

## 3DM<sup>®</sup>-GX5-35

### Attitude and Heading Reference System (AHRS) with GNSS

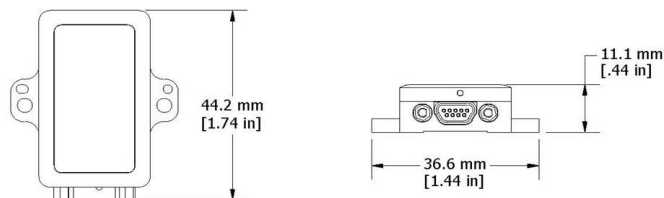


3DM-GX5-35- miniature, high-performance, industrial-grade attitude and heading reference system (AHRS) with integrated multi-constellation GNSS, high noise immunity, and exceptional performance

The LORD Sensing 3DM-GX5 family of high-performance, industrial-grade inertial sensors provides a wide range of triaxial inertial measurements and computed attitude and navigation solutions.

In all models, the Inertial Measurement Unit (IMU) includes direct measurement of acceleration and angular rate. The computed outputs vary between models and can include pitch, roll, yaw, a complete attitude and heading reference solution (AHRS), or a complete position, velocity and attitude solution (PVA), as well as integrated GNSS outputs. All sensors are fully temperature-compensated and calibrated over the operating temperature. The use of Micro-Electro-Mechanical System (MEMS) technology allows for highly accurate, small, light-weight devices.

The LORD Sensing MIP Monitor software can be used for device configuration, live data monitoring, and recording. Alternatively, the MIP Data Communications Protocol is available for development of custom interfaces and easy OEM integration.



#### Product Highlights

- High-performance integrated multi-constellation GNSS receiver and advanced MEMS sensor technology provide direct inertial measurements, and computed attitude and heading outputs in a small package
- Triaxial accelerometer, gyroscope, magnetometer, temperature sensors, and a pressure altimeter achieve the optimal combination of measurement qualities
- Economical combination of AHRS and GNSS outputs for use in customer supplied Kalman Filters

#### Features and Benefits

##### Best in Class Performance

- Fully calibrated, temperature-compensated, and mathematically-aligned to an orthogonal coordinate system for highly accurate outputs
- High-performance, low-drift gyros with noise density of  $0.005^\circ/\text{sec}/\sqrt{\text{Hz}}$  and VRE of  $0.001^\circ/\text{s}/g^2\text{RMS}$
- Accelerometer noise as low as  $25 \mu\text{g}/\sqrt{\text{Hz}}$

##### Ease of Use

- Easy integration via comprehensive and fully backwards-compatible communication protocol

##### Cost Effective

- Out-of-the box solution reduces development time
- Volume discounts

#### Applications

- GNSS-aided attitude and heading measurement
- Platform stabilization, artificial horizon
- Satellite dish, radar, and antenna pointing

## Specifications

General			
<b>Integrated sensors</b>	Triaxial accelerometer, triaxial gyroscope, triaxial magnetometer, temperature sensors, pressure sensor, and GNSS receiver		
<b>Data outputs</b>	<b>Inertial Measurement Unit (IMU) outputs:</b> acceleration, angular rate, magnetic field, ambient pressure, Delta-theta, Delta-velocity <b>Computed outputs</b> <b>Complementary Filter (CF):</b> attitude estimates (in Euler angles, quaternion, orientation matrix) stabilized, north and up vectors, GNSS correlation timestamp <b>Global Navigation Satellite System outputs (GNSS):</b> LLH position, ECEF position and velocity, NED velocity, UTC time, GNSS time, SV. GNSS protocol access mode available.		
Inertial Measurement Unit (IMU) Sensor Outputs			
	Accelerometer	Gyroscope	Magnetometer
<b>Measurement range</b>	±8 g (standard) ±2 g, ±4 g, ±20 g, ±40 g (optional)	±300°/sec (standard) ±75, ±150, ±900 (optional)	±2.5 Gauss
<b>Non-linearity</b>	±0.02 % fs	±0.02% fs	±0.3% fs
<b>Resolution</b>	0.02 mg (+/- 8 g)	<0.003°/sec (300 dps)	--
<b>Bias instability</b>	±0.04 mg	8°/hr	--
<b>Initial bias error</b>	±0.002 g	±0.04°/sec	±0.003 Gauss
<b>Scale factor stability</b>	0.03%	±0.05%	±0.1%
<b>Noise density</b>	25 µg/√Hz (2 g)	0.005°/sec/√Hz (300°/sec)	100 µGauss/√Hz
<b>Alignment error</b>	±0.05°	±0.08°	±0.05°
<b>Bandwidth</b>	225 Hz	250 Hz	-
<b>Offset error over temperature</b>	0.06% (typ)	0.04% (typ)	--
<b>Gain error over temperature</b>	0.03% (typ)	0.03% (typ)	--
<b>Vibration induced noise</b>	--	0.072°/s RMS/g RMS	--
<b>Vibration rectification error (VRE)</b>	--	0.001°/s/g <sup>2</sup> RMS	--
<b>IMU filtering</b>	Digital sigma-delta ADC sampled at 1kHz and 4kHz. 4kHz data averaged to 1kHz nominal sampling rate. Scaled into physical units at 1kHz. User adjustable IIR filter available for 1kHz data. Coning and sculling integrals computed at 1kHz.		
<b>Sampling rate</b>	1 kHz	4 kHz	50 Hz
<b>IMU data output rate</b>	1 Hz to 1 kHz		
Pressure Sensor			
<b>Range</b>	260 to 1260 hPa		
<b>Resolution</b>	0.01 hPa		
<b>Noise</b>	0.01 hPa RMS		
<b>Sampling rate</b>	25 Hz		

Computed Outputs	
<b>Attitude accuracy</b>	CF outputs: ±0.5° roll, pitch, and heading (static, typ), ±2.0° roll, pitch, and heading (dynamic, typ)
<b>Attitude heading range</b>	360° about all axes
<b>Attitude resolution</b>	< 0.01°
<b>Attitude repeatability</b>	0.2° (typ)
<b>Calculation update rate</b>	500 Hz
<b>Computed data output rate</b>	CF outputs: 1 Hz to 500 Hz
Global Navigation Satellite System (GNSS) Outputs	
<b>Receiver type</b>	72-channel GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1, SBAS L1 C/A: WAAS, EGNOS, MSAS Galileo E1B/C
<b>GNSS data output rate</b>	1 Hz to 4 Hz
<b>Time-to-first-fix</b>	Cold start: 27 second, reacquisition: 1 second, hot start: <1 second
<b>Sensitivity</b>	Tracking: -164 dBm, cold start: -147 dBm, hot start: -156 dBm
<b>Velocity accuracy</b>	0.1 m/sec
<b>Heading accuracy</b>	0.5°
<b>Horizontal position accuracy</b>	GNSS: 2.5 m CEP SBAS: 2.0 m CEP
<b>Time pulse signal accuracy</b>	30 nsec RMS < 60 nsec 99%
<b>Acceleration limit</b>	≤ 4 g
<b>Altitude limit</b>	50,000 meters
<b>Velocity limit</b>	500 m/sec (972 knots)
Operating Parameters	
<b>Communication</b>	USB 2.0 (full speed) RS232 (9,600 bps to 921,600 bps, default 115,200)
<b>Power source</b>	+4 to +36 V dc
<b>Power consumption</b>	700 mW (typ), 800 mW (max)
<b>Operating temperature</b>	-40 °C to +85 °C
<b>Mechanical shock limit</b>	500 g (calibration unaffected) 1000 g (bias may change), 5000 g (survivability)
<b>MTBF</b>	(TBD)
Physical Specifications	
<b>Dimensions</b>	44.2 mm x 36.6 mm x 11 mm
<b>Weight</b>	20 grams
<b>Enclosure material</b>	Aluminum
<b>Regulatory compliance</b>	ROHS, CE
Integration	
<b>Connectors</b>	Data/power output: micro-DB9 GNSS antenna: MMCX type
<b>Software</b>	MIP Monitor, MIP Hard and Soft Iron Calibration, Windows XP/Vista/7/8/10 compatible
<b>Compatibility</b>	Protocol compatibility across 3DM <sup>®</sup> -GX3, GX4, RQ1, GQ4, GX5 and CV5 product families
<b>Software development kit (SDK)</b>	MIP data communications protocol with sample code available (OS and platform independent)

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