



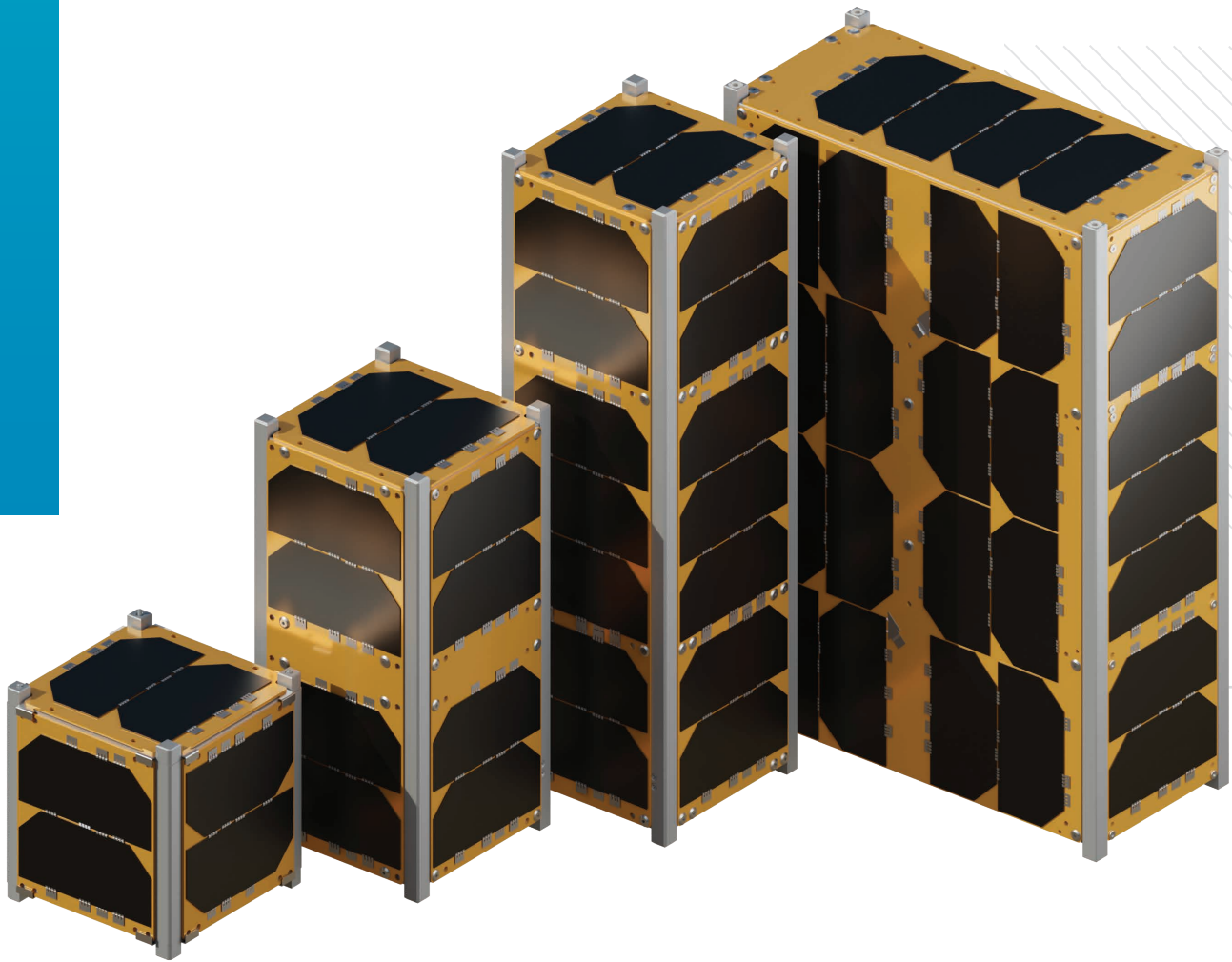
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dhvtechnology.com



CUBESAT POWER SOLUTIONS

High-quality solar panels and power subsystems for CubeSat platforms.

Products overview for CubeSats

Standard and custom solutions
for 1U, 2U, 3U, 6U, 12U and 16U
CubeSat platforms.

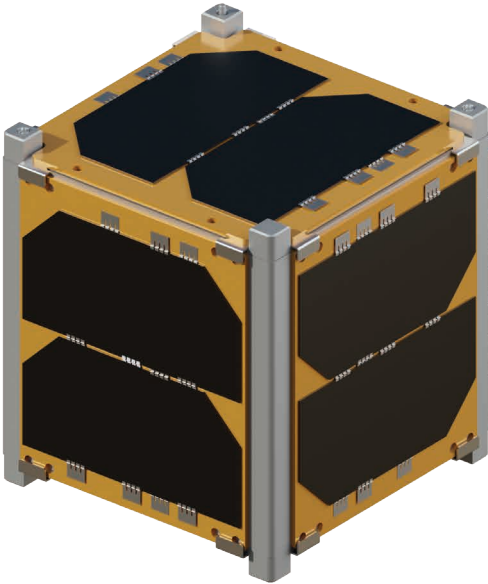


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1U CubeSat Solar Panel

• DHV-1U Series Standard solution



DHV-1U Series solar panels are designed and manufactured to provide proven reliability power generation for any 1U nanosatellite.

Besides, high-efficiency power generation is combined with useful telemetry data for thermal aspects and attitude determination and control.

DHV-1U Series can provide power generation in LEO missions for at least 3 years and temperatures between -50°C and +125°C.

DHV-1U Series ensures protection against atomic oxygen.

Key features

- Substrate made of printed circuit board made of Polyimide with Kapton coverlay
- 2 Solar Cell Assembly AzurSpace 3G30A with coverglass of 100 µm thickness
- 2 Blocking diodes in parallel
- Bypass diodes for each cell
- Electrical connectors
- Digital / Analog temperature sensor
- Photodiode
- Magnetorquer (Optional)
- Aerospace qualified silicones to protect solder joints
- Compatible with most platforms available on the market

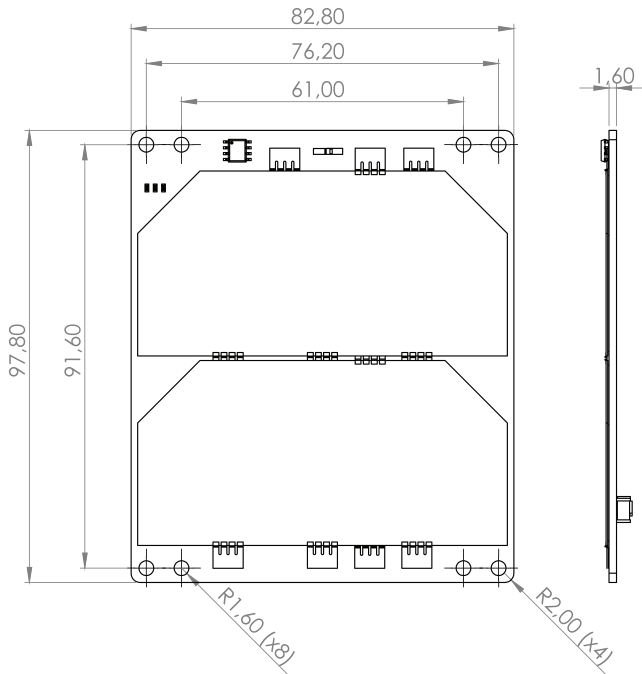


All components and processes are qualified for space environment

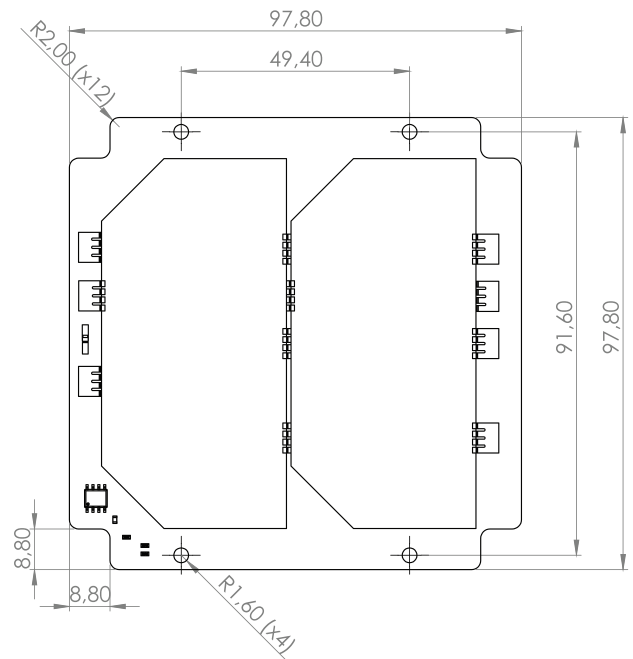
Mechanical interface

All solar panels include holes on the PCB substrate to facilitate the integration on S/C.
DHV-1U-XY panels also allow the fixation through dedicated clips.

The corners of the substrate include plated finish to allow electrical and thermal conductivity between solar panel and S/C.



Front view (DHV-1U-XY Panels)



Front view (DHV-1U-Z Panels)

Electrical parameters

The electrical parameters of the DHV-1U Series (2S1P) are shown in the table below.
These parameters consider loss factors such as blocking diode loss or UV degradation.



SOLAR ARRAY ELECTRICAL PERFORMANCE

Parameters	BOL			EOL		
Temperature (°C)	-50 °C	28 °C	125 °C	-50 °C	28 °C	125 °C
V_{oc} (V)	6.35	5.38	4.18	6.23	5.21	3.95
I_{sc} (A)	0.49	0.52	0.55	0.49	0.52	0.55
V_{mp} (V)	5.26	4.22	2.92	5.16	4.10	2.78
I_{mp} (A)	0.47	0.49	0.51	0.47	0.48	0.50
P_{mp} (W)	2.48	2.07	1.50	2.41	1.98	1.40

*EOL parameters: AM0 1367 W/m² & Fluence (at 1MeV) = $2.5 \cdot 10^{14}$ e/cm²

2U CubeSat Solar Panel

• DHV-2U Series Standard solution



DHV-2U Series solar panels are designed and manufactured to provide proven reliability power generation for any 2U/4U/6U nanosatellites.

Besides, high-efficiency power generation is combined with tuseful telemetry data for thermal aspects and attitude determination and control.

DHV-2U Series can provide power generation in LEO missions for at least 3 years and temperatures between -50°C and +125°C.

DHV-2U Series ensures protection against atomic oxygen.

Key features

- Substrate made of printed circuit board made of Polyimide with Kapton coverlay
- 4 Solar Cell Assembly AzurSpace 3G30A with coverglass of 100 µm thickness
- 2 Blocking diodes in parallel
- Bypass diodes for each cell
- Electrical connectors
- Digital / Analog temperature sensor
- Photodiode
- Magnetorquer (Optional)
- Aerospace qualified silicones to protect solder joints
- Compatible with most platforms available on the market

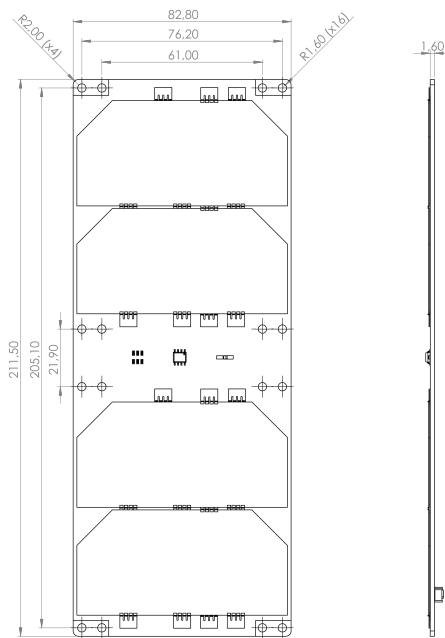


All components and processes are qualified for space environment

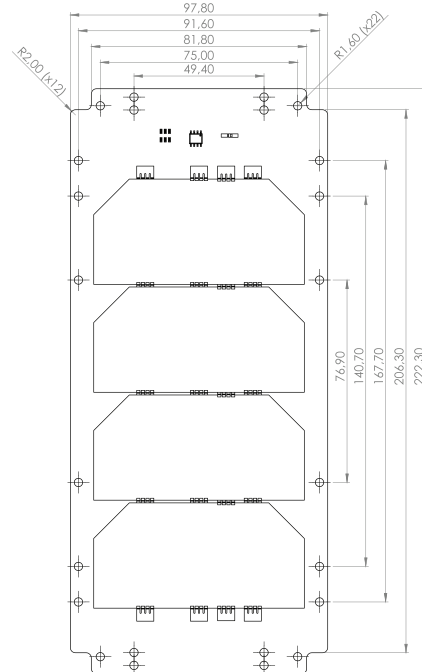
Mechanical interface

All solar panels include holes on the PCB substrate to facilitate the integration on S/C.
DHV-2U-1 panels also allow the fixation through dedicated clips.

The corners of the substrate include plated finish to allow electrical and thermal conductivity between solar panel and S/C.



Front view (DHV-2U-1 Panels)



Front view (DHV-2U-2 Panels)

Electrical parameters

The electrical parameters of the DHV-2U Series (4S1P) are shown in the table below.
These parameters consider loss factors such as blocking diode loss or UV degradation.



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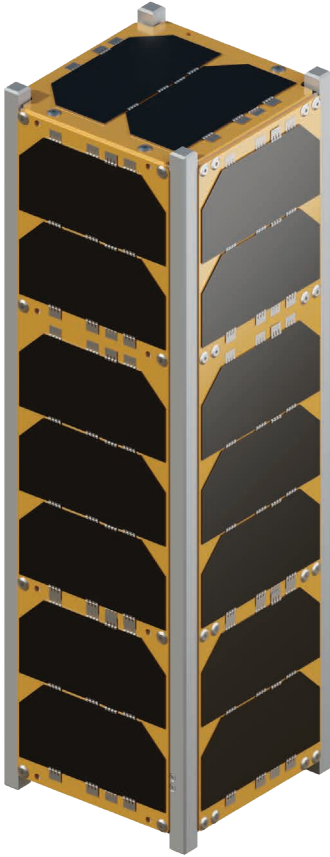
SOLAR ARRAY ELECTRICAL PERFORMANCE

Parameters	BOL			EOL		
	-50 °C	28 °C	125 °C	-50 °C	28 °C	125 °C
Temperature (°C)	-50 °C	28 °C	125 °C	-50 °C	28 °C	125 °C
V_{oc} (V)	12.69	10.76	8.35	12.45	10.42	7.90
I_{sc} (A)	0.49	0.52	0.55	0.49	0.52	0.55
V_{mp} (V)	10.52	8.44	5.84	10.32	8.20	5.56
I_{mp} (A)	0.47	0.49	0.51	0.47	0.48	0.50
P_{mp} (W)	4.94	4.14	2.98	4.84	3.94	2.78

*EOL parameters: AM0 1367 W/m² & Fluence (at 1MeV) = 2.5·10¹⁴ e/cm²

3U CubeSat Solar Panel

• DHV-3U Series Standard solution



DHV-3U Series solar panels are designed and manufactured to provide proven reliability power generation for any 3U/6U nanosatellite.

Besides, high-efficiency power generation is combined with useful telemetry data for thermal aspects and attitude determination and control.

DHV-3U Series can provide power generation in LEO missions for at least 3 years and temperatures between -50°C and +125°C.

DHV-3U Series ensures protection against atomic oxygen.

Key features

- Substrate made of printed circuit board made of Polyimide with Kapton coverlay
- 7 Solar Cell Assembly AzurSpace 3G30A with coverglass of 100 µm thickness
- 2 Blocking diodes in parallel
- Bypass diodes for each cell
- Electrical connectors
- Digital / Analog temperature sensor
- Photodiode
- Magnetorquer (Optional)
- Aerospace qualified silicones to protect solder joints
- Compatible with most platforms available on the market

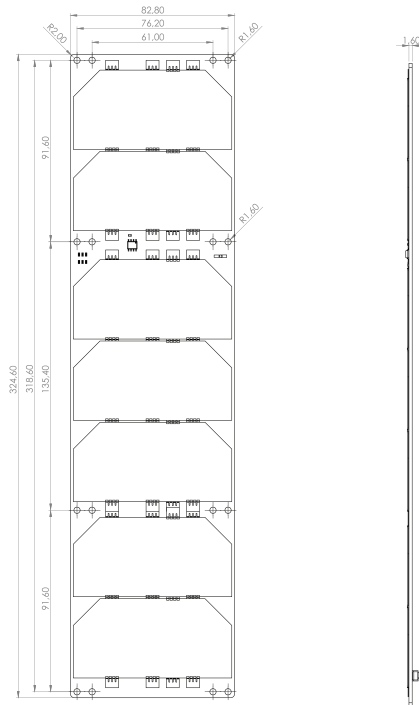


All components and processes are qualified for space environment

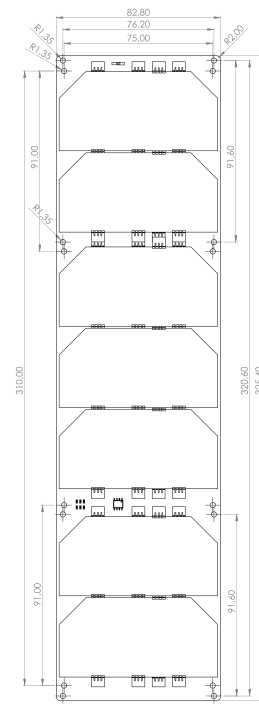
Mechanical interface

All solar panels include holes on the PCB substrate to facilitate the integration on S/C.
DHV-3U panels also allow the fixation through dedicated clips.

The corners of the substrate include plated finish to allow electrical and thermal conductivity between solar panel and S/C.



Front view (DHV-3U Panels Type 1)



Front view (DHV-3U Panels Type 2)

Electrical parameters

The electrical parameters of the DHV-3U Series (7S1P) are shown in the table below.
These parameters consider loss factors such as blocking diode loss or UV degradation.



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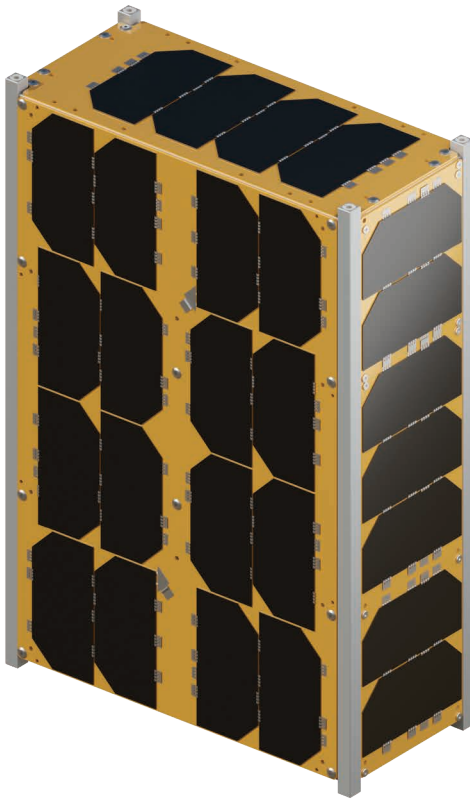
SOLAR ARRAY ELECTRICAL PERFORMANCE

Parameters	BOL			EOL		
Temperature (°C)	-50 °C	28 °C	125 °C	-50 °C	28 °C	125 °C
V_{oc} (V)	22.22	18.83	14.62	21.79	18.24	13.83
I_{sc} (A)	0.49	0.52	0.55	0.49	0.52	0.55
V_{mp} (V)	20.06	16.40	11.85	19.67	15.95	11.34
I_{mp} (A)	0.47	0.49	0.52	0.47	0.48	0.50
P_{mp} (W)	9.51	8.08	6.12	9.20	7.72	5.70

*EOL parameters: AM0 1367 W/m² & Fluence (at 1MeV) = 2.5·10¹⁴ e/cm²

6U CubeSat Solar Panel

• DHV-6U Series Standard solution



DHV-6U Series solar panels are designed and manufactured to provide proven reliability power generation for any 6U/12U nanosatellite.

Besides, high-efficiency power generation is combined with useful telemetry data for thermal aspects and attitude determination and control.

DHV-6U Series can provide power generation in LEO missions for at least 3 years and temperatures between -50°C and +125°C.

DHV-6U Series ensures protection against atomic oxygen.

Key features

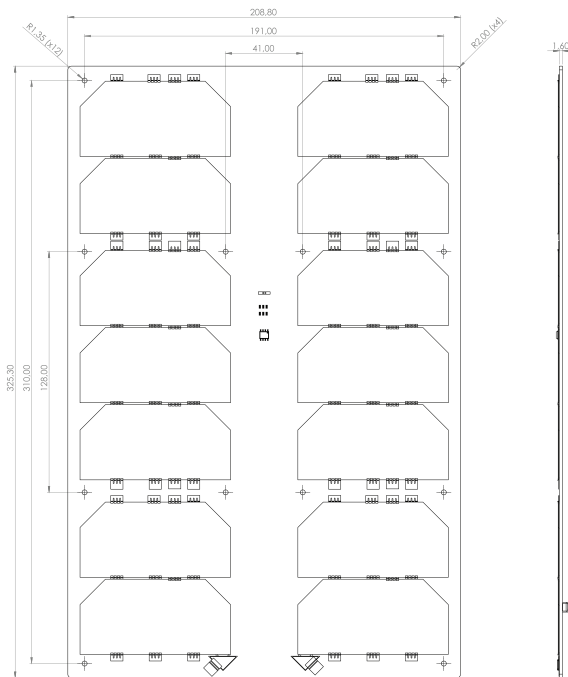
- Substrate made of printed circuit board made of Polyimide with Kapton coverlay
- 14/16 Solar Cell Assembly AzurSpace 3G30A with coverglass of 100 µm thickness
- 2 Blocking diodes in parallel
- Bypass diodes for each cell
- Electrical connectors
- Digital / Analog temperature sensor
- Photodiode
- Magnetorquer (Optional)
- Aerospace qualified silicones to protect solder joints
- Compatible with most platforms available on the market



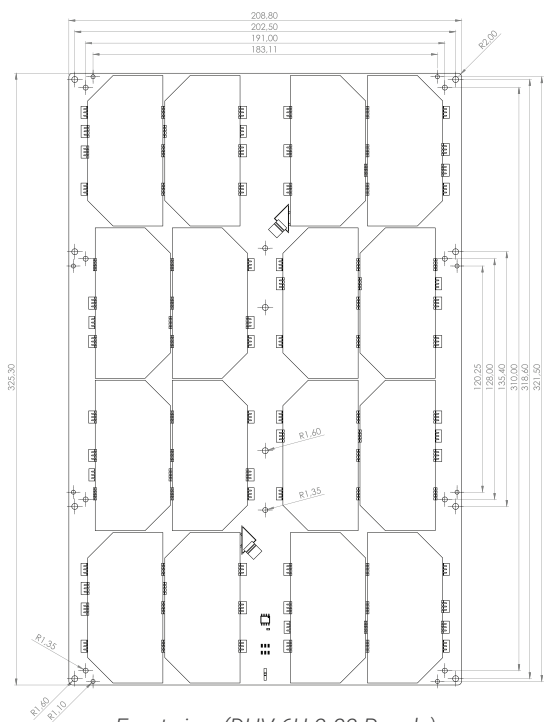
All components and processes are qualified for space environment

Mechanical interface

All solar panels include holes on the PCB substrate to facilitate the integration on S/C.



Front view (DHV-6U-1-72 Panels)



Front view (DHV-6U-2-82 Panels)

Electrical parameters

The electrical parameters of the DHV-6U Series (8S2P) are shown in the table below. Other electrical parameters configurations (4S4P and 7S2P) are also available. These parameters consider loss factors such as blocking diode loss or UV degradation.



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SOLAR ARRAY ELECTRICAL PERFORMANCE

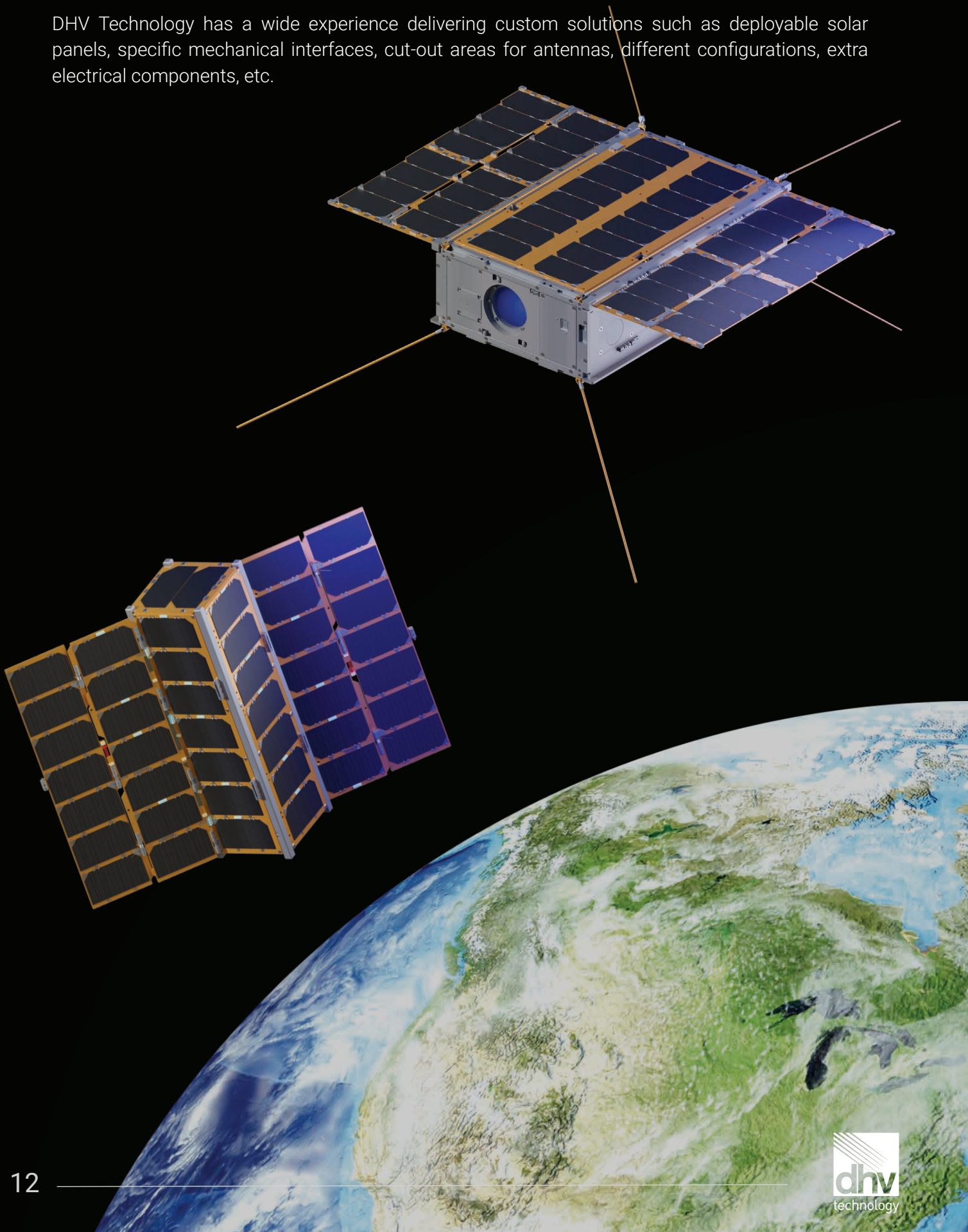
Parameters	BOL			EOL		
Temperature (°C)	-50 °C	28 °C	125 °C	-50 °C	28 °C	125 °C
V_{oc} (V)	25.39	21.52	16.71	24.90	20.85	15.80
I_{sc} (A)	0.98	1.04	1.11	0.98	1.04	1.10
V_{mp} (V)	22.99	18.81	13.61	22.54	18.30	13.02
I_{mp} (A)	0.95	0.99	1.03	0.94	0.97	1.01
P_{mp} (W)	21.80	18.54	14.05	21.10	17.70	13.10

*EOL parameters: AM0 1367 W/m² & Fluence (at 1MeV) = $2.5 \cdot 10^{14}$ e/cm²

Custom Solutions

- Deployable & Other platforms

DHV Technology has a wide experience delivering custom solutions such as deployable solar panels, specific mechanical interfaces, cut-out areas for antennas, different configurations, extra electrical components, etc.





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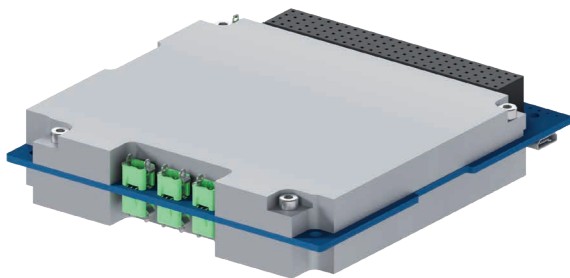
Electrical Power System

• PicoEPS - For 1U and 2U CubeSats

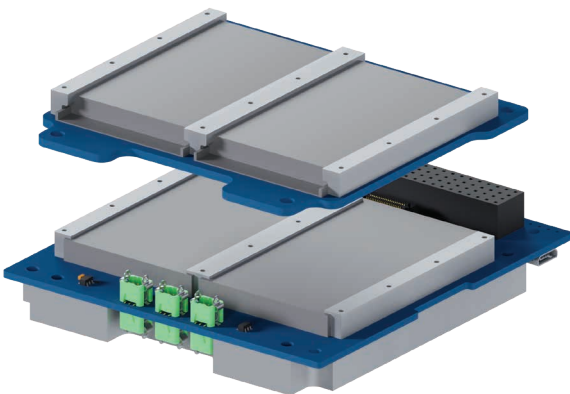
The Electrical Power System **PicoEPS** has been designed to be integrated into different CubeSats platforms from 1U to 2U.

It is the interface that manages the power of the solar panel inputs and the battery charge. This module is also responsible of the generation of 3.3V, 5V, 12V and VBAT power buses including the switched power lines.

This module is available in two different configurations: **battery integrated** and **extended battery**.



The PicoEPS unifies a Power Module and a Battery Module in one single board, optimizing mass and volume for large payloads integrated in 1U and 2U platforms.



When working with configurations where more power storage is requested, the PicoEPS battery capacity could be extended with a Battery Module, increasing its capacity up to 2800mAh.

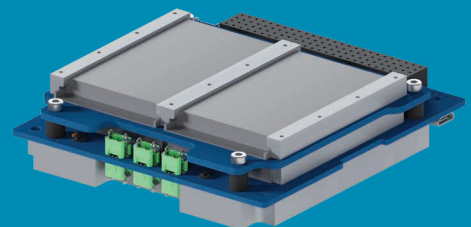


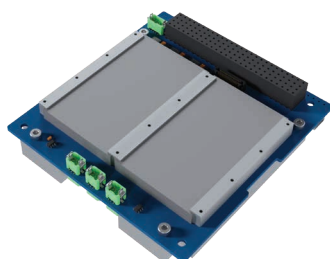
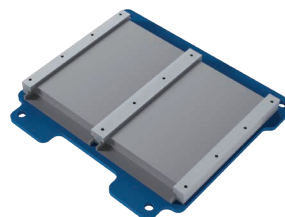
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Key features

- Scalable for CubeSats from 1U to 2U
- Battery integrated configuration with 1400 mAh capacity
- Extended additional battery module available
- Maximum Power Point Tracking (MPPT)
- Space qualified
- Thermal knife control for wing deployment
- PC104 form factor
- ISS compliant version available

All components and processes are qualified for space environment



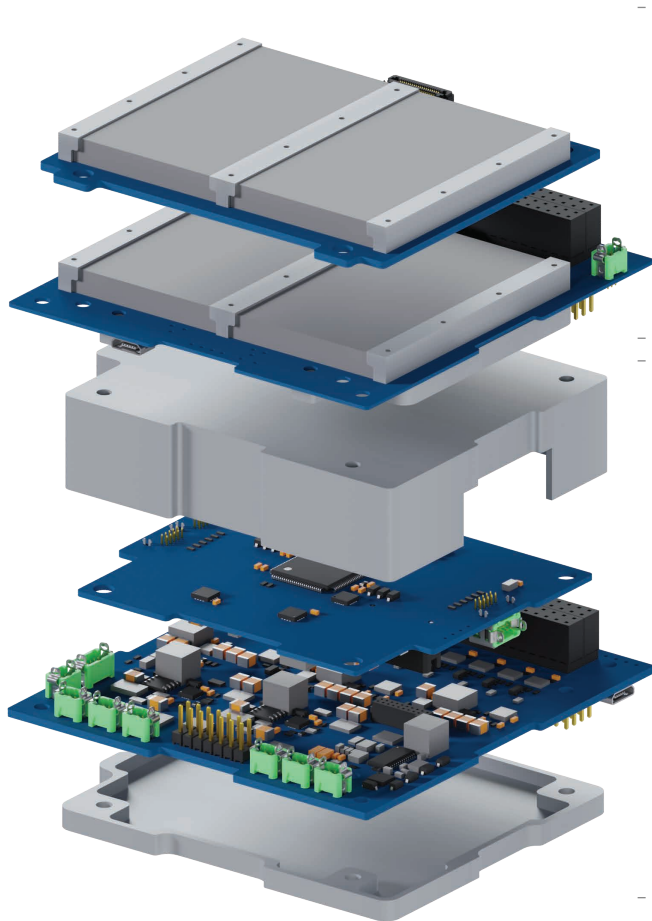
POWER MODULE		BATTERY MODULE	
Power generation <ul style="list-style-type: none">Maximum input power: 60WInput voltage from solar arrays: 3V ~ 18VSolar arrays Maximum Power Point TrackingBattery Charge Regulators Efficiency > 90% Output buses <ul style="list-style-type: none">Regulated 3.3V bus (4A max.)Regulated 5V bus (4A max.)Regulated 12V bus (1A max.)Unregulated battery bus6 switched & selectable current limited outputs3 un-switched but current limited outputsPower output efficiency > 93%		Electrical parameters <ul style="list-style-type: none">Voltage: 7.4V (nominal) / 8.4V (fully charged)Maximum charge current: 3040mAMaximum discharge current: 4000mACapacity: 2800mAh (1400mAh per board)Battery cells: Li-Po (2 series, 1 ~ 2 parallel) Battery management <ul style="list-style-type: none">Integrated cell balance circuitBuilt-in protection: voltage, current & short-circuitCapacity status and aging estimationTemperature control (embedded heaters)	
CONFIGURATION OPTIONS			
		BATTERY MODULE	
			
Motherboard		Daughterboard (0 ~ 1)	
Solar panel inputs: 6 x 3V ~ 18V (3 x 20W in total)		Capacity: 10Wh / board	
Mass: 110g	Capacity: 10Wh	Mass: 80g	Max. Capacity: 10Wh
(+100 g for optional radiation shielding case)			
SPECIFICATIONS FOR BOTH MODULES			
Mechanical specifications <ul style="list-style-type: none">PC104 standard mechanical interfaceTotal mass: 110g ~ 315g Tests <ul style="list-style-type: none">Functional / ElectricalVibration (tested to NASA GEVS levels)TVAC (1.33·10⁻³ Pa, -40°C ~ +85°C)Radiation (tested to 20kRad) Inhibits <ul style="list-style-type: none">Two redundant kill switches & one RBF switchOne battery ground switch (ISS compliant)		TM / TC <ul style="list-style-type: none">Accepts TC & provides housekeeping TM via I2CTransmission error detection codesTM data including voltages, currents, capacity, temperatures, status registers and error flags Software reliability <ul style="list-style-type: none">Memory code integrity verification via checksumProgrammable watchdog timer Manufacturing <ul style="list-style-type: none">Clean room ISO 8 class (humidity & temperature controlled)	

Electrical Power System

• NanoEPS - From 2U to 12U CubeSats

The Electrical Power System **NanoEPS** has been designed to be integrated into different CubeSats systems from non-deployable 3U to triple deployable 2U, 3U or 6U and double deployable 12U with various configurations.

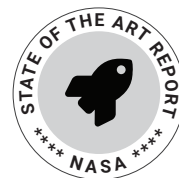
It is composed by a power management module and a battery module.



The Battery Module is responsible for energy storage, battery thermal control and contains the circuit protection against overloads, over-discharges, over-currents and short circuits.

The Power Module is the interface that manages the power of the solar panel inputs and the the battery charge.

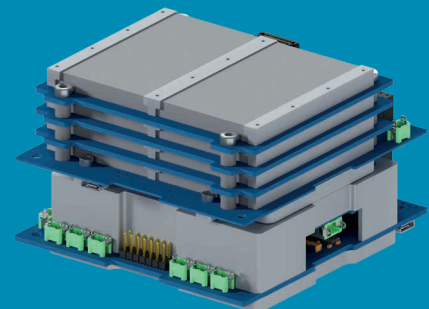
This module is also responsible of the generation of 3.3V, 5V, 12V and VBAT power buses including the switched power lines.



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Key features

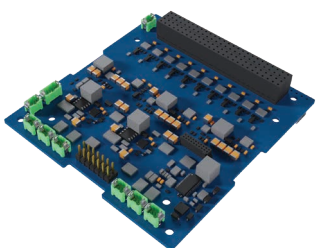
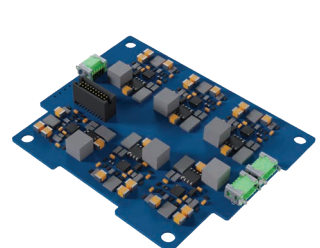
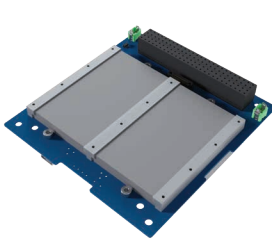
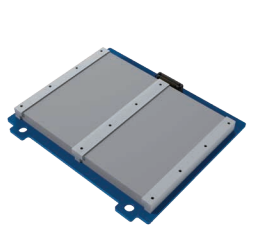
- Scalable for CubeSats from non-deployable 3U or 6U to triple deployable 2U, 3U or 6U and double deployable 12U with various configurations
- Maximum Power Point Tracking (MPPT)
- Space qualified
- Thermal knife control for wing deployment
- PC104 form factor
- ISS compliant version available



All components and processes are qualified for space environment

POWER MODULE	BATTERY MODULE
Power generation <ul style="list-style-type: none"> Maximum input power: 260W Input voltage from X, Y solar arrays: 9V ~ 28V Input voltage from Z solar arrays: 3V ~ 18V Battery Charge Regulators Efficiency > 90% Output buses <ul style="list-style-type: none"> Regulated 3.3V bus (5A max.) Regulated 5V bus (5A max.) Regulated 12V bus (2A max.) Unregulated battery bus 10 switched & selectable current limited outputs 4 un-switched but current limited outputs Power output efficiency > 93% 	Electrical parameters <ul style="list-style-type: none"> Voltage: 7.4V (nominal) / 8.4V (fully charged) Maximum charge current: 6080mA Maximum discharge current: 8000mA Capacity: 5600mAh (1400mAh per board) Battery cells: Li-Po (2 series, 1 ~ 4 parallel) Battery management <ul style="list-style-type: none"> Integrated cell balance circuit Built-in protection: voltage, current & short-circuit Capacity status and aging estimation Temperature control (embedded heaters)

CONFIGURATION OPTIONS

POWER MODULE		BATTERY MODULE	
			
Motherboard	Daughterboard (0 ~ 1)	Motherboard	Daughterboard (0 ~ 3)
Solar panel inputs 2 x 3V ~ 18V (20W in total) 4 x 9V ~ 28V (2 x 30W in total)	Solar panel inputs 6 x 9V ~ 28V (30W each)	Capacity: 10Wh	Capacity: 10Wh / board
Mass: 65g	Mass: 45g	Mass: 110g	Mass: 80g / board
(+100g for optional radiation shielding case)		(+25g for optional radiation shielding case)	
BCR capabilities: 1 x 20W + 8 x 30W		Maximum Capacity: 40Wh	

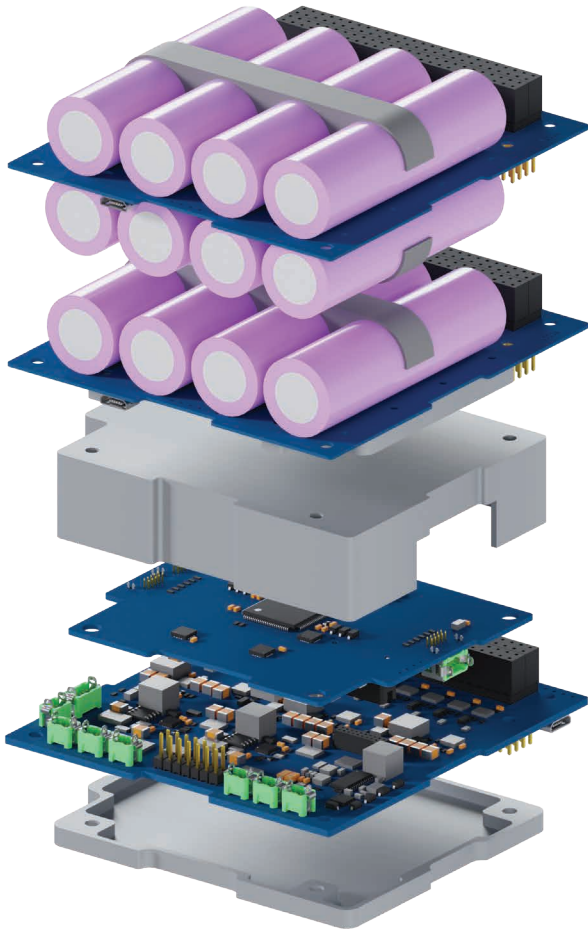
SPECIFICATIONS FOR BOTH MODULES

Mechanical specifications <ul style="list-style-type: none"> PC104 standard mechanical interface Total mass: 175g ~ 540g Tests <ul style="list-style-type: none"> Functional / Electrical Vibration (tested to NASA GEVS levels) TVAC ($1.33 \cdot 10^{-3}$ Pa, -40°C ~ +85°C) Radiation (tested to 20kRad) Inhibits <ul style="list-style-type: none"> Two redundant kill switches & one RBF switch One battery ground switch (ISS compliant) 	TM / TC <ul style="list-style-type: none"> Accepts TC & provides housekeeping TM via I2C Transmission error detection codes TM data including voltages, currents, capacity, temperatures, status registers and error flags Software reliability <ul style="list-style-type: none"> Memory code integrity verification via checksum Programmable watchdog timer Manufacturing <ul style="list-style-type: none"> Clean room ISO 8 class (humidity & temperature controlled)
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Electrical Power System

• MicroEPS - For 3U, 6U, 12U and 16U CubeSats

The Electrical Power System **MicroEPS** has been designed to be integrated into different CubeSats systems from non-deployable 6U to quad deployable 3U, 6U, 12U and 16U with various configurations. It is composed by a power management module and a battery module.



The Battery Module is responsible for energy storage, battery thermal control and contains the circuit protection against overloads, over-discharges, over-currents and short circuits.

The Power Module is the interface that manages the power of the solar panel inputs and the battery charge.

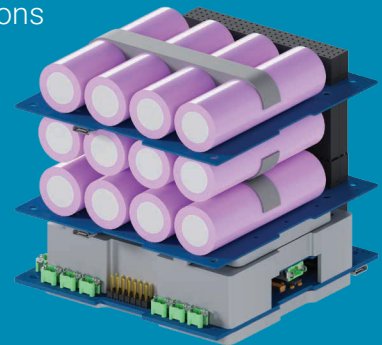
This module is also responsible of the generation of 3.3V, 5V, 12V and VBAT power buses including the switched power lines.



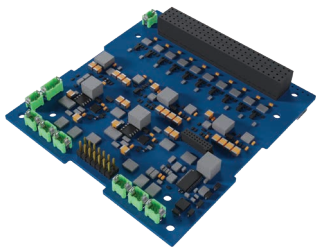
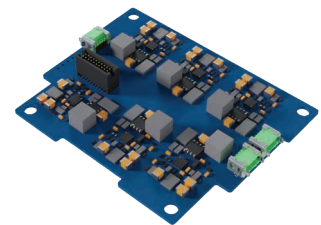


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Key features

- Scalable for CubeSats from non-deployable 6U or 12U or 16U to triple deployable 3U, 6U, 12U or 16U with various configurations
- Maximum Power Point Tracking (MPPT)
- Space qualified
- Thermal knife control for wing deployment
- PC104 form factor
- ISS compliant version available



All components and processes are qualified for space environment

POWER MODULE		BATTERY MODULE	
Power generation <ul style="list-style-type: none">Maximum input power: 570WInput voltage from X, Y solar arrays: 10V ~ 40VInput voltage from Z solar arrays: 9V ~ 28VBattery Charge Regulators Efficiency > 90% Output buses <ul style="list-style-type: none">Regulated 3.3V bus (5A max.)Regulated 5V bus (5A max.)Regulated 12V bus (5A max.)Unregulated battery bus (30A max.)16 switched & selectable current limited outputs4 un-switched but current limited outputsPower output efficiency > 93%		Electrical parameters <ul style="list-style-type: none">Voltage: 14.8V (nominal) / 16.8V (fully charged)Maximum charge current: 7500mAMaximum discharge current: 40 ACapacity: 250Wh (50Wh MB + 100Wh per DB)Battery cells: Li-Po (4 series, 1 ~ 5 parallel) Battery management <ul style="list-style-type: none">Integrated cell balance circuitBuilt-in protection: voltage, current & short-circuitCapacity status and aging estimationTemperature control (embedded heaters)	
CONFIGURATION OPTIONS			
POWER MODULE		BATTERY MODULE	
			
Motherboard	Daughterboard (0 ~ 2)	Motherboard	Daughterboard (0 ~ 2)
Solar panel inputs 2 x 9V ~ 28V (30W in total) 4 x 10V ~ 40V (2 x 30W in total)	Solar panel inputs 8 x 10V ~ 40V (30W each)	Capacity: 50Wh	Capacity: 100Wh /board
Mass: 65g	Mass: 45g	Mass: 220g	Mass: 380g / board
(+120g for optional radiation shielding case)		(+50g for optional radiation shielding case)	
BCR capabilities: 1 x 30W + 18 x 30W		Maximum Capacity: 250Wh	
SPECIFICATIONS FOR BOTH MODULES			
Mechanical specifications <ul style="list-style-type: none">PC104 standard mechanical interfaceTotal mass: 285g ~ 1305g Tests <ul style="list-style-type: none">Functional / ElectricalVibration (tested to NASA GEVS levels)TVAC (1.33·10⁻³ Pa, -40°C ~ +85°C)Radiation (tested to 20kRad) Inhibits <ul style="list-style-type: none">Two redundant kill switches & one RBF switchOne battery ground switch (ISS compliant)		TM / TC <ul style="list-style-type: none">Accepts TC & provides housekeeping TM via I2CTransmission error detection codesTM data including voltages, currents, capacity, temperature, status registers and error flags Software reliability <ul style="list-style-type: none">Memory code integrity verification via checksumProgrammable watchdog timer Manufacturing <ul style="list-style-type: none">Clean room ISO 8 class (humidity & temperature controlled)	

Solar Array Drive Assembly

• MicroSADA - From 6U to 16U CubeSats



MicroSADA is the brand new solution from DHV Technology in charge of rotating the solar arrays to keep them optimally oriented with respect to the sun and providing a path for power transfer from the arrays to the CubeSat bus.

This system has different versions (MicroSADA-10 and MicroSADA-18) compatible with 6U, 12U and 16U CubeSats platforms.

MicroSADA is customizable to include Solar Array Drive Mechanisms (SADM) and Solar Array Drive Electronics (SADE) modules in one single device.

Key features



Datasheet download

- Space-flight grade components
- Designed to rotate up +/- 180 degrees
- Solar panel position feedback
- Gimbal for one-axis concept
- High flexible electrical interface
- Reduced thickness
 - 10 mm for 6U / 12U CubeSats
 - 18 mm for 16U CubeSats
- Different communication protocols: CAN Bus or I2C

All components and processes are qualified for space environment

MicroSADA-10 - For 3U / 6U / 12U CubeSats

MicroSADA-10 is oriented for 6U and 12U CubeSat platforms with a height of 10 mm.



TECHNICAL FEATURES	
MECHANICAL FEATURES	ELECTRICAL FEATURES
<ul style="list-style-type: none">• Mass: < 250 g• Output step angle: 0.005°• Backlash: $\leq 10^\circ$• Maximum power consumption: < 5 W• Nominal voltage: 5 V ~ 10 V• Output torque (continuous): 60 mNm• Output torque (intermittent): 120 mNm• Operating temperature range: - 40°C ~ + 70°C• Survival temperature range: - 50°C ~ + 90°C• Range of motion: $\pm 180^\circ$• Minimum size (customizable): 100 x 100 x 10 mm	<ul style="list-style-type: none">• Number of signals: 15• TID: < 28 kRad *Radiation tolerant model under request• OBC interface: I2C• Max. rotation speed: 0.9°/s• Solar array incoming power: Up to 84 W

MicroSADA-18 - For 12U / 16U CubeSats

MicroSADA-18 version has improved different technical features from the previous version as the backlash of the system.

This version is oriented for 16U CubeSat platforms with a height of 18 mm.



TECHNICAL FEATURES	
MECHANICAL FEATURES	ELECTRICAL FEATURES
<ul style="list-style-type: none">• Mass: < 700 g• Output step angle: 0.01°• Backlash: $\leq 6^\circ$• Maximum power consumption: < 5 W• Nominal voltage: 5 V ~ 28 V• Output Torque (continuous): 200 mNm• Output Torque (intermittent): 400 mNm• Operating Temperature Range: - 40°C ~ + 70°C• Survival Temperature Range: - 50°C ~ + 90°C• Range of Motion: $\pm 180^\circ$• Minimum size (customizable): 226 x 80 x 18 mm	<ul style="list-style-type: none">• Number of signals: 21• TID: < 25 kRad *Radiation tolerant model under request• OBC Interface: I2C, CANBus• Max. Rotation Speed: 0.9°/s• Solar Array Incoming Power: Up to 160 W

ABOUT US

DHV Technology is a Spain based international company that designs and manufactures solar panels for space applications and other power subsystems for different platforms.

DHV Technology has been providing tailor-made solar arrays systems to different international companies at the same time the company has been developing different power subsystems implementing the most advanced technologies.

Our facilities, with a total of 3700 m², consist of:

- 1200 m² clean room
- 1000 m² offices
- 1500 m² warehouse and others



250+

Projects completed

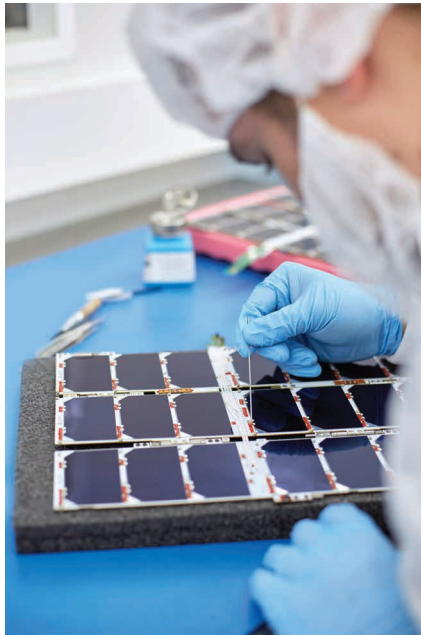
3000+

Days in orbit

150+

Satellites flying
with our solutions





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