

## IMU (Inertial Measurement Unit)

### ■ GENERAL DESCRIPTION

The M-G370PDS0 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-G370PDS0 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, small size and super low noise make it easy to create and differentiate applications in various fields of industrial systems, especially for stabilization applications.

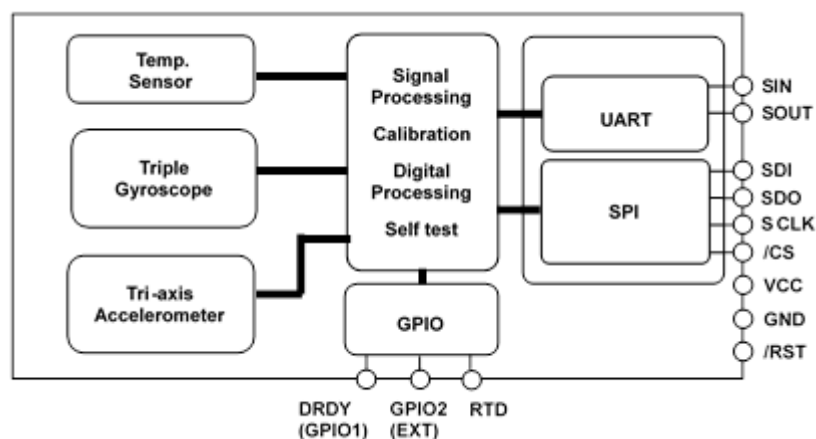
### ■ FEATURES

- Small Size, Lightweight : 24x24x10 mm<sup>3</sup>, 10 g
- Low-Noise, High-stability
  - Gyro Bias Instability : 0.8 °/h
  - Angular Random Walk : 0.03 °/√h
- Initial Bias Error : 360 °/h (1σ) / 2 mG (1σ)
- 6 Degrees Of Freedom
  - Triple Gyroscopes : ±200 °/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 2 k 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 : 16 mA (Typ.)

### ■ APPLICATIONS

- Unmanned Vehicles
- Antenna Platform Stabilization
- Camera Gimbals
- Vibration Control and Stabilization
- Navigation Systems

### ■ FUNCTIONAL BLOCK DIAGRAM



## ■ SENSOR SECTION SPECIFICATION

T<sub>A</sub>=25 °C, VCC=3.3 V, angular rate=0 °/s, ≤±1 G, unless otherwise noted.

| Parameter                                | Test Conditions / Comments        | Min.  | Typ.                    | Max.  | Unit           |
|------------------------------------------|-----------------------------------|-------|-------------------------|-------|----------------|
| <b>GYRO sensor</b>                       |                                   |       |                         |       |                |
| Sensitivity                              |                                   |       |                         |       |                |
| Output Range                             |                                   | -     | ±200                    | -     | °/s            |
| Scale Factor                             | 16 bit                            | -0.2% | 150                     | +0.2% | LSB / (°/s)    |
|                                          | 32 bit                            | -0.2% | 150x(2 <sup>16</sup> )  | +0.2% |                |
| Nonlinearity<br>(Best fit straight line) | 1 σ, <130 °/s                     | -     | 0.05                    | -     | % of FS        |
|                                          | 1 σ, >130 °/s                     | -     | 0.2                     | -     | % of FS        |
| Misalignment                             | 1 σ, Axis-to-axis, Δ = 90° ideal  | -     | 0.01                    | -     | °              |
| <b>Bias</b>                              |                                   |       |                         |       |                |
| Initial Error                            | 1 σ, -40 °C ≤ TA ≤ +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                           | -     | 0.03                    | -     | °/√h           |
| Linear Acceleration Effect               | Average                           | -     | 18                      | -     | (°/h)/G        |
| Noise Density                            | f = 10 Hz to 20 Hz                | -     | 2.52                    | -     | (°/h)/√Hz, rms |
| <b>Frequency Property</b>                |                                   |       |                         |       |                |
| 3 dB Bandwidth                           |                                   | -     | 189                     | -     | Hz             |
| <b>ACCELEROMETERS</b>                    |                                   |       |                         |       |                |
| Sensitivity                              |                                   |       |                         |       |                |
| Output Range                             |                                   | -     | ±10                     | -     | G              |
| Scale Factor                             | 16 bit                            | -0.1% | 2.5                     | +0.1% | LSB /mG        |
|                                          | 32 bit                            | -0.1% | 2.5 x(2 <sup>16</sup> ) | +0.1% |                |
| Nonlinearity<br>(Best fit straight line) | 1 σ, <5 G                         | -     | 0.1                     | -     | % of FS        |
| Misalignment                             | 1 σ, Axis-to-axis, Δ = 90 ° ideal | -     | 0.01                    | -     | °              |
| <b>Bias</b>                              |                                   |       |                         |       |                |
| Initial Error                            | 1 σ, -40 °C ≤ TA ≤ +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 Hz to 20 Hz                | -     | 60                      | -     | μG/√Hz, rms    |
| <b>Frequency Property</b>                |                                   |       |                         |       |                |
| 3 dB Bandwidth                           |                                   | -     | 167                     | -     | Hz             |
| <b>TEMPERATURE SENSOR</b>                |                                   |       |                         |       |                |
| Scale Factor *1*2                        | Output = 2634(0x0A4A)<br>@ +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.

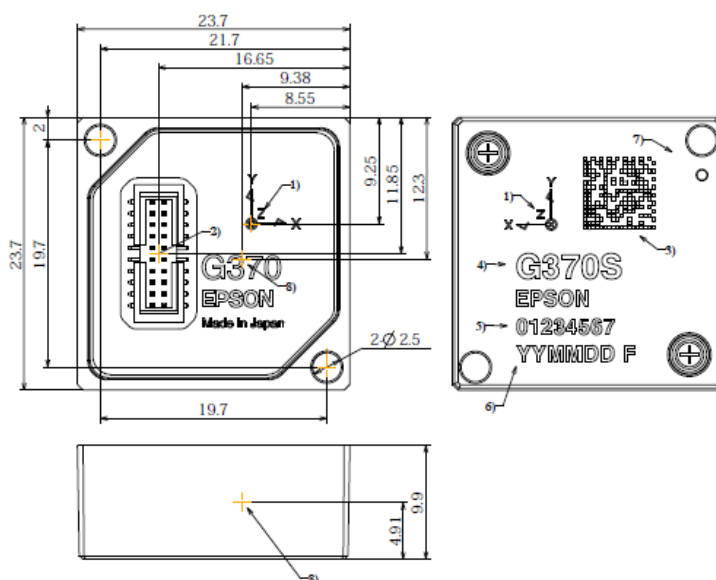
Note) The Typ values in the specifications are average values or 1σ values.

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  | —    | Vcc      | V    |
| Digital Output Voltage to GND |                                       | -0.3 | —    | Vcc +0.3 | V    |
| Calibration Temperature Range | Performance parameters are applicable | -40  | —    | 85       | °C   |
| Operating Temperature Range   |                                       | -40  | —    | 85       | °C   |

## OUTLINE DIMENSIONS



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