INSTALLATION AND OPERATION

USER MANUAL

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UM621N

Automotive Grade Dual-frequency Multi-GNSS Integrated Positioning Module

Revision History

Version	Revision History	Date
R1.0	First release	Oct. 2022

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Foreword

This document describes the information of the hardware, installation, specification and the use of Unicore UM621N modules.

Document Structure

1. Product introduction
2. Installation guide
3. Technical specifications
4. Package
5. Clean
6. Reflow soldering

Contents

1 Introduction

1.1 Overview

UM621N is a GNSS dual-frequency module with MEMS integrated navigation. It is designed for automotive applications based on the multi-system, dual-frequency and high-performance GNSS SoC – UFirebird II (UC6580A), which is independently developed by Unicore Communications, Inc. With the built-in six-axis inertial navigation device, the module supports multi-system dual-frequency joint positioning and single system standalone positioning, and can output GNSS+MEMS combined positioning results continuously even in tunnels and underground garages.

The chip of UM621N conforms to the requirements of AEC-Q100, and the manufacturing process is in line with IATF 16949.

Model	Ordering Code	PN	Grade		System							Interface				Data Update Rate
			Professional	Automotive	GPS	BDS	GLONASS	Galileo	NAVIC*	QZSS	SBAS	UART1	UART2	I²C	SPI	
UM621N	02	2310414000008		•	•	•	•	•	•	•	•	•	•	•	•	1Hz/10Hz/20Hz*

* The default data update rate is 1Hz, which can be configured to 10 Hz or 20 Hz, and the 20 Hz needs to be supported by specific firmware.

* NAVIC is supported by specific firmware.

1.2 Key Specifications

Power	
Voltage	+2.7 V~3.6 V DC
Power Consumption	330 mW
RF Input	
Constellations	GPS/GLONASS/BDS/Galileo/QZSS/NAVIC (IRNSS)*
Standing Wave Ratio	≤2.5
Input Impedance	50 Ω
Antenna Gain	15 dB ~ 30 dB
Physical Characteristics	
Dimensions	16.0 mm*12.2 mm*2.4 mm
Environmental Specification	
Operating Temperature	-40 ˚C ~ +85 ˚C
Input/ Output Data Interface	
UART x 2	LVTTL level Supported baud rate: 115200 ~ 460800 bps
I^2C x 1	Address: 7 bit Operating in slave mode Transfer rate: 400 Kbps
SPI x 1	Alternate function of pin 18~21 Operating in slave mode Maximum transfer rate: 4 Mbps
GNSS Performance	
Frequencies	GPS L1 C/A, L1C*, L5 GLONASS L1 BDS B1I, B1C*, B2a Galileo E1, E5a NAVIC* L5 QZSS L1, L5 SBAS

Time to First Fix (TTFF)	Cold Start	30s
	Hot Start	2s
	Reacquisition	2s
Horizontal Positioning Accuracy	1.5 m CEP (dual-frequency quad-constellation, open sky)	
Velocity Accuracy (RMS)	0.1 m/s	
INS Positioning Error	3D gyro + 3D accelerometer + speed signal 2%	
Sensitivity		GNSS
	Tracking	-165 dBm
	Acquisition	-148 dBm
	Hot Start	-158 dBm
	Reacquisition	-160 dBm
GNSS Data Update Rate	1 Hz / 10 Hz / 20Hz*	
INS Data Update Rate	100 Hz	
1PPS Accuracy (RMS)	20 ns	
Data Format	NMEA 0183, Unicore Protocol	

* Items marked with an asterisk are supported by specific firmware.

1.3 Interfaces

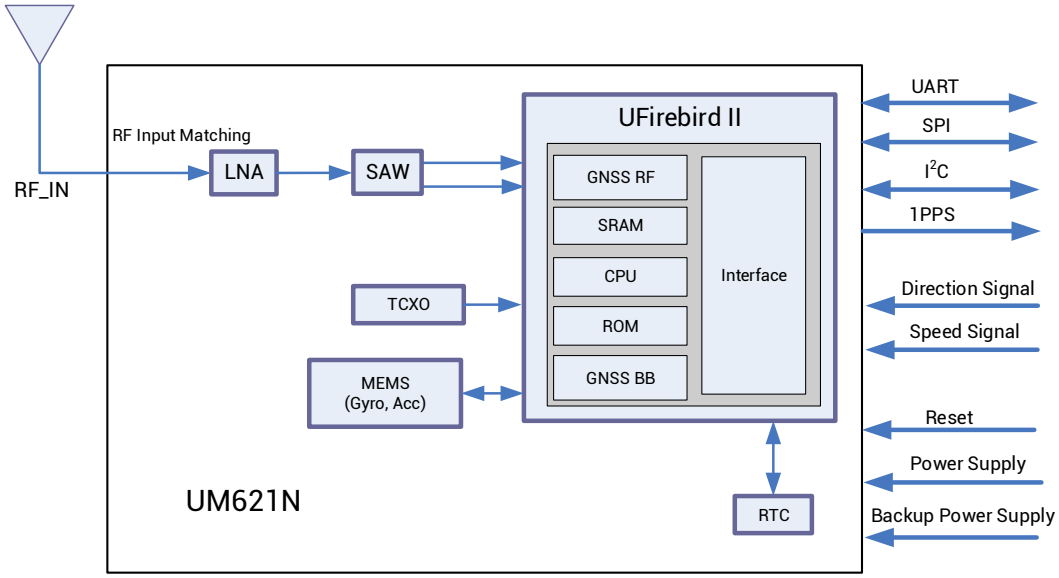


Figure 1-1 UM621N Block Diagram

UART

UART1 is the main serial port of UM621N, supporting data transmission and firmware upgrade, and the signal input/output voltage level is LVTTL. The baud rate can be configured by users flexibly, and the maximum is 460800bps. Ensure that UART1 is connected to a PC or an external processor for firmware upgrade.

UART2 only supports data transmission and can't be used for firmware upgrade.

MEMS

UM621N integrates a six-axis MEMS, a three-axis gyro and a three-axis accelerator. MEMS provides information on carrier attitude and speed changes, combined with GNSS data to output integrated positioning and navigation solution. The combination of GNSS+MEMS ensures better positioning performance than standalone GNSS, providing continuous and uninterrupted positioning, especially in the conditions with poor signals, such as tunnels, underground garages and urban canyons.

1PPS

UM621N outputs 1PPS with adjustable pulse width and polarity.

1PPS is not for timing application.

nRESET

Active LOW, and the active time should be no less than 10 ms.

2 Product Installation

2.1 Preparations

UM621N modules are Electrostatic Sensitive Devices (ESD) and must be installed with special precautions when handling. Please take the following protective measures before opening the anti-static plastic box.

- Follow the steps in section 2.2 in the correct order.
- Electrostatic discharge (ESD) may cause damage to the device. All operations mentioned in this chapter should be performed on an antistatic workbench, using an antistatic wristband and a conductive foam pad. If the antistatic workbench is unavailable, wear an antistatic wristband and connect the other end to a metal frame to play a role in antistatic protection.
- Hold the edge of the module, and DO NOT touch any components of the module.
- Please check carefully whether the module is obviously loose or damaged. If there are any problems, please contact Unicore or the local dealer.

Figure 2-1 shows the typical installation of UM621N evaluation kit (EVK).

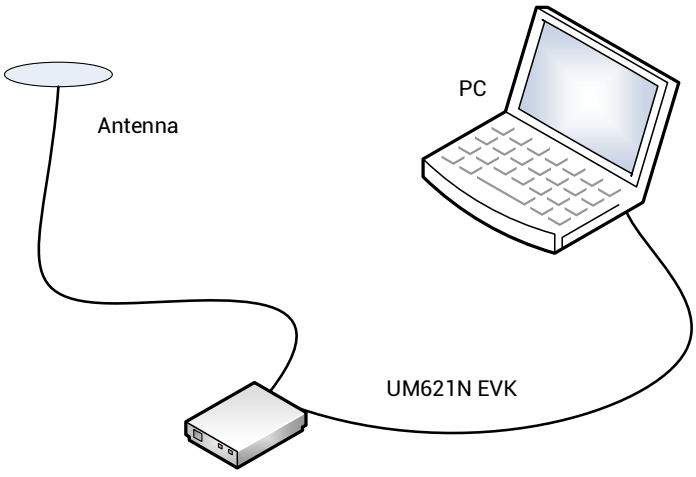


Figure 2-1 Typical Installation of UM621N

Please prepare the following items before installing UM621N.

- UM621N EVK (with AC Adapter)
- UM621N User Manual
- Unicore uSTAR software package

- Ancillary GNSS antenna
- USB cable and straight through serial cable
- PC or Laptop with serial ports (Windows 7 and above)

☞ Please keep the packing box and anti-static plastic box for storage and handling.

2.2 Hardware Installation

After the above preparations, please follow the steps below to install, which is used for satellite navigation test only.

Step 1: Make sure to take full anti-static measures, such as wearing an anti-static wristband and grounding the workbench.

Step 2: Open the UM621N evaluation kit and take out the evaluation board.

Step 3: Use the GNSS antenna with appropriate gain and fix it in a non-blocking area; use the appropriate cable to connect the antenna with UM621N evaluation board.

Step 4: Connect a PC to the EVK serial port through the USB cable or straight through serial cable.

Step 5: Open uSTAR software on the PC.

Step 6: Control the receiver through uSTAR to display constellations view, log messages, and receiver status, etc.

3 Technical Specifications

3.1 Electrical Specifications

Absolute Maximum Ratings

Item	Min	Max	Unit	Description
Power Supply (VCC)	-0.5	3.6	V	Main power supply
Backup Voltage (V_BCKP)	-0.5	3.6	V	Backup power supply for RTC
Digital IO Voltage	-0.5	3.6	V	Voltage of the digital signal pins
Antenna Input Power (RF_IN)	-	+3	dBm	Maximum input power of antenna
Storage Temperature (T_{STG})	-40	+85	°C	Storage temperature for the module

3.2 Operational Conditions

Item	Symbol	Min	Typical	Max	Unit	Condition
Power Supply (VCC)	VCC	2.7	3.3	3.6	V	
Ripple Voltage	V_{p-p}			50	mV	
Peak Current	I_{ccp}			134	mA	VCC=3.0 V
Tracking Average Current	I_{ACQ}	95	110	122	mA	VCC=3.0 V
Low Level Input Voltage	V_{IL}	0		0.2*VCC	V	
High Level Input Voltage	V_{IH}	0.7*VCC		VCC + 0.2	V	
Low Level Output Voltage	V_{OL}	0		0.4	V	I_{out}=-2 mA
High Level Output Voltage	V_{OH}	VCC– 0.4		VCC	V	I_{out}=2 mA
Antenna Gain	G_{ANT}	15	20	30	dB	
Operating Temperature	T_{OPR}	-40		+85	°C	

3.3 Dimensions

The dimensions of UM621N are as follows:

Parameter	Min (mm)	Typical (mm)	Max (mm)
A	15.9	16.0	16.5
B	12.05	12.2	12.35
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	0.7	0.8	0.9
K (Outer edge of the stamp hole)	0.7	0.8	0.9
N (Inner edge of the stamp hole)	0.4	0.5	0.6
M	0.8	0.9	1.0

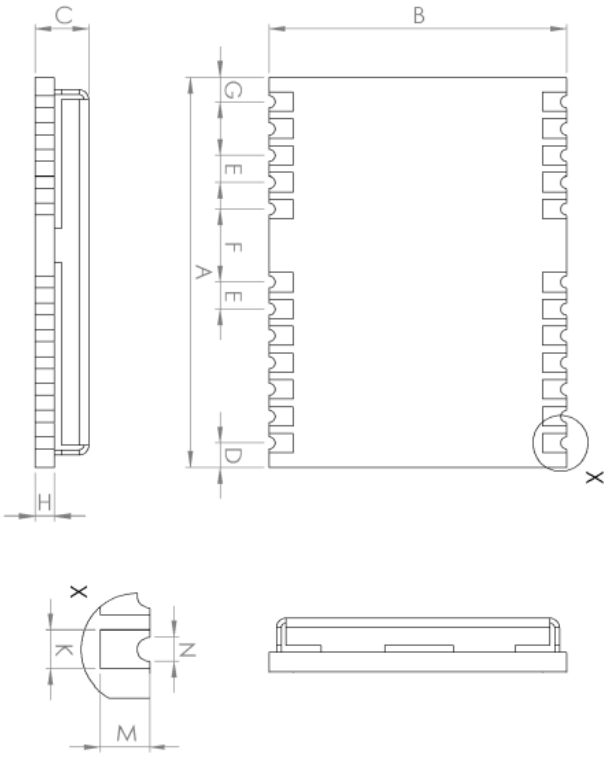


Figure 3-1 Mechanical Layout

3.4 Pin Definition

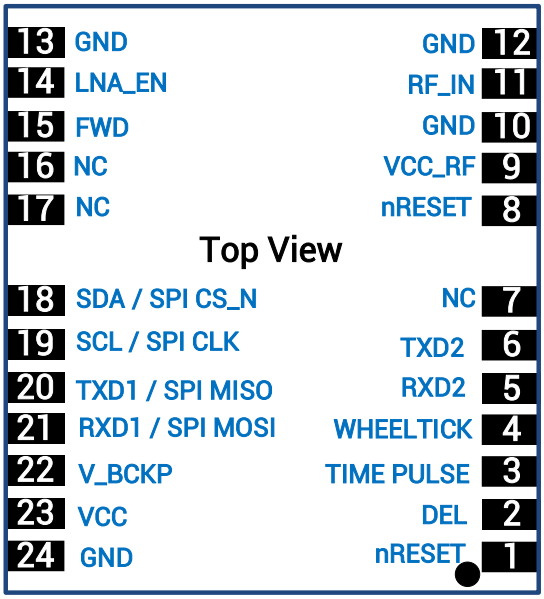


Figure 3-2 Pin Assignment

Pin No	Name	I/O	Electrical Level	Description
1	nRESET	I	LVTTL	Reset pin, active low. Keep it floating if not in use.
2	DEL	I	—	Interface selection pin. If DEL is set low level, SPI is available. If DEL is set high or floating, UART and I^2C become available.
3	TIMEPULSE	O	LVTTL	Pulse per second (1PPS)
4	WHEELTICK	I	LVTTL	Odometer speed pulse input. Keep it floating if not in use. It is strongly recommended to use this pin. The maximum pulse frequency is 5K Hz, and the minimum pulse width is greater than 100 us. Note: Incorrect signals of the odometer will lead to serious problems in the use of the product. Please make sure the signal is correct.
5	RXD2	I	LVTTL	UART 2 receiving data
6	TXD2	O	LVTTL	UART 2 transmitting data
7	NC	—	—	Floating
8	nRESET	I	LVTTL	Reset pin, active low. Keep it floating if not in use.

Pin No	Name	I/O	Electrical Level	Description
9	VCC_RF	O		Antenna feed output. It is recommended to use an external power supply rather than the VCC_RF pin to feed the antenna.
10	GND	—	—	Ground
11	RF_IN	I	—	GNSS signal input
12	GND	—	—	Ground
13	GND	—	—	Ground
14	LNA_EN	O	—	Enable external LNA
15	FWD	I	LVTTL	Odometer direction input. Keep it floating if not in use. It is strongly recommended to use it. High level = forward Low level = reverse Note: Incorrect signals of the odometer will lead to serious problems in the use of the product. Please make sure the signal is correct.
16	NC	—	—	Floating
17	NC	—	—	Floating
18	SDA / SPI CS_N	—	—	I^2C data (D_SEL=VCC or floating)/SPI chip select (D_SEL=GND)
19	SCL / SPI CLK	—	—	I^2C clock (D_SEL=VCC or floating)/SPI clock (D_SEL=GND)
20	TXD1/ SPI MISO	O	LVTTL	SPI Master In Slave Out (D_SEL=GND); UART TXD signal (D_SEL=VCC or floating)
21	RXD1/ SPI MOSI	I	LVTTL	SPI Master Out Slave In (D_SEL=GND); UART RXD signal (D_SEL=VCC or floating)
22	V_BCKP	I	1.7 V~3.6 V	Backup voltage supply, applicable for hot start. If you do not use hot start, connect V_BCKP to VCC. Do NOT leave it floating or connect it to ground.
23	VCC	—	2.7 V~3.6 V	Supply voltage
24	GND	—	—	Ground

3.5 PCB Packaging

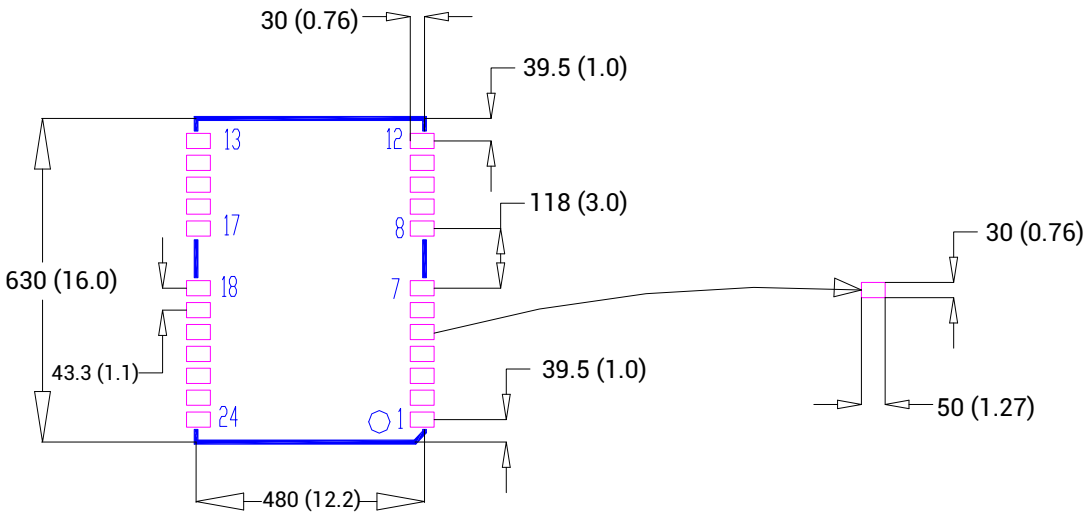
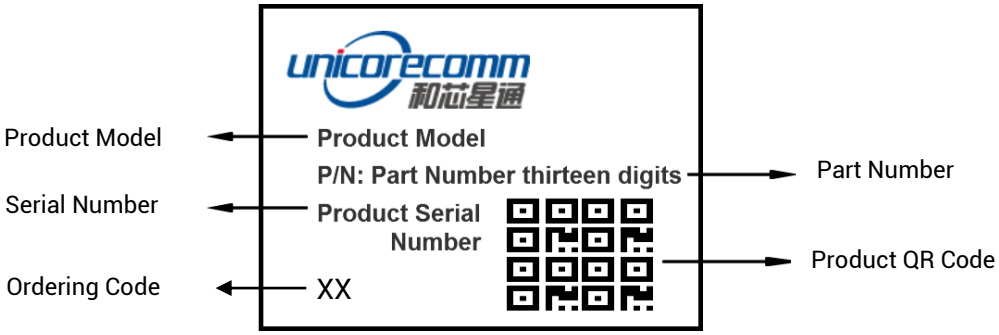


Figure 3-3 UM621N Recommended PCB Packaging (unit: mil, in brackets: mm)

☞ When designing PCB solder mask, make sure that the area under UM621N is completely coated with solder mask.

4 Package

4.1 Label Description



4.2 Ordering Information

Product Model	Ordering Code	PN	Description
UM621N	02	2310414000008	Automotive grade dual-frequency GNSS+MEMS module, supporting firmware upgrade, 16.0 mm x 12.2 mm, 500 pieces/reel

4.3 Package Description

The UM621N modules use carrier tape and reel (suitable for mainstream surface mount devices), packaged in vacuum-sealed aluminum foil antistatic bags, with desiccant inside to prevent moisture. When using reflow soldering process to solder the modules, please strictly comply with IPC standard to conduct temperature and humidity control. As packaging materials such as the carrier tape can only withstand the temperature of 55 degrees Celsius, modules shall be removed from the package during baking.

Figure 4-1 UM621N Module Package

Item	Description
Number of Modules	500 pieces/reel
Reel Size	Tray: 13" External diameter: 330 mm Internal diameter: 100 mm Width: 24 mm Thickness: 2.0 mm
Carrier Tape	Space between (center-to-center distance): 20 mm

UM621N modules are rated at MSL level 3. Please refer to the relevant IPC/JEDEC standards for baking requirements. Users may access to the website www.jedec.org to get more information.

The shelf life of UM621N modules packaged in vacuum-sealed aluminum foil antistatic bags is one year.

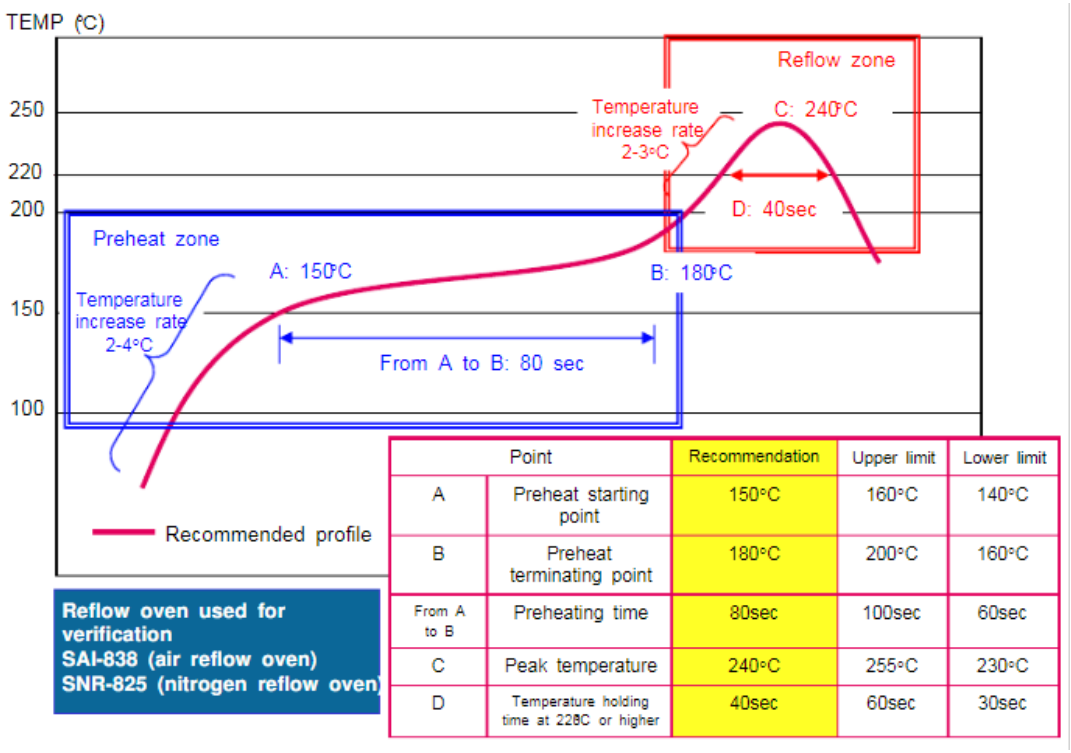
5 Clean

DO NOT use alcohol or other organic solvents to clean, which may lead to soldering flux residues flooding into the shielding shell, causing mildew and other problems.

6 Reflow Soldering

In order to avoid the device falling off, the module should be placed on the top of the main board during soldering. Reflow soldering temperature curve is recommended as shown in figure 6-1 below (M705-GRN360 is recommended for solder paste).

Note: The module can only be soldered once.



Point		Recommendation	Upper limit	Lower limit
A	Preheat starting point	150°C	160°C	140°C
B	Preheat terminating point	180°C	200°C	160°C
From A to B	Preheating time	80sec	100sec	60sec
C	Peak temperature	240°C	255°C	230°C
D	Temperature holding time at 228C or higher	40sec	60sec	30sec

Figure 6-1 Reflow Soldering Temperature Curve

Note: The apertures in the stencil need to meet the customer's own design requirements and inspection specifications, and the thickness of the stencil should be above 0.15 mm. It is recommended to be 0.18 mm.

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