TX-26-HF2

Dual-band RTK+DR centimeter-level positioning module

data book

12.2 mm* 16.0 mm * 2.4 mm

1216 size & 24PIN LCC package, PIN 2 PIN compatible with mainstream modules in the industry

It can support BDS B1I/B1C/B2a, GPS L1C/A/L5, GAL E1/E5a, GLONASS L1 four systems dual-frequency built-in dual-frequency RTK and inertial navigation fusion positioning algorithm, and supports Qianxun accelerated positioning service

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V0.3.6	2023/2/20	Update the conditions for inertial navigation accuracy
V0.3.7	2023/3/8	Modify the rod arm description problem and optimize the selection table
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catalogue

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1 Product Overview

1.1 Product Introduction

The TX-26-HF2 is a high-performance, highly integrated dual-frequency RTK+DR centimeter-level positioning module, featuring the BG1101 high-precision positioning chip. It supports all global civilian navigation systems, including BeiDou, GPS, GLONASS, Galileo, and QZSS. The TX-26-HF2 can simultaneously track BDS B1I/B1C/B2a, GPS L1C/A/L5, Galileo E1/E5a, GLONASS L1, QZSS L1/L5, and SBAS signals.

TX-26-HF2 is an integrated positioning chip and MEMS chip with super computing capability. It has built-in high-precision RTK positioning and inertial navigation fusion algorithm, which effectively solves the problem of interruption of positioning results caused by satellite signal lock loss. The module can provide continuous high-quality positioning results in tunnels, underground garages, viaducts, urban valleys and other scenarios.

TX-26-HF2 is applied in automotive navigation, vehicle management, lawn mowers, low-speed robots, precision agriculture, etc. Combined with Beidou ground-based enhancement system, it provides a "cloud integrated" solution for high-precision navigation and positioning.

1.2 Product features

Supports all civil navigation systems: BeiDou, GPS, GLONASS, Galileo, QZSS

support the Beidou 3 satellite system

Built-in dual-frequency high-precision RTK

positioning and inertial navigation fusion algorithm

on chip, up to 104Hz IMU raw observation output

High integration, using surface mount packaging mode, is conducive to production

Compatible with mainstream GNSS positioning module, easy for users to upgrade and maintain

1.3 Product pictures

Figure 1 Module product diagram

Table 1 TX-26-HF2 Product Selection Table

型号	尺寸（mm）	频段		GNSS 系统				Now more 新率	RTK	DR	原始观测量	Present 特率
		单频	双频	BDS	GPS/QZSS	Galileo	GLONASS					
TX-26-HF2-01	12.0x16.0		•	•	•	•	•	1Hz	•	•	•	115200
TX-26-HF2-02	12.0x16.0		•	•	•	•	•	10Hz	•	•	•	115200

1.4 System block diagram

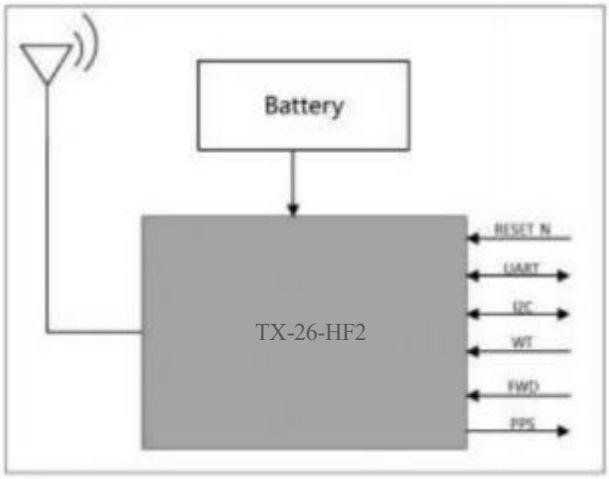


Figure 2 System block diagram

1.5性能指标

Table 2 Performance indicators

class	performance index	
GNSS, tracking channel	128	
Satellite receiving frequency band	BDS: B1I, B1C[1] , B2a	
	GPS/QZSS: L1 C/A, L5	
	GLONASS: L1	
	Galileo: E1, E5a	
Frequency of data updates	The positioning is up to 10Hz[2]	
	The maximum original observation of MEMS is 104Hz	
Position accuracy [3]	Dual-band single point	Level <1m CEP50
	double frequency RTK	Level 1cm + 1ppm CEP50 Elevation 2cm + 1ppm CEP50
	Inertial navigation accuracy	3‰ [4] driving distance
Speed and time accuracy	GNSS	<0 .05m/s CEP50
	PPS	≤20ns 1σ
Initial positioning time	warm boot	<1s
	cold boot	28s
sensitivity	cold boot	- 148dBm
	Recapture	- 158dBm
	follow the tracks of	- 165dBm
Use the limits	speed barrier	515m/s
	Extreme heights	18,000m
security detection	Built-in antenna short circuit and open circuit detection	

[1] Custom firmware output

[2] Custom firmware fusion can reach 100Hz

[3] Static in the open sky, ionosphere is not active, dual-frequency satellite positioning

[4] Conditions: ① Average speed of 45km/h; ② Speed pulse input

class	performance index	
joggle	UART	2
	I2C	1
data format	NMEA 0183 protocol Ver. 4. 1 RTCM 3.2 Chihiro has her own agreement	
going	Main power supply voltage	1.8 ~ 3.6V
	Standby voltage	1.8 ~ 3.6V
power dissipation	running mode	Single point positioning of L1+L5: 111mW@1.8V； 131mW@3.3V
		L1+L5 RTK+DR 10Hz positioning: 117mW@1 .8V； 132mW@3 .3V
	standby mode	< 28μW@1 .8V； 40μW@3 .3V
working temperature	-40°C ~ +85°C	
storage temperature	-40°C ~ +85°C	
Encapsulation size	12.2 * 16.0*2.4mm Stamp hole packaging	
meet a criterion	Complies with RoHS and REACH	

2 Module pin definition

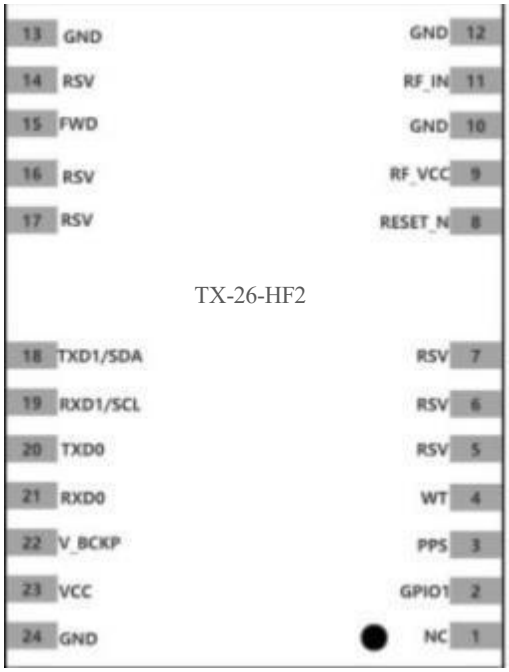


Figure 3 Module pin definition diagram

Table 3 Module pin description

引脚编号	引脚名称	信号类型	描述
1.	NC	-	Stay suspended
2.	GPIO	I	Reserve (keep suspended when not in use)
3.	PPS	O	A short pulse signal
4.	WT	I	RPM pulse (keep suspended when not in use)
5.	RSV	-	Keep in place (keep suspended when not in use)
6.	RSV	-	Keep in place (keep suspended when not in use)
7.	RSV	-	Keep in place (keep suspended when not in use)
8.	RESET_N	I	Reset (low active)
9.	RF_VCC	O	RF power output, antenna bias voltage output, available for external active antenna power supply

引脚编号	引脚名称	信号类型	描述
10.	GND	_	the earth
11.	RF_ IN	I	Antenna signal input
12.	GND	_	the earth
13.	GND	_	the earth
14.	RSV	_	Keep in place (keep suspended when not in use)
15.	FWD[5]	I	The direction of the speed (keep it suspended when not in use), and the level of the direction of the speed: high level forward, low level backward
16.	RSV	_	Keep in place (keep suspended when not in use)
17.	RSV	_	Stay suspended
18.	TXD1/SDA[6]	O	Serial port 1 outputs /I2C data
19.	RXD1/SCL[7]	I	Serial port 1 Input /I2C clock
20.	TXD0	O	Serial port 0 output
21.	RXD0	I	Enter the serial number 0
22.	V_BCKP	_	Backup power input
23.	VCC	_	power input
24.	GND	_	the earth

[5] TBD

[6] Where the SDA interface TBD

[7] Where the SCL interface TBD

3 Electrical characteristics

3.1 Limit conditions

Table 4 Limit conditions

符号	参数	最小值	最大值	单位
VCC	Main power supply voltage	-0.2	3.6	V
RF_VCC	The external active antenna is powered	-0.2	3.6	V
V_BCKP	Backup the power supply voltage	-0.2	3.6	V
Tstorage	Storage temperature	-40	+85	℃
Tsolder	Reflow soldering temperature	--	+260	℃

3.2IO port characteristics

3.2.1 PORT characteristics of RESET_N

Table 5 RESET_N port characteristics

符号	参数	条件	最小值	典型值	最大值	单位
IIZ	Input leakage current	--	--	--	±1	μA
VIH	Enter high level	--	VCC*0 .7	--	VCC	V
VIL	Enter low level	--	0	--	VCC*0 .3	V

3.2.2 RF_VCC port characteristics

Table 6 RF_VCC port characteristics

参数	条件	最小值	典型值	最大值	单位
RF_VCC Power supply current	--	--	--	60	mA
RF_VCC Supply voltage	--	1.8	--	2.82	V

3.2.3 WT port characteristics

TBD。

3.2.4 Other IO port characteristics

Table 7 Other IO port characteristics

符号	参数	条件	最小值	典型值	最大值	单位
VIH	high level input voltage	--	VCC*0 .7	--	VCC	V
VIL	low level input voltage	--	0	--	VCC*0 .3	V
VOH	high level output voltage	IOH =22.4 mA, VCC=3.3V	VCC*0 .7	--	--	V
VOL	Low level output voltage	IOL= 14.9mA, VCC=3.3V	--	--	VCC*0 .3	V
RPU	pull-up resistor	VDD_IO=3.3V Normal temperature	--	70	--	KΩ
		VDD_IO= 1.8V at room temperature	--	160	--	KΩ
Rpd	pull-down resistor	VDD_IO=3.3V Normal temperature	--	88	--	KΩ
		VDD_IO= 1.8V at room temperature	--	220	--	KΩ

3.3 DC characteristics

3.3.1 Working conditions

Table 8 Working conditions

符号	参数	最小值	典型值	最大值	Follow the group
VCC	Main power supply voltage	1.8	--	3.6	V
V_BCKP	Backup the power supply voltage	1.8	--	3.6	V
Tenv	operating ambient temperature	-40	--	+85	°C

3.3.2 Power consumption

Table 9 Power consumption

测量引脚	参数	典型值	单位
VCC	Operation mode (GNSS, L1+L5) [8]	111mW@1.8V	mW
		131mW@3.3V	mW
	Operation mode (GNSS, L1+L5 RTK + DR) [9]	117mW@1.8V	mW
		132mW@3.3V	mW
V_BCKP[10]	standby mode	28μW@1 .8V	μW
		40μW@3.3V	μW

[8] Under the open sky, GNSS L1 + L5 frequency band is successfully positioned, and the module is powered by a voltage stabilizing power supply

[9] Under the open sky, GNSS L1 + L5 frequency band and RTK+DR positioning are successful. The module is powered by a voltage stabilizing power supply with an update rate of 10Hz

[10] Condition: indoor temperature, all pins are suspended

4 Mechanical specifications

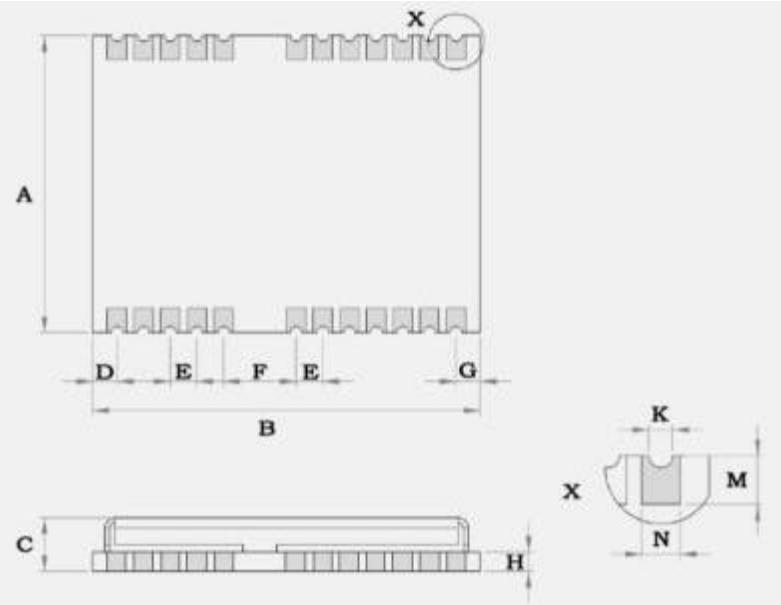


Figure 4 Module mechanical specification size

Table 10 Module mechanical specifications and dimensions

编号	最小值（mm）	典型值（mm）	最大值（mm）
A	12.0	12.2	12.4
B	15.8	16.0	16.2
C	2.2	2.4	2.6
D	0.9	1.0	1.3
E	1.0	1. 1	1.2
F	2.9	3.0	3. 1
G	0.9	1.0	1.3
H	--	0.8	--
K	0.4	0.5	0.6
M	0.8	0.9	1.0
N	0.7	0.8	0.9

S 参考设计

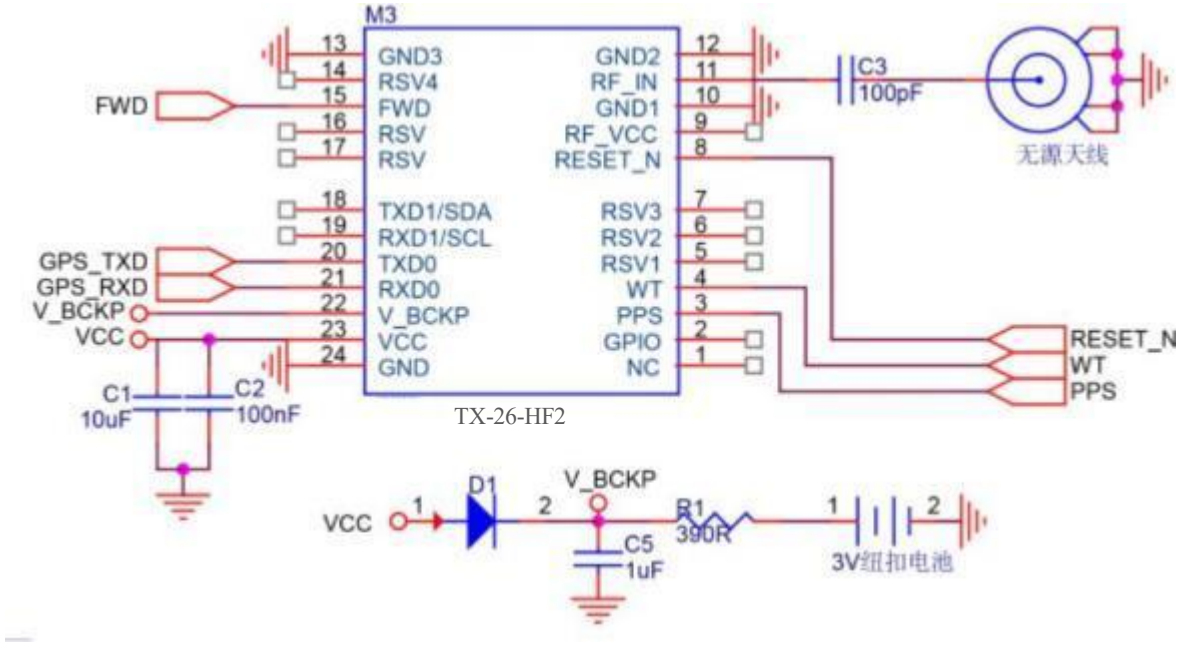


Figure 5 Reference design schematic (passive antenna)

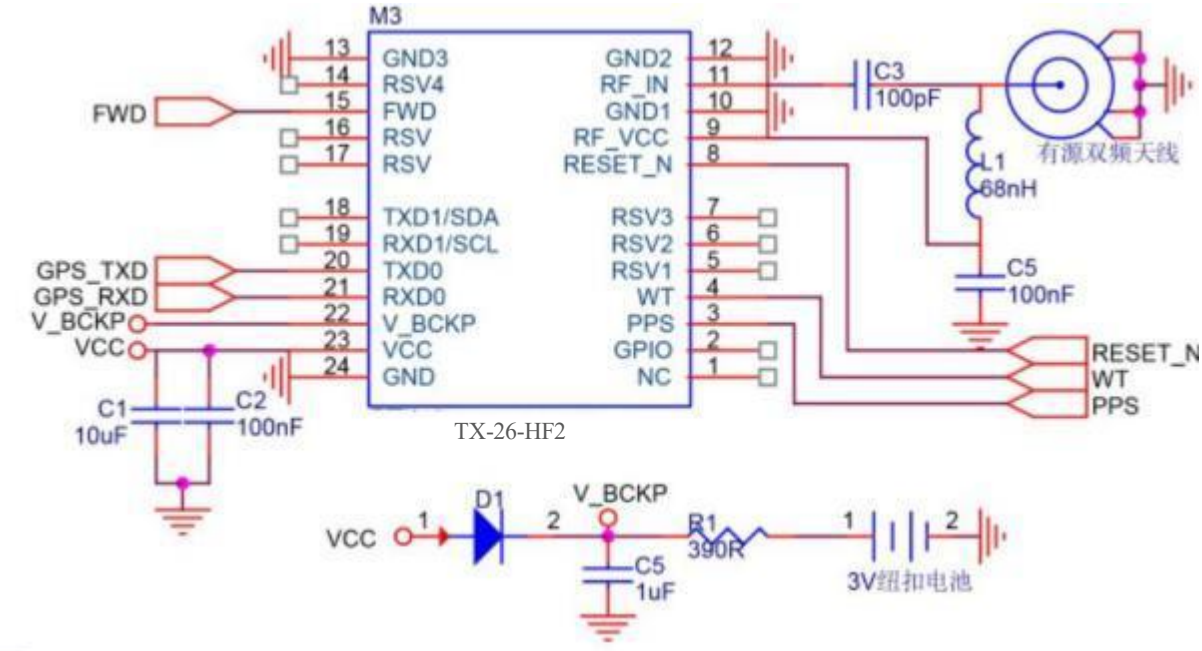


Figure 6 Reference design schematic diagram (dual frequency active antenna)

6 Installation and use

In order to ensure the normal operation of the combined navigation module, users should refer to the following installation and configuration steps: 1. Connect with the carrier rigid body;

Please ensure that the module is connected to the carrier rigid body before power on; if the installation Angle or position of the module changes, please power on again; 2. Configure the installation Angle and rod arm mode according to the installation position and Angle; (Example instructions need to end with\r

1) Angle configuration:

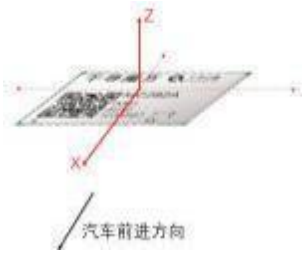
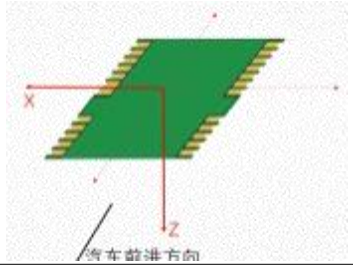
The installation Angle of this product is configured with two modes: adaptive and configuration;

The default mode is adaptive: after determining the installation Angle, users can select the configuration mode to speed up the calibration time;

A) Adaptive mode [1 1]: Automatically estimates the installation Angle, which is used when the user is not sure about the installation Angle of the module; Configuration command: $qxcfgmsa,1\r.\n

B) Configuration mode: When the user knows the installation Angle of the module, he can press the table below for configuration. The manual installation instructions are as follows;

Table 11 Examples of manual installation instructions

Z 轴	X 轴	Axisflag	示例	示意图
Z upalong	X facing forward (see right)	51	$qxcfgmsa,2 ,51	
	X to the right	52	$qxcfgmsa,2 , 52	
	X after the morning	53	$qxcfgmsa,2 , 53	
	X moves to the left	54	$qxcfgmsa,2 , 54	
Z adown	X ahead	61	$qxcfgmsa,2 ,61	
	X to the right (see right)	62	$qxcfgmsa,2 ,62	
	X after the morning	63	$qxcfgmsa,2 ,63	

[11] Note: After the adaptive mode enters the fusion state, configure $qxcfgmsa, 2,66 to automatically convert the current estimated installation Angle result into the configuration mode; and then $qxcfgsave to save the current configuration.

Z 轴	X 轴	Axisflag	示例	示意图
	X moves to the left	64	$qxcfgmsa,2 ,64	

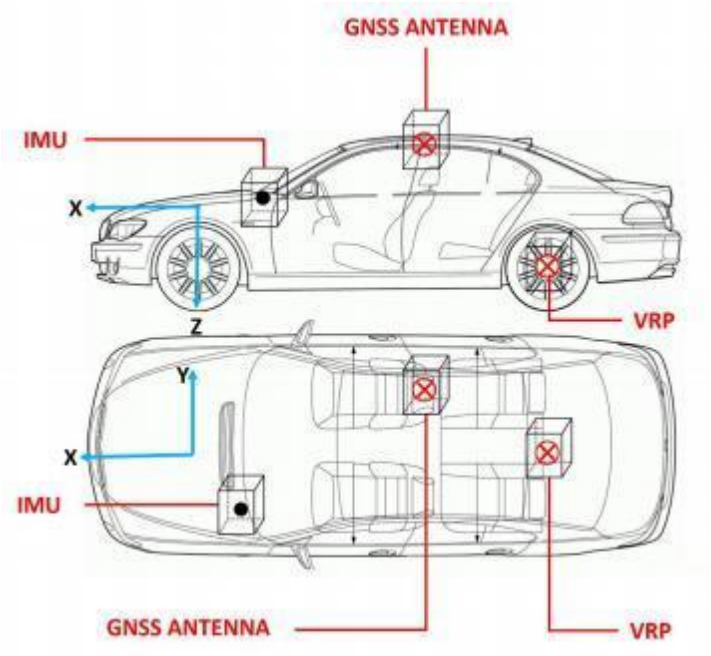


Figure 7 Antenna, VRP and module coordinate system

2) Pole arm configuration (module to satellite antenna: IMU2ANT);

A) The coordinate system of the vehicle body is located at the lower right of the IMU.

b) As shown in the figure, assuming that the satellite antenna is 1.00m behind the IMU, 0.5m to the right, and 0.6m above, then the rod arm of IMU2ANT is x: -1.00m,y:0.5m,

z:-0.6m。

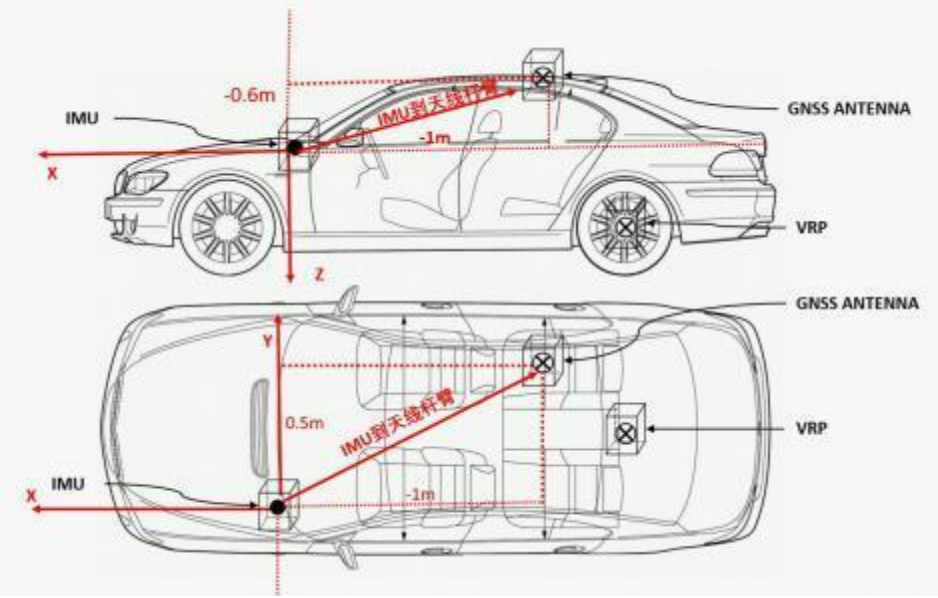


Figure 8 Coordinate system from module to satellite antenna (IMU2ANT)

c) The configuration command is: $qxcfgla,0,0,-100,50,-60\r.\n \n

D) When only the approximate position of the rod arm is known, partial accuracy loss can be accepted, and when RTK is connected, the rod arm adaptive mode can be configured as $qxcfgla,0,1,-100,30,30; The initial value error should be less than 2m.

3) Rod arm configuration (from the center of rear wheel to module: VRP2IMU);

A) The center of the rear wheel (VRP) is taken as the origin, and the coordinate system of the front right of the car body is taken as the origin.

b) As shown in the figure, assuming that the IMU is located 1.90m in front of the center of the rear wheel, 0.6m to the left, and 0.6m above, then the rod arm of VRP2IMU is x:1.90m,y:-0.6m,

z:-0.6m。

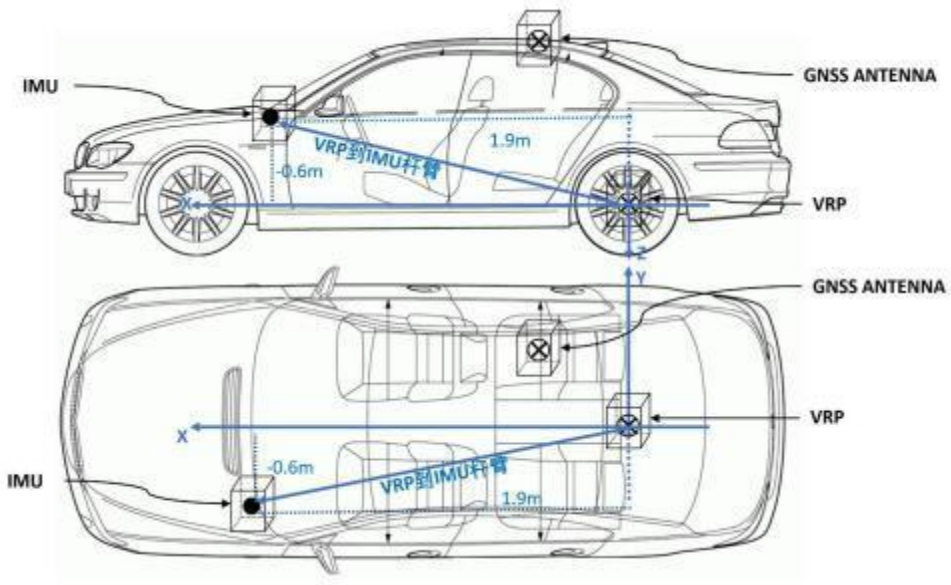


Figure 9 Co-ordinate system from the rear wheel center to the module (VRP2IMU)

c) The configuration command is: $qxcfgla, 1,0,190, -60, -60\r.\n \n

D) When only the approximate position of the pole arm is known, partial accuracy loss can be accepted. When RTK is connected, the adaptive mode of the pole arm can be configured as $qxcfgla,1,1,100,0,0; The initial value error should be less than 2m;

4) After the configuration is completed, please save ($qxcfgsave, \r\n) to avoid the loss of configuration after power failure; 3. Drive dynamically in an open environment to enter the fusion state;

The recommended steps are as follows:

1) Start up and position in an open environment;

2) Drive for more than 30km/h for 3 minutes, including more than 5 straight acceleration and deceleration;

3) Dynamic driving for 3 minutes, including acceleration and deceleration and 90 degree turn more than twice;

4. The self-calibration process must meet the above conditions such as parking, satellite quality, and mobility. The self-calibration is completed by querying the $QXDRS statement. When the status reaches 4 or higher (4: available; 5: good), the self-calibration is completed and enters the fusion state. Otherwise, repeat the above steps until the self-calibration is successful.

7 Precautions

7.1 Hardware design

In order to ensure the normal function of TX-26-HF2 and give full play to its performance,the following matters should be paid attention to in the design:

1. Power supply: low ripple and high stability power supply is adopted, the peak voltage ripple should not exceed 50mV; the power-on slope of the module must be large

At 0.5mV/μs (500V/s), and ensure that power on starts at 0V.

A) Place a decoupling capacitor near the module power pin, and the power line width is more than 0.5mm.
B) Use LDO to ensure pure power supply, and the driving current of power supply should be greater than 400mA. In layout, try to place LDO close to the module.

C) Widening the power line or using a segmented copper surface to transmit current.D) Power lines should not pass through high power and high

D) Power lines should not pass through high power and high

inductance components such as magnetic coils. E) All GND pins of the module should be grounded.

2. UART interface: Ensure that the pin signals and baud rate of the main device are consistent with those of the TX-26-HF2 module. TXD0 is an output pin, which needs to remain low for 100ms after the module is powered on; otherwise, the module will enter engineering mode and fail to work properly. Suggestions: The pin connected to TXD0 is maintained in a pulled-down state for 100ms after power-on, or is always configured as (pulled-down) input.

3. Antenna:
A) Antenna Interface: Ensure impedance matching for the antenna line, keeping it as short and smooth as possible to avoid sharp angles. It is recommended that the RF trace from the module's RF port to the antenna interface be at least 0.2mm wide and placed as close as possible. The RF traces should use a coplanar waveguide impedance model, with a spacing of about 1 times the trace width between the trace and the ground copper plane to ensure an impedance match of 50Ω. The trace from the module's RF port to the antenna interface should reference the second layer ground, ensuring the integrity of the second layer ground plane.
B) Antenna position: In order to ensure a better signal-to-noise ratio and ensure a good isolation between the antenna and the electromagnetic radiation source, especially the electromagnetic radiation in the frequency band of 1559~ 1577MHz, avoid routing under the TX-26-HF2.

C) Line gain: when using an external active antenna, it is recommended that the antenna gain be less than 30dB.

A) If active antenna is selected, the active antenna needs to be fed. The power supply for feeding can be provided by the terminal platform or powered by the module RF_VCC. It is recommended to feed the terminal platform first and use the built-in feeding function of the module carefully to avoid damage to the module when the external antenna shorts.

B) When the antenna short circuit occurs, please cut off the power supply of the module as soon as possible and troubleshoot the antenna short circuit fault. After troubleshooting the antenna short circuit fault, power on the module again.

C) The threshold current for antenna short circuit determination is as follows:

Table 12 Antenna state determination threshold current

VCC / 天线状态	3.3V	1.8V
Open circuit-> normal	About 8mA	About 4mA
Normal-> Short circuit	About 60mA	About 35mA

D) The active antenna that matches TX-26-HF2 must have a maximum operating current of less than 60mA. When the antenna is short-circuited, the module outputs an alarm (QXANTSTAT statement, as follows).

Table 13 QXANTSTAT description

执行语句	STAT 值	天线状态
$QXANTSTAT, STAT	0	normal
	1	short
	2	open a way

Note: The output is valid only when the external antenna is an active antenna and the detection circuit is working properly.

4. Anti-interference

This module is a temperature sensitive device, the performance of which will be reduced due to drastic changes in temperature. In use, try to stay away from high temperature airflow and high power heating devices.

Do not place the module near sources of interference, such as communication antennas, crystal oscillators, large inductors, and high-frequency digital signal lines. It is best to fill the bottom of the module with ground wire.

7.2 Module reset signal description

TX-26-HF2 can be reset by pulling down the RESET_N pin for more than 100μs during normal operation of the module.

7.3 Reflow soldering curve

Table 14 Characteristics of reflow soldering curves

曲线特征	无 Pb 制程
预热/渗浸 Minimum temperature (Tsmin) Maximum temperature (Tsmax) Time ts (from Tsmin to Tsmax)	150 °C 200 °C 60 ~ 120s
Rate of rise (TL to Tp)	3 °C/s (maximum)
Liquid phase temperature (TL) Time tL (time when the temperature is maintained above TL)	217°C 60 ~ 150s
Packaging body temperature peak (Tp)	It cannot exceed Tc [12]
Duration (tp) within the specified Tc temperature of 5 °C	30 * seconds [13]
Deceleration rate (from Tp to TL)	6 °C/s (maximum)
25℃ Time to peak temperature	8 minutes (maximum)

[12] Tc=260°C
[13] 255. C The time above should not exceed 30 seconds

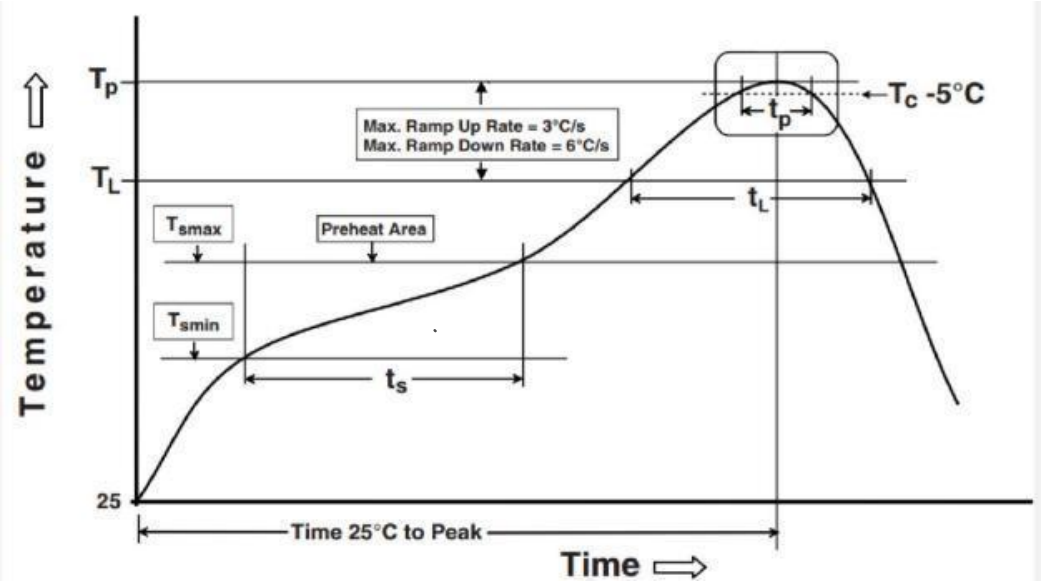


Figure 10 Reflow soldering curve (refer to IPC/JEDEC J-STD-020E specification)