M-G365PDC0/PDF0

EPSON
EXCEED YOUR VISION

IMU (Inertial Measurement Unit)

■ GENERAL DESCRIPTION

The M-G365PDC0/PDF0 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-G365PDC0/PDF0 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.

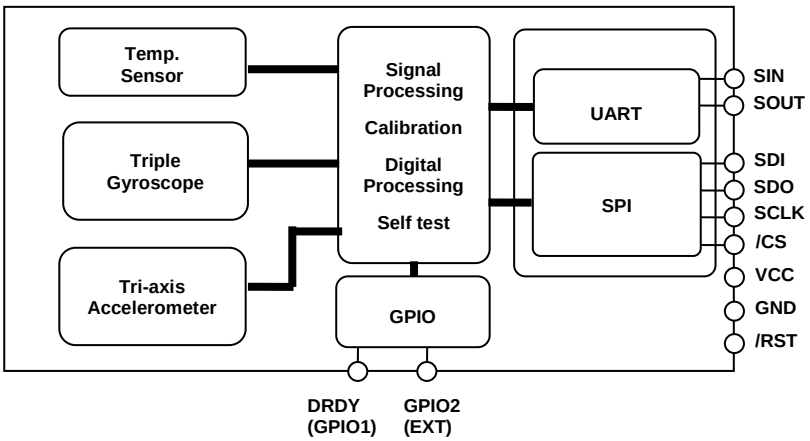
■ FEATURES

- Small Size, Lightweight : 24x24x10mm, 10grams
- Low-Noise, High-Stability
  - Gyro In-Run Bias Stability : 1.2 deg/h
  - Angular Random Walk : 0.08 deg/rt(hr)
- Initial Bias Error : 0.1 deg/s (1σ) / 3mG (1σ)
- 6 Degrees Of Freedom
  Triple Gyroscopes : ±450 deg/s,
  Tri-Axis Accelerometer : ±4 G (PDC0) / ±10 G (PDF0)
- 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
- Attitude Output Accuracy : ±0.2 deg
- 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 deg/s, ≤±1G, unless otherwise noted.

Parameter	Test Conditions / Comments	Min	Typ	Max	Unit
GYRO SENSOR					
Sensitivity					
Dynamic Range		—	±450	—	deg/s
Scale Factor	16bit	-0.2%	66	+0.2%	LSB/(deg/s)
	32bit	-0.2%	66x(2^16)	+0.2%	
Nonlinearity	1 σ, <300 deg/s	—	0.05	—	% of FS
(Best fit straight line)	1 σ, >300 deg/s	—	0.2	—	% of FS
Misalignment	1 σ, Axis-to-axis, Δ = 90° ideal	—	0.01	—	deg
Bias					
Initial Error	1 σ, −40°C ≤ T_A ≤ +85°C	—	0.1	—	deg/s
Repeatability	1 σ, turn-on to turn-on *3	—	0.01	—	deg/s
In-Run Bias Stability	Average	—	1.2	—	deg/hr
Angular Random Walk	Average	—	0.08	—	deg/√hr
Linear Acceleration Effect	Average	—	0.005	—	(deg/s)/G
Noise Density	f = 10 to 20 Hz	—	0.002	—	(deg/s)/√Hz, rms
Frequency Property					
3 dB Bandwidth		—	472	—	Hz
ACCELEROMETERS					
Sensitivity					
Dynamic Range	PDC0	—	±4	—	G
	PDF0	—	±10	—	
Scale Factor	PDC0 : 16bit	-0.1%	6.25	+0.1%	LSB/mG
	PDF0 : 16bit	-0.1%	2.5	+0.1%	
	PDC0 : 32bit	-0.1%	6.25x(2^16)	+0.1%	
	PDF0 : 32bit	-0.1%	2.5x(2^16)	+0.1%	
Nonlinearity	PDC0 : 1 σ, <2G	—	0.1	—	% of FS
(Best fit straight line)	PDF0 : 1 σ, <5G				
Misalignment	1 σ, Axis-to-axis, Δ = 90° ideal	—	0.01	—	deg
Bias					
Initial Error	1 σ, −40°C ≤ T_A ≤ +85°C	—	3	—	mG
Repeatability	1 σ, turn-on to turn-on *3	—	3	—	mG
In Run Bias Stability	PDC0 : Average	—	8	—	uG
	PDF0 : Average	—	14	—	
Velocity Random Walk	PDC0 : Average	—	0.02	—	(m/sec)/√hr
	PDF0 : Average	—	0.04	—	
Noise Density	PDC0 : f = 10 to 20 Hz	—	48	—	uG/√Hz, rms
	PDF0 : f = 10 to 20 Hz	—	80	—	
Frequency Property					
3 dB Bandwidth		—	167	—	Hz
ATTITUDE OUTPUT					
Dynamic Range	Inclination Mode	-80	—	+80	deg
	Euler Mode ANG1:Roll	-45	—	+45	
	ANG2:Pitch	-180	—	+180	
	ANG3:Yaw *4	-180	—	+180	
Scale Factor	16bit	—	0.00012207	—	rad/LSB
		—	0.00699411	—	deg/LSB
Accuracy	1 σ, Static *4	—	0.2	—	deg
	1 σ, Dynamic *4*5 (100dps, max)	—	0.2	—	
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.
*4) Yaw axis is not compensated for errors caused by drift.
*5) Dynamic accuracy is based on measurement data that has been measured from a stationary state.
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