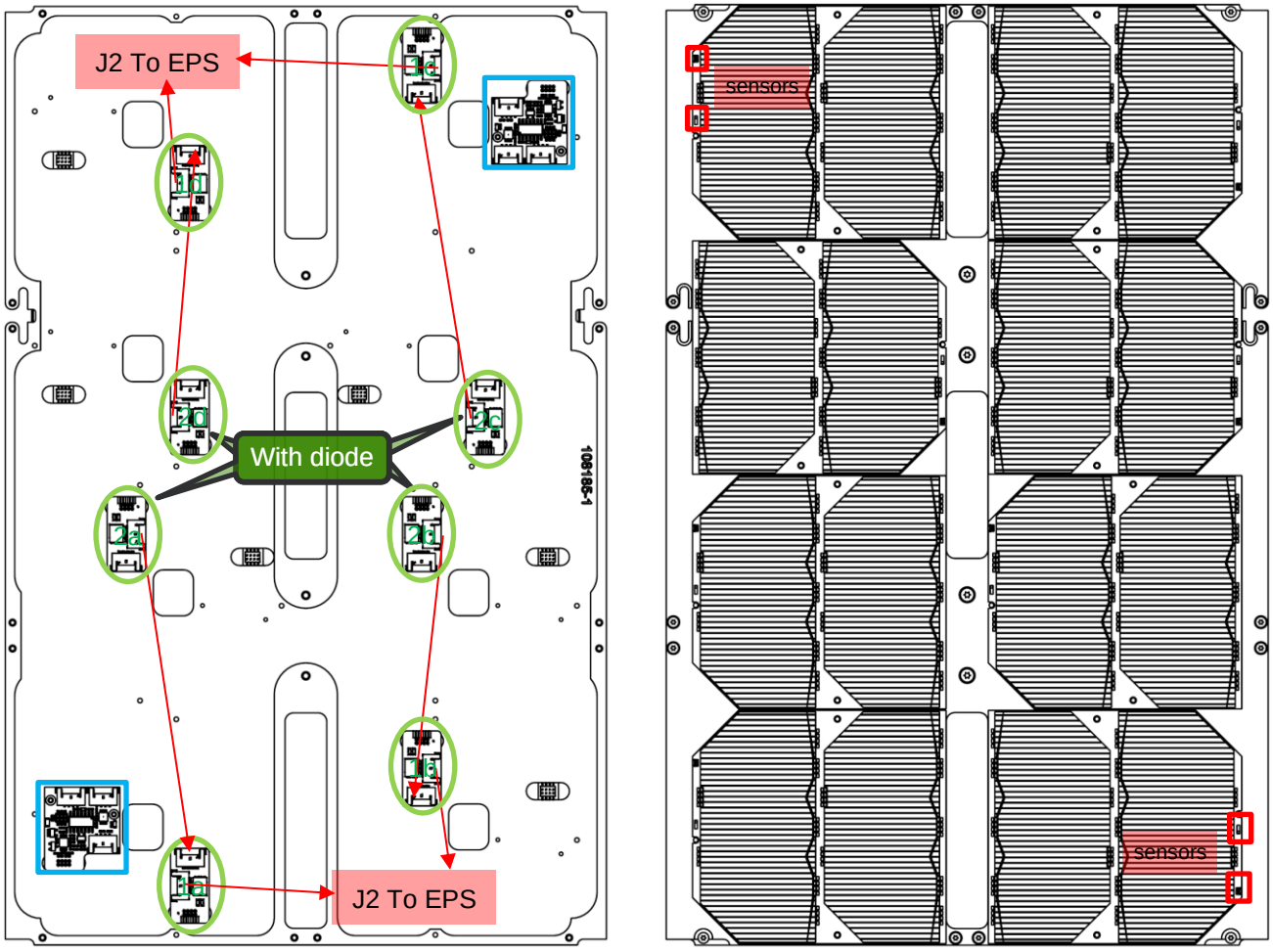

Figure 5-13: The MSP B-4-4 Module.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.5.2 MSB B-8-2 MK2 (111284)

The MSP B-8-2 has 2 outputs, each 4 x Dual Cell Modules (8 solar cells total) arranged in series using one S2C board per Dual Cell Module. In total 8 dual cell modules and 8 x S2C board are used. 2 of the S2C boards are with blocking diode – see Figure 5-14.

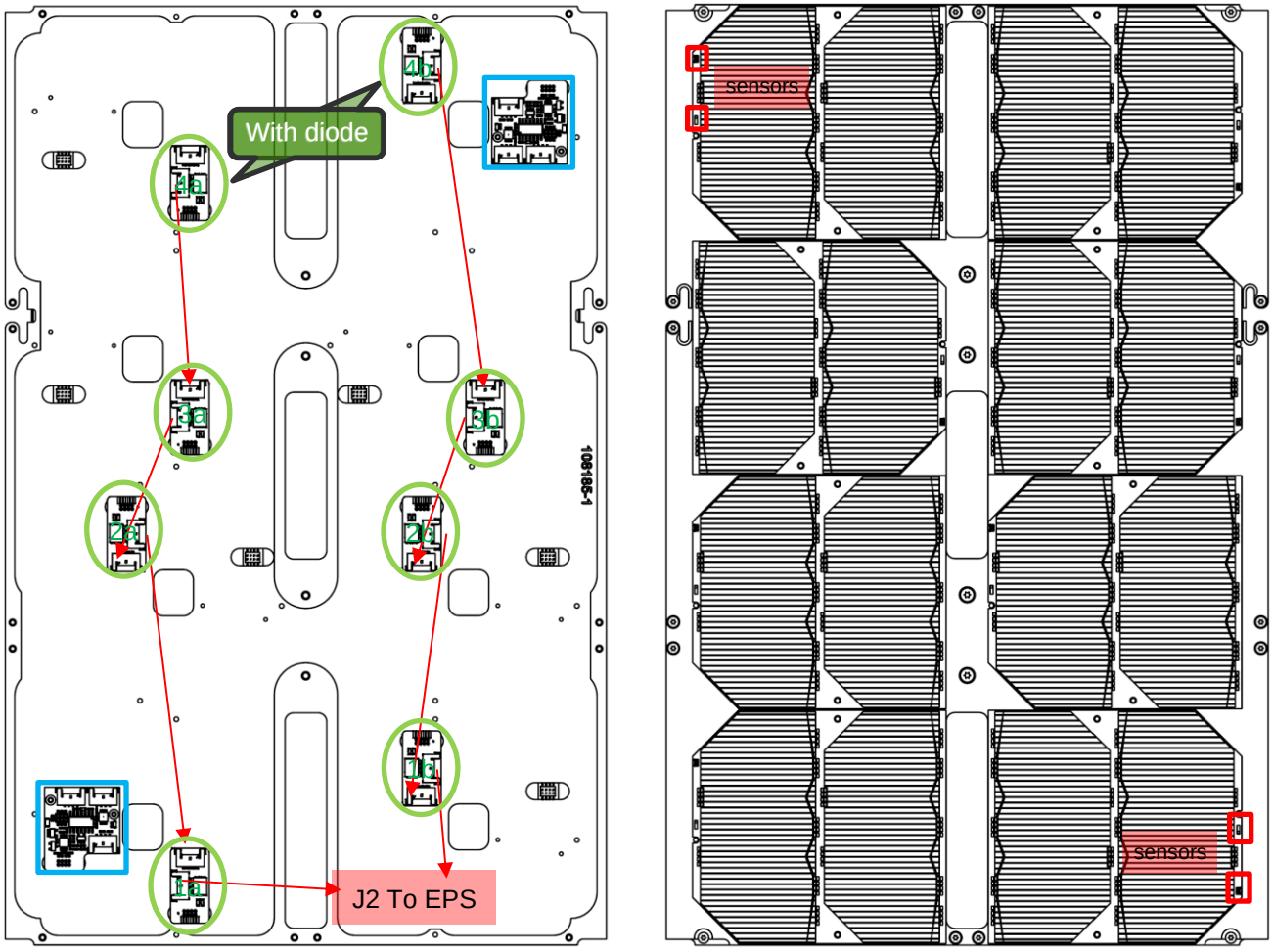

Figure 5-14: The MSP B-8-2 Module.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.5.3 MSB B-4-1 MK2 (111276)

The MSP B-4-1 has 1 output using 2 x Dual Cell Modules (4 solar cells total) arranged series using one S2C board per Dual Cell Module. In total 2 dual cell modules and 2 x S2C board are used. 1 of the S2C boards is with blocking diode – se Figure 5-15.

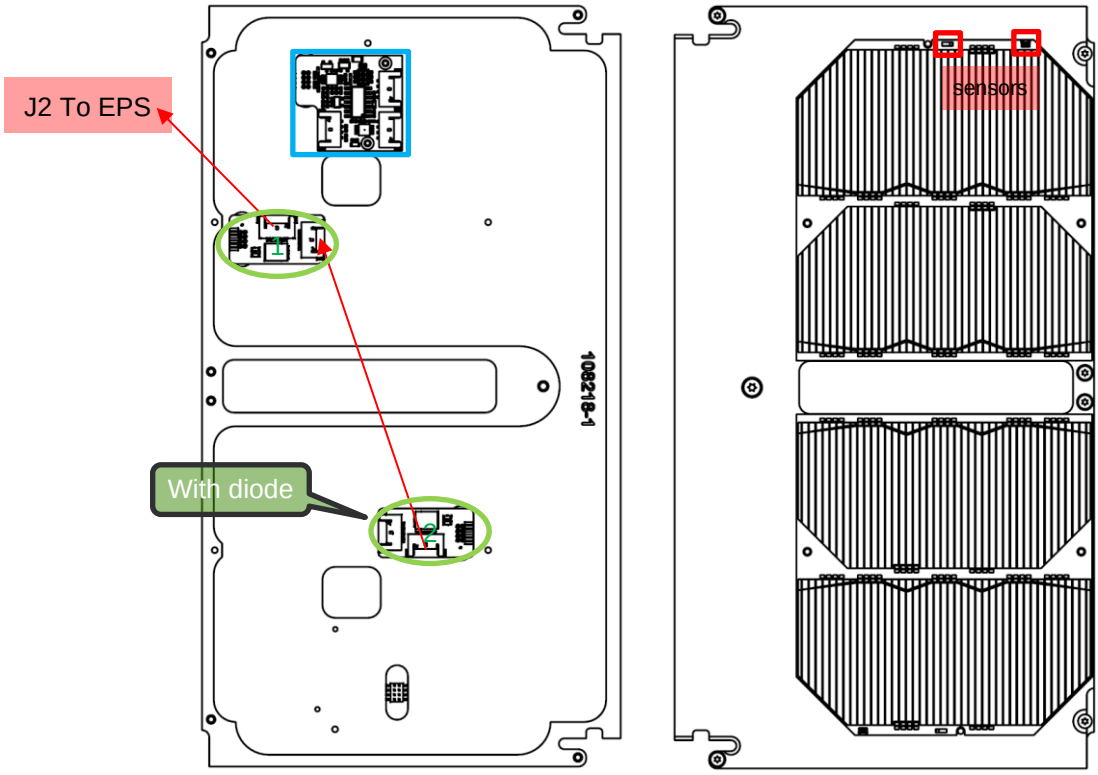

Figure 5-15: The MSP B-4-1 Module.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

5.5.4 Central Cover Plates

Down the middle of the B side there are three rectangular cut-outs. Two kinds of cover plates are made to fit here – see Figure 5-16:

- 1.5 mm aluminium cover plate.
- 1.5 mm aluminium cover plate with recess, a sunk slot with room for the GS NanoSense Fine Sun Sensor (FSS).

Figure 5-16: Cover plates – flat (104731) seen left and with recess (104737) seen right.

5.6 C Side

5.6.1 MSP C-4-1 MK2 (111307)

The C-side solar panel MSP C-4-1 is a bracket mounted panel using the MSP A-4-1 module – see Figure 5-17. The MSP C-4-1 is a 4 solar cells series coupled with an adapter bracket for the C side. 2 pcs S2C modules combines two dual cells board into one output – one S2C has a blocking diode. For wiring, see Figure 5-8.

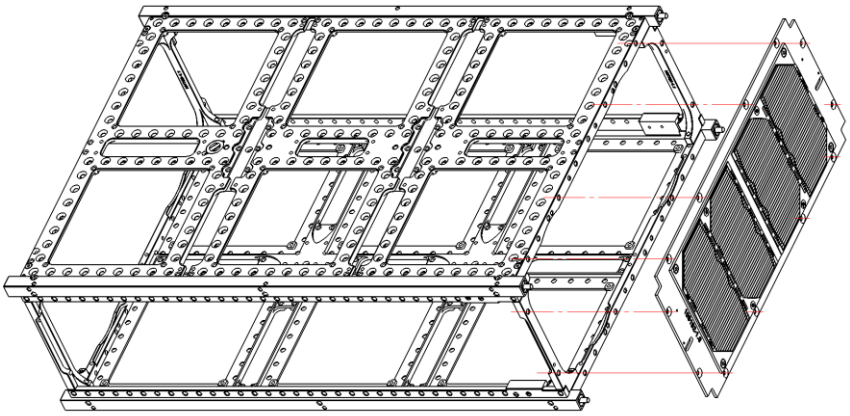

Figure 5-17: MSP-C-4-1 placed on C side.

5.7 D Side

Both C-side and D-side can be co-fitted with the GS NanoCom ANT-6F – see Figure 5-18. The ordering of the ANT-6F is done with the ANT-6F option sheet. It can be mounted with either two modules MSP A-1-1 – see section 5.4.7 – with one solar cell each, or with one module with four solar cells MSP D-4-1 – see section 0.

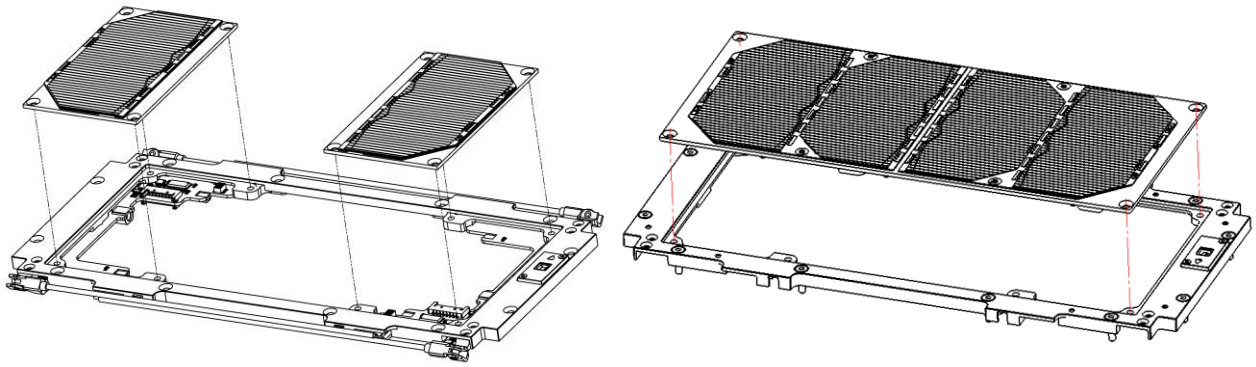

Figure 5-18: Ant-6F with solar cells.

5.7.1 MSP D-4-1 MK2 (111283)

The MSP D-4-1 is a 4 solar cells series coupled for fitting the Ant-6F bracket. 2 pcs S2C modules combines two dual cells board into one output – one S2C has a blocking diode – see Figure 5-19 for wiring.

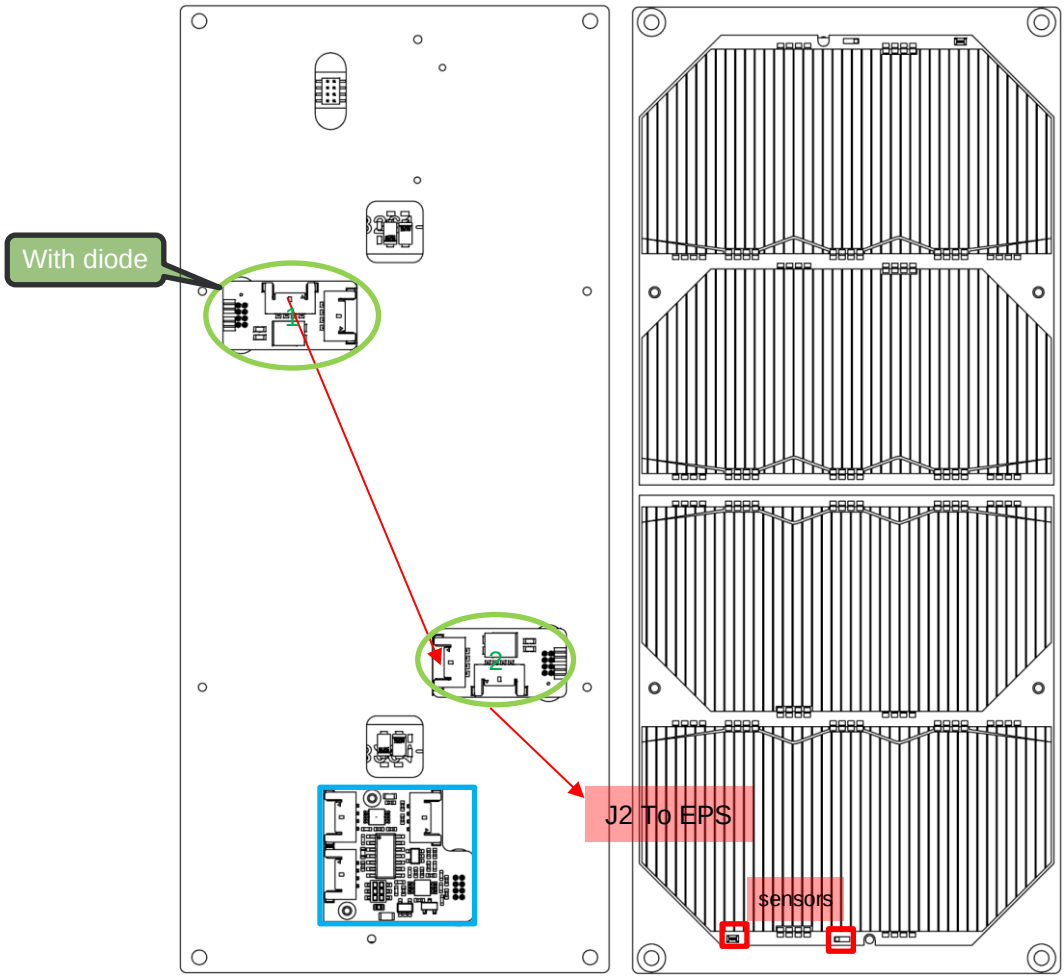

Figure 5-19: The MSP D-4-1.

Wiring of the S2C is explained in detail in section 6.3.1.
Wiring to MSP-GSSB is explained in detail in section 6.2.1.

6 Module Component Descriptions

6.1 The Solar Cell

The main components in the MSP are the solar cells, components transforming incoming sunlight into electric energy. GomSpace use a few vendors that provides highly efficient solar cells designed for use in space. GomSpace provides 2 types of solar cell components, the Single Cell module, and the Dual Cell module. Both modules have a PT100 as external temperature sensor and a coarse light detection diode (sun sensor). The external temperature sensor range is -55 to +175 °C.
The sun sensor is a simple detector if in shadow or not.
The individual solar cell modules must be combined in series or parallel thru Gomspace interface boards S2C/P2C for safe operation.
The GS Solar Cell Module, both the single and dual cell modules include a bypass diode parallel to every solar cell that will conduct if the parallel connected cell performs poorly.
Each satellite side with solar cells requires as minimum one MSP-GSSB bard enabling use of internal and external temperature sensor – and the coarse sun sensor.

6.1.1 The Single Cell Module (108254, 111289)

The Single Cell Module has one solar cell, one coarse light sensor diode and one PT100 temperature sensor; connectors for MSP-GSSB and P2C/S2C and a bypass diode, all are placed on the PCB backside.
The module PCB dimensions are 81 x 45 mm^2.

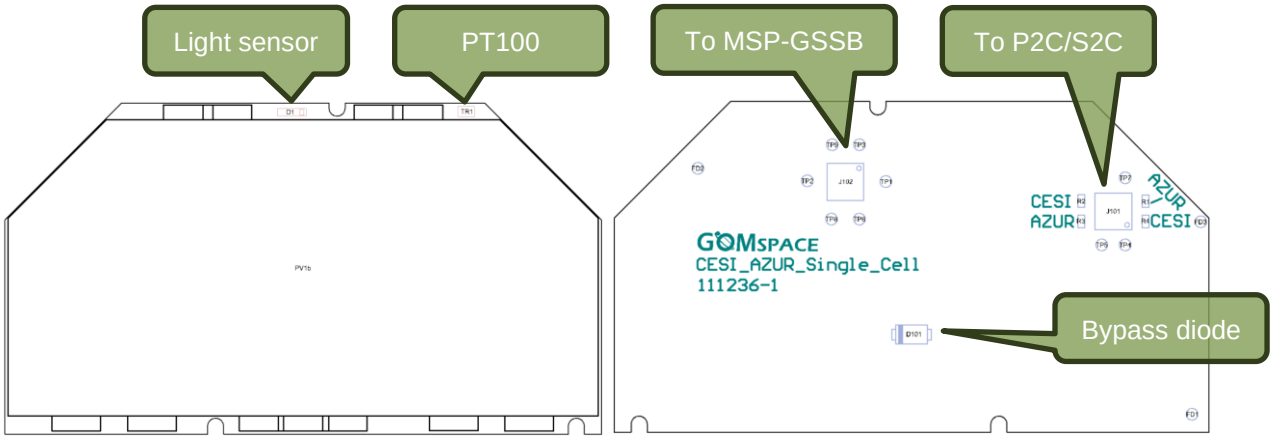

Figure 6-1: The Single Cell Module, exterior left, and interior right.

There are variants depending on the component availability.

6.1.2 The Dual Cell Module (108256, 108300, 111274, 111294)

The Dual Cell consist of two solar cells arranged in series with bypass diodes, one light sensor diode and one temperature sensor; connections to MSP-GSSB and P2C/S2C are placed on backside.
The module PCB dimensions are 81 x 88 mm^2.

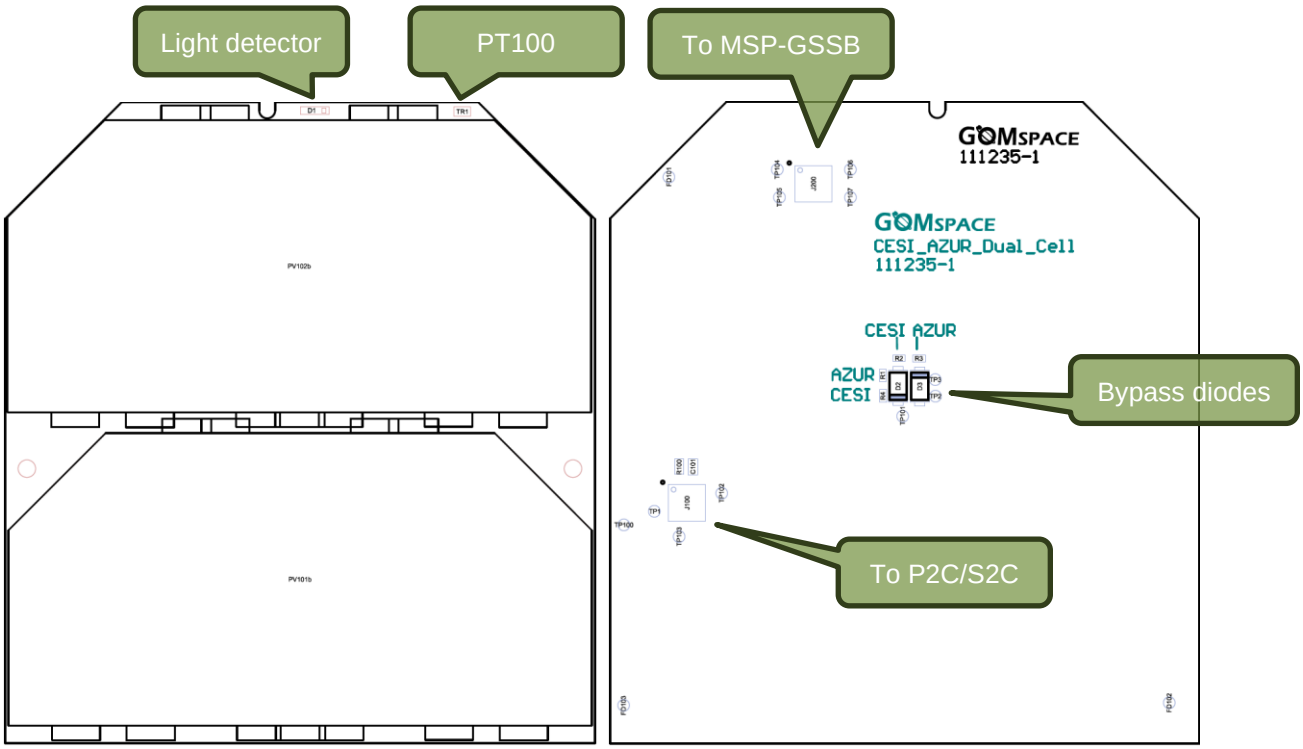

Figure 6-2: The Dual Cell Module, exterior left, and interior right.

There are variants depending on the component availability and use case.

6.2 Gomspace Sensor System Bus Module, GSSB (108258)

The MSP-GSSB module is placed on the solar array backside, directly connected to the solar array via a soldered connection.
The MSP-GSSB module reads the fine sun sensor, coarse sun sensor, and the temperature sensor. Data is routed to the system via the I^{2}C bus using an onboard processor.
Internal temperature sensor range is -40 to +85 °C.
The MSP-GSSB blocks are sketched in Figure 6-3.

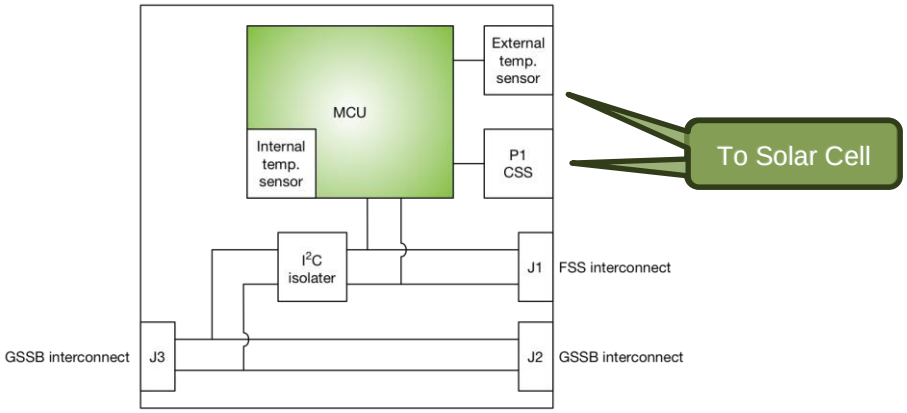

Figure 6-3: MSP-GSSB block diagram.

6.2.1 MSP-GSSB Connector Interface

The MSP-GSSB has 4 connectors J1, J2, J3 and J4 – see Figure 6-4.

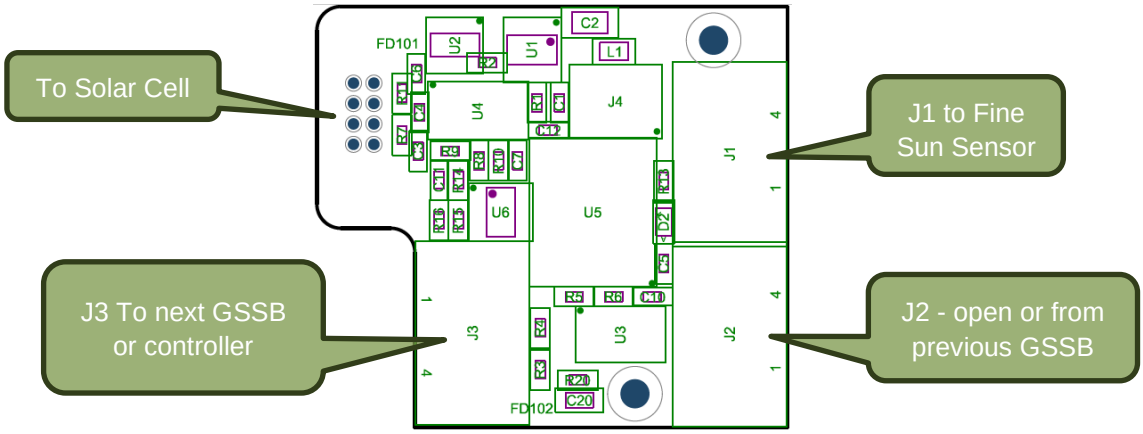

Figure 6-4: MSB-GSSB component placement.

J1 is for the optional Fine Sun Sensor and J2 + J3 is an I²C bus for sensors. J4 is for GomSpace internal use. 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.

6.2.1.1 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

6.2.1.2 J2 – GSSB IN

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

Pin	Description
1	GND
2	GSSB_SCL
3	GSSB_SDA
4	GSSB_VCC

6.2.1.3 J3 – GSSB OUT

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

Pin	Description
1	GSSB_VCC
2	GSSB_SDA
3	GSSB_SCL
4	GND

6.2.1.4 J4 – GomSpace

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

This connector is used for programming the processor on the PCB.

6.3 Solar Cells Connection Interface

The solar cells can be combined in serial or parallel – default for all MSPs is serial. If solar cells are located to point in the same direction, it is convenient to connect the cells in either parallel or serial; mainly to simplify the harness but also because we do not have unlimited numbers of connections into the EPS power system.
By connecting solar cells in serial, voltage grows but keeps the current low.
By connecting a larger number off cells in serial, the voltage can become too high, therefore we can divide the cells in multiple serial strings with lower number off cells and connect each string to the EPS.

6.3.1 Serial Connection using the S2C (108246, 108248)

Connecting solar cell modules in serial requires use of the S2C module; N pcs modules in series using N pcs S2C modules – see a three modules example in Figure 6-5:

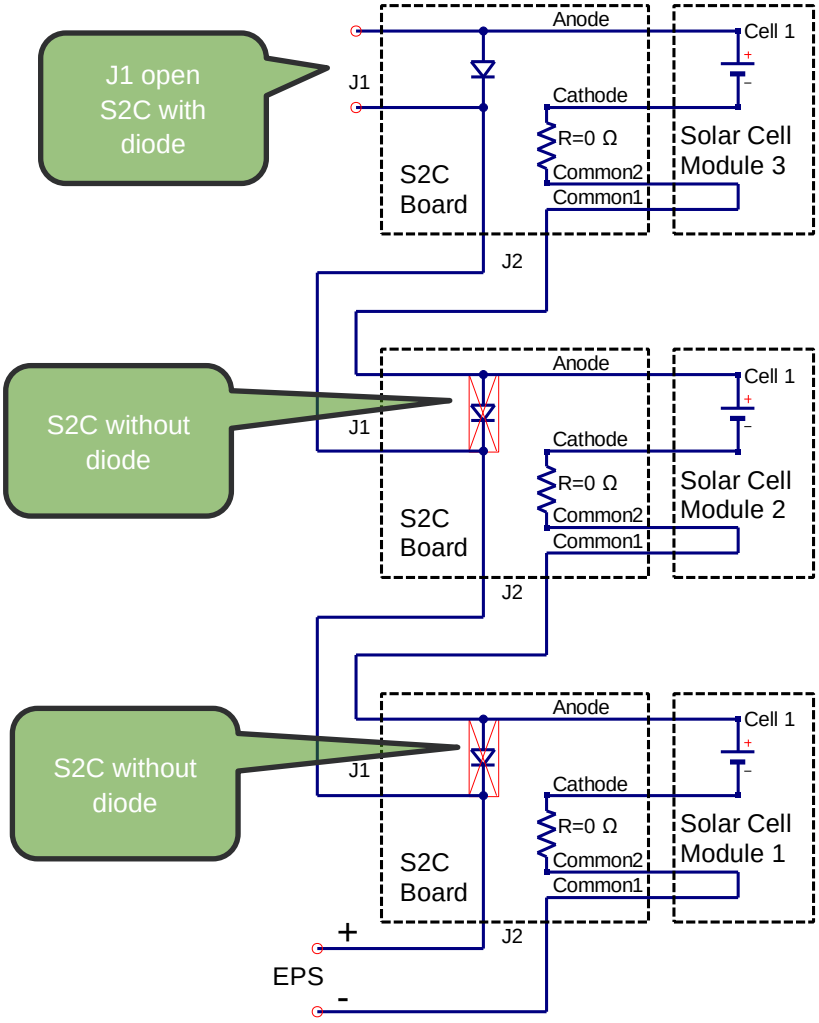

Figure 6-5: Schematic of serial string with three solar cell modules

Note that the last module has a diode for routing and blocking in case this string does not perform well, and with other strings in parallel and it will not load the good working strings.
By not having the diodes in some S2C boards, we eliminate the loss from reverse bias – therefore two versions.

6.3.1.1 Blocking Diode on the S2C Module

The blocking diode is a low loss SS10P4 Schottky with very low forward voltage drop for low loss.

6.3.1.2 Connector Location on the S2C board.

All serial connected solar cell modules are routed via the S2C module which is connected directly to the solar cell from inside the satellite. The connections are shown in Figure 6-6.

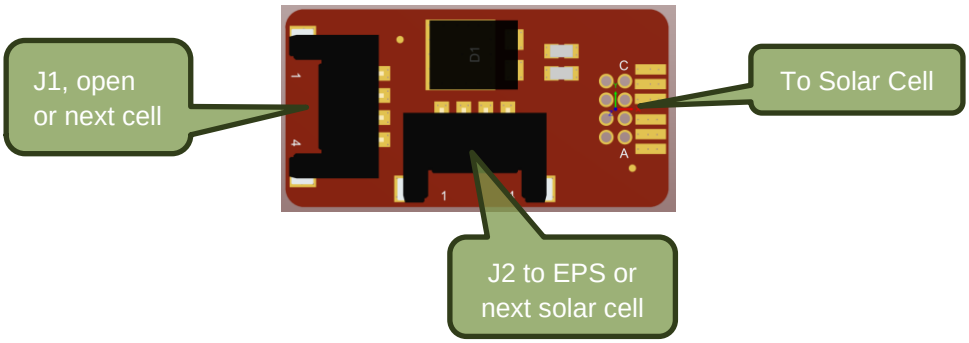

Figure 6-6: Connector location of the S2C Board

6.3.1.3 J1 – Serial Connector 1

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

Pin	Description
1	Cathode
2	Cathode
3	Anode
4	Anode

6.3.1.4 J2 – EPS Connector 2

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

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

7 Thermal Ratings

Thermal environments beyond those listed under Thermal Ratings may cause permanent damage to the MSP. Exposure to thermal rating conditions for extended periods may affect the reliability.

Symbol	Description	Min.	Max.	Unit
$T_{SolarCell}$	Temperature on the solar cell*	-150	+150	°C
$T_{nonOperational}$	Most extreme non-operational temperature tested (1000 thermal cycles)	-77	104	°C
$T_{Operational}$	Electronics operating temperature	-40	+85	°C

* Data from CESI

8 Electrical Characteristics

Parameter	Condition, AZUR cell	BOL	EOL 2.5E14	EOL 5.0E14
Single Solar Panel	AM0 = 1367 W/m²@ 28° C			
• Voltage	Max power	2.41 V	2.34 V	2.29 V
• Current	Max power	503 mA	502 mA	499 mA
• Voltage gradient	Max power	-6.7 mV/°C	-6.8 mV/°C	-7.1 mV/°C
• Current gradient	Max power	0.24 mA/°C	0.20 mA/°C	0.24 mA/°C

1) Standard: CASOLBA 2005 (05-20MV1, etc); Spectrum: AM0 WRC = 1367 W/m²; T = 28° C
2) @fluence 1 MeV [e/cm²]

Parameter	Condition, CESI cell	BOL	EOL 2.5E14	EOL 5.0E14
Single Solar Panel	AM0 = 1367 W/m²@ 25° C			
• Voltage	Max power	2.32 V		2.18 V
• Current	Max power	436 mA		422 mA
• Voltage gradient	Max power	-6.3 mV/°C		-6.9 mV/°C
• Current gradient	Max power	0.21 mA/°C		0.27 mA/°C

3) Standard: CASOLBA 2005 (05-20MV1, etc); Spectrum: AM0 WRC = 1367 W/m²; T = 25° C
4) @fluence 1 MeV [e/cm²]

Parameter	Condition	Min	Typ.	Max	Unit
GSSB_VCC		3.1	3.3	3.5	V
GSSB_I_idle			2.6		mA
Course Sun Sensor					
• Current	Short current at 1367 W/m²		930		µA
• Cosine error			1.85	3.5	°
Temperature Sensor External					
• Range		-75		+175	°C
• Resolution				3.5	%
Temperature Sensor Internal					
• Range		-40		85	°C
• Resolution		-10		10	%

9 Physical Characteristics

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

Values are of modules with solar panels:

Name	Configuration	Plate Size [mm]	Mass
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	81
MSP-A-4-1	4 in series	182.9 x 82.6 x 1.5	103
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 3	453
MSP-B-8-2	8 serial 2 parallel	326.5 x 209.0 x 3	453
MSP-B-4-1	4 serial	114.9 x 209 x 3	145
MSP-C-4-1	4 in series	221.5 x 97.5 x 1.5	132
MSP-D-4-1	4 in series	189.0 x 83.6 x 1.5	112

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

9.1 Cover Plates

The covering plates with FSS mounting 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 FSS mounting)	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 FSS mounting)	74.0 x 14.0 x 5.5 (1.5)	mm

10 Disclaimer

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