HARDWARE

REFERENCE DESIGN

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UM220-INS

Multi-GNSS Integrated Navigation and Positioning Module

Revision History

Version	Revision History	Date
Ver.1.1	First release	Aug. 2019
R1.2	Update Copyright time	Apr.2020
R1.3	Add odometer and direction signal requirements	Apr. 2020
R1.4	Fix typo	Jun. 2021
R1.5	Update the range of power supply	Aug. 2021
R1.6	Add notes about ESD protection	Nov. 2021
R1.7	Optimize the description of antenna power supply; Add Chapter 3 Power Supply Requirements	Apr. 2023

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Contents

1 Minimum System Reference Circuit

- Supply 3.0V~3.6V power VCC
- Ground all GND pins of the module
- Connect RF_IN signal to antenna, note the 50 Ω impedance match on the circuit
- Upgrade the module via port 1, ensuring that serial port 1 can interconnect with a PC through the interface
- If the user has a high requirement for ESD (> ±2000 V), the user should consider other method to feed the antenna rather than using the VCC_RF pin.

  If the antenna power supply and the module's main supply VCC use the same power rail, the ESD, surge and overvoltage from the antenna will have an effect on VCC, which may cause damage to the module. Therefore, it's recommended to design an independent power rail for the antenna to reduce the possibility of damage to the module.

  When designing the antenna feed circuit, it is recommended to choose a power supply chip with high ESD protection level. Gas discharge tube, varistor, TVS tube and other high-power protective devices may also be used in the power supply circuit to further protect the module from ESD damage or other Electrical Over-Stress (EOS).

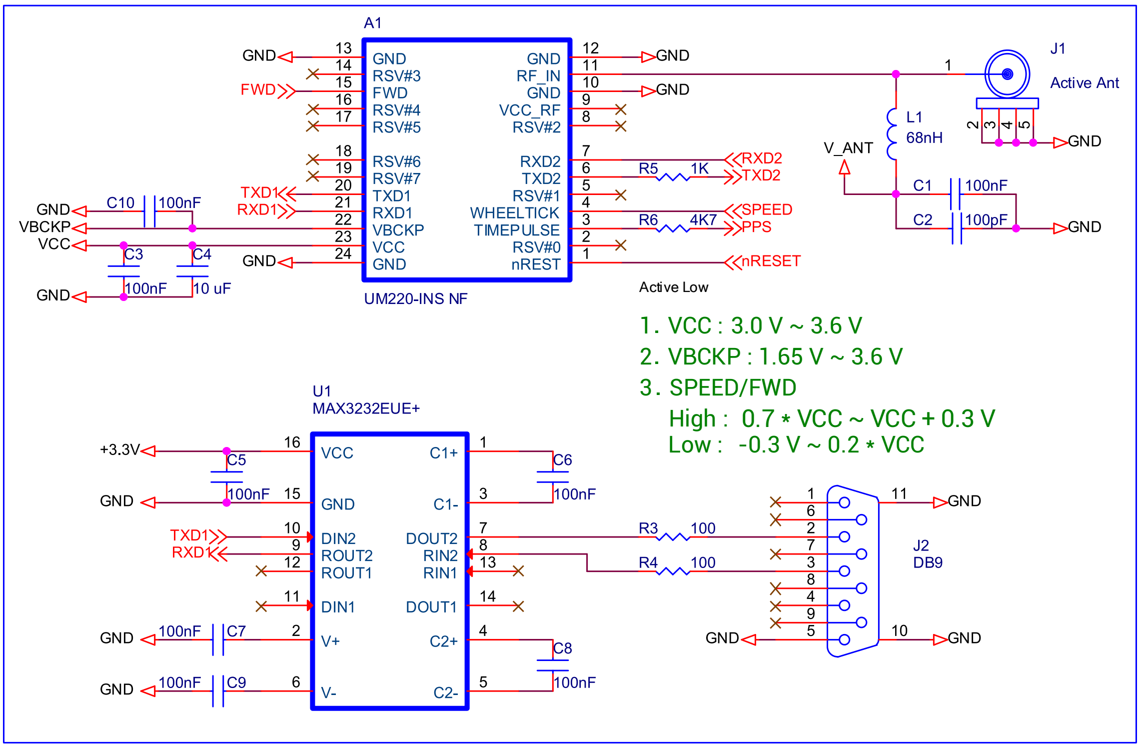

Figure 1 Minimum System Reference Circuit

2 Reference Circuit Using a Passive Antenna

- To ensure the system performance, low noise amplifier and filter should be added between the passive antenna and the module RF_IN
- If the user has a high requirement for ESD (> ±2000 V), the user should consider other method to power LNA rather than using VCC_RF.

  When designing the antenna feed circuit, it is recommended to choose a power supply chip with high ESD protection level. Gas discharge tube, varistor, TVS tube and other high-power protective devices may also be used in the power supply circuit to further protect the module from ESD damage or other Electrical Over-Stress (EOS).
- RF wire (Antenna → LNA → SAW → RF_IN), note the impedance matching at 50Ω

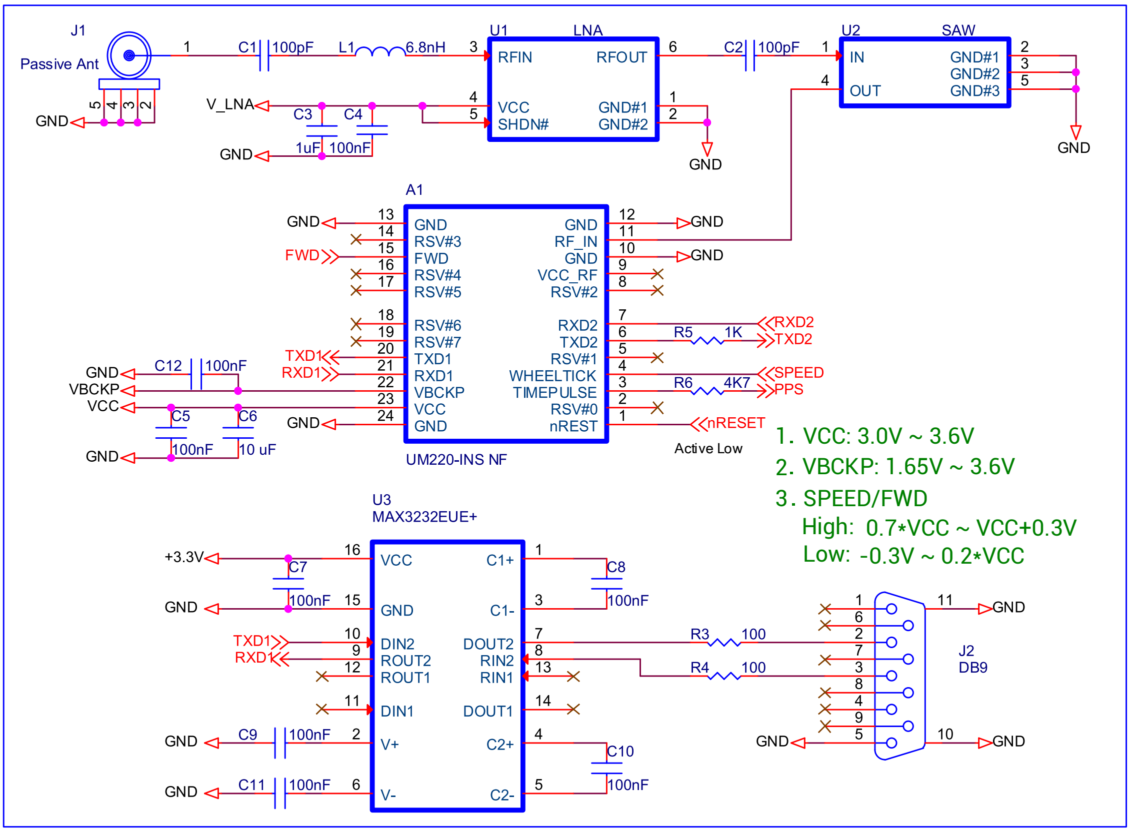

Figure 2 Reference Circuit Using a Passive Antenna

3 Power Supply Requirements

3.1 Main Supply (VCC)

The voltage range of VCC is 3.0 V ~ 3.6 V.

Notes:

- The VCC initial level when power-on should be less than 0.4 V.
- The VCC ramp when power-on should be monotonic, without plateaus.
- The voltages of undershoot and ringing should be within 5% VCC.
- VCC power-on waveform: The time interval from 10% rising to 90% must be within 100 μs ~ 10 ms.
- Power-on time interval: The time interval between the power-off (VCC < 0.4 V) to the next power-on is recommended to be larger than 500 ms.

3.2 Backup Supply (V_BCKP)

If the hot start function is needed, users should supply backup power to the module. The voltage range of V_BCKP is 1.65 V ~ 3.6 V.

Notes:

- The V_BCKP initial level when power-on should be less than 0.4 V.
- The V_BCKP ramp when power-on should be monotonic, without plateaus.
- The voltages of undershoot and ringing should be within 5% V_BCKP.
- V_BCKP power-on waveform: The time interval from 10% rising to 90% must be within 100 μs ~ 10 ms.
- Power-on time interval: The time interval between the power-off (V_BCKP < 0.4 V) to the next power-on is recommended to be larger than 500 ms.
- The V_BCKP pin cannot be floating or connected to ground. When V_BCKP is not used, it should be connected to VCC or connected to backup power.

4 Key Device Type Selection Reference

	Component	Order No	Manufacturer
U1	LNA	MAX2659ELT+	Maxim
U2	SAW	TA0757A/TA1661A	TAI-SAW

5 Odometer Waveform Diagram

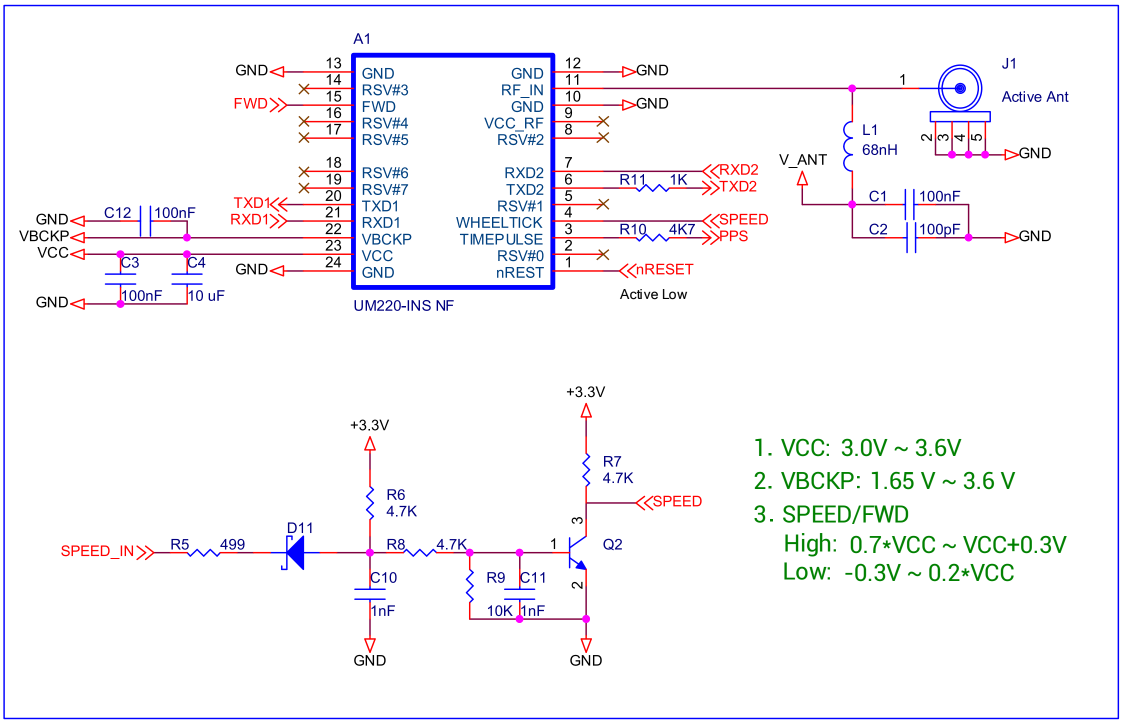

Figure 3 Odometer Reference Circuit

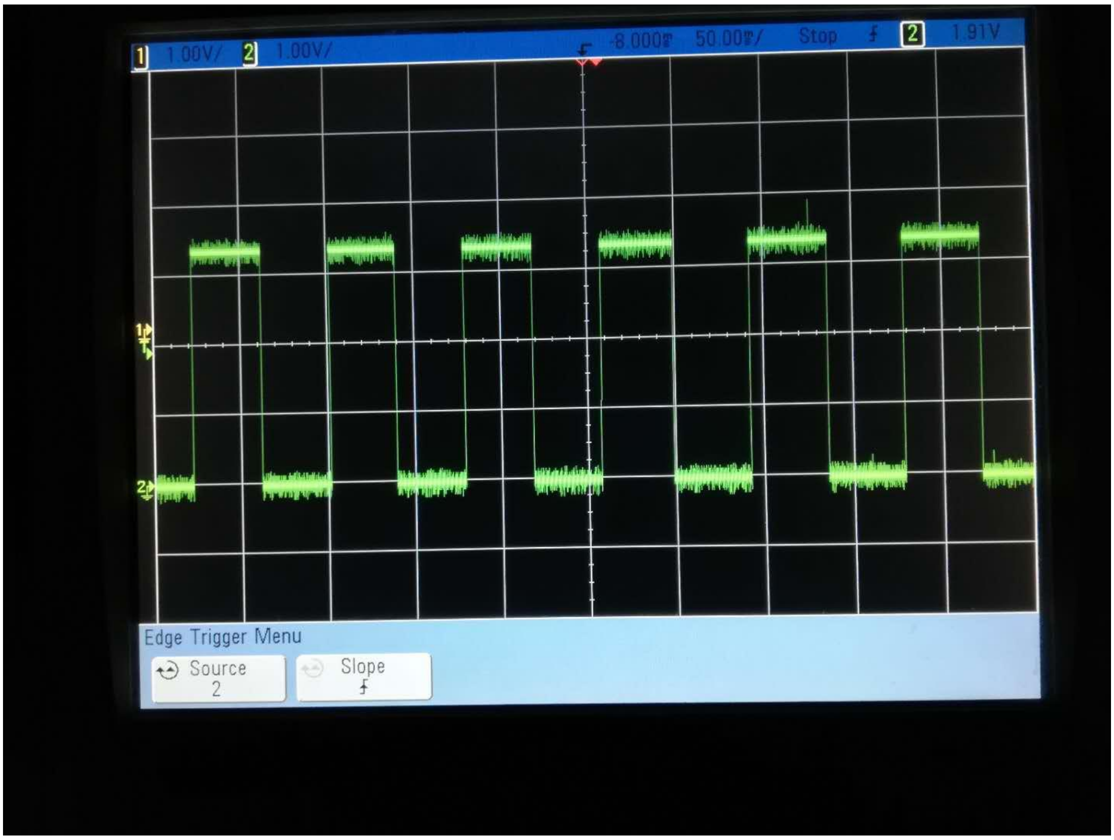

Figure 4 Odometer Waveform Diagram

6 Odometer and Direction Signal

6.1 Operation Condition

Item	Pin	Min.	Typ.	Max.	Unit	Condition
Power Supply (VCC)	Vcc	3.0	3.3	3.6	V	
Ripple Voltage	Vp-p			50	mV	
Low Level Input Voltage	V_{IL}	-0.3		0.2*Vcc	V	
High Level Input Voltage	V_{IH}	0.7*Vcc		Vcc+0.3	V	

6.2 Odometer (WHEELTICK) Frequency

1. The odometer signal requires the input of a square wave signal with a frequency not higher than 5KHz.
2. The distance of a square wave signal is required to be between 1cm and 50cm, and the typical value is 10cm.
3. The chip detects the rising edge quantities of square wave signal, and the time of high level and low level should not be lower than that of 100μs.
4. If the carrier is still (for example, parking), WHEELTICK pin level must remain constant

6.3 Direction (FWD) Signal

The module defaults to forward at high level and reverse at low level.
It can be configured through the commands as shown below. Please refer to the protocol manual for details

$CFGODOFWD,1 *forward at high level and reverse at low level*
$CFGODOFWD,0 *forward at low level and reverse at high level*

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