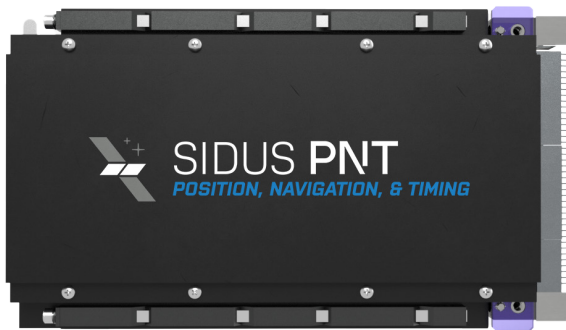


Sidus Position, Navigation, and Timing (PNT)

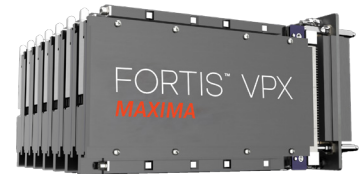
3U Position, Navigation, and Timing Module



The Sidus Position, Navigation, and Timing (PNT) module is a standalone 3U VPX solution engineered for extreme environments and size-constrained applications. It delivers high-precision navigation and timing with robust, radiation-hardened reliability.

The Sidus PNT is a part of the Fortis™ VPX suite, which includes the following product line options:

- » Sidus Single Board Computer (SSBC)
- » FeatherEdge™ AI/ML Processor
- » Global Positioning System (GPS) Receiver
- » Custom Input/Output (I/O) Card
- » Power Converter Card
- » Software Defined Radio (SDR)



Key Features

- » **Integrated PNT Solution** – Combines low-noise atomic clocks, M-Code GNSS with anti-jamming/spoofing, and an onboard IMU for precise, resilient positioning and timing
- » **Plug-and-Play SOSA® Design** – Enables seamless integration into existing systems, enhancing operational readiness
- » **Advanced Processing and FPGA Integration** – Powered by a Quad Core ARM® processor and low-power PolarFire® FPGA for efficient, high-performance computing
- » **Radiation-Hardened, MIL-SPEC Design** – Built to withstand harsh conditions with up to 100 krad radiation tolerance

Applications



Air

- » Aerial Drones
- » Ballistic Missiles
- » Commercial and Civil Aircraft



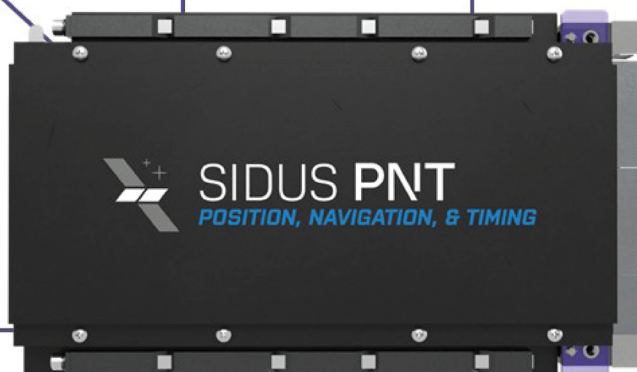
Sea

- » Submarines
- » Surface Ships
- » Underwater Drones



Land

- » Command and Control (C2) Network
- » Electronic Warfare (EW)
- » Intelligence, Surveillance, and Reconnaissance (ISR)
- » Unmanned Ground Vehicles (UGVs)



Space

- » Counterspace Operations
- » Satellites
- » Space Defense
- » Space Situational Awareness



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Sidus Position, Navigation, and Timing (PNT)

3U Position, Navigation, and Timing Module



System Architecture

System on Chip (SoC)	Teledyne e2V QLS1046 » High-speed security protocol processing, including IPsec, SSL, TLS, and IKE
Processor	Quad Core ARM® Cortex®-A72 » 64-bit ARM® Cortex®-A72 (with ECC-protected L1 and L2 cache memories) » RAM 4GB DDR4 with ECC, 72-bit interface, operating @ up to 1050 MHz » Up to 1.8 GHz operation
FPGA	Rad-hard PolarFire® up to 5 Softcore RISC V Processors (RTOS)
Board Resources	» Watchdog (x2 SoC internal and x1 SoC external) » Temperature sensors » Voltage sensors

Multi-Frequency Global Navigation Satellite Receiver Specifications

Receiver	Architecture	Single RF Input, up to 256 full parallel tracking channels for all-in-view tracking.	
	Services Supported	» GPS L1 C/A, L1C, L2C, L5 » Galileo E1, E5a » GLONASS G1 (FDMA) » Future software options to support: Galileo E5b; BeiDou B1 (including B1I, B1A, B1C); SBAS (WAAS, EGNOS, GAGAN, etc.) Reception (L1, L5)	
Signal Acquisition and Tracking	Acquisition Sensitivity	Fixed and Low Dynamics	174 dBW
		Medium Dynamics	167 dBW
		High Dynamics (where available)	167 dBW
	Tracking Sensitivity	Fixed and Low Dynamics	192 dBW
		Medium Dynamics	177 dBW
		High Dynamics (where available)	167 dBW
	PVT Rate	Including 1, 10, 20, 50 Hz (Programmable < 1 Hz for low-power operation)	
	External Aiding	Provided through host interface: almanac, ephemeris, time, position, heading, velocity, satellite visibility, and inertial aiding may be provided.	
Interfaces	Frequency / Timing Outputs	» 3 Host configurable timing marker outputs (nPPS) » 2 Host configurable frequency outputs (1 Hz to 10 MHz)	
	General Input / Output	» 3 Event marker inputs » Configurable GPIO3 » SPI with 4 chip selects to control peripherals » Sync in, Sync out (for multi-device measurement synchronization)	
	Host / Measurements	» 3 UART ports up to 3 MBaud, SDLC option	
	External Inertial Measurement Unit Input	» Incorporates an SDLC high speed interface capable of accepting inputs from high performance IMUs. Supports STANAG-4572 and SiIMU02 (other IMUs subject to software support)	
	Protocols	» STANAG-5645 Host ICD NMEA-0183 Support Q20 ICD Legacy Support	

Mechanical	Module Dimensions		31.75 mm (D) x 25.4 mm (W) x 4.0 mm (H)
	Module Weight		<7g
	Operating Temperature		-55° C to +125° C
	Storage Temperature		-55° C to +125° C
	Operational Humidity		95% relative humidity (non-condensing)
	Shock	Operational	>600g, 1/2 sine, 1 msec in any axis
		Physical Setback	25,000g
Vibration		25g RMS from 200 Hz to 2000 Hz	
Power	Input Supply Range	3.3 VDC ± 10%	
	I/O Supply Range	1.8 VDC ± 10% or 3.3 VDC ± 10%	
	Input Power	< 500 mW @ 3.3 VDC nominal ¹ , <2.4 W maximum ²	
Altitude	Maximum		» 50 km (radiation, without additional shielding) » 1,000 km (36,000 km at reduced accuracy)
	Rate of Change		± 3000 m/s max
Reliability	MTBF (MIL-HDBK-217)		To > 175,000 hours; MTBF for specific operating environments available on request



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3U Position, Navigation, and Timing Module



CSAC SA65 Chip Scale Atomic Clock Specifications

Radiation Tolerance Features

- » At least 20 kRad Cobalt Gammas
- » 64 MeV proton irradiations up to $5.7 \times 10^{+10}/\text{cm}^2$ total fluence demonstrated full recoveries to all observed events
- » Short-term stability (Allan Deviation) of 3×10^{-10} at $t = 1$ sec
- » IPC-610 Class 2

Analog Tuning

Range	$\pm 2.2 \times 10^{-8}$	
Resolution	1×10^{-11}	
Input	0 V - 2.5 V into 100 k Ω	
Digital Tuning Range	$\pm 1 \times 10^{-6}$	
Resolution	1×10^{-12}	
Maximum Retrace	(48 hrs off)	$\pm 5 \times 10^{-10}$
	Monthly	$< 9 \times 10^{-10}$
	Yearly	$< 1 \times 10^{-8}$
Maximum Offset at	Shipment $\pm 5 \times 10^{-11}$	

RF Outputs

Frequency	10 MHz
Format	CMOS
Amplitude	0 V to VCC
Load Impedance	1 M Ω
User Flash	<180 s
PPS Output	1
PPS Input	1 PPS input for synchronization

IMU (Inertial Measurement Unit) Specifications

Features

Low-Noise, High-Stability (LNHS)	Gyro Bias Instability	0.8°/h
	Angular Random Walk	0.06° / $\sqrt{\text{h}}$
Initial Bias Error	360 °/h (1 σ) / 2 mG (1 σ)	
6 Degrees of Freedom	Triple Gyroscopes	± 450 °/s
	Tri-Axis Accelerometer	± 8 G/ ± 16 G
Digital Serial Interface	SPI/UART	
Data Output Rate (Max.)	~ 2k Sps	
Other Features	» 16/32-bit Data Resolution » Calibrated Stability (bias, scale factor, axial alignment) » External Trigger Input / External Counter Reset Input » Delta Angle / Delta Velocity Output	



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