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CATALOGUE 2024

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Particle Detectors Boards

CosmoSiPM

Particle detector for Cubesat



CosmoSiPM is a **dual channels all-in-one** particle detector designed for applications in particle physics and beyond with aerospace standards. The **CosmoSiPM**, thanks to its small size, weight and low power consumption, lends itself to aerospace applications, aboard **Cubesats** or balloons. The high performance of the electronic components of the **CosmoSiPM** enables also the use of the detector in the field of analytical chemistry, enabling the innovative use of **SiPMs** in portable or field devices.

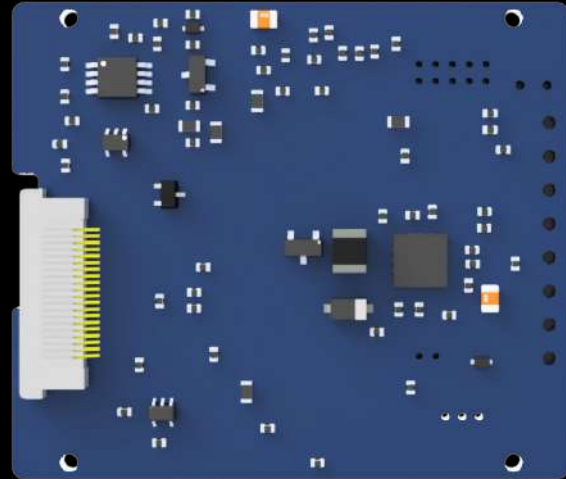
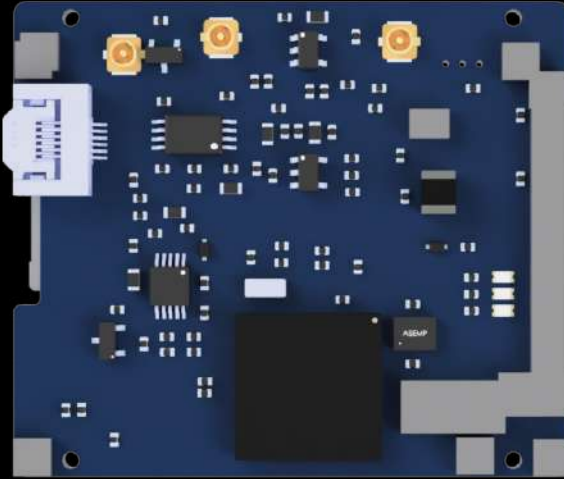
FEATURES

- SAMV71 ARM Cortex-M7 - 300MHz
- Discriminator threshold adjustable for minimum detection less than one photons (dependent on SiPM used).
- 2x Independent channels
- Measures incident particle arrival time.
- Measures rate of incident particles.
- Measures incident particle signal amplitude
- SiPM analog signal output

NanoSiPM

Particle detector for Picosat

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The **NanoSiPM** is a **single** channel **all-in-one** particle detector specially designed for aerospace application and it doesn't have a built-in power supply.

It can be used on **Cubesats** and **Picosats**.

The **NanoSiPM** system is controlled by a dedicated firmware and is a complete control and acquisition system for a **SiPM** detector that is highly sensitive to light (less than one photon) generated by the passage of ionizing particles through a scintillator.

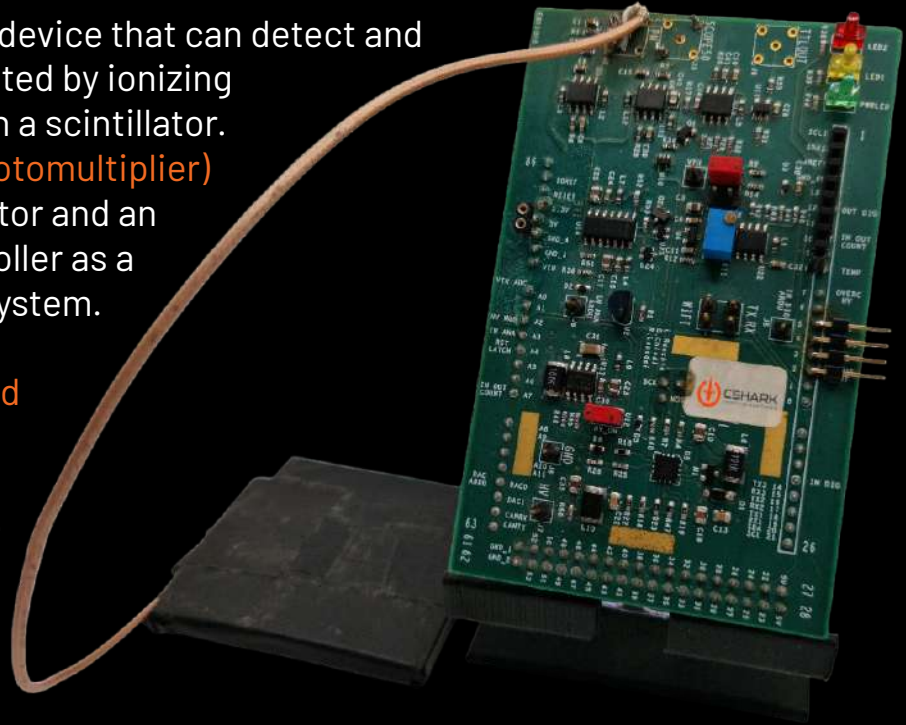
FEATURES

- SAMV71 ARM Cortex-M7 - 300MHz
- Discriminator threshold adjustable for minimum detection less than one photons (dependent on SiPM used).
- Size reduced by $\frac{1}{4}$ compared to CosmoSiPM.
- Measures incident particle arrival time.
- Measures rate of incident particles.
- Measures incident particle signal amplitude
- SiPM analog signal output

ArduSiPM

Particle detector for research

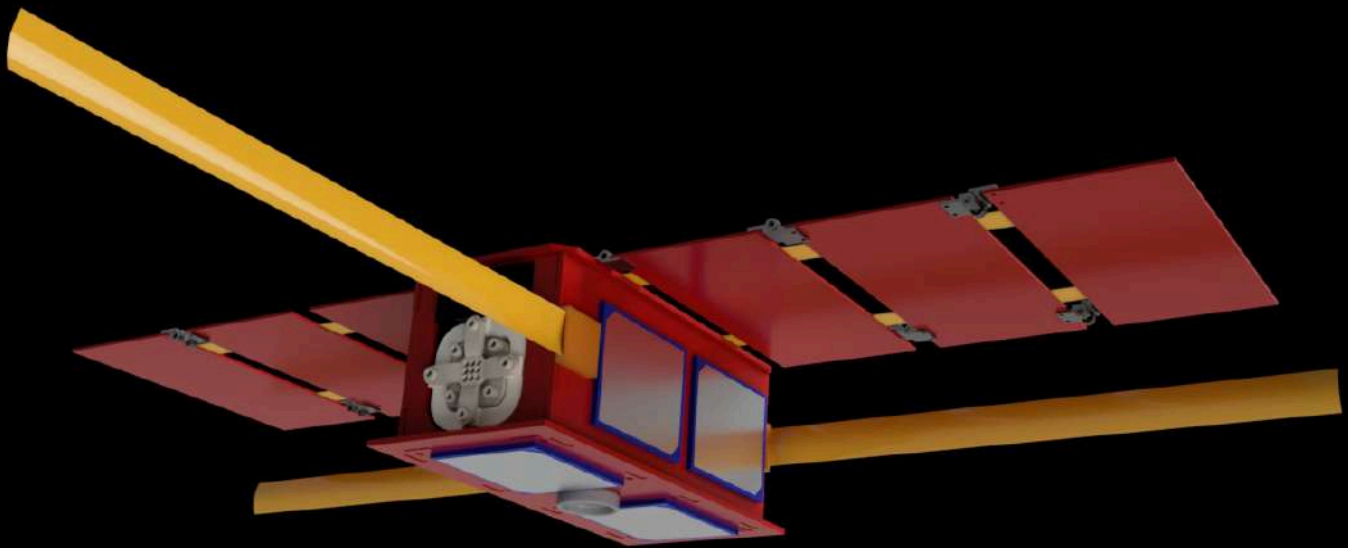
ArduSiPM is a hand-held device that can detect and measure the light generated by ionizing particles passing through a scintillator. It uses a **SiPM (silicon photomultiplier)** as a sensitive light detector and an **Arduino DUE** microcontroller as a control and acquisition system. The device has a custom designed **ArduSiPM Shield** that contains various electronic features to monitor, set, and acquire the **SiPM** signals. **ArduSiPM** is used for various applications, including educational laboratories, radiation monitoring, chemical and medical analysis, and even nanosatellites.



FEATURES

Microcontroller	Arduino DUE
Power supply	5V - micro-USB type A
Measurement frequency	Up to 40MHz
Time arrival measurement	
Resolution	~22ns
Max rate sampling	40MHz
Amplitude measurement	
Resolution	12 bit
Full scale	3.3V
Max frequency	~1 MHz (active)
SiPM Trigger	programmable operational voltage
Trigger threshold	hardware and software settable
Resolution	12 bit
Full scale	27.5 mV
Offset	5.5 mV
Connector outputs	3 SMA connectors, 1 TTL output
	1 preamp analog output
	SiPM signal/power supply
Serial communication	USB and PIN connectors
	TX/RX
	UART
	Baudrate: 115'000

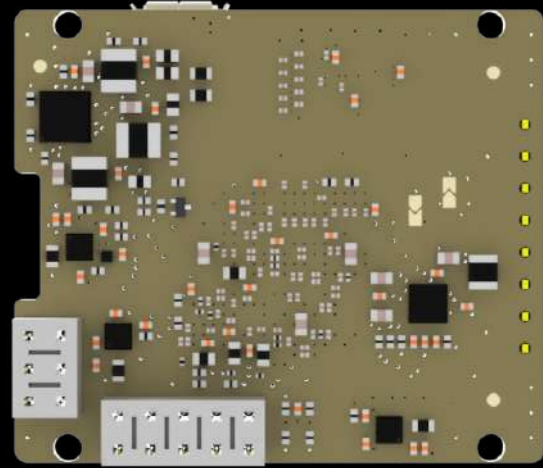
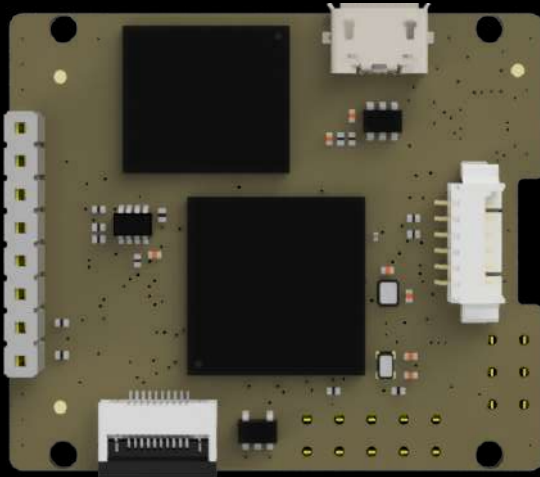
Picosatellite Sub-Systems



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OBC

On Board Computer



The **On-Board Computer (OBC)** is the satellite's central processor responsible for core flight functions and subsystem monitoring.

The **OBC** mounts **SoC (SAMA5D27 by Microchip)** and it is **I/O Board expandable**. It handles critical tasks like **EPS, ADCS, RF** checks, telemetry, and communication with other subsystems.



SAMA5D2 ARM Cortex-A5



Ultra-low-power mode with fast wake-up



FreeRTOS based OS

MCU

Manufacturer

Microchip Technology

Series

SAMA5D2

Processor Type

ARM Cortex-A5

Clock Frequency

Up to 500MHz

Special Features

ARM NEON SIMD engine, 128 kB L² cache

Memory Support

Supports multiple memories like DDR3 and QSPI Flash

BOARD FEATURES

NANOSiPM COMPATIBILITY

I/O BOARD EXPANDABLE

FLIGHT CONTROL AND
TELEMETRY SYSTEM

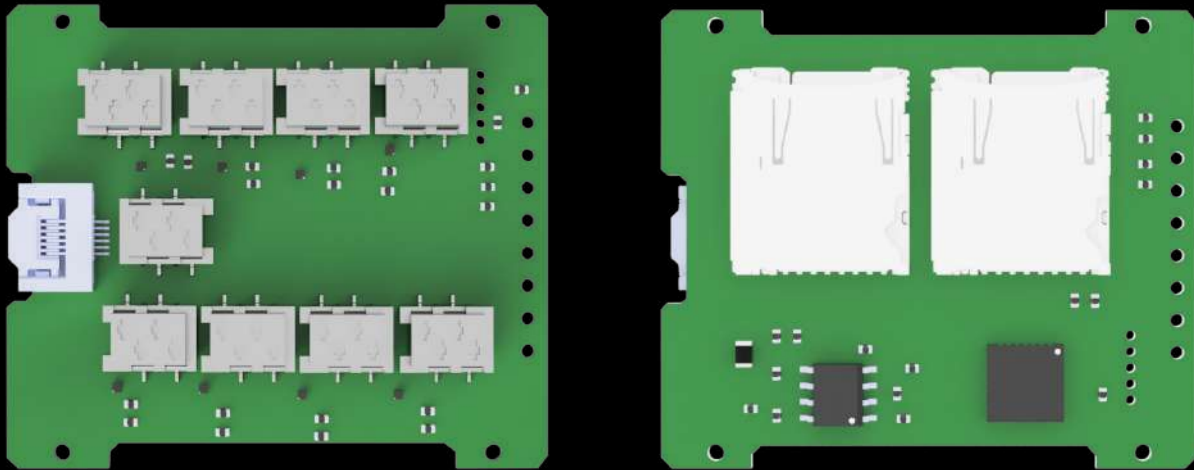
PERIPHERALS

2X QSPI, 2X SPI, 5X UART, 2X MMC HOSTS, 1X IDPHS PORT

I/O Board

Peripheral Expansion

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The **I/O board** is an I/O expansion board compatible with the **OBC**. It also interfaces with the **EPS (Energy & Power Supply)** to deliver power to most other subsystems.

Being connected to the **EPS**, it is always operational, alongside the **EPS** itself. It has the power to turn on/turn off/reset the **SoC**.

MCU

Manufacturer

Microchip Technology

Series

PIC PIC® XLP™ 24F

Processor Type

Mod. Harvard

Clock Frequency

Up to 32MHz

Memories

16 Kbytes program memory, 1.5Kbytes embedded SRAM

I/O

Up to 24 I/O lines with external interrupt capability

BOARD FEATURES

SEU/SEL protection

2 microSD slots

Up to 10 power lines

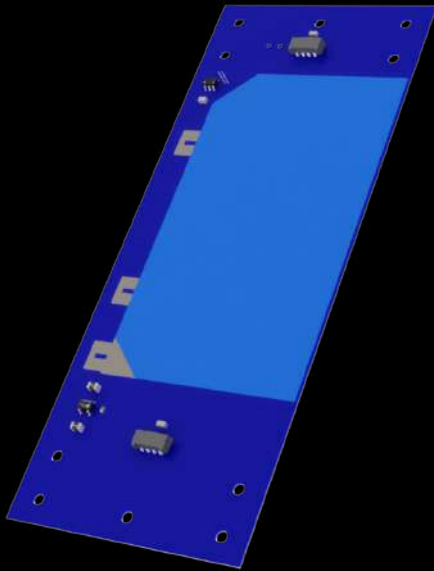
PERIPHERALS

Up to 10 SPI and 8 I2C connections


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EPS

Electrical Power System



 STM32 ARM Cortex-A5

 High efficiency power supply

 Optimized solar energy harvesting

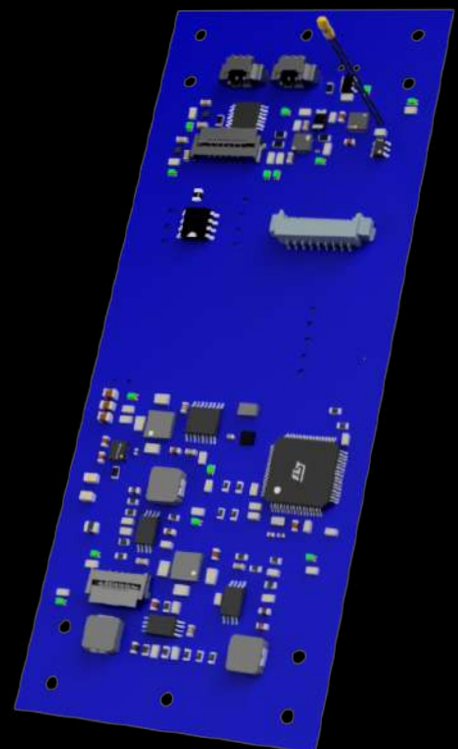
Our **electrical power system** (EPS) provides to the **satellite power supply**, power source, energy storage, power distribution, voltage management, monitoring **spacecraft status** and protection against over-currents.

FEATURES

- *3x Independent MPPT lines for wings and top fly panel*
- *Full redundancy*
- *ADCS compatible sensors (4X sun sensors, external temperature)*
- *Integrated solar panel*
- *Smart battery handler, battery temperature sensor and heater.*

Comms integration

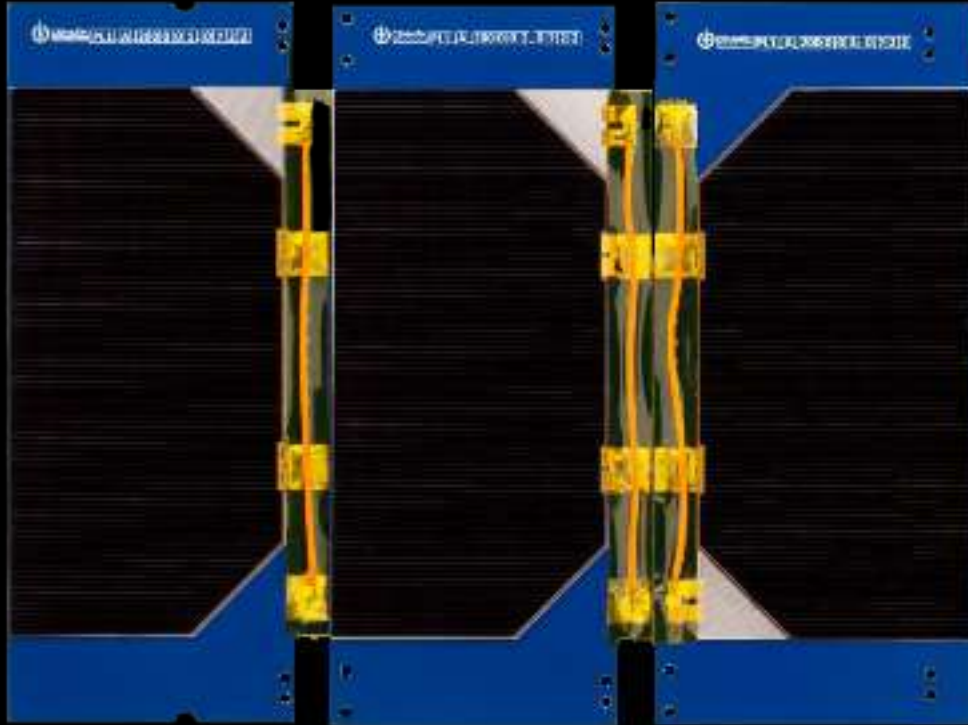
SPI, ADCS interface, IO Board compatibility



Solar Panels

Inner - Middle - Outer

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The panels are composed of **high-efficiency, triple-junction space solar cells** that cater to missions with high power requirements. These cells have an efficiency of 29.5% and include a **built-in bypass** diode to protect series-connected strings from shading effects. The cells are assembled using **NASA-qualified 3M low-outgassing** adhesive materials in a clean room environment. The circuit design avoids current loops to prevent spontaneous satellite spin-up. The panels also feature an integrator cover glass for durability and radiation protection.

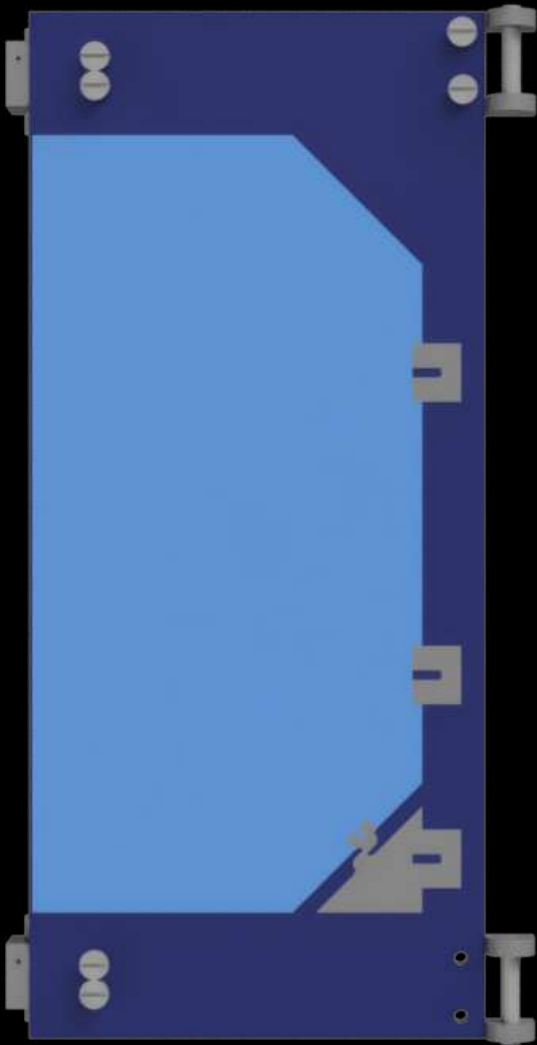
FEATURES

- *Up to 29,5% efficiency*
- *36,85 mW/cm² power generation capacity in LEO*
- *Less than 1,7mm PCB thickness*
- *FR-4 (IPC-6012B) panel material*
- *IPC A600H class 3, calibration according to ESA ECSS Q 70 08 specifications assembly*
- *-40°C to +85°C operating temperature*
- *Copper for improved EMI compatibility - NASA Qualified Cell Adhesive internal ground panels*

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Solar Panels

Inner



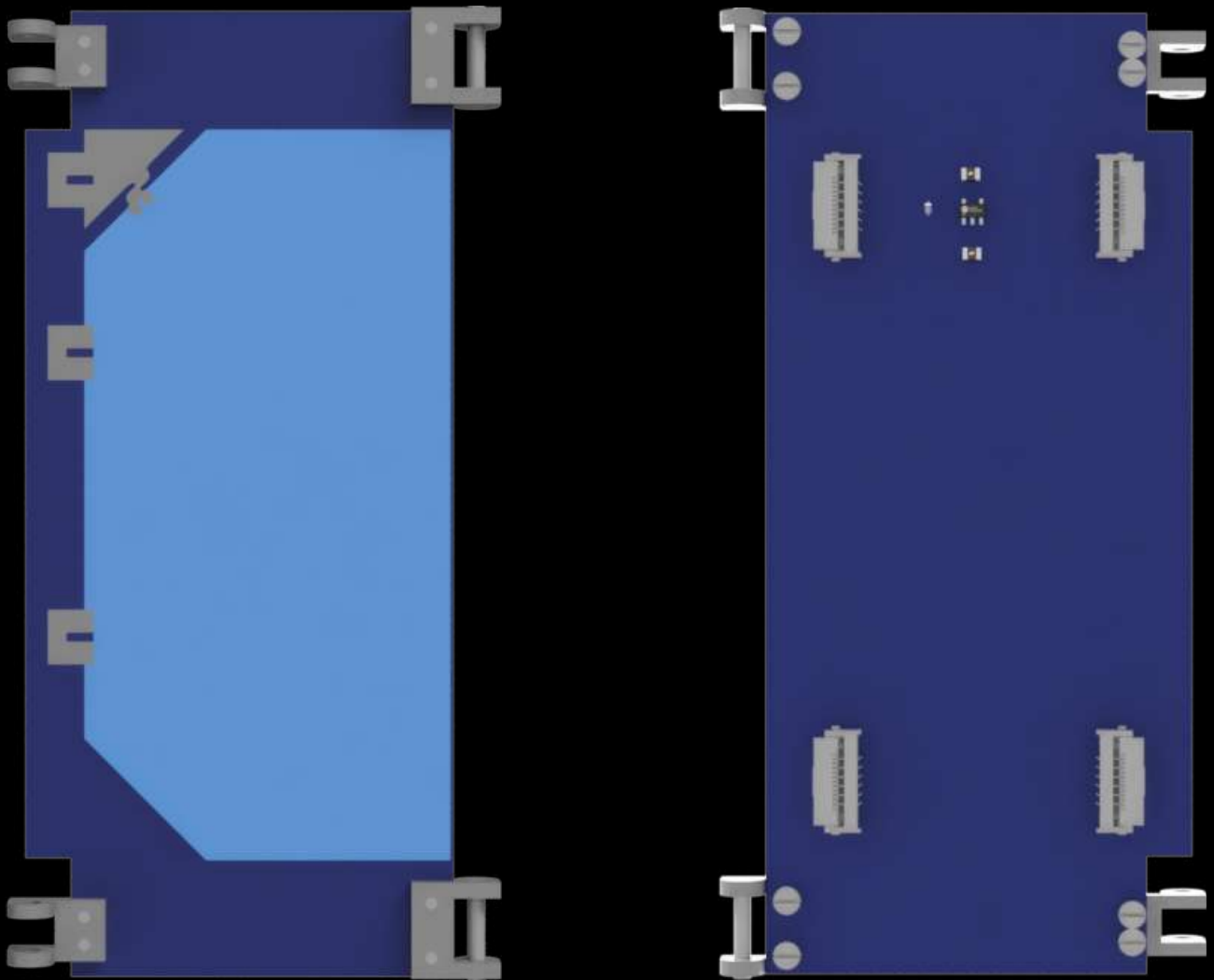
Features

The **inner solar panel board** is **directly** connected to the **EPS** and the **modular structure**. It can be **connected** to a **middle** or an **outer panel**.

Solar Panels

Middle

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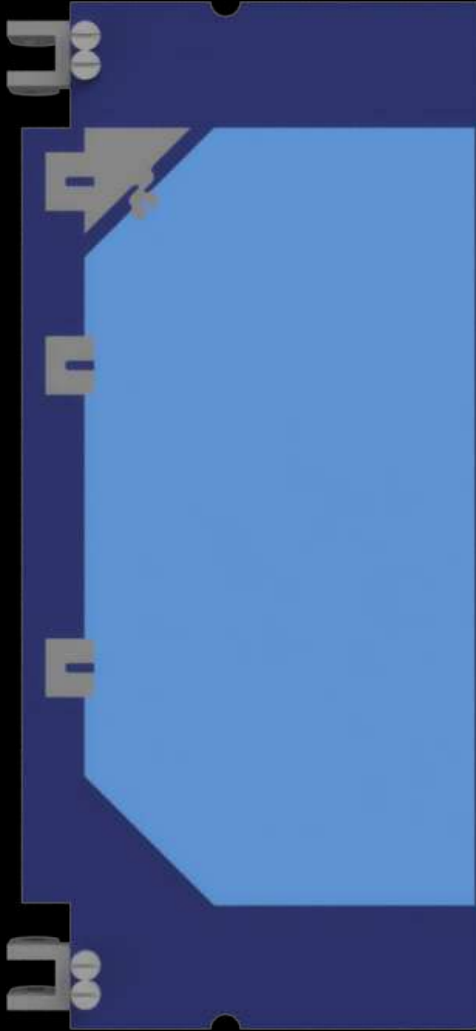
Features

The **middle solar panel board** thanks to **4 connectors**, can be **connected to all the panels** and you can **add as many panels** as you want.

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Solar Panels

Outer



Features

The **outer panel board** is the very **last** one of the **solar chain**. It can be **connected directly** to the **EPS**, to an **inner** or a **middle board**.

Thruster

Ionic Liquid Electrospray



One of the most significant points of performance and lifetime of the **Picosat** is the lasts of the mission itself, in the correct orbit and preventing degradation of it that is naturally constantly decreasing from the inisial altitude. This subsystem's objective is to avoid or **delay** the **de-orbiting**, to increase lifetime by the use of an ionic thruster designed for picosats. By monitoring the altitude through the **ADCS** we can decide to shoot an ionic pulse to increase the craft's altitude and mantain nominal orbit for longer.

Features

Thruster type: *macro-scale bulk-emission ionic liquid ion source*

Fuel: *EMI-BF₄*

Thrust: *3 μ N*

Size: *45 x 45 x 16 mm*

Fuel Capacity: *1g*

Max power drawn: *<0.1W*

IPS: *>4500s*

Total thruster mass: *40g*

Test readiness level (TRL): *5-6*

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Koube

LoRaWAN Gateway with camera



KOUBE is an **Optical Payload** suitable for **IoT** and **Earth** observation applications with flight legacy and is designed for picosats or larger sizes. A connection can be established using the LoRa protocol with devices/sensors/nodes on the ground. The system can be used as a **gateway** for an **IoT network** and can be integrated via a **UFL connector** with region-specific frequency band antennas.

Features

Dimensions: 47.5 x 47.5 x 30.5 mm

Uplink frequencies: LoRa 868/915 MHz

MCU: SAMA5D27 reworked to fit KOUBE

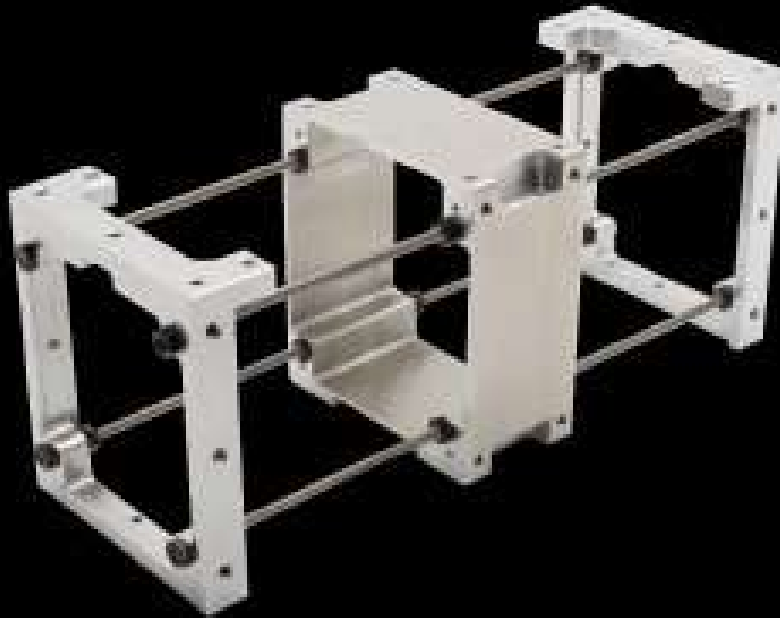
Radio module: SX1302

Panel material: FR-4(IPC-6012B)

Optics: customizable

Modular Structure

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The **mechanical structure** of the satellite consists of three internal brackets made of aircraft aluminum, 1.7mm FR4 PCBs and complies with the 2P canon. This structure absorbs axial and lateral loads and has been successfully tested.

The design of the structure and bars is also conceived to fit any size standard during assembly (e.g., CubeSat).

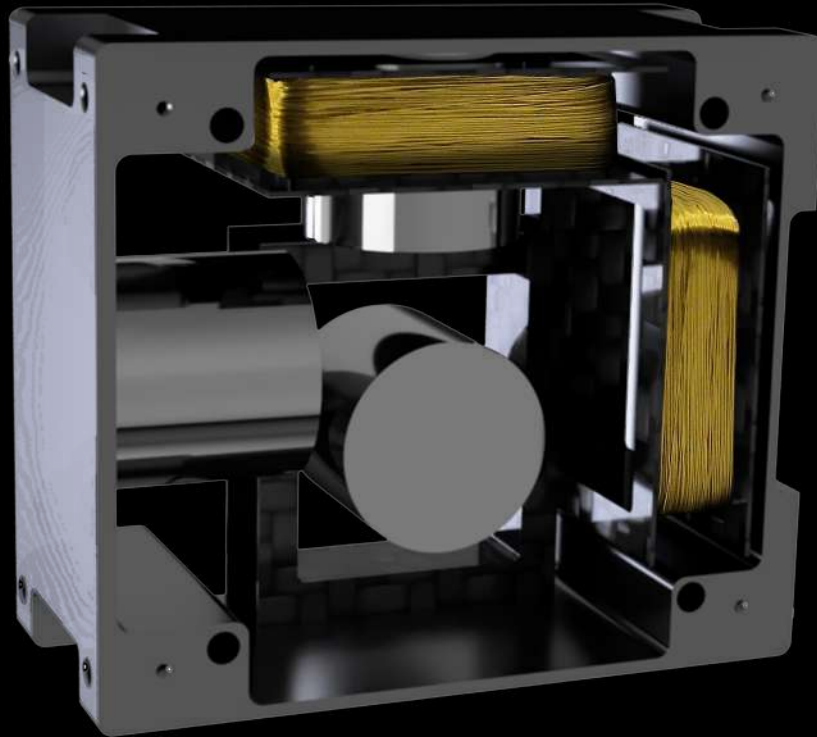
Size: 5 x 5 x 10 cm

Weight: 75g

Material: *Aluminium EN AW-7075 / 3.4365 / Al-Zn6MgCu*

ADCS

Attitude Determination
Control Systems



The **Attitude Determination and Control System (ADCS)** is a vital component of a satellite. It is responsible for determining and controlling the orientation of the satellite in space. The **ADCS** is often used to control the spacecraft during trajectory correction maneuvers and, using accelerometers, to terminate maneuvers when the desired velocity change has been achieved.

Features

Sensors:

Gyroscope

Magnetometer

Accelerometer

Sun Sensor

Earth Sensor

Actuators:

Reaction Wheels

Magnetorquer

Magnetorquer

Al\Aromatic Polyamid Coil



The **Magnetorquer navigates** spacecraft orientation by interacting with Earth's magnetic field, enabling precise adjustments without propellants. With simplicity, **low power** demands, and adaptability, it ensures **efficient satellite control**. Integrated with **sensors**, it forms a responsive **closed-loop** system, crucial for various mission objectives.

Features

Frame Material: Carbon Fiber

Insulation Material: Kapton

Autoclave Impregnation: 200°C

Output Wire Length: on request

Wire Weight: 2.1g

Frame Weight: 1g

Kapton Weight: 0.2g

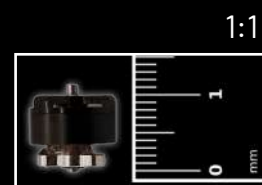
Turns N.: 1000 (up to 2000)

Connector: on request

Total Coil Weight: 3.3g

Reaction Wheel

Brushless Motor



The **Reaction Wheel**, integral to satellite **Attitude Control and Determination Systems (ACDS)**, maintains precise orientation in space by conserving angular momentum. With **high-precision** bearings, **redundancy** for reliability, and **low power** consumption, it seamlessly integrates with sensors to ensure efficient, **real-time adjustments**, making it a crucial component for diverse mission objectives.

Features

Dimensions: Ø 11.50mm x h 10.20mm

Shaft Diameter: 1.50 mm

Power: 3.3V

Weight: 2.556g

Speed: 0-6000 RPM

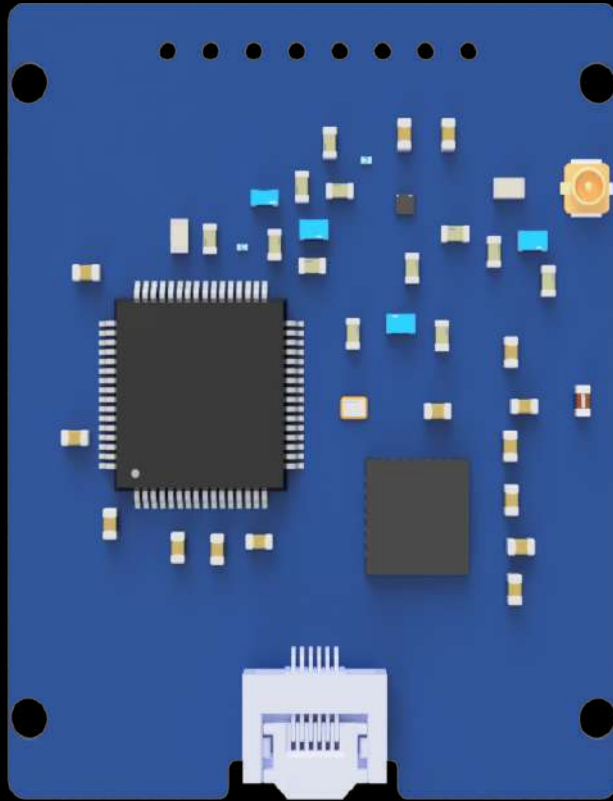
Poles N.: 10

No-Load Current: 0.2A

Resistance: 0.70 mOhm

KIM

RF module - UHF band



KIM excels as an **RF Payload** for **UHF-based IoT** and ground communications, ideal for **picosats** and larger satellites. It seamlessly integrates with ground devices via the **LoRa** protocol, functioning as a versatile **IoT network gateway**. While FSK serves as the primary modulation, **KIM** effortlessly supports LoRa, offering adaptability within the UHF spectrum.

Features

Frequency Range: 400 to 403MHz or 430 to 470MHz.

Transmit Power: up to +20dBm

Receiver Sensitivity: down to -148dBm

Default Modulation: FSK, LoRa

Data Rate: up to 300kbps

Interface: SPI, I2C

Modulation Scheme: FSK, GFSK, MSK, GMSK, LoRa and OOK modulation