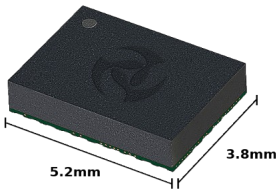
Technical Brief

Yost Labs 3-Space Sensor™ Nano



Single Chip High-Performance Attitude & Heading Reference Systems / Inertial Measurement Units

Product Overview

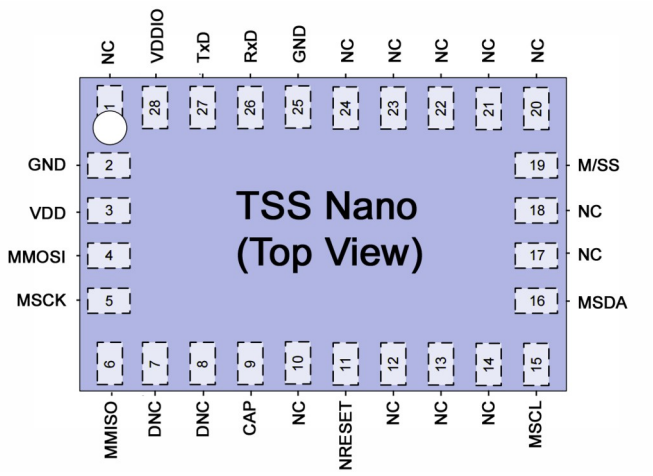
The Yost Labs 3-Space Sensor™ Nano is an super-miniature, 24-Pin DFN IC and AHRS with high-precision, high-reliability, low-cost, and extremely low power consumption.

The Nano is a DFN Attitude and Heading Reference System (AHRS) / Inertial Measurement Unit (IMU) which uses triaxial gyroscope, accelerometer, and compass sensors in conjunction with advanced processing and on-board quaternion-based orientation filtering algorithms to determine orientation relative to an absolute reference in real-time.

Orientation can be returned in absolute terms or relative to a designated reference orientation. The gradient descent calibration process and high update rates increase accuracy and greatly reduce and compensate for sensor error. The Yost Labs 3-Space Sensor™ system utilizes QGRAD2™ sensor fusion along with an advanced dynamic confidence algorithm and advanced on-board magnetometer auto-calibration that work together to ensure optimal accuracy and precision across a wide range of operating conditions.

The Yost Labs 3-Space Sensor™ Nano module features are accessible via a well-documented open communication protocol that allows access to all available sensor data and configuration parameters. Versatile commands allow access to raw sensor data, normalized sensor data, and filtered absolute and relative orientation outputs in multiple formats including: quaternion, Euler angles (pitch/roll/yaw), rotation matrix, axis angle, two vector (forward/up).

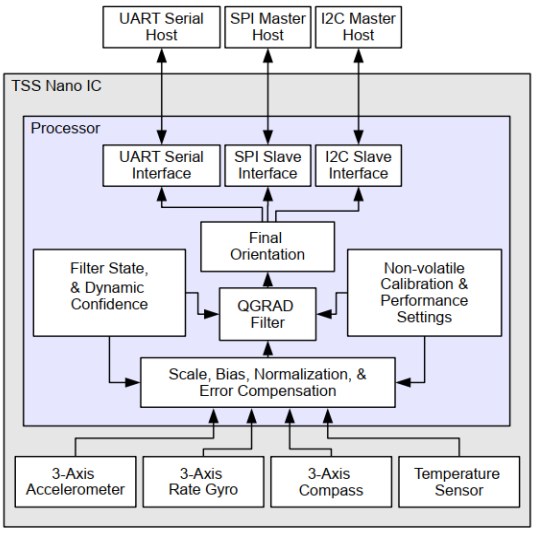
TSS-Nano Technical Diagrams

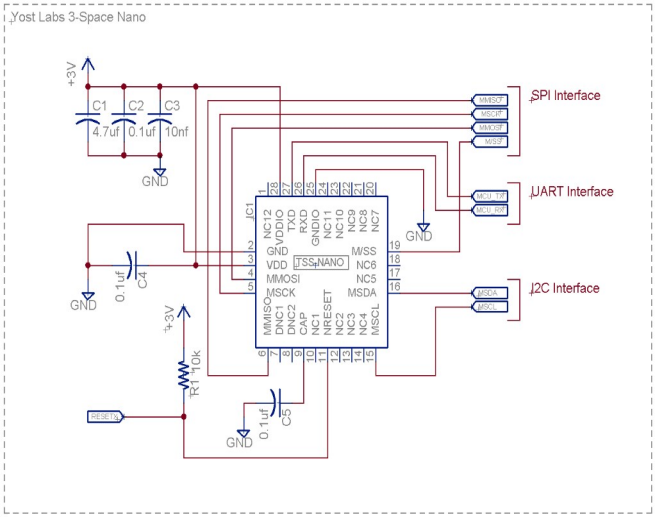


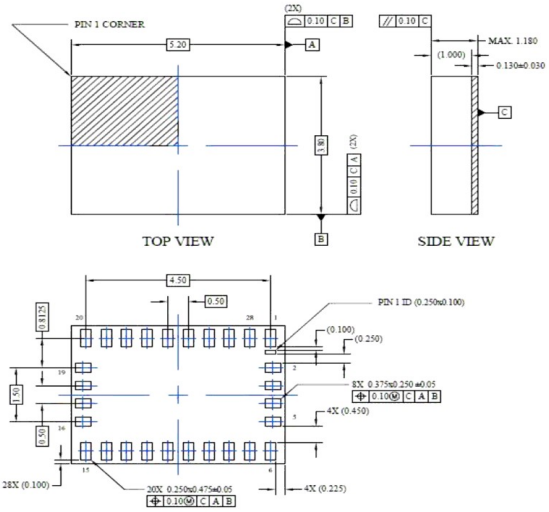
Key Features

The Yost Labs 3-Space Sensor™ Nano has many features that allow it to be a flexible all-in-one solution for your orientation sensing needs. Below are some of the key features:

- 24-Pin DFN IC and AHRS at 3.8mm x 5.2mm x 1.1mm and 0.01 grams
- Advanced on-board magnetometer auto-calibration allows the sensor to quickly adapt to changing magnetic environments.
- Highly customizable orientation sensing with options such as tunable filtering, oversampling, and orientation error correction
- Advanced integrated QGRAD2™ filtering allows sensor orientation outputs at up to 200Hz while automatically reducing the effects of sensor noise and sensor error
- Robust open protocol allows commands to be sent in human readable form, or more quickly in machine readable form
- Orientation output format available in absolute or relative terms in multiple formats (quaternion, rotation matrix, axis angle, two-vector)
- Absolute or custom reference axes
- Access to raw sensor data
- Flexible communication options: SPI, I2C, UART
- USB communication through a virtual COM port using the available Evaluation Kit
- Castellated SMT edge pads provide secure SMT mounting and allow optional through-hole mounting is available with our Nano Embedded Package.
- Online Upgradeable firmware
- Programmable interrupt capability
- Development kit available
- Open Source API Available
- Nano Carrier Board and Evaluation Kit available to simplify development.







Specifications

General	
Part number	TSS-Nano
Dimensions	3.8mm x 5.2mm x 1.1mm
Weight	0.01 grams
Supply voltage	+3.3v ~ +3.3v
Power consumption	20mA @ 3.3v
Communication interfaces	SPI, I2C, Asynchronous Serial
Filter update rate[1]	Up to 200Hz with QGRAD2 AHRS
Orientation output	absolute & relative quaternion, Euler angles, axis angle, rotation matrix, two vector
Other output	raw sensor data, corrected sensor data, normalized sensor data, temperature.
SPI clock rate	2.5 MHz max
Serial baud rate	1,200~921,600 selectable, default: 115,200
Shock survivability	5000g
Temperature range	-40C ~ 85C (-40F ~ 185F)
Orientation range	360º about all axes
Orientation accuracy[2]	±1.5º for dynamic conditions & all orientations
Orientation resolution	<0.08º
Orientation repeatability	0.085º for all orientations
Accelerometer scale	±2g / ±4g / ±8g / ±16g selectable
Accelerometer resolution	16 bit
Accelerometer noise density	90µg/√Hz
Accelerometer sensitivity	0.000061g/digit-0.000488g/digit
Accelerometer temperature sensitivity	±0.01%/°C
Gyro scale	±125/±250/±500/±1000/±2000 º/sec selectable
Gyro resolution	16 bit
Gyro noise density	0.000006º/sec/√Hz
Gyro bias stability @ 25°C	11º/hr average for all axes
Gyro sensitivity	0.004375º/sec/digit for ±250º/sec 0.070º/sec/digit for ±2000º/sec
Gyro non-linearity	0.2% full-scale
Gyro temperature sensitivity	±0.03%/°C
Compass scale	±13Ga
Compass resolution	16 bit
Compass sensitivity	1.5 mGa/digit
Compass non-linearity	±0.0003 mGa/°C

1. Depends upon communication mode and filter mode. Specifications are subject to change.
2. Average value when calibrated.
Version: 2.2.1

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Patents Pending
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