Tactical MEMS

6-DOF Inertial Sensor

FSS-IMU614E Product Manual

Characteristic

Tactical MEMS gyroscope

- **3.0°/h bias stability**
- **0.04°/s bias repeatability**
- **0.05°/s output noise**

Tactical MEMS accelerometer

- **Zero bias stability of 30ug**
- **1 mg bias repeatability**
- **0.7mg output noise**

Wide range temperature compensation

- **Temperature compensation from -40 ℃ to 85 ℃**
- **Fine temperature calibration**

Turntable Calibration

- **Independent calibration for each module: sensitivity, bias, non-orthogonal error**
- **Provide user installation error calibration interface**

High reliability

- **Shock resistance: 2000g (0.5ms, half sine, 3-axis)**
- **Stable operation at full temperature: -40 ℃~85℃**
- **100% magnetic shielding**

Flexible digital interface, small size

- **Configurable output sampling rate up to 400Hz**
- **Support serial port, I2C, SPI multiple interfaces**
- **Size of 14.5 * 17 * 3.7mm and weighs only 2g**

Product Description

FSS-IMU614E is a 6-DOF MEMS inertial sensor module made by Forsense technology. Standard outputs are three-axis gyroscope and acceleration informations and high-precision attitude angles.

It is high precision, high resolution, it can capture subtle vibration and tilt. The output of a large number of processes makes it possible to sense the movement in large dynamic situations. All modules are equipped with wide temperature range of temperature compensation and independent calibration in the factory, so that the module can work in various extreme conditions, and ensure the high consistency.

The reserved integrated navigation interface can be compatible with the current mainstream satellite navigation.

Application Area

- Automatic driving: vehicle, agricultural machinery, engineering vehicle, underwater
- Precision measurement: underground, tunnel, vibration, tilt
- Stable platform: PTZ, UAV
- Automatic control: industrial equipment, automatic control system

On the basis of standard performance and output parameters, Forsense also provides **customized services for your special needs**.

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1. Performance Paeameter

1.1 Key specification of Gyroscope

Table 1 Key specification of Gyroscope

Parameter	Test conditions /remarks	Min	Typ	Max	Unit
Measuring range			±500		°/s
Bias stability X-axis	@25℃, 1σ		3.0		°/hr
Bias stability Y-axis	@25℃, 1σ		2.0		°/hr
Bias stability Z-axis	@25℃, 1σ		2.0		°/hr
Bias repeatability	@25℃, 1σ		0.04		°/hr
Non orthogonal between axes			±1.0		‰
G value sensitive error			0.007		°/s/g
Internal low pass cutoff frequency	Software adjustable	0.2	47	47	Hz
ODR[1]		1	100	400	Hz
Measurement delay				5.0	ms
Zero bias variation in full temperature range[2]	-40 ~ 85℃， rms		0.015		°/s
Random walk X-axis[3]	Allan variance@25℃， 1σ		0.4		$°/\sqrt{hr}$
Random walk Y-axis	Allan variance@25℃， 1σ		0.2		$°/\sqrt{hr}$
Random walk Z-axis	Allan variance@25℃， 1σ		0.2		$°/\sqrt{hr}$
Output noise[4]	rms@47Hz cf		0.05		°/s
Scale factor error			±0.6‰		
Scale factor nonlinearity			0.05%		

[1]The maximum output update rate is not greater than 200Hz@115200bps

[2]Temperature range means the test environment, but also the RMS value

[3]According to IEEE standard, Allan variance curve is given under static 25 ℃

[4]RMS index under static 25 ℃ environment and cut-off frequency of 47Hz

1.2 Key specifications of Accelerometer

Table 2 Key specifications of Accelerometer

Parameter	Test conditions /remarks	Min	Typ	Max	Unit
Measuring range			±6		g
Bias stability	@25℃, 1σ		30		μg
Bias repeatability	@25℃, 1σ		1.0		mg
Non orthogonal between axes			±1.0		‰
Internal low pass cutoff frequency	Software adjustable	0.2	47	47	Hz
ODR[1]		1	100	400	Hz
Measurement delay				5.0	ms
Zero bias variation in full temperature range[2]	-40 ~ 85℃， rms		1.5		mg
Random walk X-axis[3]	Allan variance@25℃， 1σ		0.05		$m/s/\sqrt{hr}$
Random walk Y-axis	Allan variance@25℃， 1σ		0.04		$m/s/\sqrt{hr}$
Random walk Z-axis	Allan variance@25℃， 1σ		0.04		$m/s/\sqrt{hr}$
Output noise[4]	rms@47Hz cf		0.7		mg

[1]The maximum output update rate is not greater than 200Hz@115200bps

[2]Temperature range means the test environment, but also the RMS value

[3]According to IEEE standard, Allan variance curve is given under static 25 ℃

[4]RMS index under static 25 ℃ environment and cut-off frequency of 47Hz

1.3 Key parameters of Attitude Angle

Table 3 Key parameters of Attitude Angle

Parameter	Test conditions /remarks	Min	Typ	Max	Unit
Roll angle	Static / Dynamic		±0.3/±0.8		°
Pitch angle	Static / Dynamic		±0.3/±0.8		°
Heading angle	@10min， dynamic, non auxiliary, discontinuous rotation		±2.5		°
ODR[1]		1	100	400	Hz

[1]The maximum output update rate is not greater than 200Hz@115200bps

注 The condition of attitude accuracy measurement is that the carrier moves smoothly.

Figure 1 Allan variance curve of Gyroscope

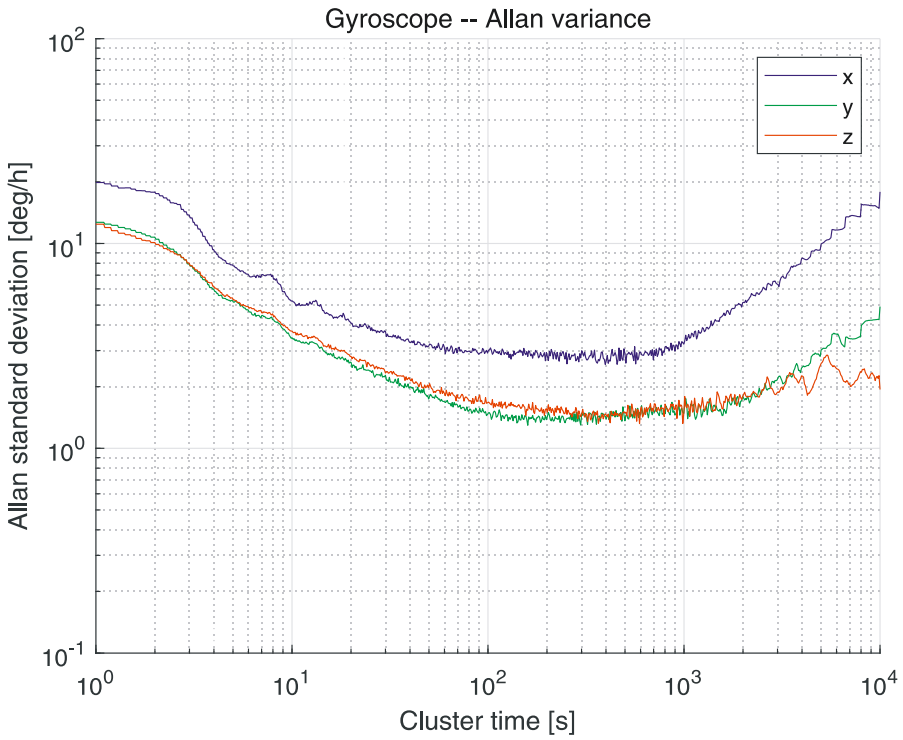
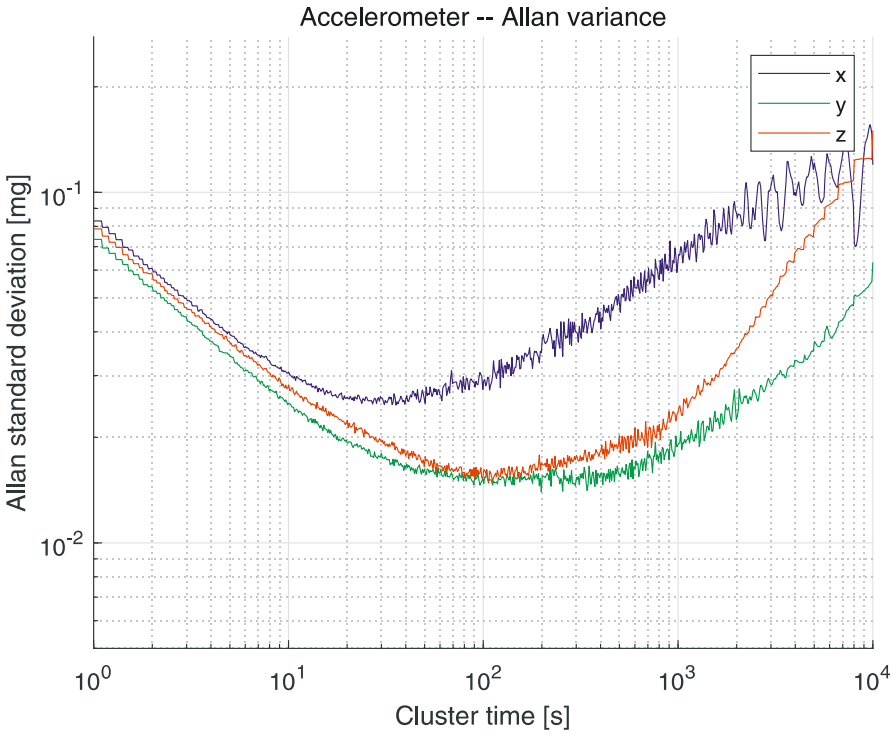
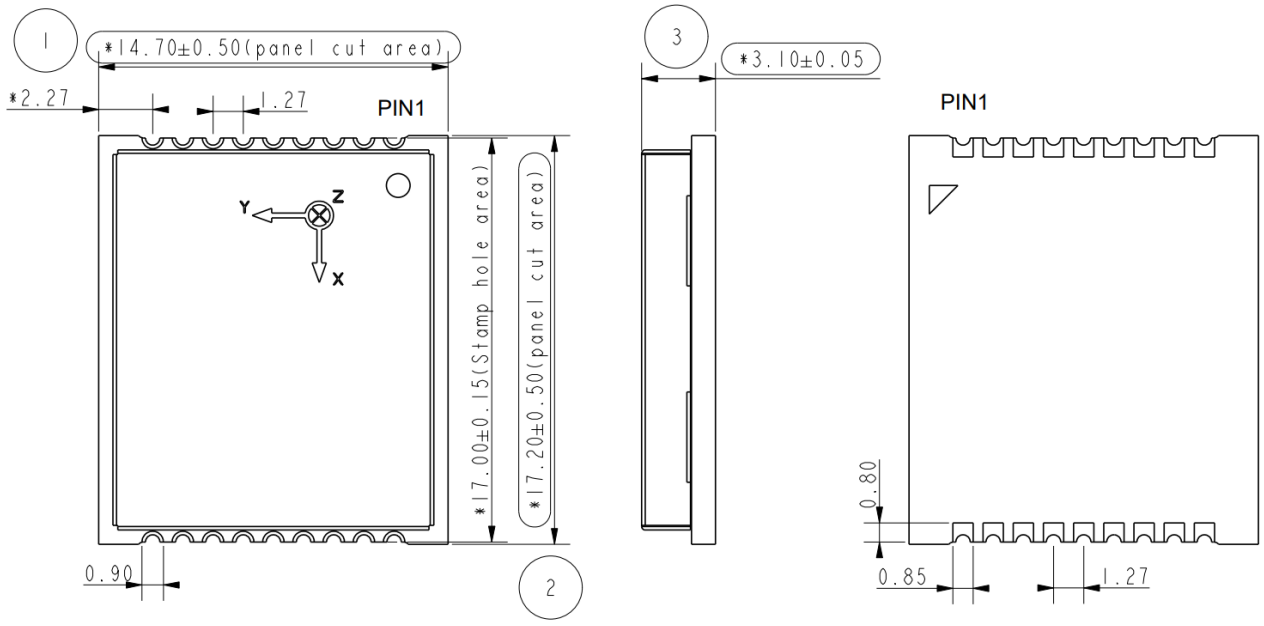


Figure 2 Allan variance curve of Accelerometer



2. Configuration

Figure 3 Outline structure and dimensions（Company：mm）



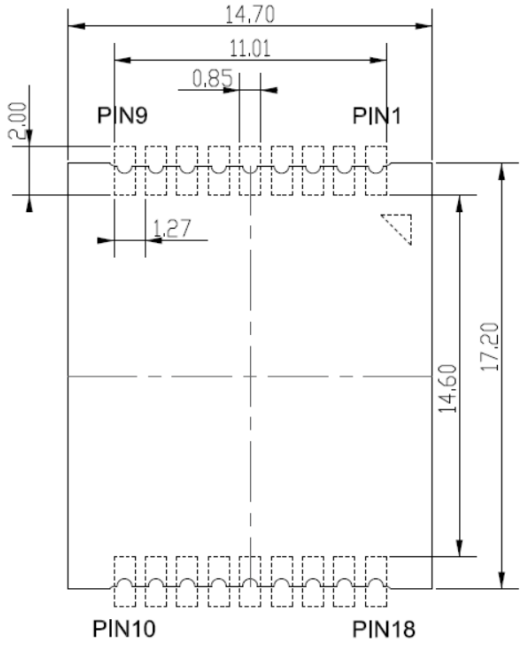
3. Electrical Characteristics

Table 4 Electrical characteristics

Parameter	Symbol	Interface type	Min	Max	Unit
Power input	VCC		3.0	3.3	V
Power ground	GND				
Serial output	TX1	UART	0.3	3.3	V
Serial input	RX1	UART	0.3	3.3	V
Reserved pin	NC	IO	0.3	3.3	V
Electric current	I		50	150	mA
Temperature	T		-45	85	℃

4. Pin Description

Figure 4 Pin diagram



RECOMMENDED PCB LAYOUT TOP VIEW

Table 5 Pin description

Pin	Signal	Remarks
1	VCC	Power input, 2.8 ~ 3.3V input, 60mA, ripple wave no more than 40mv
2	GND	Power ground
3	RST	External reset pin, recommended to be empty or external pull-up
4	SWDIO	Factory burn
5	SWCLK	Factory burn
6	TX2	Serial port 2 is used to upgrade IMU firmware. It is recommended to lead out test points
7	RX2	Serial port 2 is used to upgrade IMU firmware. It is recommended to lead out test points
8	TX1	IMU data communication port(LVTTL)
9	RX1	IMU data communication port(LVTTL)
10	I2C_SCL	Standby I2C interface
11	I2C_SDA	Standby I2C interface
12	RX3	Standby interface

13	MOSI	SPI data input
14	MISO	SPI data output
15	SCK	SPI serial clock
16	NSS	Selected SPI films
17	PPS	External synchronous sampling trigger signal
18	DR	Data ready indication

注1 When the host is initialized, reset the IMU hardware once by using / rst