

Space

S3 SMART SUN SENSOR

S3 (Smart Sun Sensor) is a two axes solar sensor based on an Active Pixel Sensor (APS) detector. S3 has been optimised for the commercial market of Earth Observation satellites and, thanks to the intrinsic radiation hardness of the detector, for the GEO Telecommunication spacecrafts.

The SSS is also capable of being used for Interplanetary missions (up to 50AU) and for spinning spacecrafts (up to 100rpm). S3 has a large dynamic range providing medium/high accuracy, and wide FOV (Field Of View), thus combines the functions traditionally performed by separate fine and coarse Sun sensors.

S3 uses no optics to sense the Sun angle for a broad FOV and its accurate attitude measurement is based on the baricenter detection of the incident energy of the Sun, in the visible and near infra-red light spectrum.

The philosophy of the SSS is directed to weight and dimension reduction. The core of the sensor is the APS detector, with integrated capabilities of direct pixel addressing, analog to digital conversion, anti-blooming circuit. The S3 ASIC collects all intelligent management functionality.

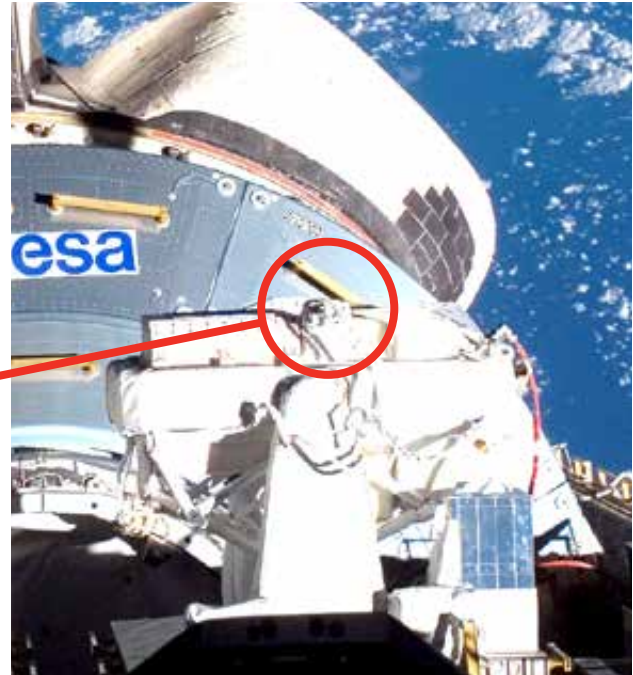
S3 is further provided with a latch up protection circuit, an optional DC/DC circuit and the RS-422 DS38/DS16 data interface.

The single box concept, associated to high reliability, radiation tolerance (all the EEE parts can be purchased radiation hardened up to 300 kRad), small size, low mass and ITAR free status, make S3 suitable for a wide range of applications.

HERITAGE

S3 has been recently developed and qualified within European Space Agency and internal R&D studies and takes advantages on over 20 years company expertise in Sun sensors development, manufacturing and testing.

An S3 prototype is flying since Feb. 2008 on the ESA Coarse Pointing Device (CPD) of the Columbus module (International Space Station). Flight Models are flying since beginning of 2009 on the ESA GOCE Earth Observation Mission and on the SICRAL-1B Military Telecommunication Spacecraft. The S3 will also will fly on board the Lisa Pathfinder Scientific Mission of ESA.



Smart Sun Sensor installed on the Space Shuttle

TECHNICAL CHARACTERISTICS

Operating modes

- Integration time selection (bi-level)
- Sun acquisition mode
- Sun Tracking mode
- 10Hz refreshing rate

Performance

- FOV 128° x 128° FOV (resizable)
- Accuracy <math><0.02^\circ</math> (2 σ)
- Resolution <math><0.005^\circ</math>

Data Interfaces

- Sun co-ordinates + House Keeping (STD-RS-422 with DS48 or DS16 serial output protocol)
- Sun presence in the FOV - (bi-level)
- Integration time selection (bi-level)

Electrical Interfaces

- +5V \pm 10% pre regulated or 24 to 50V unregulated power bus
- Power consumption
 - <math><700\text{mW}</math> for pre-regulated voltage
 - <math><1\text{W}</math> for 50V unregulated bus

Mechanical Interfaces

- Size 112 x 12 x 43 mm
- Mass <math><330</math> grams

Environmental Conditions

- Operational temperature -25 °C to +60 °C
- Storage temperature -40 °C to +75 °C
- Ambient and space vacuum pressure
- Vibration levels
 - Sine: 20g peak
 - Random 26.8g rms
 - Shock 2000g from 3 to 10kHz
- Lifetime in GEO > 15 years
- Radiation hardened
 - 100 Krad components (300 krad opt.)
 - Detector up to 1 Mrad
 - SEU tolerant
 - Latch-up free
- Altitude
 - 3,000Km to 40,000Km
 - Interplanetary up to 50AU

Reliability

- 270 FIT for pre-regulated voltage version
- 350 FIT for 50V unregulated bus version