PRODUCT SPECIFICATION

VN-200 SMD GNSS/INS

Sensor Datasheet (Hardware v3.0)

VECTORNAV

HIGHLIGHTS

0.2° Dynamic Heading Accuracy (INS)	**5-7°/hr (typ.)** Gyro In-Run Bias Stability	**Up to 400 Hz** Position, Velocity and Attitude Data	**Up to 800 Hz** IMU Data
0.03° Dynamic Pitch/Roll Accuracy	**< 0.04 mg** Accel In-Run Bias Stability	**1.0 m / 1.5 m** Horizontal / Vertical Position Accuracy	**SWaP** 24 x 22 x 3 mm; 4 grams; 445 mW

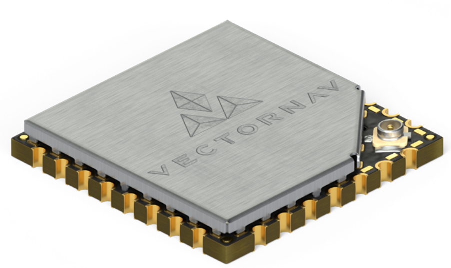
Product Overview

The VN-200 Surface Mount Device (SMD) is a miniature, high performance GNSS-Aided Inertial Navigation System (GNSS/INS) that combines 3-axis gyros, accelerometers and magnetometers, a high-sensitivity GNSS receiver, and advanced Kalman filtering algorithms to provide optimal estimates of position, velocity, and attitude.

The VN-200 SMD is the world's first GNSS/INS in a single surface mount package. At the size of a postage stamp, the VN-200 SMD requires only a single 3.2-5.5V power supply and can be directly embedded into a user's electronics for unprecedented SWAP advantages.

Calibration and Testing

Each individual VN-200 SMD sensor undergoes a robust calibration and acceptance testing process at VectorNav's AS9100 certified manufacturing facility. Performance specifications are based on comprehensive field testing and results from real-world applications and are regularly tested to ensure continued conformance to such specifications.



VN-200 SMD

Features

Industry-Leading INS

The VN-200 SMD features VectorNav's proprietary Extended Kalman Filter INS algorithm, which is proven to excel under the most challenging dynamic conditions.

True Inertial Navigation System

No mounting orientation restrictions or configuration modes; Automatic filter initialization and dynamic alignment.

Ease of Availibility

ITAR-free and Made in the USA; Ships in 1-2 days.

72-Channel GNSS Reciever

Onboard GNSS receiver, supporting GPS, Galileo and SBAS corrections, providing the most compact, high-performance industrial-grade INS in the market.

Software Compatibility

The VN-200 SMD shares a common communication protocol with the entire VectorNav product line.

User Configurable Messages

ASCII, SPI, NMEA-0183, and VectorNav Binary messages.

Sensor Summary

- All VN-200 units are calibrated for bias, scale factor, misalignment and gyro g-sensitivity errors across the full temperature range of the sensor from -40˚C to +85˚C
- Real-time gyro and accel bias tracking and compensation
- Hard/Soft Iron Compensation (Real-time and Manual 2D & 3D)
- Raw Pseudorange, Doppler and Carrier Phase outputs
- Real-time and delayed heave estimation
- Coning and sculling integrals (ΔV's, Δθ's)

CONTENTS

VectorNav Support

Whether you are looking for details on the VN-200 or assistance with your application, a wealth of information is available to assist you in product design and development. Check out the *Inertial Systems Primer* on our website, and be sure to register for access to a wide range of resources:

PRODUCT SPECIFICATIONS	TECHNICAL NOTES	APPLICATION NOTES
▪ User Manual	▪ Time Synchronization	▪ Gimbal Stabilization & Pointing
▪ Interface Control Document	▪ Hard & Soft Iron Calibration	▪ Satellite Communications
▪ Datasheet	▪ External GNSS Aiding	▪ Lidar Mapping
▪ Quick Start Guide	▪ Firmware Update	▪ Aerial Photogrammetry

All VectorNav products are backed by our customer-focused, robust and responsive support ecosystem. Our team is committed to supporting you through your entire product life-cycle, from concept design to in-field support. Please feel free to contact us by phone or email, our global team of engineers and representatives is ready to work with you through every challenge you know of, and every challenge you don't.

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1 INS PERFORMANCE

Attitude

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Range (Heading/Yaw, Roll)	-180		180	deg	
Range (Pitch)	-90		90	deg	
Output Rate	1		400	Hz	User configurable.
Heading (Magnetic)		2		deg	RMS[1]
Heading (INS)		0.2		deg	1 σ[2]
Pitch/Roll (Static)		0.5		deg	RMS
Pitch/Roll (INS)		0.03		deg	1 σ[2]
Pitch/Roll Mounting Misalignment		0.1		deg	1 σ[3]
Angular Resolution		0.001		deg	
Heave Accuracy		5 or 5%		cm	
Delayed Heave Accuracy		2 or 2%		cm	

[1] With proper magnetic declination, suitable magnetic environment and valid hard/soft iron calibration.
[2] With sufficient motion for dynamic alignment.
[3] Constant on a per part basis. Can be calibrated out during system integration using boresighting of other alignment processes.

TABLE 1

Position/Velocity

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Output Rate	1		400	Hz	User configurable.
Horizontal Position Accuracy		1		m	RMS[1]
Vertical Position Accuracy		1.5		m	RMS[1]
Free Inertial Position Drift		3		cm/s^2	[2]
Velocity Accuracy		0.05		m/s	RMS

[1] Dependent on SBAS, clear view of GNSS satellites, good multipath environment, compatible GNSS antenna, and measurement duration period.
[2] Typical rate of growth in error of position estimates after loss of GNSS signal, provided INS full alignment prior to loss.

TABLE 2

2 IMU SPECIFICATIONS

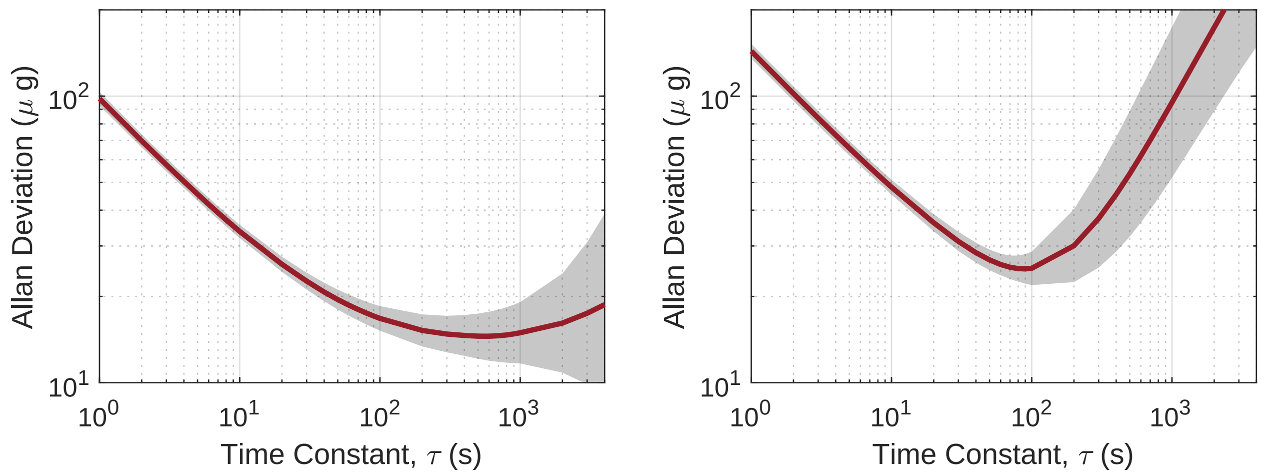
2.1 Accelerometer

Accelerometer

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Range		±16		g	
In-Run Bias Stability			0.04	mg	
Noise Density		0.14		$mg/\sqrt{Hz}$	
Sample Rate		800		Hz	
Bandwidth		230		Hz	
Cross-Axis Sensitivity			0.05	deg	
Resolution		0.5		mg	

TABLE 3

Allan Deviation



(a) XY-Axis Allan Deviation

(b) Z-Axis Allan Deviation

FIGURE 1

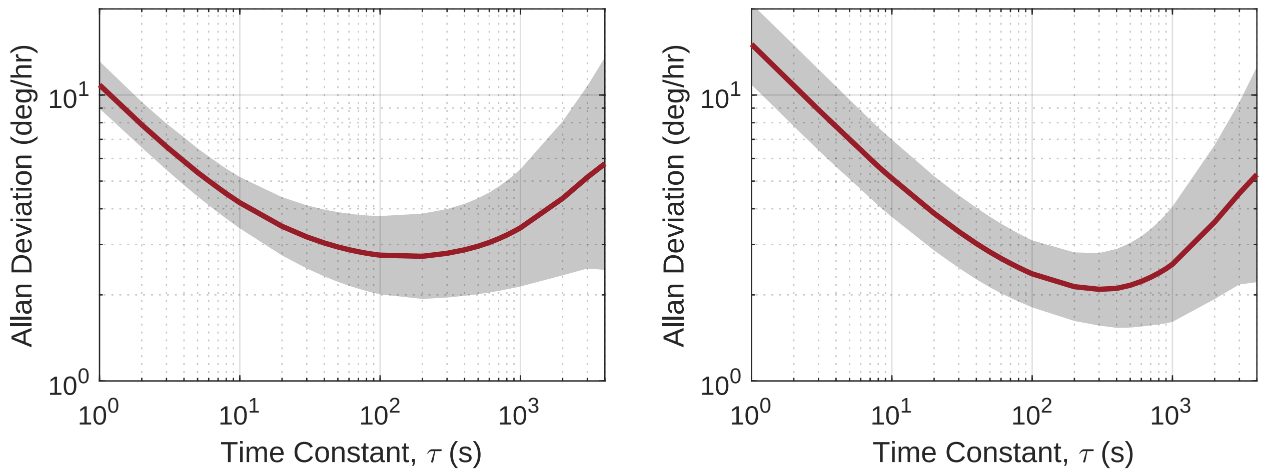
2.2 Gyroscope

Gyroscope

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Range		±2000		°/s	
In-Run Bias Stability		5	10	°/hr	
Noise Density		0.0035		$°/s/\sqrt{Hz}$	
Sample Rate		800		Hz	
Bandwidth		265		Hz	
Cross-Axis Sensitivity			0.05	deg	
Resolution		0.02		°/s	

TABLE 4

Allan Deviation



(a) XY-Axis Allan Deviation (b) Z-Axis Allan Deviation

FIGURE 2

2.3 Magnetometer & Barometer

Magnetometer

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Range		±2.5		G	
Noise Density		140		$\mu G/\sqrt{Hz}$	
Sample Rate	200			Hz	
Cross-Axis Sensitivity			0.05	deg	
Resolution		1.5		mG	

TABLE 5

Barometer

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Range	10		1200	mbar	
Sample Rate		250		Hz	
Resolution		0.042		mbar	
Accuracy		1.5		mbar	$1\,\sigma$

TABLE 6

3 GNSS RECEIVER

3.1 Receiver Specifications

GNSS Receiver Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Solution Update Rate		5		Hz	
Time-to-First-Fix					
Cold Start		29		s	
Hot Start		1		s	
Sensitivity					
Tracking		-159		dBm	
Reacquisition		-153		dBm	
Cold Start		-138		dBm	
Max RF Power			0	dBm	[1]
Altitude Limit			50000	m	
Velocity Limit			500	m/s	

[1] Measured at the GNSS connector.

TABLE 7

Supported Frequencies

- GPS - L1C/A
- Galileo - E1B/C
- GLONASS - L1OF
- BeiDou - B1I
- QZSS - L1C/A & L1 SAIF
- SBAS - L1C/A

3.2 Antenna Requirements

GNSS Antenna Electrical Requirements

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Input Voltage		3		V	
Current Draw			50	mA	
Short-Circuit Current Limit Response Time		5		μs	
Gain	20		30	dB	
Noise			2	dB	
U.FL Mating Cycles		10			

TABLE 8

Recommended Antennas

MANUFACTURER	MODEL	TYPE	NOTES
Tallysman	TW2712	Patch	General Purpose
Tallysman	TW4722	Patch	Smaller form factor
Tallysman	HC771	Helical	
ANTCOM	4G15AV	Patch	

TABLE 9

VectorNav does not recommend using a multi-frequency antenna with the VN-200 SMD. Other frequencies will appear as noise on the L1 band, slightly degrading GNSS performance.

4 MECHANICAL

4.1 Size

Dimensions

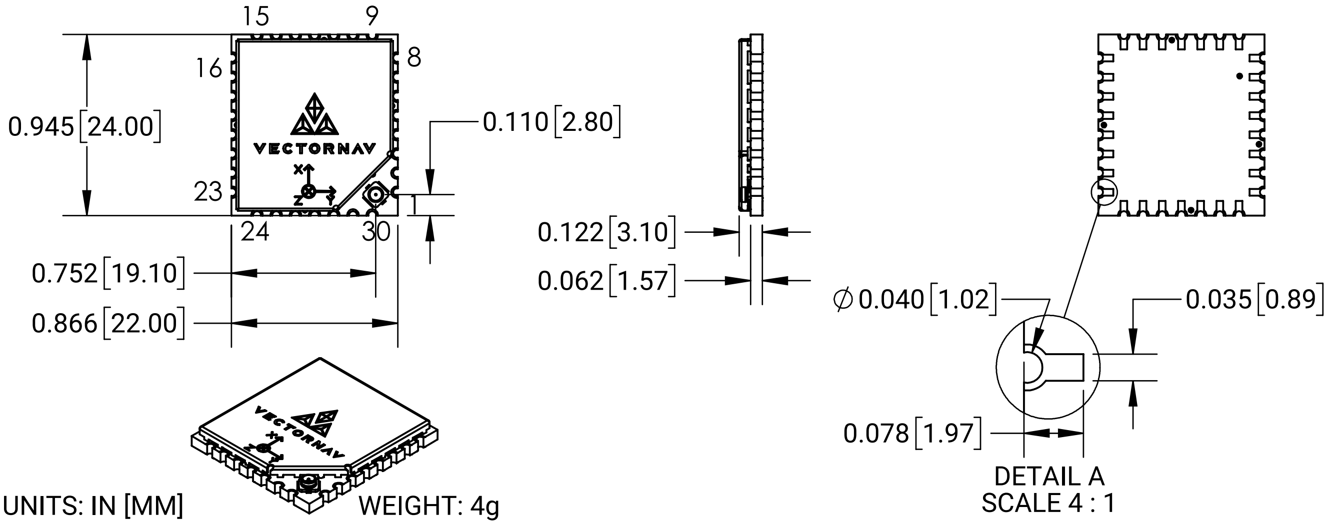


FIGURE 3

4.2 Environmental

Environmental

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Operating Temperature	-40		85	°C	
Storage Temperature	-40		85	°C	
MTBF	240000			Hr	[1]

[1] The environment assumption was an Airborne Uninhabited Cargo (AUC) with 100% duty cycle, which includes environmentally uncontrolled areas which cannot be inhabited by an aircrew during flight. Contact VectorNav for more information.

TABLE 10

Shock and Vibration

The VN-200 SMD has been designed such that when embedded into a larger system it passes standard MIL-STD-810 shock and vibration testing. Ultimately, conforming to MIL-STD-810 is up to the system designers, but several customers using VectorNav Industrial Series sensors have been qualified to date.

The VN-100 SMD has experienced the most shock and vibration testing, and shares an identical IMU core with the VN-200 SMD.

The VN-100 SMD has been tested with powered shock levels at 500 g without significant changes in gyro/accel bias, scale factors, or misalignments. Similar results were seen with the VN-100/200 SMD unpowered with shock levels up to 10,000g. Through all shock testing to date, the gyroscopes recovered immediately after the shock event while the accelerometers recovered in a few milliseconds. The VN-100 SMD has also successfully operated through sinusoidal vibration tests ranging from 10 Hz to 2 kHz at amplitudes of 6 g.

5 ELECTRICAL

Pinout Schematic

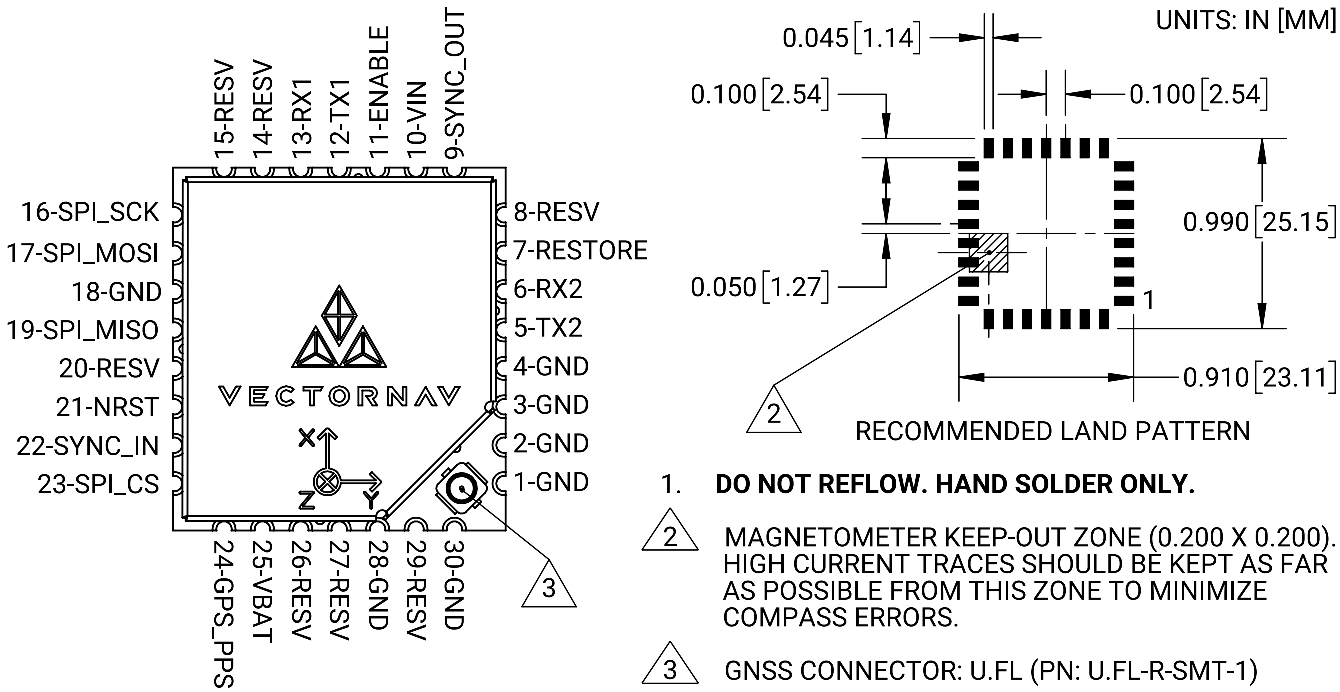


FIGURE 4

PIN ASSIGNMENTS

PIN	PIN NAME	TYPE	DESCRIPTION
1	GND	Supply	Ground
2	GND	Supply	Ground
3	GND	Supply	Ground
4	GND	Supply	Ground
5	TX2	Output	Serial UART-2 data output (sensor)
6	RX2	Input	Serial UART-2 data input (sensor)
7	RESTORE	Input	During power on or device reset, holding this pin high will cause the module to restore the default factory settings. Internally held low with a 10 kΩ resistor.
8	RESV	N/A	Reserved for internal use. Do not connect
9	SYNC_OUT	Output	Output signal used for synchronization purposes. Software configurable to pulse when ADC, IMU, or attitude measurements are available.
10	VIN	Supply	3.2 - 5.5 V input
11	ENABLE	Input	Leave high for normal operation. Pull low to enter sleep mode. Internally pulled high with a 10 kΩ pull-up resistor.
12	TX1	Output	Serial UART-1 data output (sensor)
13	RX1	Input	Serial UART-1 data input (sensor)
14	RESV	N/A	Reserved for internal use. Do not connect
15	RESV	N/A	Reserved for internal use. Do not connect
16	SPI_SCK	Input	SPI clock
17	SPI_MOSI	Input	SPI input
18	GND	Supply	Ground
19	SPI_MISO	Output	SPI output
20	RESV	N/A	Reserved for internal use. Do not connect
21	NRST	Input	Microcontroller reset line. Pull low for > 20 μs to reset MCU. Internally pulled high with 40 kΩ
22	SYNC_IN	Input	Input signal for synchronization purposes. Software configurable to either synchronize the measurements or the output with an external device
23	SPI_CS	Input	SPI chip select
24	GPS_PPS	Output	GPS time pulse. One pulse per second, synchronized on rising edge. Pulse width is 100 ms.
25	VBAT	Supply	Optional GNSS RTC battery backup. 1.4 V to 3.6 V input.
26	RESV	N/A	Reserved for internal use. Do not connect
27	RESV	N/A	Reserved for internal use. Do not connect
28	GND	Supply	Ground
29	RESV	N/A	Reserved for internal use. Do not connect
30	GND	Supply	Ground

TABLE 11

5.1 Power

Power Supply Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Input Voltage (VIN)	3.2		5.5	V	
Power Consumption			445	mW	[1]
Current (VIN @ 3.3 V)		105 330		mA µA	 ENABLE=Low
VBAT	1.4	 15	3.6	V µA	 VBAT @ 3 V

[1] Not including active antenna power consumption

TABLE 12

VIN

The VN-200 SMD module has a single input power supply (VIN). On the module a combination of both switching and linear regulators are used to supply power to the components.

VBAT

The VBAT pin provides power to the real-time clock and backup RAM on the GNSS module. When used, this optional pin provides the GNSS receiver the ability to recover in either a Hot Start or Warm Start configuration which provides considerably lower GNSS signal acquisition time at startup. If not providing backup power, leave the pin as no connect.

5.2 General Purpose I/O

ENABLE Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Input Logic-Low Voltage	0		0.2	V	
Input Logic-High Voltage	1.1		VIN	V	
Pull-up Resistor		10		kΩ	

TABLE 13

RESET (NRST) Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Input Logic-Low Voltage	-0.3		0.8	V	
Input Logic-High Voltage	2		5.5	V	
Pull-up Equivalent Resistor	30	40	50	kΩ	
Pulse Width	20			µs	

TABLE 14

SYNC_IN Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Input Logic-Low Voltage	-0.3		0.8	V	
Input Logic-High Voltage	2		5.5	V	
Pull-up/down Equivalent Resistor	30	40	50	kΩ	
Pulse Width	100			ns	

TABLE 15

SYNC_OUT Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Output Logic-Low Voltage	0		0.4	V	
Output Logic-High Voltage	2.4		3	V	
High to Low Fall Time			125	ns	
Low to High Rise Time			125	ns	
Output Frequency	1		1000	Hz	
Jitter			20	μs	
Sink/Source Current	-8		8	mA	

TABLE 16

RESTORE Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Input Logic-Low Voltage	-0.3		0.8	V	
Input Logic-High Voltage	2		5.5	V	
Pull-down Resistor		10		kΩ	

TABLE 17

GPS_PPS Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Output Logic-Low Voltage	0		0.4	V	
Output Logic-High Voltage	2.6		3	V	
Sink/Source Current	-4		4	mA	
Time Accuracy		30	60	ns	

TABLE 18

ENABLE

The ENABLE pin directly controls the output of all onboard regulators on the VN-200 SMD module. Pulling this pin low will disable power to all onboard devices and will place the module into an ultra-low power mode. If not using this pin, leave as no connect.

NRST/RESET

The NRST pin provides a hardware reset for the sensor. In the event that communication is lost with the device, this pin can be used to reset the device back to its power-on state. This pin is internally pulled high to 3 V with a 40 kΩ pull-up resistor. To reset the device, pull low for greater than 20 μs. Note: This line is toggled low on a software reset command of the module and can interfere with other devices if they are connected to this line. If connected to an external GPIO, this pin must be driven as an open-drain. If not using this pin, leave as no connect.

SYNC_IN

The SYNC_IN pin is a 5 V tolerant input that drives SyncIn *Events*. It can be configured to detect either rising or falling edges. A SyncIn *Event* occurs when an internal counter exceeds a user defined SyncInSkipFactor. This allows SyncIn *Events* to occur at some multiple of the input signal such that a high-frequency input signal can be provided that is divided to the desired rate (eg. providing a 10 kHz signal that the sensor responds to only every 100 triggers will yield a 100 Hz response). At every SyncIn *Event* timeSyncIn is reset and syncInCount is incremented. SyncIn *Events* can also be configured to trigger several other actions (see the VN-200 SMD ICD for more details).

SYNC_OUT

The SYNC_OUT pin is an output pin with configurable output polarity and pulse-width that is driven by SyncOut *Events*. A SyncOut *Event* occurs when an internal counter exceeds the user configurable SyncOutSkipFactor. The internal counter is incremented at a configurable rate defined by the SyncOutMode (See VN-200 SMD ICD for more details).

RESTORE

The RESTORE pin allows the sensor to be reset via hardware. At startup, if the state of this pin is high, the sensor will restore all of its configuration registers to their factory default state. This functionality serves as a fail-safe mechanism to avoid the situation that could possibly arise where invalid parameters are accidentally written to the device which could result in a loss of communication to the device. If this was to occur pulling this pin high and pulsing the NRST pin low would reset the sensor and restore it to a factory default state. This pin needs to be held high for at least 5 ms after power-on to successfully restore factory settings. If not using this pin, leave as no connect.

GPS_PPS

The GPS_PPS pin is an output pin that is directly connected to the onboard GNSS receiver. It provides a very accurate timing reference that is aligned to the GPS signal. While the GPS has a valid time reference fix, the accuracy for the time pulse signal is better than 60 ns 99% of the time. The signal is a square wave, synchronized to the rising edge that pulses high for 100 ms.

5.3 Communication

UART Interface Specifications (TTL)

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Input Logic-Low Voltage	-0.3		0.8	V	
Input Logic-High Voltage	2		5.5	V	
Output Low-Level Voltage	0		0.4	V	
Output High-Level Voltage	2.4		3	V	
Data Rate	9600		921600	bps	

TABLE 19

Serial Peripheral Interface (SPI) Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS	NOTES
Input Logic-Low Voltage	-0.3		0.8	V	
Input Logic-High Voltage	2		5.5	V	
Output Logic-Low Voltage	0		0.4	V	
Output Logic-High Voltage	2.4		3	V	
Clock Frequency			16	MHz	
Close Rise/Fall Time			8	ns	

TABLE 20

UART-1 & UART-2

The VN-200 SMD has two fully separate and independently configurable Universal Asynchronous Receiver Transmitter (UART) serial interfaces. The TX1 and RX1 pins are the main serial port and TX2 and RX2 are the secondary serial port. Note that only the main serial port supports Firmware updates.

SPI

A Serial Peripheral Interface (SPI) is available on the VN-200 SMD in which the sensor acts as a slave device. Four hardware lines are required to implement a SPI interface with this sensor: a clock (SPI_SCK), two data lines (SPI_MOSI and SPI_MISO), and a chip select pin (SPI_CS). The master is responsible for driving both the clock signal and the chip select lines. The SPI interface must use the following configuration:

Chip Select . . . . Active Low
Clock Polarity . . . . Idle High (CPOL=1)
Clock Phase . . . . Sample second clock edge (CPHA=1)
Data Format . . . . Most significant bit first (MSB)
Byte Order . . . . Least significant byte first (little-endian)

The chip select line should be pulled low when the master wants to communicate with the slave. If multiple slave devices are used on the same bus, then each slave will have its own dedicated chip select line while sharing the clock and data lines. This sensor will leave the SPI_MISO line in a high impedance state while the SPI_CS line is high, enabling communication with other slave devices on the same SPI bus. When the master is finished communicating with the slave the chip select line is pulled high. If interfacing with a 5 V system, it is recommended that a logic level translation circuit be used to ensure reliable communication.

SPI Diagram

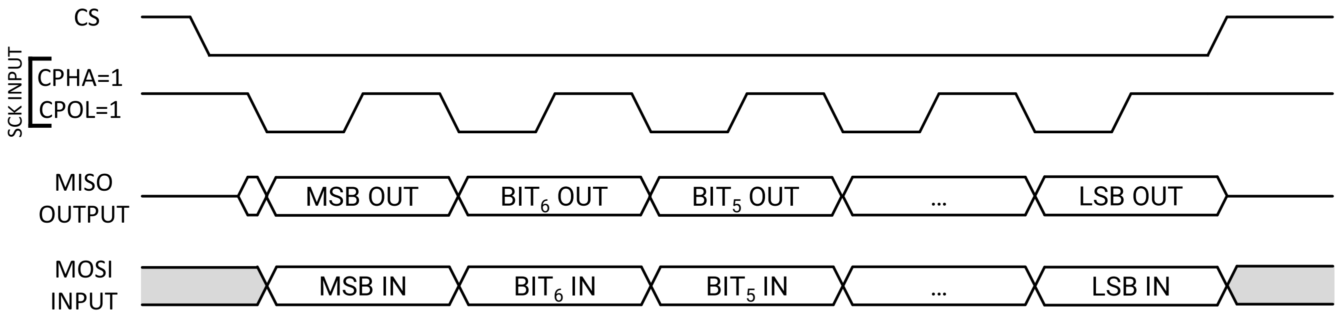


FIGURE 5

6 PRODUCT HANDLING AND INSTALLATION

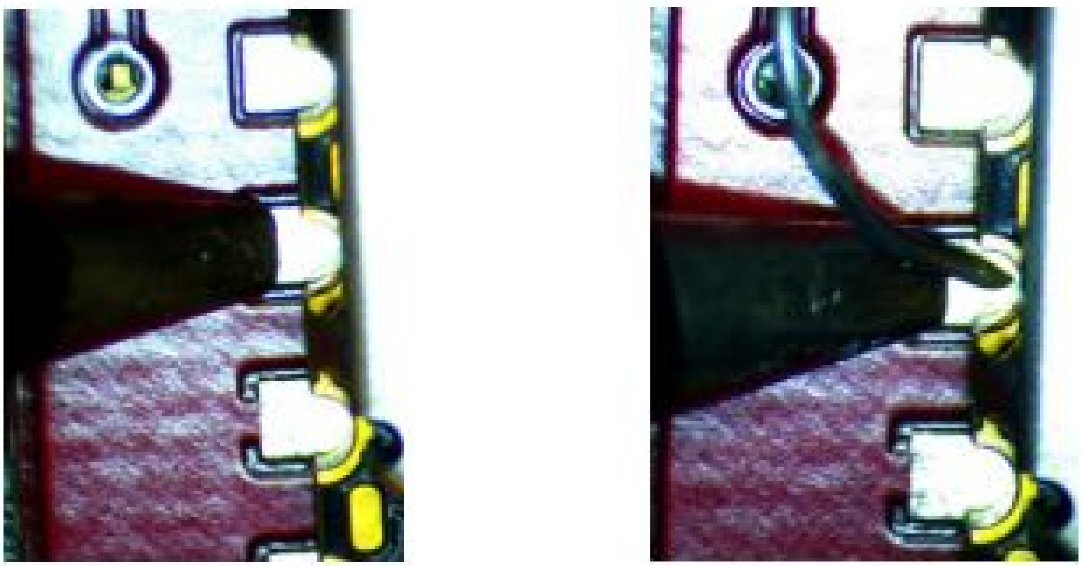
6.1 Soldering and Cleaning

> Caution: The component is **static sensitive**. Proper ESD controls must be exercised when handling.

> Caution: **Do not reflow**. The component is unable to withstand reflow. We specify **hand soldering** for the part installation.

> Caution: **Do not clean** using an inline or dishwasher style cleaner as this will harm the onboard pressure sensor. The component is unable to withstand submersion in a cleaning process.

Soldering Tip & Wire Recommendations



(a) Recommended Soldering Tip

(b) Recommended Soldering Wire

FIGURE 6

6.2 Soldering Recommendations

We recommended a 0.020” no-clean cored solder wire and a 1 mm (0.040”) chisel tipped solder iron tip. To install, first align the device to the LAND. Tack the device in place by soldering 4 of the non-ground LANDS described as follows: heat the PCB LAND with the soldering tip, feed the solder to the PCB LAND between the component and the solder tip, and allow the solder to flow up the castellation. The solder should not exceed the height of the castellation. With the device tacked into place, solder the remaining connections by soldering every other castellation until all are soldered. This will aid in the heat distribution.

VectorNav does not recommend cleaning of no-clean solder joints. If the board must be cleaned after soldering, use either a flux cleaner or IPA at the board surface only. Ensure that no liquid penetrates beneath the lid of the device. This device **must** be hand soldered. Reflow temperatures will invalidate the factory calibration and can damage the sensor. Similarly, high heat methods such as heat guns or bottom heaters, cannot be used during the installation as they can expose the chip to excessive temperatures.

The VN-200 SMD does not require bake-out prior to installation. It is recommended to install the sensor last on the PCB. We also recommend verifying and testing the target PCB prior to installation due to the high BOM cost of the VN-200 SMD.

6.3 GNSS Antenna Considerations

The VN-200 SMD requires an active antenna to be connected. For long cable runs we recommend using LMR-400 cable. In most dynamic applications, some vibration and shock will be present—it is important to secure the

U.FL connector with staking compound to prevent it from disconnecting. Do this after the RF path has been verified. It is also important to avoid the U.FL jumper cable crimps from touching the EMI shield on the device. Depending on the lay of the U.FL jumper cable this can be avoided. If they lay of the cable is such that the metal crimps must cross over the EMI shield, some Kapton tape and staking compound is recommended to guarantee that the metal never physically touches the shield. Because U.FL connectors are rated for a relatively low connect/disconnect cycles, VectorNav recommends using a U.FL to bulkhead adapter.

6.4 Magnetic and Vibration Considerations

Magnetic disturbances and vibration are two forms of interference that can reduce performance and accuracy of an orientation sensor. In most applications it is not possible to avoid magnetic and vibration interference entirely, so the effect of these disturbances on the navigation sensor need to be minimized by careful design.

Magnetic Interference

Magnetic interference occurs when nearby objects emit either a static or time-varying magnetic field that interferes with the navigation sensor's ability to measure Earth's magnetic field which is used to estimate heading. Components such as electric motors, iron-core inductors, and current carrying wires can emit a magnetic field which will interfere with the VN-200 SMD.

Static magnetic fields do not vary with time. This type of static interference can be compensated for by performing a hard/soft iron calibration of the magnetometer on the VN-200 SMD if the component creating the interference rigidly rotates with the sensor and always maintains the same distance and direction with respect to the sensor. If the source of the magnetic field rotates separately from the sensor, for instance is installed on a separate moving platform or arm, then it cannot be compensated for using a hard/soft iron calibration. Where possible, locate the sensor as far away from sources of magnetic interference as possible.

Dynamic magnetic fields vary with time and are created by items such as electric motors or current carrying wires. This form of magnetic disturbance is difficult for the sensor to handle without adverse effect on navigation performance. When designing the navigation sensor into your product, pay careful attention to the location of current carrying conductors and their location with respect to the sensor. Where possible, move these wires as far away from the sensor as possible to reduce its effect on the sensor's performance. Be sure not to run any high current traces underneath or near the navigation sensor on the PCB.

Vibration

The VN-200 SMD has been incorporated into numerous helicopter, racing vehicles, and fixed winged aircraft applications. Whether your application is one of the aforementioned or another use case, there are a few important considerations with regard to vibration when using the VN-200 SMD.

VectorNav recommends rigidly mounting the sensor with no vibration isolation. Vibration isolation is difficult to implement correctly and can degrade the performance of the sensor if done incorrectly. However, if isolation is determined to be necessary, the best practice is to isolate the subsystem that the VN-200 SMD is on or isolate the source of vibration.

Note that random vibrations on the order of 4.5 g RMS will saturate the accelerometers, causing significant performance degradation of the navigation filters.

6.5 Environmental Protection

If the VN-200 SMD requires additional environmental protection, a conformal coating can be applied to the sensor. A conformal coating will compromise the pressure sensor. During the coating process, VectorNav recommends keeping the temperature under 85 °C.

6.6 Electrostatic Discharge (ESD) Precautions

Electrostatic discharge (ESD) is the sudden and momentary electrical current that flows between two objects at different electrical potentials when they come in contact or very close proximity to each other. This discharge is the same effect that occurs when you walk across the carpet and touch a door knob. ESD has the potential to damage and possibly destroy electronic equipment due to the very high voltages that can be reached during the discharge of current between the two devices. Proper ESD precautions should be taken while handling the VN-200 SMD to avoid the risk of possible damage to the device.

- Leave the module in its anti-static packaging until it is ready to be installed.
- Follow standard ESD practices when handling and working directly with the module.

6.7 Board Stress Precautions

Flexing of the carrier board for the VN-200 SMD can impact the sensor's performance. Consideration should be given to avoid stresses and strains from entering the module. Consider the various accelerations that the application will experience and that these can deflect heavy cables. Proper strain relieves can mitigate this as well as avoiding large connectors to be PCB mounted near the module. Avoid having heavy components installed without proper support close to the module for this same reason.

Post Installation

After installation and cleaning of the VN-200 SMD, the heat and stress caused by soldering the sensor will cause bias shifts that must be calibrated prior to use. A bias calibration can be performed by connecting the sensor to VectorNav Control Center and using the Bias Calculator tool.

6.8 Maintenance

There is no recommendation for returning the unit for recalibration. The factory calibrations are effective over the life of the part. However, biases do drift over the life of the part regardless of the quality of the factory calibration. In rare circumstances the biases may drift enough to elicit a user calibration. Contact VectorNav support for more information if you believe a bias calibration is necessary for your sensor.

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Version 25-200-SMD-30-R1