

PRODUCT SPECIFICATION

产品规范

适用于

For

QN601 GNSS 模块
QN601 GNSS Module



©2022, QinNav Technology Ltd. All rights reserved. QinNav is the trade mark of QinNav Technology Ltd, registered in People's Republic of China. All other trademarks are the property of their respective owners.

REVISION HISTORY / 修订历史

Revision/版本	Modification/更改	Date/日期
1.0	New Release / 新发	2022/12/21

DIRECTORY / 目录

REVISION HISTORY / 修订历史	2
DIRECTORY / 目录	3
1. INTRODUCTION / 简介	5
1.1. Product Characteristics / 产品特性	5
1.2. Firmware Update / 固件升级	6
2. SPECIFICATION OF QN601 / QN601技术规范	7
2.1. Performance Parameters / 性能参数	7
2.2. Dimension / 尺寸	9
3. PIN LAYOUT / 引脚布局	10
3.1. Pin Definition / 引脚定义	10
3.2. Application Interface / 应用接口	12
3.2.1. UART Interface / UART接口	12
3.2.2. I2C Interface / I2C接口	12
4. Hardware Parameters / 硬件参数	13
4.1. Electrical Characteristics / 电气特性	13
4.2. Withstand Voltage / 承受电压	13
4.3. Supply Voltage / 供电电压	14
5. Hardware Integration / 硬件集成	15
5.1. Antenna Input Interface / 天线输入接口	15
5.2. Electrostatic Protection / 静电保护	16
5.3. Hardware Integration Considerations / 硬件集成注意事项	17
5.4. Connection Example / 连接示例	18
5.5. QN601G IMU Assembling Note / QN601G惯导安装说明	20
6. Packaging Production / 包装生产	21
6.1. Packaging / 包装	21

Figures

Figure 1.Product Photo / QN601实物图	9
Figure 2.Dimension View / QN601三视图	9
Figure 3. Pin Drawing of QN601(Front View) / QN601引脚（正视图）	10
Figure 4.Reference Design of Antenna Access (Passive Antenna) / 天线接入参考设计（无源天线）	15
Figure 5. Reference Design of Antenna Access (Active Antenna) / 天线接入参考设计（有源天线）	15
Figure 6. QN601 Module Connection Example (Passive Antenna Connection Mode) / QN601连接示例（无源天线连接方式）	19
Figure 7. QN601 Module Connection Example (Active Antenna Connection Mode) / QN601连接示例（有源天线连接方式）	19

Figure 8. Example of Connection Between QN601 RS232 COM1, 2 and Other Devices Using UART Interface /	
QN601 RS232 COM1、2与其他使用UART接口的设备之间的连接示例	19
Figure 9. Example of COM Serial Port TTL to RS232 Connection / COM串口TTL转RS232连接示例.....	20
Figure 10. IMU Assembling guide / IMU安装图	20
Figure 11. Label Description / 标签说明	21

Tables

Table 1 Product Characteristics/产品特性	5
Table 2. QN601 Specification/QN601性能参数	7
Table 3 . QN601 Pin Description / QN601引脚描述	10
Table 4. LVCMOS 3.0V电气标准.....	13
Table 5 . LVTTTL 3.0V电气标准	13

1. INTRODUCTION / 简介

QN601 is high precision positioning multi-system GNSS Modules. They track constellations including BDS-2 、 BDS-3 、 GPS 、 Galileo、 GLONASS and QZSS , are mainly designed and used for Mower、 UAV and handheld devices with size, weight, and power requirements.

QN601 模块是钦天导航自主研发的全系统、多频点、小尺寸高精度定位 GNSS 模块，满足多系统多频点导航卫星系统模块需求，支持 BDS-2 、 BDS-3 、 GPS 、 Galileo、 GLONASS 以及 QZSS 。适用于如割草机、无人机和手持设备等对模块尺寸、重量和功耗要求严格的领域。

QN601 is surface mount modules with 24 LCC pins and sizes of 12mm×16mm×2.4mm.

QN601 模块为表面贴片式模块，共有 24 个 LCC 引脚，尺寸为 12mm×16mm×2.4mm。

1.1. Product Characteristics / 产品特性

Table 1 Product Characteristics / 产品特性

Characteristics特性			QN601	QN601G
Signal 信号	BDS	B1I	◆	◆
		B2a	◆	◆
	GPS	L1C/A	◆	◆
		L5	◆	◆
	Galileo	E1	◆	◆
		E5a	◆	◆
	GLONASS	G1	◆	◆
	QZSS	L1C/A	◆	◆
		L5	◆	◆
	SBAS	L1C/A	◆	◆
FUNCTION 功能	高精度GNSS		◆	◆
	IMU		-	◆
	RTK		◆	◆

VCC Voltage VCC电压	3.1~3.6V 典型值: 3.3V(Typical)	◆	◆
V_BCKP Voltage V_BCKP电压	2.2~5.5V 典型值: 3.3V(Typical)	◆	◆
IO Voltage IO电压	典型值: 3.0V(Typical)	◆	◆
Communication 通信接口	UART	◆	◆
	I2C	◆	◆

1.2. Firmware Update / 固件升级

QinNav will release the latest version of firmware for performance optimization from time to time.

钦天导航 QN601 GNSS 模块出厂时已预安装正式固件,后续将不定期发布性能优化的最新版本固件。

2. SPECIFICATION OF QN601 / QN601技术规范

Following table presents the detailed specification of QN601 GNSS Module. Specific technical characteristics are listed with its physical interface and electrical parameters.

下表中为 QN601 GNSS 模块的详细规范。同时，还列出了该模块的各项技术性能，以及它的物理接口和电气接口参数。

2.1. Performance Parameters / 性能参数

Table 2. QN601 Specification / QN601性能参数

QN601 Specification / QN601 规范			
Signals 信号	QN601	Positioning 定位	BDS: B1I, B2a
			GPS: L1C/A, L5
			Galileo: E1, E5a
			GLONASS: G1
			QZSS: L1C/A, L5
			SBAS: L1C/A
			IRNSS: L5*
	带*项会随同版本进行调整		
Time to First Fix 首次定位时间	Cold Start 冷启动	<24s(Adding Acceleration Capture Module, 增加捕获加速模块)	
	Hot Start(with RTC) 热启动	<10s(Typical, 典型)	
Acquisition 信号捕获	Signal Tracking Sensitivity 信号跟踪灵敏度	-165dBm	
	Signal Capture Sensitivity 信号捕获灵敏度	-148dBm	
Accuracy 精度	Time Accuracy 授时精度	5ns	
	SPP Accuracy 标准单点定位精度	H ≤ 1.5m, V ≤ 3m (1σ, PDOP≤4)	
	Speed accuracy 测速精度	≤ 0.02m/s (PDOP ≤4)	

©2022, QinNav Technology Ltd. All rights reserved. QinNav is the trade mark of QinNav Technology Ltd, registered in People's Republic of China. All other trademarks are the property of their respective owners.

QN601 Specification / QN601 规范		
RTK	RTK Initialization time RTK初始化时间	< 15s (baseline < 10km, 基线长小于10km)
	Initialization Reliability 初始化置信度	> 99.9 %
	RTK Accuracy RTK精度	H: $\pm (8 + 10^{-6} \times D)$ mm V: $\pm (15 + 10^{-6} \times D)$ mm D - Baseline length (Unit: km) D为基线长度(单位: km)
Data Rates 数据速率	Measurements & Position 测量&定位	5Hz (Subsequent upgrade support 10Hz) 5Hz (后续升级可支持10Hz)
	RTK: Positioning RTK:定位	5Hz (Subsequent upgrade support 10Hz) 5Hz (后续升级可支持10Hz)
Electrical 电气特性	Voltage 供电电压	+ 3.3 V $\pm$ 5 % DC
	Power Consumption 功耗	0.15 W (Anti-Interference on,默认开启抗干扰)
Environmental 环境要求	Operating Temperature 工作温度	-40°C — +85°C
	Storage Temperature 储存温度	-40°C — +85°C
Data Formats 输出数据格式	NMEA-0183	GPGGA, GPGSV, GPGLL, GPGSA, GPGST, GPRMC, GPVTC, GPZDA, GPNTR etc.
	RTCM3.X	1005, 1019, 1020, 1042, 1044, 1046 MSM4, MSM7
Antenna 天线接口	Impedance Matching 阻抗匹配	布线50欧姆阻抗匹配
	LNA Gain 天线增益要求	15~35dB
Hardware Interface 硬件接口		LGA (24PIN)
Physical 物理参数	Size 尺寸	12mm×16mm×2.4mm
	Weight 重量	0.9 grams (克)

2.2. Dimension / 尺寸

In this section, product photo, three-side views and the dimension of QN601 is provided for customers' further hardware design and installation.

本节提供了 QN601 的实物图，便于用户进一步的系统硬件设计和安装。

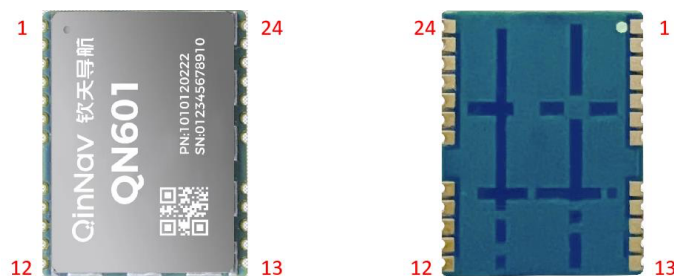


Figure 1.Product Photo / QN601实物图

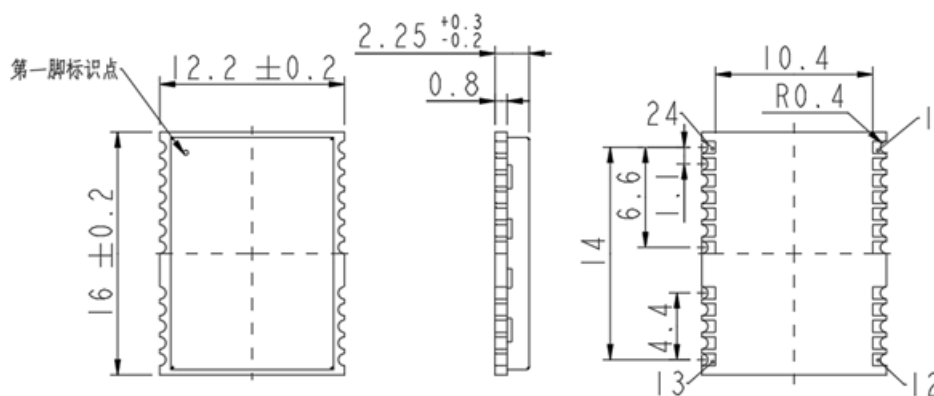


Figure 2.Dimension View / QN601三视图

3. PIN LAYOUT / 引脚布局

3.1. Pin Definition / 引脚定义

QN601 module includes 24pin, surface mounted module, which can be integrated by users through definition.

QN601 模块包括 24pin，表贴式模块，通过定义用户可自行集成。

13	GND	GND	12
14	GPI02	ANT	11
15	RXD2	GND	10
16	TXD2	VDD_RF	9
17	RSV	RESET_N	8
18	SDA (SLV)	VDD_EXT	7
19	SCL (SLV)	USB_DP	6
20	TXD1	USB_DM	5
21	RXD1	GPIO	4
22	V_BACKP	PPS	3
23	VCC	RSV	2
24	GND4	WAKEUP	1

Figure 3. Pin Drawing of QN601(Front View) / QN601引脚 (正视图)

Table 3. QN601 Pin Description / QN601引脚描述

PIN	SIGNAL	TYPE	DESCRIPTION	
1	WAKEUP	I	Wake up the module in Backup mode(1.8V)	Backup 模式中唤醒模块(1.8V)
2	RSV1	-	Reserved	保留
3	PPS	O	Pulse Per Second	秒脉冲
4	GPIO1	I/O	General-purpose input/output	通用IO
5	USB_DM	I/O	USB data	USB数据
6	USB_DP	I/O	USB data	USB数据
7	VDD_EXT	I	3.0V power output , 100mA max current output	3.0V电源输出 最大电流输出为100mA

©2022, QinNav Technology Ltd. All rights reserved. QinNav is the trade mark of QinNav Technology Ltd, registered in People’s Republic of China. All other trademarks are the property of their respective owners.

8	RESET_N	I	RESET_N	复位
9	VDD_RF	O	Voltage for external RF (If unused this pin , not connect)	电流输出能力取决于 VCC 3.3V, 用于为外部有源天线供电, 不用则悬空(不连接)
10	GND1	-	Ground Reference	参考地
11	ANT	I	GNSS Positioning Antenna	GNSS定位天线
12	GND2	-	Ground Reference	参考地
13	GND3	-	Ground Reference	参考地
14	GPIO2	I/O	General-Purpose Input/Output	通用I/O
15	RXD2	I	UART2 Input	串口2输入
16	TXD2	O	UART2 Output	串口2输出
17	RSV2	-	Reserved	保留
18	SDA (SLV)	I/O	I2C Data	I2C数据
19	SCL (SLV)	I/O	I2C Clock	I2C时钟
20	TXD1	O	UART1 Output	串口1输出
21	RXD1	I	UART1 Input	串口1输入
22	V_BACKP	PWR	Backup Supply Voltage (Must Supply 2.5~5.5V)	RTC电源 (必须供电2.5~5.5V)
23	VCC	PWR	Voltage Supply	电源输入
24	GND4	-	Ground Reference	参考地

Remarks: Please keep the Reserved and unused pins hanging (not connect).

备注:预留和未使用的引脚请保持悬空（不连接）。

3.2. Application Interface / 应用接口

3.2.1. UART Interface / UART接口

QN601 provides two UART interfaces, and supports NMEA standard statement output, binary data input/output and firmware upgrade; Support 9600, 14400, 19200, 38400, 57600, 115200, 230400, 460800 and 921600 bps; Hardware flow control and synchronization operations are not supported.

模块提供两路 UART 接口，并且支持 NMEA 标准语句输出、二进制数据输入/输出和固件升级；支持 9600、14400、19200、38400、57600、115200、230400、460800 和 921600 bps；不支持硬件流控和同步操作。

3.2.2. I2C Interface / I2C接口

The module provides one I2C interface, which supports slave mode; Support 7-bit or 10 bit addressing; Both standard (100 kbps) and fast (400 kbps) modes are supported.

模块提供一路 I2C 接口，该接口支持从模式；支持 7 位或 10 位寻址；支持标准（100 kbps）和快速（400 kbps）两种模式。

4. Hardware Parameters / 硬件参数

4.1. Electrical Characteristics / 电气特性

COM1/2 (TX&RX), GPIO and PPS are LVCMOS 3.0V levels. All these signals are compatible with LVCMOS/LVTTL 3.0V.

COM1/2(TX&RX), GPIO , PPS 为 LVCMOS 3.0V 电平，所有这些信号均兼容 LVCMOS/LVTTL 3.0V。

Table 4. LVCMOS 3.0V电气标准

Symbols/符号	Description/描述	Min/最小	Max/最大
VIH	Input high voltage 输入高电压	2.0V	3.08V
VIL	Input low voltage 输入低电压	-0.3V	0.8V
VOH	High-level output voltage 高电平输出电压	2.2V	3.08V
VOL	Low-level output voltage 低电平输出电压	--	0.4V
IOH	Sourcing current 拉电流	4mA	
IOL	Sinking current 灌电流	4mA	

Table 5. LVTTL 3.0V电气标准

Symbols/符号	Description/描述	Min/最小	Max/最大
VIH	Input high voltage 输入高电压	2.0V	—
VIL	Input low voltage 输入低电压	-0.3V	0.8V
VOH	High-level output voltage 高电平输出电压	2.4V	----
VOL	Low-level output voltage 低电平输出电压	---	0.4V
IOH	Sourcing current 拉电流	4mA	
IOL	Sinking current 灌电流	4mA	

4.2. Withstand Voltage / 承受电压

The signals can withstand the voltage of 3.0V are as follows: COM1/2 (TX&RX), PPS; The signals can withstand the voltage of 1.8V are as follows: WAKEUP, RESET_N.

所能承受电压为 3.0V 的信号如下：COM1/2(TX&RX), PPS；所能承受电压为 1.8V 的信号如下：WAKEUP, RESET_N.

4.3. Supply Voltage / 供电电压

VCC main power supply, voltage range: 3.3V (DC). Voltage ripple and peak pulse shall be less than 50mV. Voltage ripple and peak pulse shall be less than 50mV. V_BCKP, voltage 2.5V~5.5V, voltage ripple and peak pulse are required to be less than 30mV.

VCC 主供电电源，电压范围：3.3V（直流）。电压纹波和尖峰脉冲要求小于 50mV。电压纹波和尖峰脉冲要求小于 50mV。V_BCKP，电压 2.5V~5.5V，电压纹波和尖峰脉冲要求小于 30mV。

5. Hardware Integration / 硬件集成

During the integration of QN601, the following precautions are required:

在集成 QN601 过程中，有以下注意事项：

5.1. Antenna Input Interface / 天线输入接口

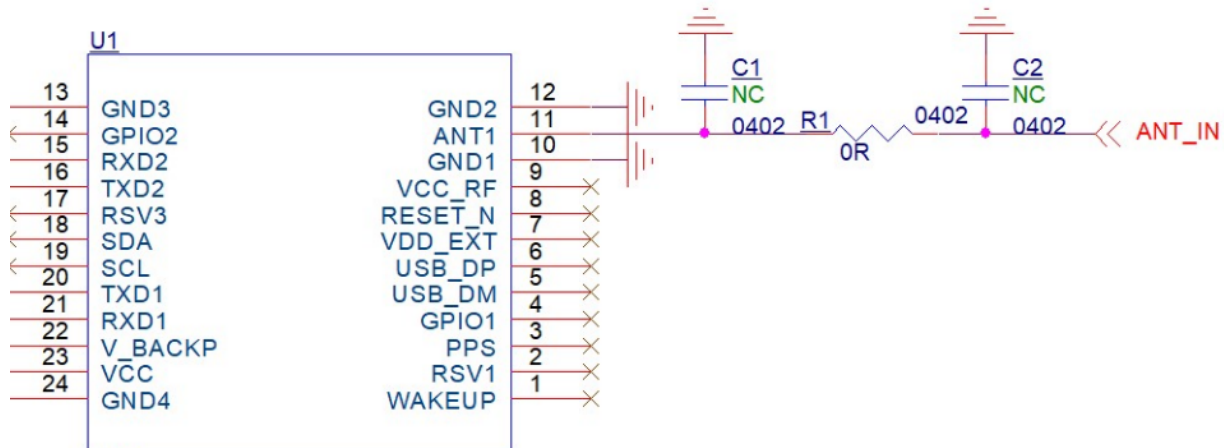


Figure 4. Reference Design of Antenna Access (Passive Antenna) / 天线接入参考设计 (无源天线)

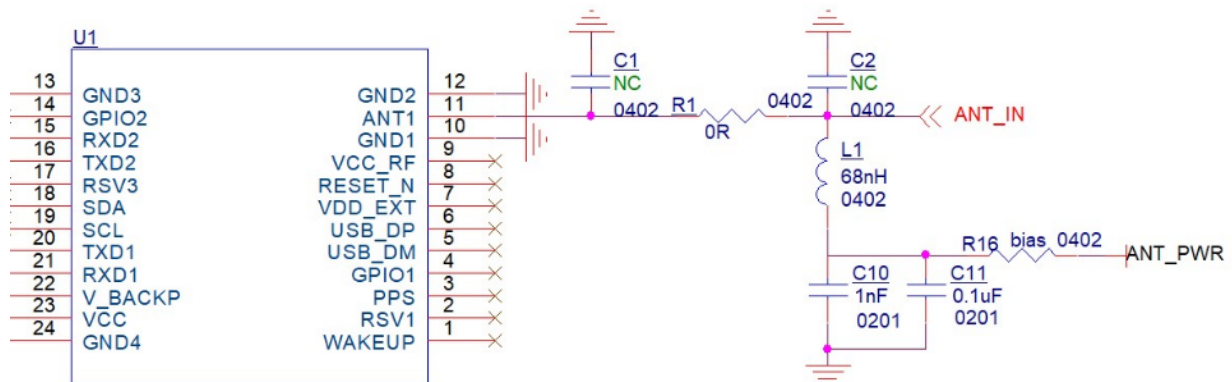


Figure 5. Reference Design of Antenna Access (Active Antenna) / 天线接入参考设计 (有源天线)

C1, R1 and C2 components Π Type B matching circuit is used to optimize the input impedance of the antenna. By default, R1 is 0, C1 and C2 are empty. Anti static protection device has been placed inside the module to protect RF signal input from ESD damage. The impedance of the RF line must be controlled at 50 Ω and the wiring should be as short as possible.

C1、R1 和 C2 组件组成 Π 型匹配电路，用于优化天线的输入阻抗。默认情况下，R1 为 0，C1 和 C2 空贴。模块内部已经放置防静电保护装置，用于保护射频信号输入免受 ESD 的损害。射频线的阻抗必须控制在 50 Ω ，且布线尽可能短。

Note: In order to prevent the feed inductance L1 from being burnt out in case of antenna short circuit, a current limiting resistance R2 is connected in series on the antenna feed chain. The resistance value of R2 should be selected according to the antenna feed voltage and the rated current value of L1, to ensure that the current value of the feed circuit is less than the rated current value of the feed inductance in case of antenna short circuit. If users want higher data quality, active antenna design is preferred.

注意：为防止天线短路时，烧坏馈电电感 L1，在天线馈电链路上串联了一个限流电阻 R2，R2 的电阻值要根据天线馈电电压和 L1 的额定电流值来选定，确保天线短路时，馈电电路电流值小于馈电电感的额定电流值。如果用户想要得到数据质量更高的，优先考虑有源天线设计。

5.2. Electrostatic Protection / 静电保护

Some components on QN601 module are easily damaged by static electricity, thus affecting IC circuit and other components. Therefore, electrostatic protection measures shall be taken during use.

- 1) When taking the module, you should try to wear gloves or finger cots and anti-static wrist straps that meet the electrostatic protection standards
- 2) In the process of taking the module, only the edge of the board shall be taken, and the solder joint, circuit part or element shall not be directly contacted to avoid sweat fingerprints from contaminating solder joints
- 3) Soft protective pads shall be used between modules and module intervals for protection during transportation
- 4) When the module is idle, it should be placed on the soft protective pad (such as anti-static sponge pad), and should not be stacked randomly
- 5) Modules shall be placed in order, with a certain interval between modules to avoid mutual collision
- 6) The module shall be handled with care during use to prevent damage to the module due to rough operation
- 7) When powering on, pay attention to the positive and negative poles of the power supply and the voltage to avoid reverse connection and burning of the module due to excessive voltage
- 8) When welding the module to the motherboard, make sure that GND is welded first, then ANT_ IN pin

- 9) Processing ANT_ Please do not touch any charged capacitor or material (such as surface mount antenna, coaxial cable, electric soldering iron, etc.) when pins are placed, so as to prevent the charge generated or stored by the above capacitor or material from damaging the ANT_ IN pin
- 10) Be sure to use an electric soldering iron with static protection to weld ANT_ IN pin

QN601 模块上的部分元器件易受静电影响而损坏,进而影响 IC 电路及其他元件。因此在使用时应注意做好静电防护措施:

- 1) 拿取模块时应尽量戴好手套或者指套以及符合静电防护标准的防静电腕带;
- 2) 模块拿取过程中应只拿取板卡的边缘部位, 不能直接接触焊点, 线路部分或者元器件, 避免汗液指印污染焊点;
- 3) 模块在运输过程中模块与模块间隔之间应该采用软性防护垫进行保护;
- 4) 模块闲置时应放置在软性防护垫上(如防静电海绵垫等), 不要随意堆叠;
- 5) 模块摆放应摆放整齐有序, 模块之间保持一定间隔, 避免相互碰撞;
- 6) 模块在使用过程中应该轻拿轻放, 防止粗暴作业损坏模块;
- 7) 上电时, 注意电源正负极以及电压, 避免反接和电压过高烧毁模块;
- 8) 将模块焊接到主板时, 请确保 GND 先焊接, 然后再焊接 ANT_IN 引脚;
- 9) 处理 ANT_ 引脚时, 请勿接触任何带电电容或材料(例如表贴天线、同轴电缆、电烙铁等), 以免上述电容或材料所产生或存储的电荷损坏 ANT_IN 引脚;
- 10) 请确保使用带静电保护的电烙铁焊接 ANT_IN 引脚。

5.3. Hardware Integration Considerations / 硬件集成注意事项

- 1) VCC power on has good monotonicity, and the starting level is lower than 0.4V, and the down rush and ringing guarantee are within 5% of VCC
- 2) Use VCC pin to provide reliable power supply and all GND pins of the module are grounded
- 3) Connect ANT_ IN signal to antenna, pay attention to 50 ohm impedance matching of the line
- 4) Module reset pin RST_ N is quick reset, please connect it correctly to ensure that the module can be reset reliably
- 5) Special attention shall be paid to:
Power supply: guarantee of stable and low ripple power supply, and the peak and peak value of ripple voltage should not be higher than 50mVpp. It is recommended to use a power chip with a current output capacity greater than 2A to power the board. In addition to using LDO

©2022, QinNav Technology Ltd. All rights reserved. QinNav is the trade mark of QinNav Technology Ltd, registered in People's Republic of China. All other trademarks are the property of their respective owners.

- to ensure the purity of power supply, it is also necessary to consider: ①
- Widen the power supply wiring or use the split copper surface to transmit current; ② LDO shall be placed as close to the module as possible in the layout; ③ Power supply wiring shall not pass through high-power and highly inductive components such as magnetic coils
- 6) Antenna interface: the antenna line shall be as short and smooth as possible to avoid sharp corners; Pay attention to 50ohm impedance matching
 - 7) Avoid wiring directly below QN601
 - 8) The module shall be kept away from high temperature airflow as far as possible
- 1) VCC 上电具有良好的单调性,且起始电平低于 0.4V,下冲与振铃保障在 5%VCC 范围内
 - 2) 用 VCC 引脚提供可靠的电源且模块所有 GND 引脚接地
 - 3) 连接 ANT_IN 信号至天线,注意线路 50 欧姆阻抗匹配
 - 4) 模块复位引脚 RST_N 为快速复位, 请正确连接以保证模块可以可靠复位
 - 5) 在设计中应特别注意:
 - 6) 供电: 稳定及低纹波电源的保证,纹波电压峰峰值最好不高于 50mVpp。建议采用电流输出能力大于 2A 的电源芯片给板卡供电。除了可采用 LDO 保证供电纯净外,还需要考虑: ①加宽电源走线或采用分割铺铜面来传输电流; ②布局上尽量将 LDO 靠近模块放置; ③电源走线避免经过大功率与高感抗器件如磁性线圈。
 - 7) 天线接口:天线线路尽量短且顺畅, 避免走锐角; 注意 50ohm 阻抗匹配
 - 8) 避免在 QN601 正下方走线
 - 9) 模块尽量远离高温气流

5.4. Connection Example / 连接示例

This section provides an application connection example of QN601 module in the form of specific circuit. With reference to the figure below, you can easily establish the communication circuit between QN601 module and other terminals (such as PC, GPRS module, Bluetooth module or other devices with UART).

本部分以具体电路的形式提供一个 QN601 模块应用连接示例。参照下面的图示, 您可以很方便建立 QN601 模块和其他终端 (如 PC, GPRS 模块, 蓝牙模块或其他带有 UART 的设备) 之间的通讯电路。

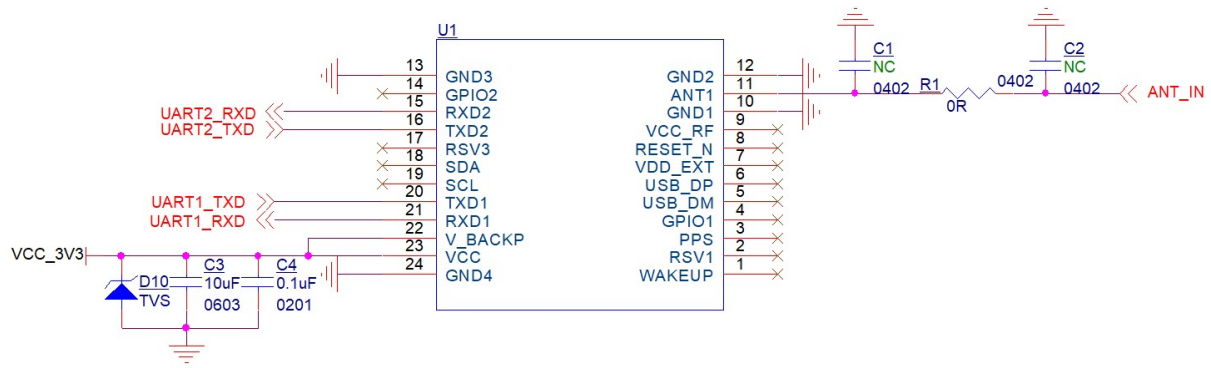


Figure 6. QN601 Module Connection Example (Passive Antenna Connection Mode) / QN601连接示例 (无源天线连接方式)

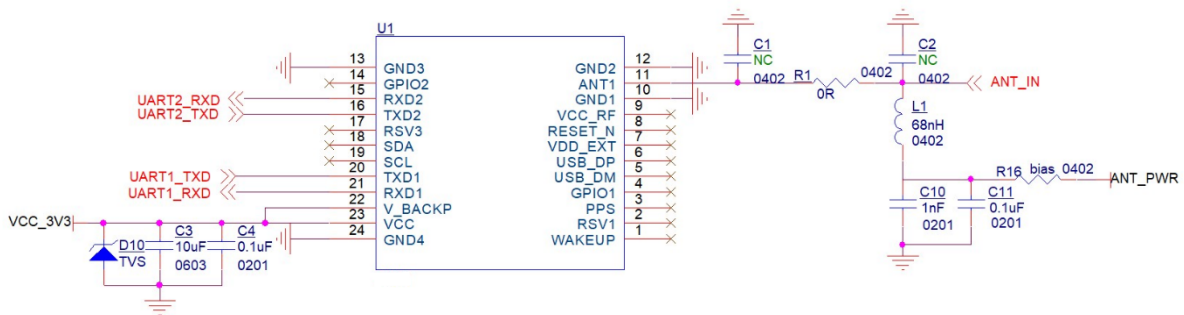


Figure 7. QN601 Module Connection Example (Active Antenna Connection Mode) / QN601连接示例 (有源天线连接方式)

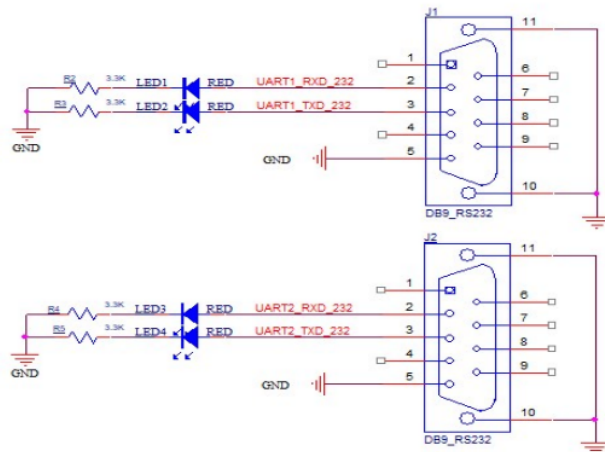


Figure 8. Example of Connection Between QN601 RS232 COM1, 2 and Other Devices Using UART Interface / QN601 RS232 COM1、2与其他使用UART接口的设备之间的连接示例

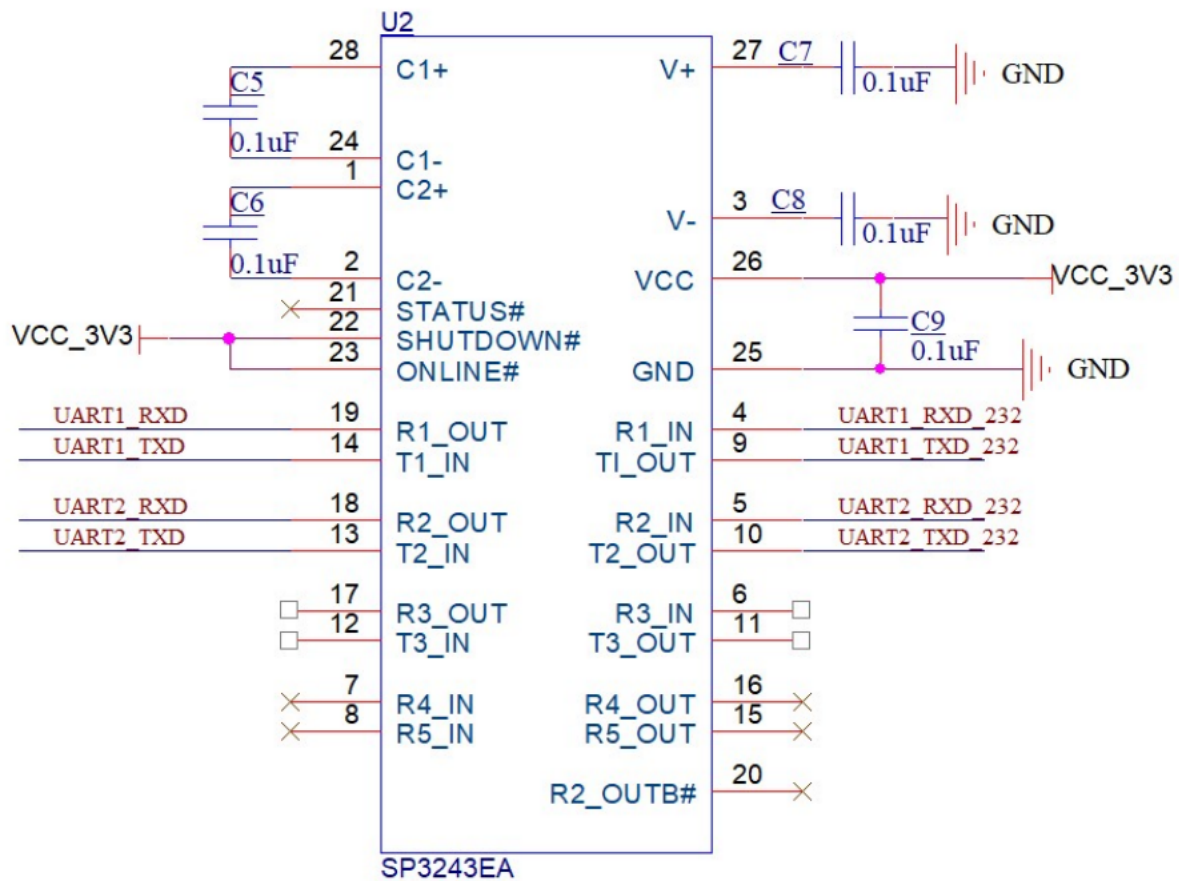


Figure 9. Example of COM Serial Port TTL to RS232 Connection / COM串口TTL转RS232连接示例

5.5. QN601G IMU Assembling Note / QN601G惯导安装说明

If you need to use the inertial navigation function of the QN601G module, please keep the marked Y-axis parallel or vertical to the carrier's travel direction.

若需使用 QN601G 模块的惯导功能，请保持标识的 Y 轴与载体进行方向平行或垂直。



Figure 10. IMU Assembling guide / IMU安装图

6. Packaging Production / 包装生产

6.1. Packaging / 包装

The appearance and structure of the specific packaging shall be subject to the actual delivery. The following suggestions are made for module packaging in this chapter:

具体包装的外观、结构以实际交货为准，本章节对于模块包装有以下几点建议：



Figure 11. Label Description / 标签说明

QN601 module uses tape and reel (applicable to mainstream surface mounting equipment), minimum package is 500/plate, and is packaged in a vacuum sealed aluminum foil electrostatic discharge bag containing desiccant to prevent moisture. When using reflow soldering process to weld modules, please strictly follow IPC standards to control the humidity of modules. As the carrier belt and other packaging materials can only withstand 65 °C, the module needs to be taken out of the package during baking.

QN601 模块使用载带、卷盘方式（适用于主流表面贴装设备），最小包装为 500/盘。包装在真空密封的铝箔防静电袋中，内含干燥剂防潮。采用回流焊工艺焊接模块时，请严格遵守 IPC 标准对模块进行湿度管控。由于载带等包装材料只能承受 65°C，在进行烘烤作业时需要将模块从包装中取出。