

IMU (Inertial Measurement Unit)

■ GENERAL DESCRIPTION

The M-G370PDF1 is a small form factor inertial measurement unit (IMU) with 6 degrees of freedom: triaxial angular rates and linear accelerations, and provides high-stability and high-precision measurement capabilities with the use of high-precision compensation technology. A variety of calibration parameters are stored in memory of the IMU, and are automatically reflected in the measurement data being sent to the application after the power of the IMU is turned on. With general-purpose SPI/UART support for host communications, the M-G370PDF1 reduces technical barriers for users to introduce inertial measurement and minimizes design resources to implement inertial movement analysis and control applications. The features of the IMU such as high stability, high precision, and small size make it easy to create and differentiate applications in various fields of industrial systems.

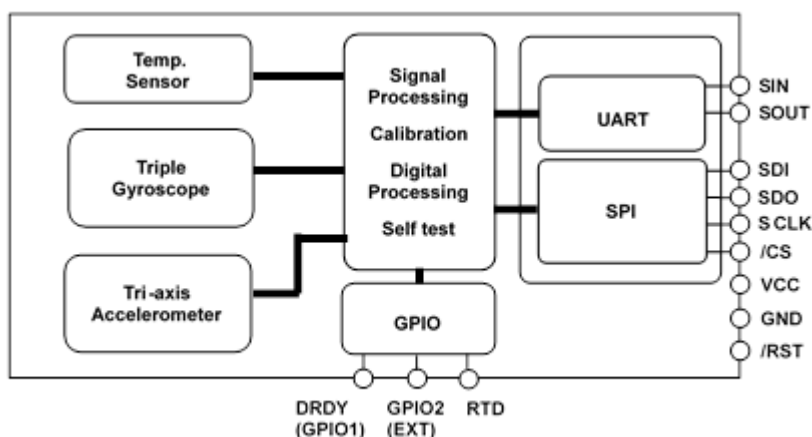
■ FEATURES

- Small Size, Lightweight : 24x24x10mm³, 10g
- Low-Noise, High-stability
 - Bias Instability : 0.8 °/h
 - Angular Random Walk : 0.06 °/√h
- Initial Bias Error : 360 °/h (1σ) / 2mG (1σ)
- 6 Degrees Of Freedom
 - Triple Gyroscopes : ±450 °/s,
 - Tri-Axis Accelerometer : ±10 G
- 16/32bit data resolution
- Digital Serial Interface : SPI / UART
- Calibrated Stability (Bias, Scale Factor, Axial Alignment)
- Data Output Rate : to 2k Sps
- External Trigger Input / External Counter Reset Input
- Delta Angle/Delta Velocity Output
- Calibration Temperature Range : -40°C to +85°C
- Operating Temperature Range : -40°C to +85°C
- Single Voltage Supply : 3.3 V
- Low Power Consumption : 16mA (Typ.)

■ APPLICATIONS

- Antenna Platform Stabilization
- Camera Gimbals
- Navigation Systems
- Vibration Control and Stabilization
- Pointing and Tracking Systems
- Autonomous Vehicle

■ FUNCTIONAL BLOCK DIAGRAM



■ SENSOR SECTION SPECIFICATION

T_A=25°C, VCC=3.3V, angular rate=0 °/s, ≤±1G, unless otherwise noted.

Parameter	Test Conditions / Comments	Min	Typ	Max	Unit
GYRO SENSOR					
Sensitivity					
Output Range		—	±450	—	°/s
Scale Factor	16bit	-0.2%	66	+0.2%	LSB/(°/s)
	32bit	-0.2%	66x(2 ¹⁶)	+0.2%	
Nonlinearity (Best fit straight line)	1 σ, <300 °/s	—	0.05	—	% of FS
	1 σ, >300 °/s	—	0.2	—	% of FS
Misalignment	1 σ, Axis-to-axis, Δ = 90° ideal	—	0.01	—	°
Bias					
Initial Error	1 σ, -40°C ≤ T _A ≤ +85°C	—	360	—	°/h
Repeatability	1 σ, turn-on to turn-on *3	—	36	—	°/h
Bias Instability	Average	—	0.8	—	°/h
Angular Random Walk	Average	—	0.06	—	°/√h
Linear Acceleration Effect	Average	—	18	—	(°/h)/G
Noise Density	f = 10 to 20 Hz	—	4.68	—	(°/h)/√Hz, rms
Frequency Property					
3 dB Bandwidth		—	189	—	Hz
ACCELEROMETERS					
Sensitivity					
Output Range		—	±10	—	G
Scale Factor	16bit	-0.1%	2.5	+0.1%	LSB/mG
	32bit	-0.1%	2.5x(2 ¹⁶)	+0.1%	
Nonlinearity (Best fit straight line)	1 σ, <5G	—	0.1	—	% of FS
Misalignment	1 σ, Axis-to-axis, Δ = 90° ideal	—	0.01	—	°
Bias					
Initial Error	1 σ, -40°C ≤ T _A ≤ +85°C	—	2	—	mG
Repeatability	1 σ, turn-on to turn-on *3	—	2	—	mG
Bias Instability	Average	—	12	—	μG
Velocity Random Walk	Average	—	0.025	—	(m/s)/√h
Noise Density	f = 10 to 20 Hz	—	60	—	μG/√Hz, rms
Frequency Property					
3 dB Bandwidth		—	167	—	Hz
TEMPERATURE SENSOR					
Scale Factor *1*2	Output = 2634(0x0A4A) @ +25°C	—	-0.0037918	—	°C/LSB

*1) This is a reference value used for internal temperature compensation. There is no guarantee that the value gives an absolute value of the internal temperature.

*2) This is the temperature scale factor for the upper 16bit (TEMP_HIGH).

*3) Turn-on to turn-on / Day by day, estimated variation during 5 consecutive days.

Note) The values in the specifications are based on the data calibrated at the factory. The values may change according to the way the product is used.

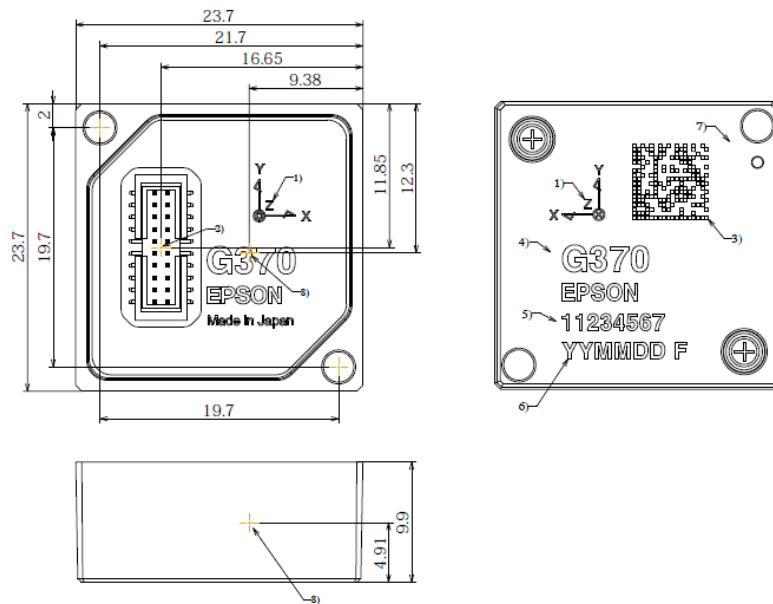
Note) The Typ values in the specifications are average values or 1σ values.

Note) Unless otherwise noted, the Max / Min values in the specifications are design values or Max / Min values at the factory tests

RECOMMENDED OPERATING CONDITION

Parameter	Condition	Min	Typ	Max	Unit
VCC to GND		3.15	3.3	3.45	V
Digital Input Voltage to GND		GND	—	V _{CC}	V
Digital Output Voltage to GND		-0.3	—	V _{CC} +0.3	V
Calibration Temperature Range	Performance parameters are applicable	-40	—	85	°C
Operating Temperature Range		-40	—	85	°C

OUTLINE DIMENSIONS



Outline Dimensions (millimeters)

Notice of the Document

NOTICE : PLEASE READ CAREFULLY BELOW BEFORE THE USE OF THIS DOCUMENT ©Seiko Epson Corporation 2022
The content of this document is subject to change without notice.

1. This document may not be copied, reproduced, or used for any other purposes, in whole or in part, without the consent of Seiko Epson Corporation("Epson").
2. Before purchasing or using Epson products, please contact with our sales representative for the latest information and be always sure to check the latest information published on Epson's official web sites and sources.
3. Information provided in this document such as application circuits, programs, usage, etc., are for reference purpose only. Please use the application circuits, programs, usage, etc. in the design of your equipment or systems at your own responsibility. Epson makes no guarantees against any infringements or damages to any third parties' intellectual property rights or any other rights resulting from the information. This document does not grant you any licenses, intellectual property rights or any other rights with respect to Epson products owned by Epson or any third parties.
4. Epson is committed to constantly improving quality and reliability, but semiconductor products in general are subject to malfunction and failure. In using Epson products, you shall be responsible for safe design in your products; your hardware, software and systems are designed enough to prevent any harm or damages to life, health or property even if any malfunction or failure might be caused by Epson products. In designing of your products with using Epson products, please be sure to check and comply with the latest information regarding Epson products (this document, specifications, data sheets, manuals, Epson's web site, etc.). When using the information included in the above materials such as product data, chart, technical contents, programs, algorithms and application circuit examples, you shall evaluate your products both in stand-alone basis and within your overall systems. You shall be solely responsible for deciding whether or not to adopt and use Epson products.
5. Epson has prepared this document and programs provided in this document carefully to be accurate and dependable, but Epson does not guarantee that the information and the programs are always accurate and complete. Epson assumes no responsibility for any damages which you incurred by due to misinformation in this document and the programs.
6. No dismantling, analysis, reverse engineering, modification, alteration, adaptation, reproduction, etc., of Epson products is allowed.
7. Epson products have been designed, developed and manufactured to be used in general electronic applications (office equipment, communications equipment, measuring instruments, home electronics, etc.) and applications individually listed in this document ("General Purpose"). Epson products are NOT intended for any use beyond the General Purpose that requires particular/higher quality or reliability in order to refrain from causing any malfunction or failure leading to harm to life, health or serious property damage or severe impact on society, including, but not limited to listed below. Therefore, you are advised to use Epson products only for the General Purpose. Should you desire to buy and use Epson products for the particular purpose other than the General Purpose, Epson makes no warranty and disclaims with respect to Epson products, whether express or implied, including without limitation any implied warranty of merchantability or fitness for any particular purpose.
【Particular purpose】
Space equipment (artificial satellites, rockets, etc.)
Transportation vehicles and their control equipment (automobiles, aircraft, trains, ships, etc.)
Medical equipment (other than applications individually listed in this document) / Relay equipment to be placed on sea floor
Power station control equipment / Disaster or crime prevention equipment / Traffic control equipment / Financial equipment
Other applications requiring similar levels of reliability as the above
8. Epson products listed in this document and our associated technologies shall not be used in any equipment or systems that laws and regulations in Japan or any other countries prohibit to manufacture, use or sell. Furthermore, Epson products and our associated technologies shall not be used for developing military weapons of mass destruction, military purpose use, or any other military applications. If exporting Epson products or our associated technologies, you shall comply with the Foreign Exchange and Foreign Trade Control Act in Japan, Export Administration Regulations in the U.S.A (EAR) and other export-related laws and regulations in Japan and any other countries and follow the required procedures as provided by the relevant laws and regulations.
9. Epson assumes no responsibility for any damages (whether direct or indirect) caused by or in relation with your non-compliance with the terms and conditions in this document.
10. Epson assumes no responsibility for any damages (whether direct or indirect) incurred by any third party that you assign, transfer, loan, etc., Epson products.
11. For more details or other concerns about this document, please contact our sales representative.
12. Company names and product names listed in this document are trademarks or registered trademarks of their respective companies.

2022.08

© Seiko Epson Corporation 2023. All rights reserved.

SEIKO EPSON CORPORATION

MD SALES & MARKETING DEPT.

https://global.epson.com/products_and_drivers/sensing_system/contact/

Revised date JUN, 2023 in Japan