1 FEATURES

1.1 Hardware

- High performance MEMS IMU
- Factory temperature compensation from -40 to 85°C, calibrated for scale factor,cross-axis and zero bias
- Gyroscope zero bias instability up to 1.6°/h
- Accelerometer zero bias instability up to 18ug
- Fully symmetrical design
- Supports programmable IO output signals (including but not limited to synchronization input/output, alarm functions, etc.)
- Excellent vibration resistance
- Integrated temperature sensor
- Surface mount package, easy to integrate
- RoHS, CE certification
- Integrated hardware reset circuit (CH040/CH040MP only)

1.2 Software

- Adaptive Extended Kalman Filter fusion algorithm, up to 1KHz output
- Excellent dynamic tracking performance and superior vibration suppression capabilities
- Outstanding linear acceleration rejection
- Startup time<1s
- Supports multiple protocols: Binary, CANopen, Modbus,etc.
- Direct data output without external configuration commands
- Rich user-configurable commands
- Multi-functional GUI for easy operation
- Demo codes for ROS, C etc.

2 APPLICATION

- Precision instrumentation
- Platform stabilization and control
- Construction machinery
- Construction machinery
- Construction machinery

3 DESCRIPTION

3.1 Product appearance

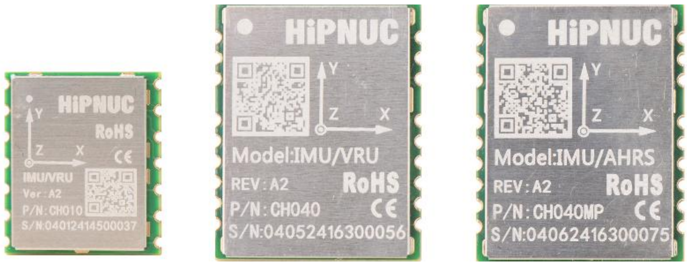

Figure1: CH0X0

3.2 System block diagram

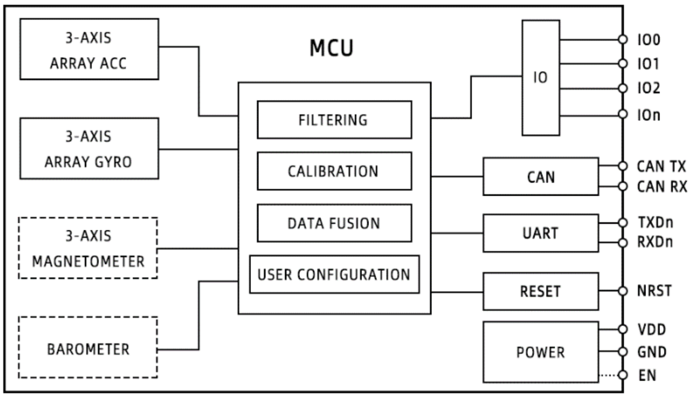

Figure2: Functional Block Diagram

Note1: Dotted lines indicate features not available on all models (refer to Table 1).

3.3 General description

The CH0X0 series integrates MEMS-IMU, magnetometer, and barometer to form IMU/VRU/AHRS sensors. Equipped with proprietary adaptive EKF, IMU noise dynamic analysis, and motion state estimation algorithms, it delivers high-accuracy attitude measurements under dynamic conditions while minimizing forward-angle drift.

Each sensor undergoes rigorous factory compensation for temperature, bias, scale factor, and cross-axis errors.

Data transmission via UART with rich user configuration options. For CAN interface, users must integrate external CAN transceivers.

The GUI can rapid product configuration,including module setup,data display,firmware updates,and data logging.

For ordering information, see Tables 1-2.

Content

4 PRODUCT ORDERING

4.1 Ordering Information

Table 1: Ordering Information

Part Number	Name	Description	Note
CH010	IMU/VRU Module	6DoF 3°/h 30ug	
CH020	IMU/VRU Module	6DoF 2.2°/h 22ug	
CH040	IMU/VRU Module	6DoF 1.6°/h 18ug	
CH040MP	IMU/AHRS Module	6DoF+Magnetic+Pressure 1.6°/h 18ug	

4.2 Contact us

1. Email:overseas1@hipnuc.com
2. web: www.hipnuc.com

5 DOCUMENT INFORMATION

5.1 Scope

5.1.1 Firmware Revision

Firmware: Features require ≥ v1.5.4 (subject to confirmation)

5.1.2 Hardware Revision

Compatible with version ≥ A2 modules

5.2 Document Revision

Table 2: Document revision

Rev	Date	Author	Changes
1.0	2024-4-23	Hipnuc	Initial version
1.1	2024-7-15	Hipnuc	Adjust the shielding cover pins
1.2	2024-7-17	Hipnuc	更改多功能 IO 引脚的复用说明，以及规格书样式
1.3	2024-10-22	Hipnuc	变更 9.1，9.4 的 F1 型号与规格
1.4	2024-10-25	Hipnuc	变更推荐封装尺寸
1.5	2024-11-21	Hipnuc	变更 7.14 产品尺寸，以及 9.2 同步信号说明
1.6	2025-3-13	Hipnuc	增加 15 章节-常见问题 更新 Allan 方差参数 增加 10s 平滑指标

5.3 Related Documents

1. *Command&Programing Manual*
2. *CAE/Package*
3. *EVAL-CH0X0 User Manual*
4. *CE/RoHS Certificates*
5. *GUI&Demo code*
6. *CH0X0 Test Reports*

6 SPECIFICATIONS

If there are no special remarks,the test temperature is 25℃,the supply voltage is 5V,the gyroscope range is 2000°/s,the accelerometer range is 12g,and the magnetic field range is 2 Gauss.

6.1 Absolute Maximum Ratings

Table 3: Absolute maximum ratings

Parameters	Limit	Comment
Mechanical Shock	2000g	Duration <1ms
Storage Temperature	-40℃-85℃	
ESD HBM	2KV	JEDEC/ESDA JS-001
Input Voltage	6.5V	
IO To GND	-0.3-5V	

6.2 Normal Operating Conditions

Table 4: Normal operating conditions

Parameters	Condition	Min	Nom	Max	Unit	Note
Input Voltage		3.2	-	5.5	V	
Power Consumption	CH010			160	mW	
	CH020			205		
	CH040/CH040MP			305		
Operating Temperature		-40	-	85	℃	
Gyroscope Range		125	2000	2000	°/s	1
Accelerometer Range		3	12	24	g	1
Startup Time				2	s	2

Note1: If you need to configure other ranges, please refer to the command and programming manual for configuration

Note2: The startup time refers to the duration from powering on the system to the output of valid data. During this period, the module should remain stationary.

6.3 Interface

Table 5: Interface parameters

Interf	Parameters	Condition	Min	Nom	Max	Unit	Note
UART(TTL)	Baud Rate		9600	115200	921600	bps	
	Start bit		0	1		bit	
	Data Length		0	8		bits	
	Stop Bit			1		bit	
	Parity			None		bit	
	Output Frame Rate		0	100	1000	Hz	1
	Logic Voltage	High	2.0	3.3	3.6	V	
		Low			0.6		
CAN	Baud Rate		125	500	1000	kbps	2
	Output Frame Rate		5	100	200	Hz	3
	Logic Voltage	High	2.0	3.3	3.6	V	
		Low			0.6		
NRST(RESET)	Logic Voltage	High	2.0	3.3	3.6	V	
		Low			0.6		
	Reset Time		140			ms	
IO	Logic Voltage	High	2.0			V	
		Low			0.6		
	Synchronous Trigger Delay	From trigger generation to data transmission			800	us	4

Note1: The sensor supports data output at 1, 5, 10, 50, 100, 200, 250, 500, and 1000 Hz

Note2: The supported baud rates for CAN communication are 125K, 250K, 500K, and 1000K

Note3: The sensor supports data output at 5, 10, 50, 100, and 200 Hz for CAN communication

Note4: For multifunction IO operations and configuration, please refer to the command and programming manual

6.4 Gyroscope

Table 6: Gyroscope parameters

Parameters	Condition	Product	Min	Nom	Max	Unit	Note
Range				2000		°/s	
Resolution				16bit			
Scale Factor	100°/s	CH010 CH020 CH040/CH040MP		<600 <500 <280	800 750 350	ppm	1
Scale Factor Asymmetry			-0.03		0.03	%	1
Scale Factor Nonlinearity	Best Fit Line Fs=250°/s		-0.03	-	0.03	%Fs	1,2
3dB Bandwidth				116		Hz	
Sampling Rate				1000		Hz	
Bias Instability	Allan Variance	CH010 CH020 CH040/CH040MP		3 2.2 1.6		°/h	3
Bias Stability	10s Smoothing	CH010 CH020 CH040/CH040MP		10 7 5		°/h	
Bias Repeatability	Allan Variance	CH010 CH020 CH040/CH040MP		15 12 8		°/h	3
Angle Random Walk	Allan Variance	CH010 CH020 CH040/CH040MP		0.42 0.33 0.25		°/√h	3
Bias Temperature Variation -40-85℃	Z Y X			0.015 0.05 0.03	0.035 0.18 0.08	°/s	
Accelerometer Sensitivity	All three axis			0.1		°/s/g	

Note1: The turntable rotates 10 turns in both directions, and the average is measured. This value may be affected after user soldering; please refer to actual conditions.

Note2: Maximum deviation from the best fit line within the specified range.

Note3: Average value of test samples, reference 6.9 - Allan variance curve.

6.5 Accelerometer

Table 7: Accelerometer parameters

Parameters	Condition	Product	Min	Nom	Max	Unit	Note
Range				12		g	
Resolution				16bit			
Initial Bias					10	mg	1
Nonlinearity	Best Fit Line Fs=3g			0.5		%Fs	2
3dB Bandwidth				145		Hz	
Sampling Rate				1600		Hz	
Bias Instability	Allan Variance	CH010		30		ug	3
		CH020		22			
		CH040/CH040MP		18			
Bias Stability	10s Smoothing	CH010		70		ug	
		CH020		50			
		CH040/CH040MP		35			
Bias Repeatability	Allan Variance	CH010		0.34		mg	3
		CH020		0.3			
		CH040/CH040MP		0.15			
Random Walk	Allan Variance	CH010		0.08		m/s√h	3
		CH020		0.06			
		CH040/CH040MP		0.04			
Bias Temperature Variation	-40-85℃			1	5	mg	

Note1: This value may change after user soldering; please refer to actual conditions.

Note2: Maximum deviation from the best fit line within the specified range.

Note3: Average value of test samples, reference 6.9 - Allan variance curve.

6.6 Magnetometer

Table 8: 6.6 Magnetometer parameters

Parameters	Condition	Min	Nom	Max	Unit	Note
Range			2	8	Gauss	
Resolution	Fs=2G		2		mGauss	
Sampling Rate			200Hz			
Linearity	Best Fit Line Fs=2G		0.1		Fs%	

6.7 Barometer

Table 9: Barometer parameters

Parameters	Condition	Min	Nom	Max	Unit	Note
Range		300	-	1200	hPa	
Resolution			± 0.006		hPa	
Accuracy			± 0.06		hPa	

6.8 Temperature Sensor

Table 10: Temperature sensor parameters

Parameters	Condition	Min	Nom	Max	Unit	Note
Range		-104	-	150	℃	
Offset error			±1		K	

6.9 Allan Variance

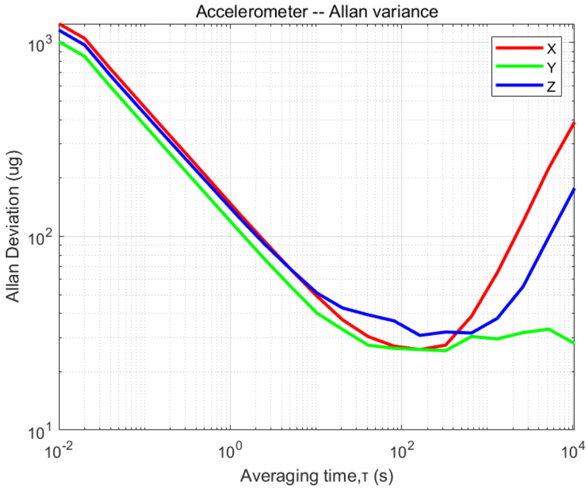

Figure3: CH010 Accelerometer Allan Variance

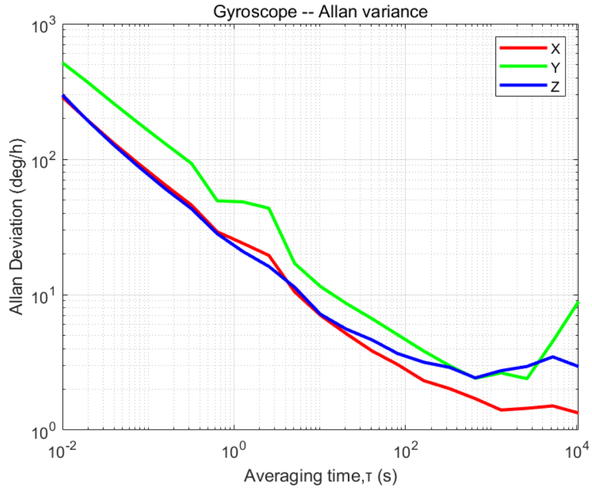

Figure4: CH010 Gyroscope Allan Variance

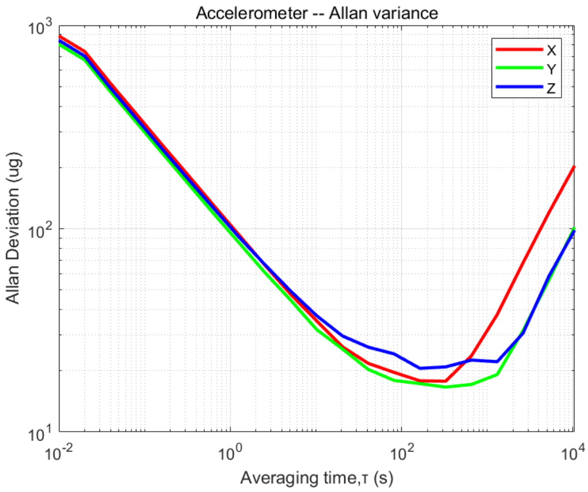

Figure5: CH020 Accelerometer Allan Variance

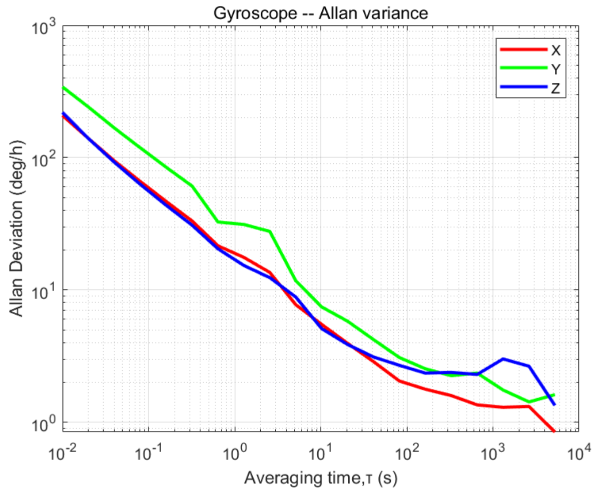

Figure6: CH020 Gyroscope Allan Variance

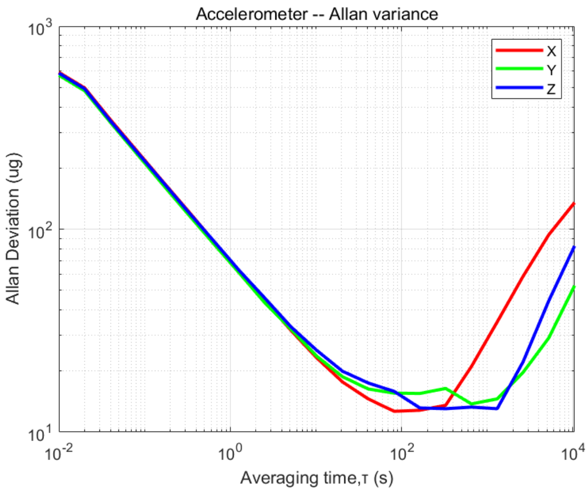

Figure7: CH040 Accelerometer Allan Variance

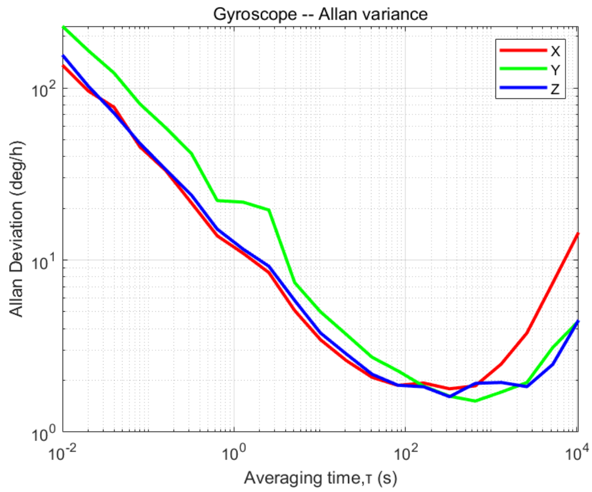

Figure8: CH040 Gyroscope Allan Variance

6.10 Fusion Parameters

Table 11: Fusion prarameters

Parameters	Value
Pitch	±90°
Roll	±180°
Yaw	±180°
Quaternion	Support
Resolution	0.01°

6.11 Attitude Angle Accuracy

Table 12: Attitude angle accuracy

Parameters	Condition	Product	Min	Nom	Max	Unit	Note
Pitch/Roll (Static)				0.1	0.2	°	1
Pitch/Roll (Dynamic)				0.1	0.2	°	1
Yaw Angle Static Drift (6DOF)	Static 2h			0.1	0.2	°	2
Yaw Angle Dynamic Drift (6DOF)		CH010 CH020 CH040/CH040MP		9 7 5		°	3
Yaw Angle Magnetic Assistance (AHRS)		CH040MP		2	3	°	4
Yaw Angle Rotation Error (6DOF)	100°/s rotation	CH010 CH020 CH040/CH040MP		<1	3 2.5 1.3	°	1,5

Note1: This value may be affected after soldering; please refer to actual conditions.

Note2: The module is level and stationary for 2 hours.

Note3: The module was measured while moving on an indoor cleaning robot for 1 hour. 1σ.

Note4: Measured after geomagnetic calibration, with no magnetic field interference nearby. The product needs to be configured in AHRS mode.

Note5: The turntable rotates continuously for 10 turns, measuring cumulative yaw angle error.

6.12 Mechanical and Environmental Parameters

Table 13: Mechanical and environmental parameters

Parameters	Product	Value
Size	CH010/CH020 CH040/CH040MP	17.78X15.24X2.7mm 25X20X2.7mm
Weight	CH010/CH020 CH040/CH040MP	<1.6g <2.5g
Shiled material		Nickel Copper
Vibration Resistance		1.0mm(10Hz-58Hz)&≤20g(58Hz-600Hz)
Environmental Protection		RoHS Directive 2011/65/EU
CE		LVD Directive 2014/35/EU
Drop Test		Free fall 3 times from a height of 75 cm
Temperature Shock		Temperature rises from -40℃ to 85℃ within 1 hour, 5 times

6.13 Product Dimensions

All Dimensions in mm units.

6.13.1 Mechanical dimensions of CH010/CH020

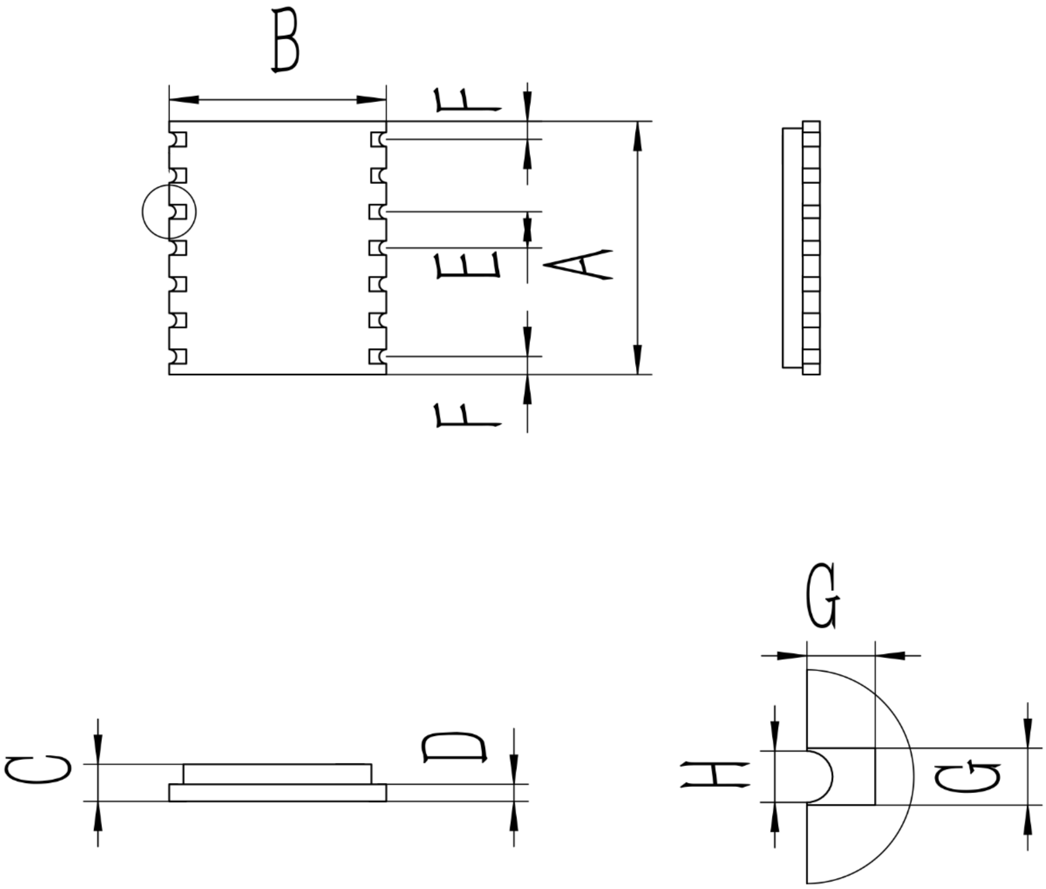

Figure9: CH010/CH020 mechanical dimension

6.13.2 CH010/CH020 dimensions sheet

Symbol	Min(mm)	Typ(mm)	Max(mm)
A	17.58	17.78	17.98
B	15.04	15.24	15.44
C	2.7	2.8	2.9
D	1.1	1.2	1.3
E	2.44	2.54	2.64
F	1.07	1.27	1.47
G	1.1	1.2	1.3
H	0.85	0.9	0.95

6.13.3 Recommended Package Dimensions for CH010/CH020

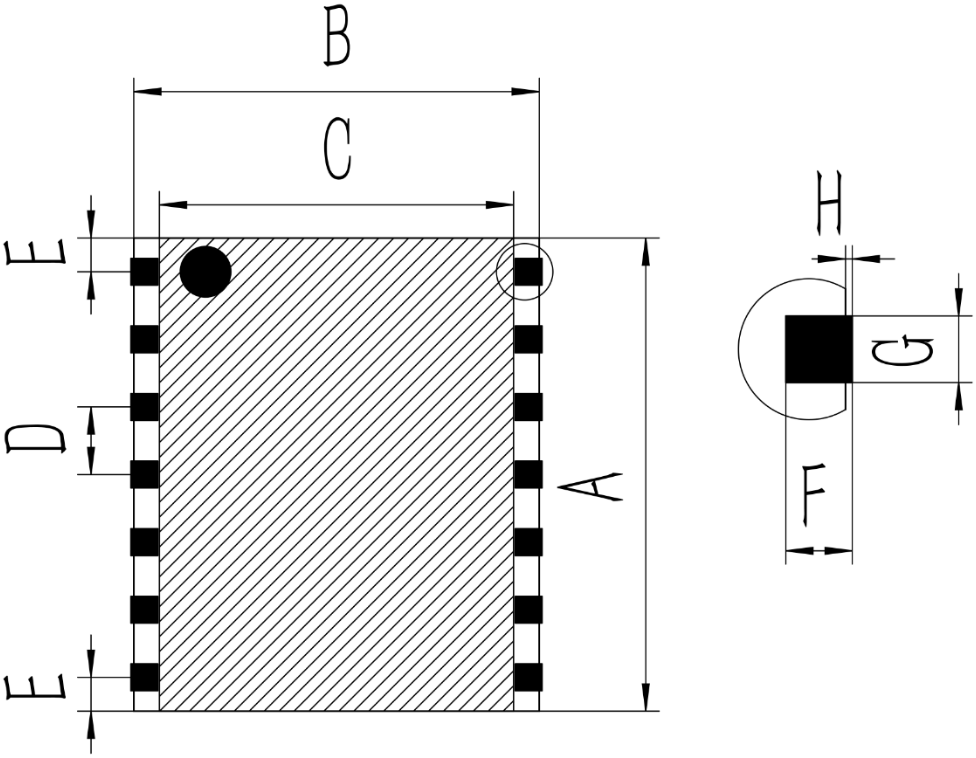

Figure10: CH010/CH020 recommended PCB footprint

Note1: The static copper and traces within the shaded area

6.13.4 Recommended Package Dimensions Data Sheet for CH010/CH020

Symbol	Min(mm)	Typ(mm)	Max(mm)
A		17.78	
B		15.24	
C		13.0	
D		2.54	
E		1.27	
F		1.4	
G		1.2	
H		0.38	

6.13.5 Pin Definitions for CH010/CH020

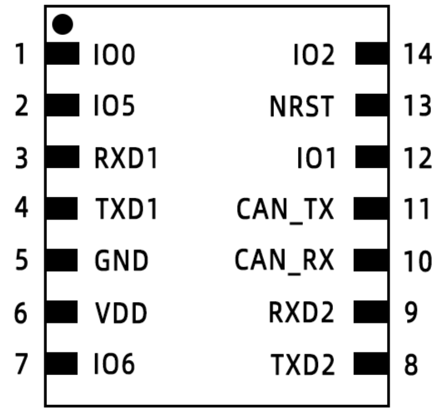

Figure11: CH010/CH020 Pin Name

Table 14: CH010/CH020 pin description

Pin Number	Pin Name	Type	Functional			Note
1	IO0	I/O	Reserved Floating			
2,7,12,14	IO5,IO6,IO1,IO2	I/O	PMUX1	SYNC_IN	Synchronous input/PPS input, can be left floating	1
			PMUX2	SYNC_OUT	Synchronous output, can be left floating	
			PMUX3	LED	LED operation indicator, can be left floating	
			PMUX4	SOUT_DIV	Synchronous output divider, can be left floating	
			PMUX5	ALARM	Alarm signal output, can be left floating	
3	RXD1	I	Module UART1 receive			2
4	TXD1	O	Module UART1 transmit			
5	GND	POWER	GND			
6	VDD	POWER	Power input 3.3-5V			
8	TXD2	O	Module UART2 transmit			
9	RXD2	I	Module UART2 receive			
10	CAN_RX	I	CAN_RX			3
11	CAN_TX	O	CAN_TX			
13	NRST	I	Reset pin, low level resets the module. No external resistor-capacitor needed, recommended to connect to the host GPIO, can also be left floating			

Note1: Multifunctional IO pins, default functions refer to Table 18, detailed descriptions refer to the programming manual.

Note2: UART1 is mainly used for data transmission and module configuration

Note3: If CAN functionality is required, an external CAN transceiver is needed, such as TJA1044GT/3Z.

6.13.6 Mechanical dimensions of CH040/CH040MP

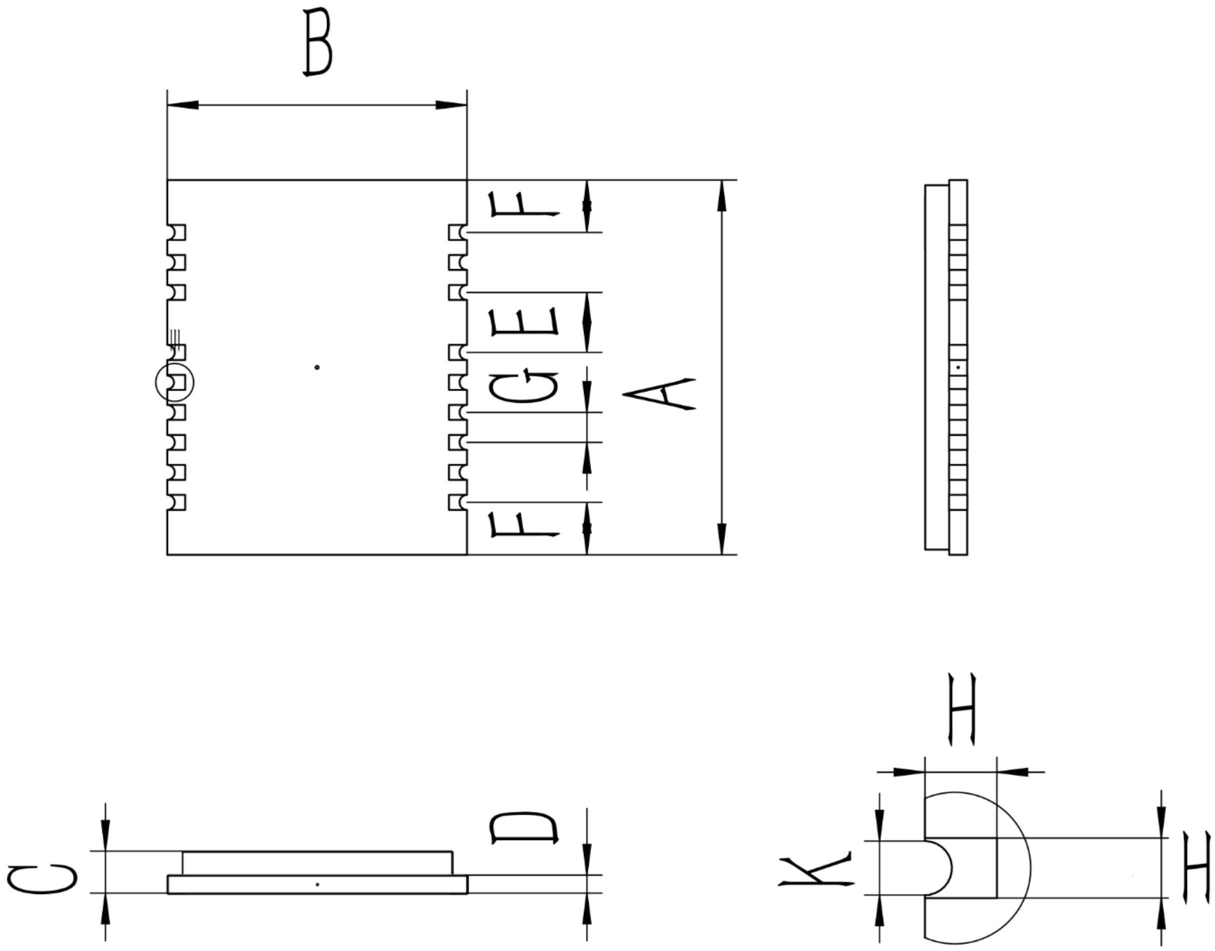

Figure12: CH040/CH040MP mechanical specifications

6.13.7 CH040/CH040MP mechanical dimensions sheet

Symbol	Min(mm)	Typ(mm)	Max(mm)
A	24.8	25	25.2
B	19.8	20	20.2
C	2.5	2.6	2.7
D	0.9	1	1.1
E	3.9	4	4.1
F	3.3	3.5	3.7
G	1.9	2	2.1
H	1.1	1.2	1.3
K	0.85	0.9	0.95

6.13.8 Recommended Package Dimensions for CH040/CH040MP

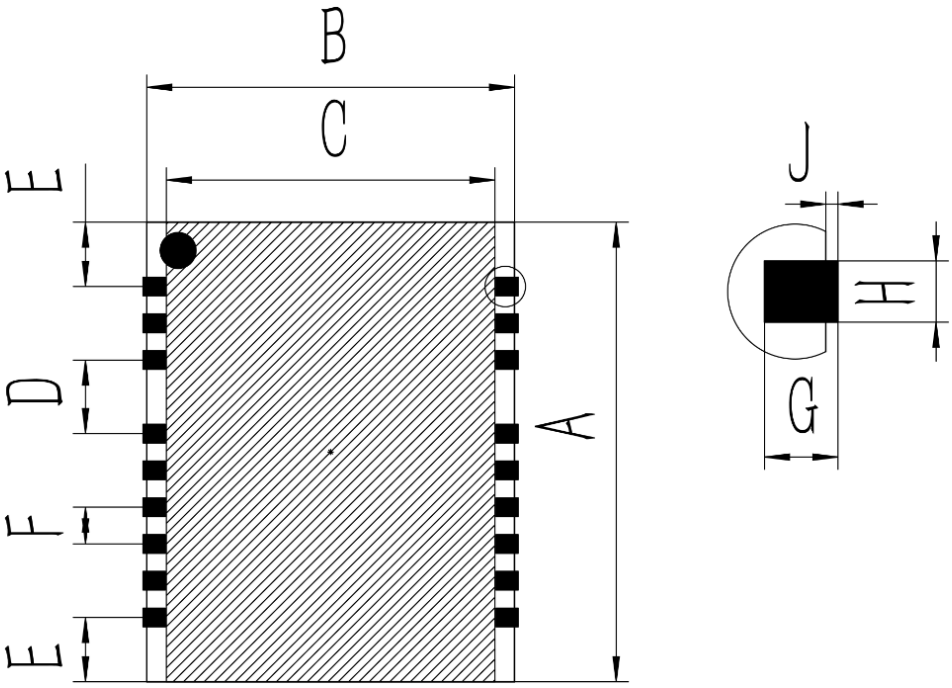

Figure13: CH040/CH040MP recommended PCB footprint

Note1: The static copper and traces within the shaded area

6.13.9 Recommended package dimensions sheet for CH040/CH040MP

Symbol	Min(mm)	Typ(mm)	Max(mm)
A		25	
B		20	
C		18.6	
D		4	
E		3.5	
F		2	
G		1.4	
H		1.2	
J		0.4	

6.13.10 Pin Definitions for CH040/CH040MP

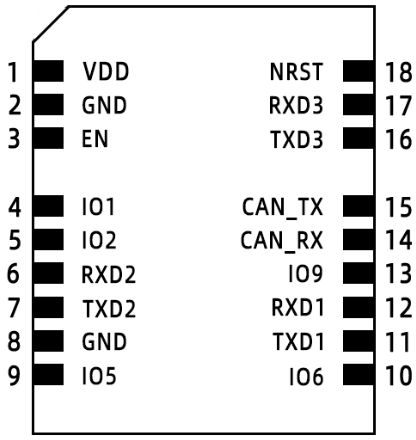

Figure14: CH040/CH040MP Pin Name

Table 15: CH040/CH040MP pin description

Pin Number	Pin Name	Type	Description	Note
1	VDD	POWER	Power input 3.3-5V	
2	GND	POWER	GND	
3	EN	I	Enable pin, active high, internal pull-up; can pull EN low to disable the module, can be left floating	
4,5,9,10	IO1,IO2,IO5,IO6	I/O	PMUX1 SYNC_IN Synchronous input/PPS input, can be left floating	1,
			PMUX2 SYNC_OUT Synchronous output, can be left floating	
			PMUX3 LED LED operation indicator, can be left floating	
			PMUX4 SOUT_DIV Synchronous output divider, can be left floating	
			PMUX5 ALARM Alarm signal output, can be left floating	
6	RXD2	I	Module UART2 receive	
7	TXD2	O	Module UART2 transmit	
8	GND	POWER	GND	
11	TXD1	O	Module UART1 transmit	2
12	RXD1	I	Module UART1 receive	
13	IO9	I/O	Reserved, can be left floating	
14	CAN_RX	I	CAN_RX	3
15	CAN_TX	O	CAN_TX	
16	TXD3	O	Module UART3 transmit; currently needs to be floating	
17	RXD3	I	Module UART3 receive; currently needs to be floating	
18	NRST	I	Reset pin, low level resets the module; can be left floating	

Note1: Multifunctional IO pins, detailed descriptions refer to the programming manual.

Note2: UART1 is mainly used for data transmission and module configuration

Note3: If CAN functionality is required, an external CAN transceiver is needed, such as TJA1044GT/3Z.

Table 16: Default functions of IO pins

IO	Functions
IO1	PMUX1
IO2	PMUX2
IO5	PMUX3
IO6	PMUX4

7 Coordinate System Definition

7.1 Coordinate system

The vehicle coordinate system uses a Right-Front-Up (RFU) coordinate system, while the geographic coordinate system uses an East-North-Up (ENU) coordinate system. The axes for acceleration and gyroscope are shown in the figure below:

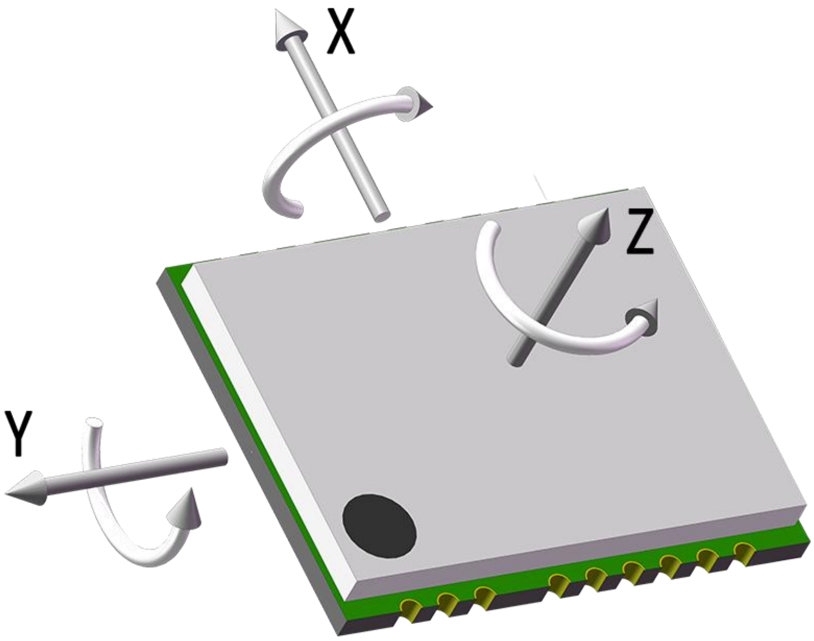

Figure15: CH0X0 Coordinate System

The Euler angle rotation sequence is East-North-Up-312 (first rotate around the Z-axis, then the X-axis, and finally the Y-axis). The specific definitions are as follows:

Rotation around the Z-axis:Yaw\psi(ψ) range: -180° - 180°

Rotation around the X-axis:Pitch\theta(θ) range: -90°-90°

Rotation around the Y-axis:: Roll\phi(ϕ) range: -180°-180°

If the module is viewed as an aircraft, the positive direction of the Y-axis should be considered as the nose direction. When the sensor coordinate system coincides with the inertial coordinate system, the ideal output of the Euler angles is: Pitch = 0°, Roll = 0°, Yaw = 0°.

Users who need to change the default sensor coordinate system can refer to the instructions and programming manual. In addition,the product also supports coordinate systems such as North-West-Up and North-East-Down.

7.2 Sensor Center Position

Table 17: Center position of CH0X0 series sensors

Axis	X-offset	Y-offset	Z-offset	Unit
X	0	0	0	mm
Y	0	0	0	mm
Z	0	0	0	mm

8 Typical Reference Design

8.1 Power Supply

The CH0x0 series features a built-in LDO and power filtering circuit to minimize external power noise interference with the internal system. Therefore, users can choose to power the module using LDO/DC-DC converters, with a voltage range of 3.3-5V.

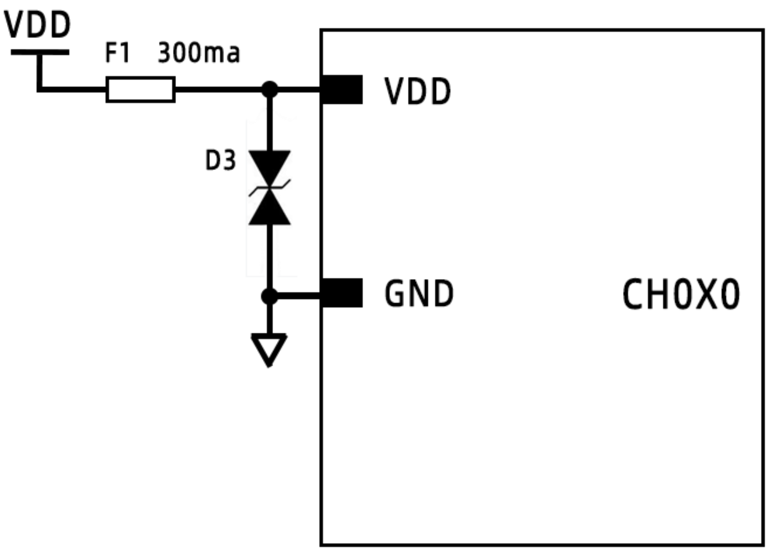

Figure16: CH0X0 Power Reference Circuit

8.2 Serial Communication

It is recommended that the logic level of the user's processor be 3.3V. If communication with 5V or 1.8V processors is required, users need to add a level-shifting chip themselves. Without affecting the serial transmission speed, we recommend the 74LVCH1T45GW,125.

8.2.1 Minimum System Reference Design for Serial Communication

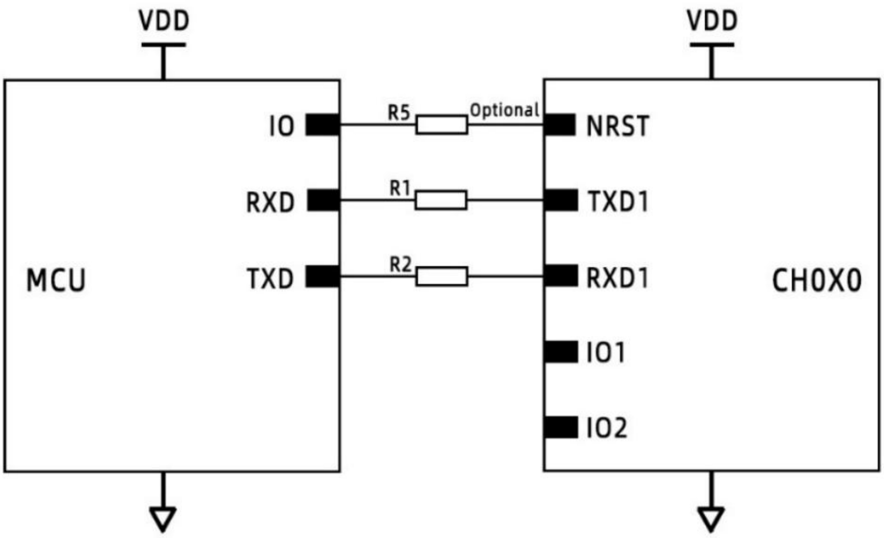

Figure17: CH0X0 CH0X0 Serial Communication Reference Circuit

8.2.2 Serial Communication (IMU and Host Synchronization)

This connection method requires users to connect IO1/IO2 to the host system for data synchronization. They can be used independently, and the specific choice depends on the user's system design.

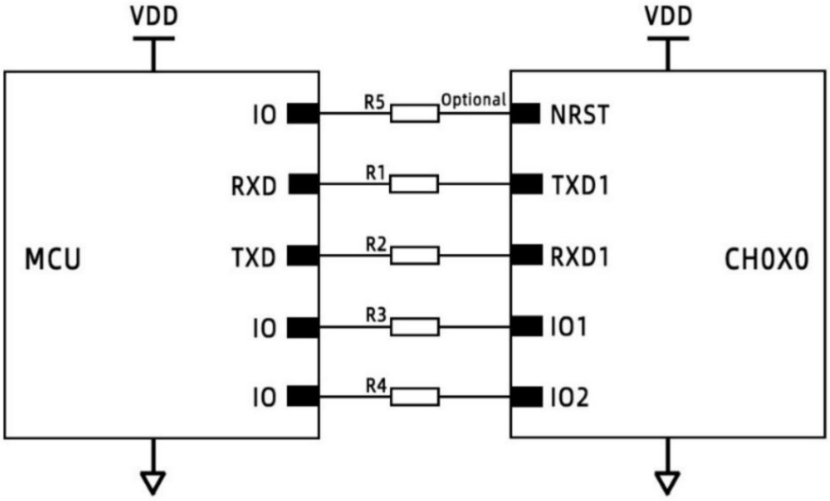

Figure18: CH0X0 Serial Communication and User Host Synchronization

Note1: If the user uses IO1, then IO1 should be set to synchronous input function (PMUX1). At this time, the pulses generated by the MCU IO should be in sync with the data frame rate. GNSS's PPS can also be used for synchronization with the device; for details, refer to the programming manual.

Note2: If the user uses IO2, then IO2 should be set to synchronous output function (PMUX2). At this time, the pulses received by the MCU IO can be either in sync or out of sync with the data frame rate. The default is in sync, which can be treated as a Data Ready signal. For details, refer to the synchronization function and programming manual. It is recommended that users use this method for data synchronization with the host.

8.3 CAN Communication

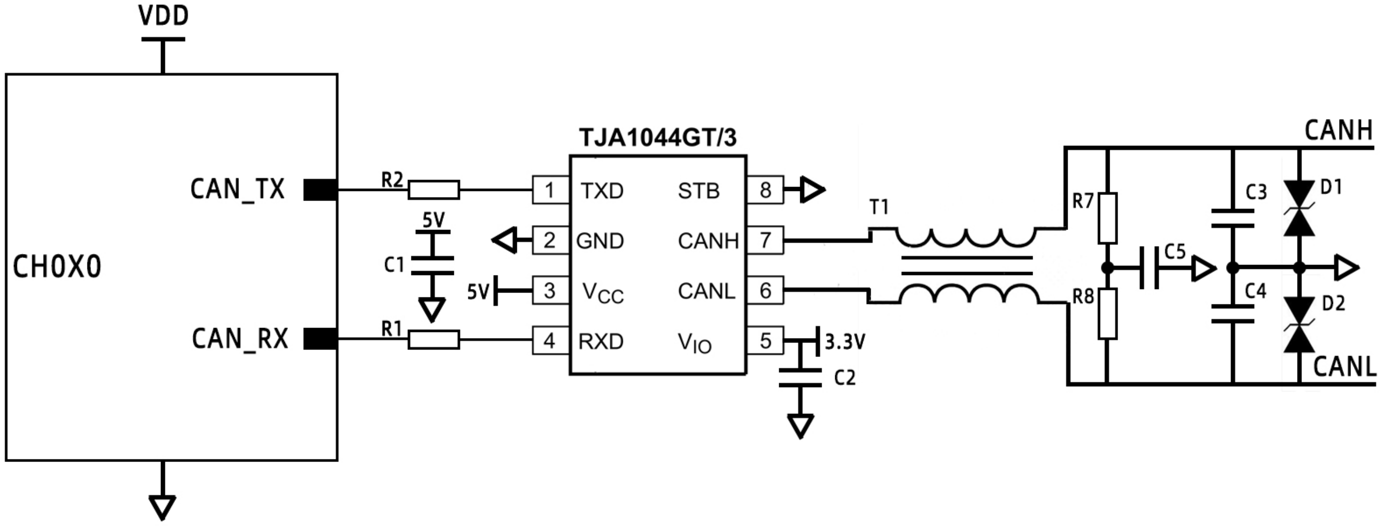

Figure19: CH0X0 Series CAN Communication Circuit Reference

Note1: R6 and R7 are the CAN bus matching resistors, with a resistance value of 60.4Ω. Users can consider whether to solder them based on actual conditions.

8.4 Reference Design BOM

Table 18: Bill of Materials Information for Reference Design

Item	Reference	Part	P/N	Vendor
Fuse	F1	300mA	JK-SMD0603-030-6	JK
TVS	D3	SMF5.0CA	SMF5.0CA	TWGMC
Resistor	R1,R2,R3,R4,R5,R6	1K	RC0402JR-071KL	YAGEO
Resistor	R7,R8	60.4Ω	RC1206FR-0760R4L	YAGEO
Capacitor	C1,C2	0.1uF	CC0402KRX5R7BB104	YAGEO
Capacitor	C3,C4	100pF	CC0402JRNPO9BN101	YAGEO
Capacitor	C5	1nF	CC0402KRX7R9BB102	YAGEO
Common Choke	T1	5.8kΩ@10MHz 100uH@100kHz 150mA	ACT45B-101-2P-TL003	TDK
TVS	D1,D2	SMBJ15CA	SMBJ15CA	BORN

9 Initial Configuration

The CH0X0 series is designed for users to perform minimal configuration to cover the vast majority of application scenarios. Therefore, the default configuration can already meet many working conditions, but we also provide users with additional configuration options to address special scenarios.

9.1 Interface Initial Configuration

Table 19: Interface Initial Configuration

Interf	Parameters	Value	Unit	Note
UART	Baud Rate	115200	bps	2
	Start Bit	1	bit	
	Data Length	8	bits	
	Stop Bit	1	bit	
	Parity Bit	None		1
	Protocol	二进制协议(91)		
	Data Frame Rate	100	Hz	3
CAN	Protocol	CANopen		1
	Baud Rate	500K	bps	2
	Data Frame Rate	100	Hz	3

Note1: For protocol changes, please refer to the instruction and programming manual.

Note2: For baud rate changes, please refer to the instruction and programming manual.

Note3: For output frame rate changes, please refer to the instruction and programming manual.

9.2 Sensor Initial Configuration

Table 20: Sensor initial configuration

Parameters	Value	Unit	Note
Gyroscope Range	±2000	°/s	1
3dB Bandwidth	90	Hz	1
Accelerometer Range	±12	g	1
3dB Bandwidth	80	Hz	1
Magnetometer Range	±2	Gauss	1
Mode	6DOF		1

10 Communication Protocols

10.1 Serial Binary Protocol

To facilitate user usage, we provide a variety of serial protocols for users to choose from. For more detailed information, please refer to the instruction and programming manual.

10.2 Modbus

The RS485 communication protocol follows the Modbus RTU protocol specification. Data is sent and received in registers, with each register occupying 2 bytes and using big-endian format (most significant byte first). For detailed protocol information, please refer to the instruction and programming manual.

10.3 CAN

10.3.1 CANopen

The CAN interface complies with the CANopen protocol, and all communications use standard data frames, transmitting data using TPDO1-7. It does not receive/send remote frames or extended data frames, and all TPDOs use asynchronous timed triggering mode. For detailed protocol information, please refer to the instruction and programming manual.

10.3.2 J1939

The default output protocol for the module is CANopen. If SAE J1939 protocol is required, please contact us.

11 SMT and INSTALLATION

11.1 SMT Profile

The recommended SMT profile is shown in the figure below, with a peak temperature of up to 250°C. It is generally not recommended for users to manually solder the module, as this may affect the module's accuracy.

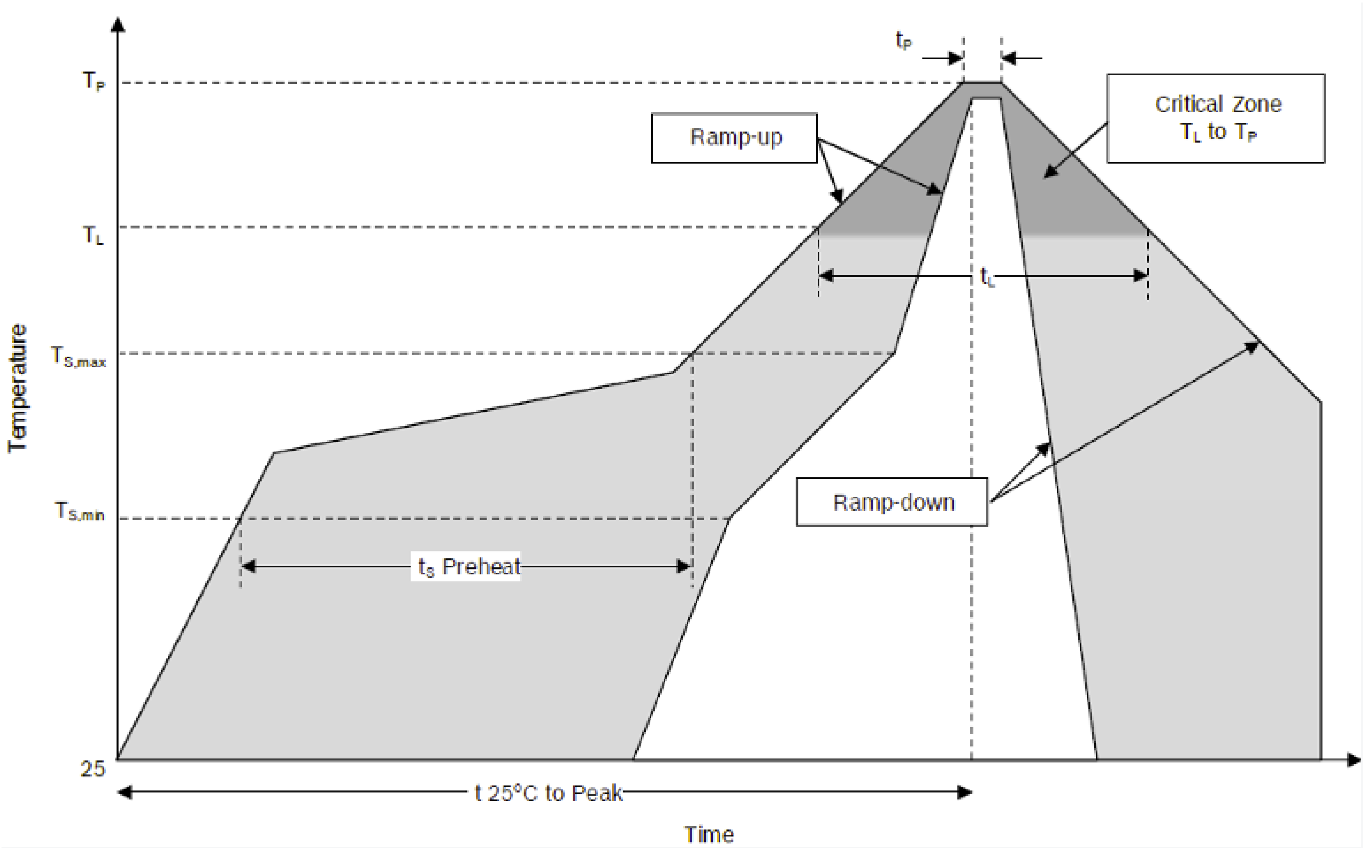

Figure20: SMT profile

Table 21: Explanation of SMT Profile Parameters

Parameters	Descriptions
Average ramp-up rate (T_{Smax} to T_p)	3℃/s max
Temperature min (TSmin)	150℃
Temperature max (T_{Smax})	200℃
Time (TSmin to TSmax)	60-180s
Temperature (T_L)	170℃
Time (tL)	60-150s
Peak classification temperature (T_P)	250℃
Time within 5 °C of actual peak temperature (tp)	20-40s
Ramp-down rate	6℃/min max
Time 25°C to peak temperature	8min max

11.2 Installation Recommendations

Generally speaking, MEMS sensors are high-precision measurement devices composed of electronic and mechanical structures, designed to achieve accuracy, efficiency, and mechanical robustness. When installing the sensors on a printed circuit board (PCB), the following recommendations should be considered:

- It is recommended to place the module horizontally on the measured carrier.
- It is not advisable to place the sensor directly below or next to button contacts, as this can cause mechanical stress.
- It is not advisable to place the sensor near high-temperature hotspots (e.g., controllers or graphics chips), as this can cause the PCB to heat up, leading to sensor overheating. Additionally, the sensor should not be placed near areas of maximum mechanical stress (e.g., at the center of diagonal crossings), as mechanical stress can cause bending of the PCB and sensor.
- It is not advisable to install the sensor too close to screw holes, and avoid placing the sensor in areas of the PCB that may or are expected to experience resonance (vibration).

If the above recommendations cannot be adequately implemented, performing specific online offset calibration after placing the device on the PCB may help minimize potential impacts.

12 PACKAGE

12.1 Tape Dimension

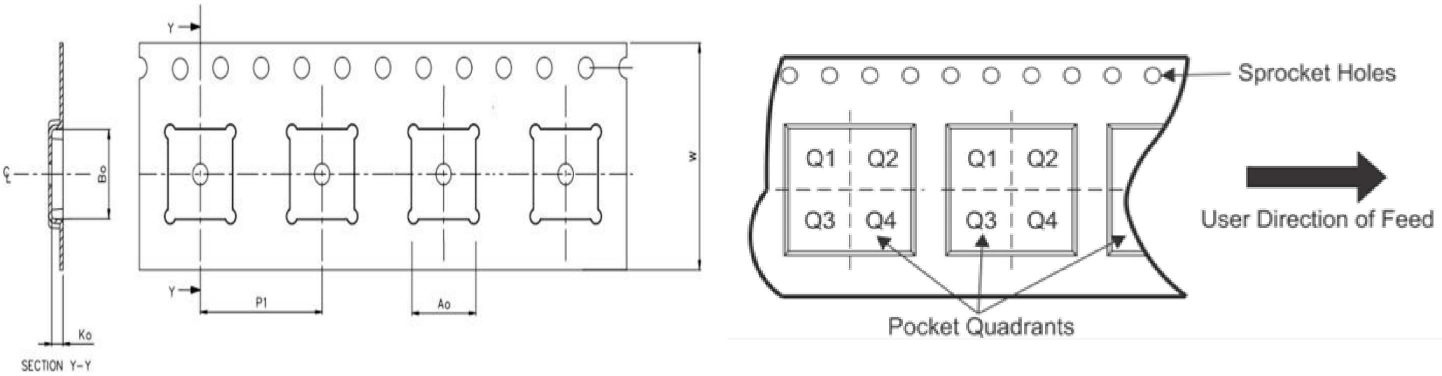

Figure21: Tape Dimension and pin 1

Table 22: Tape Dimension Information

Device	A0(mm)	B0(mm)	K0(mm)	P1(mm)	W(mm)
CH010/CH020	16.5	20	3.5	20	32
CH040/CH040MP	23	28	3.5	28	44

12.2 Reel Dimension

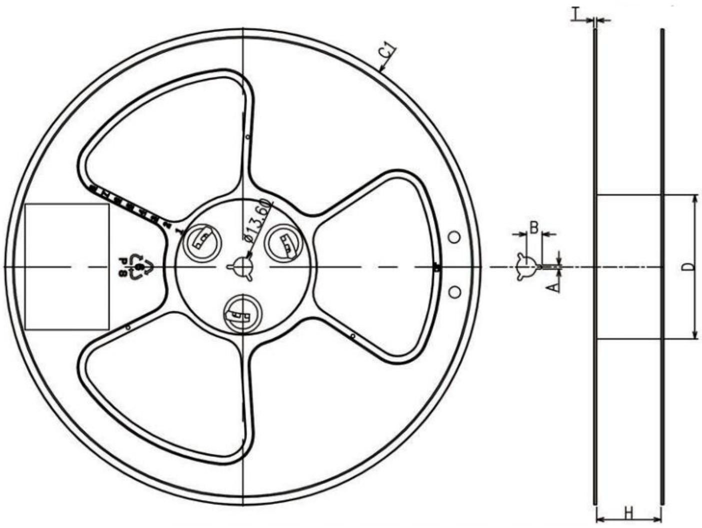

Figure22: Reel Dimension

Table 23: Reel Dimension Information

Device	SPQ(PCS)	Reel Diameter C1(mm)	Reel Width H(mm)	A(mm)	B(mm)	T(mm)	D(mm)
CH010/CH020	1000	330	32.8	2.5	11	2.0	100
CH040/CH040MP	500	330	44.8	2.5	11	2.0	100

12.3 Packaging Method

The CH0X0 series uses standard cardboard packaging.

Table 24: Packaging

CH0X0 | Reel | Vacuumize | Box

Table 25: Carton Dimensions

Device	SPQ(PCS)	L(mm)	W(mm)	H(mm)
CH010/CH020	1000	360	360	40
CH040/CH040MP	500	360	360	55

13 FAQ

13.1 Serial Port Issues

There are many reasons why the IMU cannot be configured or why IMU data cannot be received correctly. Some typical situations include:

1. The IMU's serial port is not cross-connected to the host's serial port, resulting in an inability to configure the IMU or receive IMU data, as shown in the figure below:

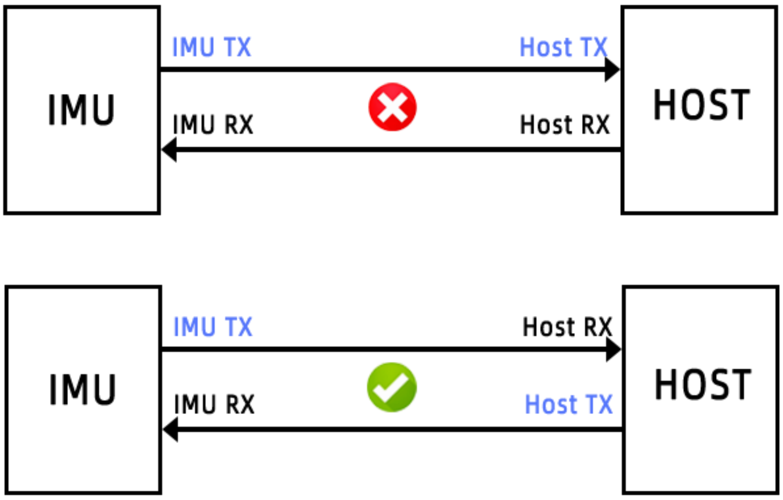

Figure23: IMU 串口与单主机相连

2. Incorrect Serial Port Configuration

There are many configurations for the serial port, including baud rate, start bit, data length, parity, and stop bit. The default configuration can be referenced in Section 9.1.The most common error is a mismatch in baud rate, especially when users change the IMU baud rate and forget to make the corresponding change to the host's baud rate. The result is an inability to configure the IMU or receive IMU data, as shown in the figure below:

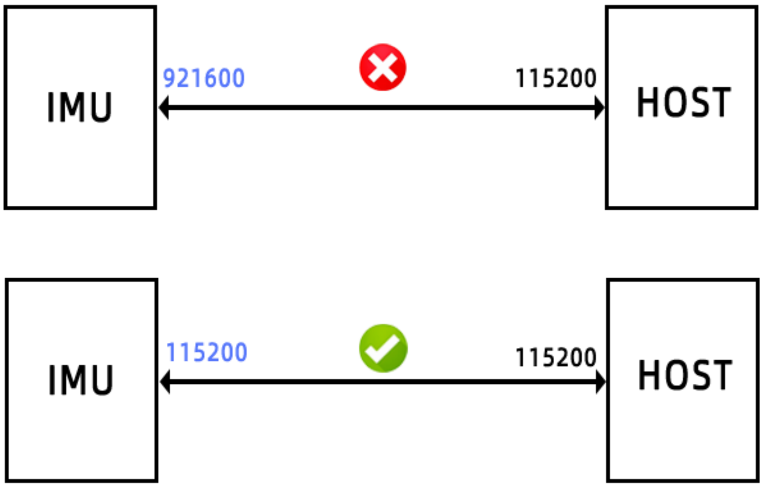

Figure24: IMU 串口与单主机相连

Note1: The aforementioned baud rate issue also applies to the CAN interface, which requires the baud rate of the IMU to match that of the user's host.

3. IMU Reception (RX) Connected to Multiple Devices' Transmission (TX)

Sometimes users may unknowingly connect the serial port to two host devices. In this case, both host devices will receive IMU data, but they will not be able to configure the IMU. A typical situation is when the user mistakenly connects the IMU to both the user's host and our upper computer simultaneously, as shown in Figure 27.

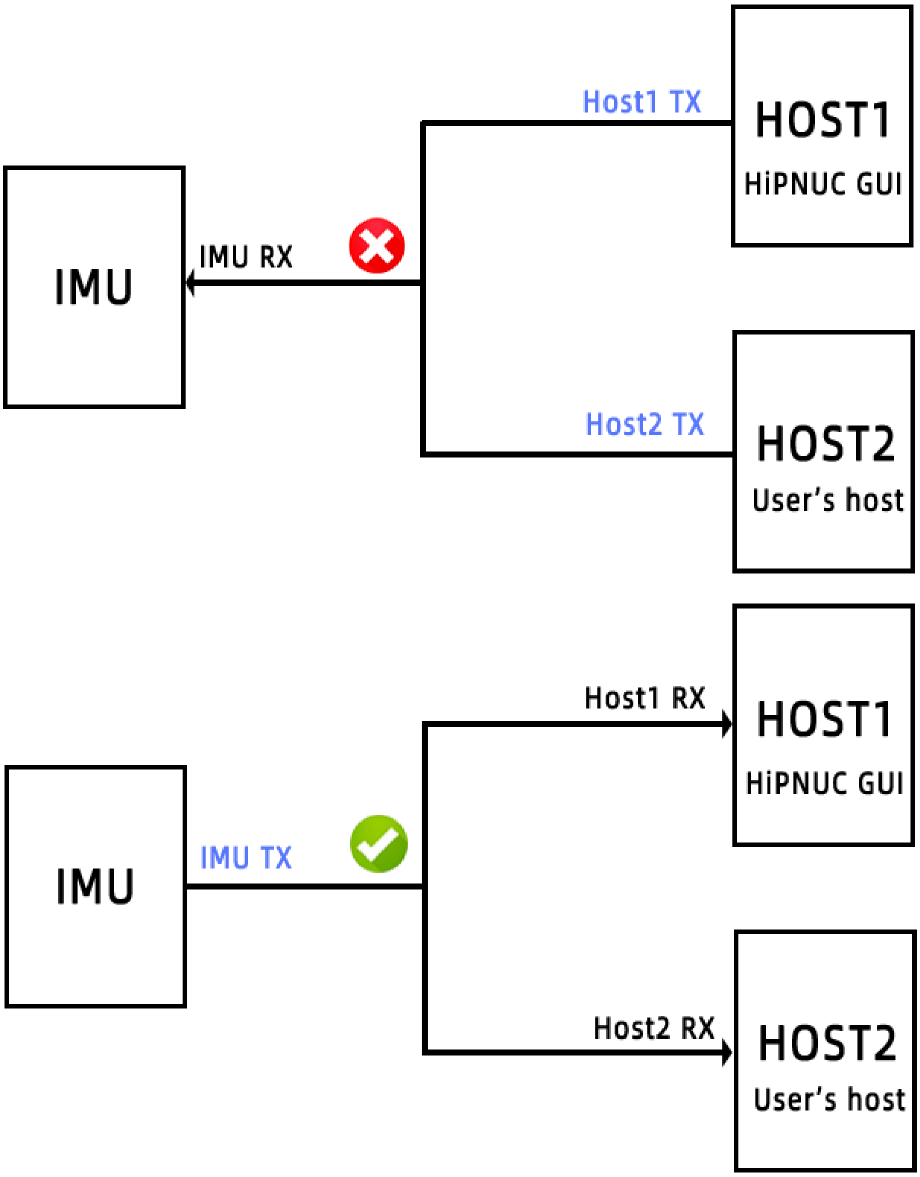

Figure25: IMU Serial Port Connected to User Host and HiPNUC GUI Simultaneously

4. Software issues

The receiving program written by the user may not be robust, such as failing to correctly parse data or having incorrect CRC checks, which can lead to an inability to properly receive and configure IMU data. In such cases, please refer to our official parsing examples or contact us for technical support.

5. Other issues

Hardware cold soldering or loose connections, overly long or poor-quality wiring harnesses. It is recommended to prioritize using the USB-to-serial cable we have prepared for users. Our wiring harnesses are designed with the user's full application scenarios in mind.

