



# OpenIMU300ZI

## EZ-Family High-Performance IMU



The ACEINNA OpenIMU300ZI "EZ" is an easy-to-use high-performance 9-DOF open inertial platform. The OpenIMU300ZI features a precision 3-Axis Accelerometer, low-drift 3-Axis Rate Gyro, and 3-Axis Magnetometer. The low-power platform is powered by a 168MHz ARM M4 CPU with a Floating Point Unit. The OpenIMU300ZI runs the OpenIMU open-source stack that includes an optimized full-state Kalman Filter for Attitude and GPS-Aided Position-Velocity-Time (PVT) measurement. A free tool-chain based on VS Code supports PC, MAC, and Ubuntu.



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The ACEINNA OpenIMU300ZI is designed for use in embedded applications and operates from a 3.0 to 5.5 power supply. The cost-effective and light-weight cast aluminum housing provides rigidity and minimizes potential stress coupling from the PCBA to the sensor. Four mounting holes are provided to secure the OpenIMU300ZI to your PCBA with screws.

## Applications

- Autonomous Vehicles
- Unmanned Vehicles
- Self-Driving Taxis / Delivery Vehicles
- Agriculture Vehicles and Implements
- Forklifts
- Robotics Control / Feedback
- Antenna / Camera Gimbaling and Stabilization



## Features

- Easy to Customize Open Source Algorithms
- Precision 3-axis MEMS Accelerometer
- Low-Drift 3-axis MEMS Angular Rate Sensor
- High Performance 3-axis AMR Magnetometer
- 168 MHz ARM M4 processor
- SPI and up to 3 UART interfaces
- Open Source Tool Chain
- Open Source Algorithms (VG / AHRS / INS)
- Built in 16-State Open Source Extended Kalman Filter
- Open Community & Support
- Wide Temp Range, -40C to +85C
- High Reliability, MTBF > 50k hours

This product has been developed exclusively for commercial applications. It has not been tested for, and makes no representation or warranty as to conformance with, any military specifications or its suitability for any military application or end-use. Additionally, any use of this product for nuclear, chemical or biological weapons, or weapons research, or for any use in missiles, rockets, and/or UAV's of 300km or greater range, or any other activity prohibited by the Export Administration Regulations, is expressly prohibited without the written consent and without obtaining appropriate US export license(s) when required by US law. Diversion contrary to U.S. law is prohibited. Specifications are subject to change without notice.



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### Performance Specification

Ta = 25°C, VDC = 3.3 V, unless otherwise stated

| Angular Rate                           | MIN   | TYP <sup>2</sup> | MAX   |
|--|-------|------------------|-------|
| Range (°/s)                            | -400  |                  | +400  |
| Bias Instability (°/hr) <sup>1</sup>   |       | 6                |       |
| Bias Stability over Temp (°/s)         |       | 0.3              |       |
| Scale Factor Accuracy (%)              |       | 0.03             |       |
| Cross-Axis Error (%FSR)                |       | 0.02             |       |
| Angle Random Walk (°/√hr) <sup>1</sup> |       | 0.3              |       |
| Configurable Bandwidth (Hz)            | 5     |                  | 50    |
| Acceleration                           | MIN   | TYP <sup>2</sup> | MAX   |
| Range (g)                              | -8    |                  | +8    |
| Bias Instability (μg) <sup>1</sup>     |       | 10               |       |
| Bias Stability over Temp (mg)          |       | 3                |       |
| Scale Factor Accuracy (%FSR)           |       | 0.03             |       |
| Non-Linearity (%FSR)                   |       | 0.03             |       |
| VRW (m/s/√hr) <sup>1</sup>             |       | 0.06             |       |
| Configurable Bandwidth (Hz)            | 2     |                  | 50    |
| Magnetic Field                         | MIN   | TYP <sup>2</sup> | MAX   |
| Range (mGauss)                         | -8000 |                  | +8000 |
| Resolution (mGauss)                    |       | 0.25             |       |
| Noise (mGauss/√Hz)                     |       | 0.25             |       |
| Bandwidth (Hz)                         |       | 5                |       |

Note 1: Allan variance curve, constant temperature

Note 2: Typical values are 1-sigma values unless otherwise noted

### Electrical Specifications

| Characteristic              | Specification |
|-----------------------------|---------------|
| Input voltage               | 3.0 – 5.5 V   |
| Power Consumption           | < 350 mW      |
| Interface                   | SPI and UART  |
| Max Output Data Rate - SPI  | 200 Hz        |
| Max Output Data Rate - UART | 200 Hz        |
| Input Clock Sync            | 1pps, 1 kHz   |

### Physical Specifications

| Characteristic   | Specification                     |
|------------------|-----------------------------------|
| Size             | 24.15 x 37.7 x 9.5 mm             |
| Weight           | <17 gram                          |
| Connector        | 20-Pin (10x2) 1.0 mm pitch header |
| Mating Connector | SAMTEC CLM-110-02                 |
| Mounting holes   | 4 x 2.5 mm thru hole              |

### Environmental Specifications

| Characteristic        | Specification    |
|-----------------------|------------------|
| Operating Temperature | -40 °C to 85 °C  |
| Storage Temperature   | -55 °C to 105 °C |

### ESD Specification

| Model          | Class | MAX    |
|----------------|-------|--------|
| Human Body     | 2     | 2000 V |
| Charged Device | II    | 500 V  |

### Qualification Summary (Not inclusive of all tests)

| Item                  | Condition   | Summary  |  |
|-----------------------|-------------|--|--|
| Hot Soak - Operating  | Powered     | 96 Hours 85 °C per IEC 60068-2-2, method BE  |  |
| Cold Soak - Operating | Powered     | 96 Hours -40 °C per IEC 60068-2-1, method AD   |  |
| Temperature Cycle     | Not Powered | 415 cycles, -40 °C to 85 °C  |  |
| Temperature Cycle     | Powered     | 141 cycles, , -40 °C to 85 °C  |  |
| Temperature Shock     | Not Powered | 50 Cycles; -40 °C to 85 °C, <60 s transition, 1 hour dwell                             |  |
| Mechanical Shock      | Powered     | 3 Shocks x 3 axis x 2 directions (18 total) 500 m/s <sup>2</sup> , ½ sine, 11 ms pulse |  |
| Vibration Swept Sine  | Powered     | 5 to 2000 Hz; 5 to 55 Hz Disp. = 0.01 in; 55 Hz to 2000 Hz, 1.5 g Peak                 |  |
| Vibration Random      | Powered     | Frequency Breakpoint   | Acceleration Spectral Density (g <sup>2</sup> /Hz) |
|                       |             | 5  | 0.015  |
|                       |             | 100  | 0.04   |
|                       |             | 1000   | 0.04   |
|                       |             | 2000   | 0.02   |



# OpenIMU300ZI

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### Evaluation and Development Kit

- OpenIMU300ZI EVK
- ST-Link/v2 debugger for in-system development of application code
- Fixture and Interface Board
  - JTAG, USB and UART Interfaces

### Open Navigation Platform

Embedded navigation applications quickly developed on PC, MAC, and Ubuntu and deployed to run on OpenIMU hardware.

- Code / Compile / Debug / Simulate / Analyze

Aceinna Navigation Studio developer tools and GUI are found on our developer site: [developers.aceinna.com](http://developers.aceinna.com)

Full manual, API and Algorithm documentation are found at: [openimu.readthedocs.io](http://openimu.readthedocs.io)

IDE and Compilation tools: download and Install Microsoft VS Code and add the free Aceinna Extension: [code.visualstudio.com](http://code.visualstudio.com)

### Development System Requirements

- PC or MAC
- USB Port (2.0)
- Internet Connection

### Ready to Use Open Source Algorithms

- Calibrated IMU, 3D Acceleration, 3D Rate, 3D Mag
- VG / AHRS, Dynamic Roll, Pitch and Heading
- INS, Position, Velocity, Attitude and Heading

| VG / AHRS Performance <sup>3</sup>                    | Typical |
|---|---------|
| Pitch and Roll Dynamic Accuracy (Degree) <sup>4</sup> | 0.5     |
| Heading Accuracy (Degree) <sup>5</sup>                | 2       |
| INS Performance <sup>3</sup>                          |         |
| Position Accuracy (m) <sup>6</sup>                    | 2       |
| Velocity Accuracy (m/s) <sup>6</sup>                  | 0.05    |
| Heading Accuracy (Degree) <sup>6</sup>                | 1       |

Note 3: Aceinna Open Source Reference Algorithm

Note 4: RMS Error as referenced to Novatel SPAN during 30 minute drive test.

Note 5: Tested in low distortion magnetic environment.

Note 6: RMS Error as referenced to Novatel SPAN during 30 minute drive test using GNSS input from UBLOX M8

### Ordering Information

| Embedded High-Performance OpenIMU Platform |  |
|--|--|
| OpenIMU300ZI                               | 9 DOF IMU, FSR = 400dps / ±8 g / ±8 Gauss                      |
| OpenIMU300ZI EVK                           | Developer Kit with OpenIMU300ZI, JTAG, STLink/v2 Pod and Cable |



### Dimensioned Drawing (mm)

