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INSTALLATION AND OPERATION

USER MANUAL

UM220-IV NV

Automotive Grade Multi-GNSS Positioning Module

Revision History

Version	Revision History	Date
Ver. 1.0.0	Primary. *Unicorecomm UM220-IV NV-GN user manual* Version 1.0	Dec.2017
Ver. 1.0.1	Alpha release. Update definition name and performance parameter of pins	Oct.2018
Ver. 1.0.2	Alpha release. Update reflow soldering information; Update product label description; Update product Mechanical Layout;	May.2019
R1.1	Chapter 4.1: revise the frequency range in the description of antenna position Chapter 6.2 Package description: add the shelf life	Sep. 2019
R2	Chapter 6.2: revise the MSL instructions Revise the following parameters: power consumption, Iccp, I_{ACQ} and Input VSWR 1.1 Overview: add the product PN and HW version	Feb. 2020
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R3.1	Add description on reset and stencil	Jun. 2021
R3.2	Update power supply VCC and V_BCKP	Aug. 2021
R3.3	Add information in the Table in section 1.1; Add Notes in Section 4.5	Nov.2021
R3.4	If hot start is not used, connect V_BCKP to VCC.	Nov. 2022
R3.5	Optimize the description of antenna power supply; Add Chapter 4.2 Power Supply Requirements	Apr. 2023

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Foreword

This document offers you information in the features of the hardware, the installation, specification and use of UNICORECOMM UM220-IV NV-GN product.

Readers it applies to

This document is applied to the technicians who know GNSS Receiver to some extent but not to the general readers.

Structure of the file

This document includes the following:

Introduction: Briefly explaining the functions, performances and installation of the product

Installation: Containing the list of the product package and the details of product installation

Technical Specification: Offering technical specifications of the product

Hardware Specification: Offering all the information of hardware interface of the product

Mechanical Features: Offering UM220-IV NV-GN dimensions, layout, and top views.

Contents

1 Introduction

1.1 Overview

UNICORECOMM UM220-IV NV-GN is a multisystem GNSS module. It is designed on the basis of UNICORECOMM's low power GNSS SoC-UFirebird™ and supports GPS L1+BDS B1/GLONASS+Galileo+QZSS dual-system joint positioning or single system positioning. It can receive the QZSS signal and support AGNSS. When connected to network, the positioning speed will be improved by UNICORECOMM's assist data service.

UM220-IV NV-GN is compact in size and uses SMT pads to support fully automatic integration of standard discharge and reflow soldering, especially suitable for low cost and low power consumption fields.

Figure 1-1 UM220-IV NV-GN Module Diagram

Model	PN	Standard		System						Interface		Data Updating Rate
		Professional	Automotive	GPS	GLONASS*	BDS	Galileo*	QZSS	SBAS*	UART1	UART2	
UM220-IV NV-GN	2310408000023		●	●	●	●	●	●	●	●	●	1Hz
	2330322000033		●	●		●	●	●	●	●	●	1Hz

*Only supported by the firmware with revision of 3.4.0 or above

Notice: Module order number (GN) is displayed in the lower left corner of the module (see chapter 6.1). Automotive grade product is certified by AEC-Q100 and TS16949. The operating temperature range of automotive grade and industrial grade product is -40℃ ~ +85℃.

1.2 Key Features

Power	
Voltage	+3.0~3.6 VDC
Power Consumption[1]	90mW
RF Input	
Input VSWR	≤2.5
Input Impedance	50Ω
Antenna Gain	15～30dB
Physical Characteristics	
Dimension	16.0*12.2*2.4mm
Weight	0.8g
Environment	
Operating Temperature	-40℃ ~ +85℃
Storage Temperature	-45℃ ~ +90℃
RoHS	Accord
Input/ Output Data Interface	
UART	2 UART, LVTTL. Acceptable baud rate 9600 ~ 460800bps
GNSS Performance	
Frequency	BDS B1: 1561.098MHZ GPS L1: 1575.42MHZ GLO L1: 1602.5625MHZ
Time to First Fix (TTFF)	Cold Start: 28s Hot Start: 1s Reacquisition: 1s AGNSS[2]: 4s
Positioning Accuracy[3]	2.0m (Dual system horizontal, open sky) 3.5m (Dual system vertical, open sky)

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[1] Continuous positioning，typical value
[2] Timely input of assist data
[3] CEP, 50%

| Velocity Accuracy (RMS)	0.1m/s(Dual system horizontal, open sky)			
Sensitivity[4]		GN	BDS	GPS	GLONASS
	Tracking	-161dBm	-159dBm	-161dBm	-158dBm
	Acquisition	-147dBm	-144dBm	-147dBm	-142dBm
	Hot Start	-154dBm	-149dBm	-154dBm	-148dBm
	Reacquisi-tion	-157dBm	-156dBm	-157dBm	-153dBm
1PPS(RMS) [5]	20ns			
Data Update Rate	1Hz			
Data Output[6]	NMEA 0183，Unicore Protocol			

1.3 Interface
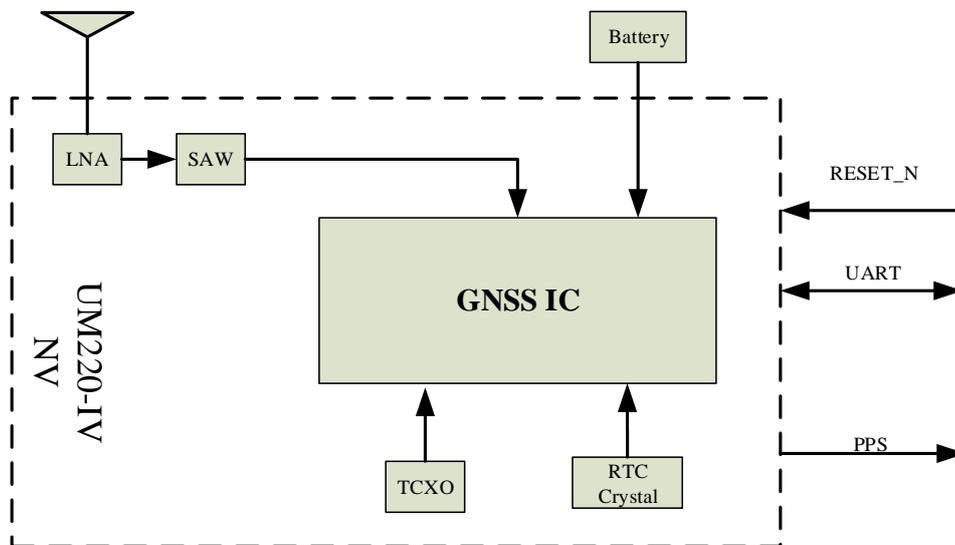
Figure 1-2 Structure Chart

UART

UM220-IV NV-GN module COM1 is the primary serial port, which supports data transfer and firmware upgrade function. The signal input/output level is LVTTL. The default baud rate varies according to the version of firmware, and the baud rate can be configured up

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[4] When C/N0 is 41db
[5] 1 hour statistics, timing is not recommended
[6] Configurable, refer to *UFirebird_Standard Positioning Products Protocol Specification* for details

to 460800bps[7]. During design in, please ensure that COM1 is connected to a PC or an external processor for firmware upgrades.

COM2 only supports data transmission, and cannot be used for firmware upgrade purpose. It is reserved for future use.

1PPS

UM220-IV NV-GN outputs 1PPS with adjustable pulse width and polarity.

2   Product Installation

2.1   Installation Preparation

UM220-IV NV-GN Modules are Electrostatic Sensitive Devices and require special precautions when handling.

- ➢ 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 carried out on an antistatic workbench, wear an antistatic wrist strap and use a conductive foam pad. If an antistatic workbench is not available, wear an antistatic wrist strap and connect the other end to a metal frame to prevent the damage of ESD
- ➢ Hold the edge of the module, not in direct contact with the components
- ➢ Please check carefully whether the module has obviously loose or damaged components. If you have questions, please contact us or your local dealer.

Figure 2-1 shows the typical installation of UM220-IV NV-GN EVK suites
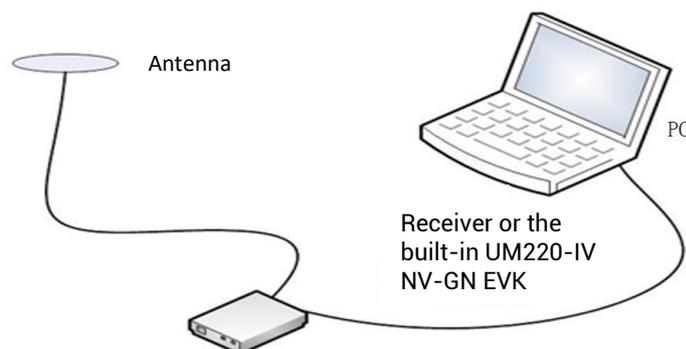

Figure 2-1

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[7] Refer to *UFirebird_Standard Positioning Products Protocol Specification* for details

Please check the contents of the package carefully after receiving the package of UM220-IV NV-GN.

- ➤ UM220-IV NV-GN EVK suite (with AC Adapter)
- ➤ UM220-IV NV-GN User manual
- ➤ uSTAR application package
- ➤ Qualified antenna
- ➤ Antenna connection cable
- ➤ Direct serial cable
- ➤ PC or Laptop with serial ports (Win7 or above)

Please keep the box and anti-static plastic bags for storage and handling

2.2 Hardware Installation

After the above preparations, follow the steps below to install:

Step 1： Make sure to take full anti-static measures, such as wearing an anti-static wrist strap, grounding the workbench;

Step 2： Open the UM220-IV NV-GN evaluation kit;

Step 3： Select the GNSS antenna with appropriate gain, fix it in a non-block area, using the appropriate cable to connect the antenna with UM220 EVK;

Step 4： Connect the PC to the EVK serial port through direct serial cable;

Step 5： Power the evaluation board and initialize the UM220-IV NV-GN;

Step 6： Run the uSTAR

Step 7： Control the receiver through uSTAR to display constellations view, log messages, and receiver status.

3 Technical Specifications

3.1 Electrical Specifications

Absolute Maximum Ratings

Item	Pin	Min	Max	Unit	Condition
Power Supply(VCC)	Vcc	-0.5	3.6	V	
VCC Ripple	Vrpp		50	mV	
Digital IO	Vin	-0.5	Vcc +0.2	V	
Storage Temperature	Tstg	-45	90	℃	
MSL	□Level 1 □Level 2 ■Level 3 □TBD				

3.2 Operation Condition

Item	Pin	Min	Typical	Max	Unit	Condition
Power Supply(VCC)	Vcc	3.0	3.3	3.6	V	
Peak Current	Iccp			60	mA	Vcc = 3.0 V
Tracking Average Current	I_{ACQ}	28	30	32	mA	Vcc = 3.0V
Low Level Input Voltage	Vin_low			0.7	V	
High Level Input Voltage	Vin_high	1.2			V	
Low Level Output Voltage	Vout_low			0.4	V	Iout = -8 mA
High Level Output Voltage	Vout_high	Vcc−0.4			V	Iout = 8 mA
Antenna Gain	Gant	15		30	dB	
Noise Figure	Nftot		2		dB	
Operating Temperature	Topr	-40		85	℃	

3.3 Dimensions

Table 3-1 Dimensions

Symbol	Min (mm)	Type (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 (Outside the hole)	0.7	0.8	0.9
N (Inside the hole)	0.4	0.5	0.6
M	0.8	0.9	1.0
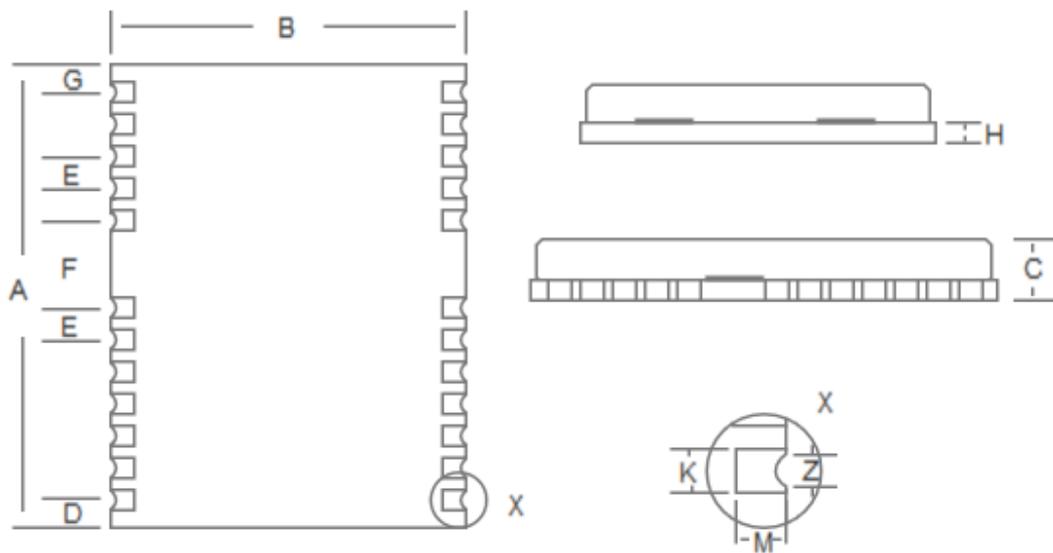
Figure 3-1 Mechanical Layout

3.4 Pin Definition (Top View)
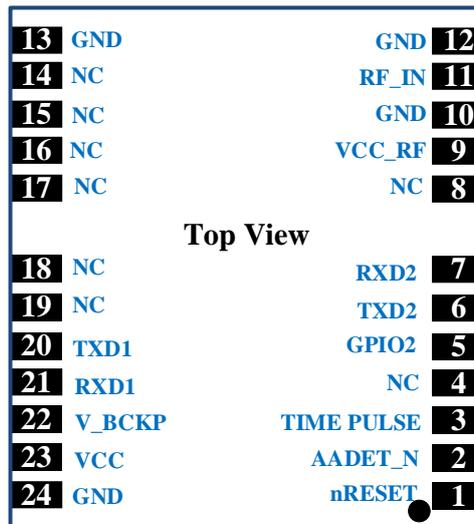
Figure 3-2 UM220-IV NV-GN Top View

No	Name	I/O	Electrical level	Description
1	nRESET	I	LVTTL	For reset, Low level active, if you do not use the pin, please leave it hanging
2	AADET_N	I	LVTTL	Antenna detection
3	TIMEPULSE	O	LVTTL	Time pulse(1PPS)
4	NC	I	LVTTL	reserve
5	GPIO2	I	LVTTL	Antenna detection
6	TXD2	O	LVTTL	UART 2-TX
7	RXD2	I	LVTTL	UART 2-RX
8	NC			reserve
9	VCC_RF	O	=VCC	Output voltage RF section
10	GND	—		Ground
11	RF_IN	I		GNSS signal input (BDS B1+GPS L1, GPS L1+GLONASS L1）
12	GND	—		Ground
13	GND	—		Ground
14	NC			reserve
15	NC			reserve

No	Name	I/O	Electrical level	Description
16	NC			reserve
17	NC			reserve
18	NC	I/O	LVTTL	reserve
19	NC	I/O	LVTTL	reserve
20	TXD1	O	LVTTL	UART 1-TX
21	RXD1	I	LVTTL	UART 1-RX
22	V_BCKP	I	1.65V~3.6V	Backup voltage supply If you do not use the hot start function, connect V_BCKP to VCC. Do NOT connect it to ground or leave it floating.
23	VCC	—	3.0V~3.6 V	Main power
24	GND	—		Ground

3.5 PCB Packaging
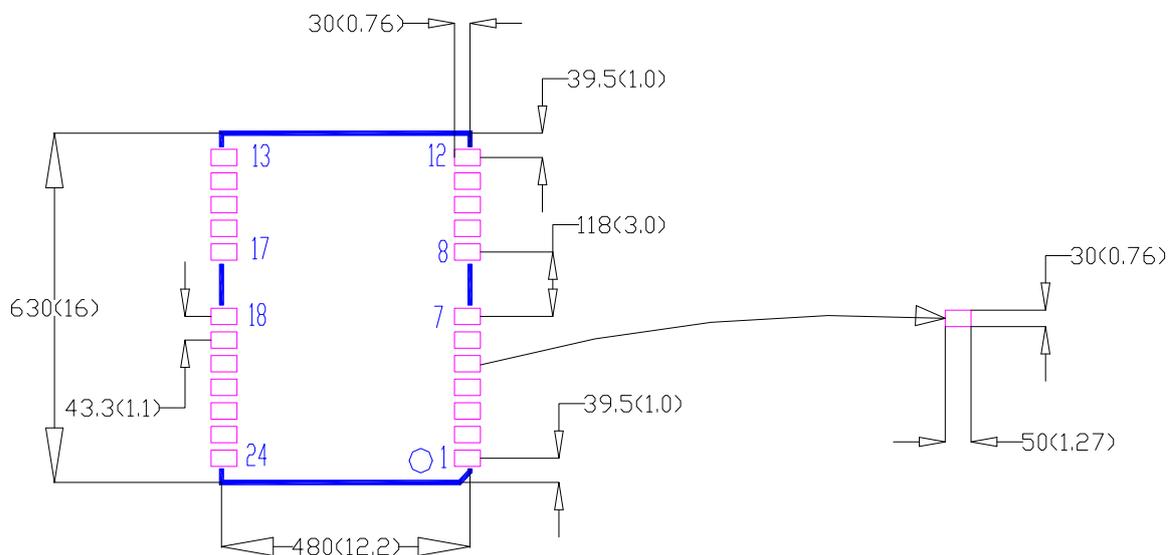
Figure 3-3 UM220-IV NV-GN Recommended PCB Packaging (unit: mil, in brackets: mm)

In the design of PCB solder, make sure the area of the UM220-IV NV-GN modules are fully covered with solder layer

4 Hardware Design

4.1 Design in Considerations

To ensure that UM220-IV NV-GN works normally, please pay attention to the following:

➢ Connect all the GND pins to ground.

➢ Connect the RF_IN signal to the antenna, and the line should keep 50Ω impedance matching

➢ Ensure COM1 is connected to a PC or an external processor, users can use this serial port to receive position data. COM1 is also necessary for firmware upgrades.

In order to obtain good performance, special concern should be paid during the design:

➢ Power supply: Stable and low ripple power is necessary for good performance. Make sure the peak to peak voltage ripple does not exceed 50mV.

- Use LDO to ensure the purity of power supply

- Try to place LDO close to the module in layout

- Widen the power circuit or use copper pour surface to transmit current

- Avoid walking through any high-power or high inductance devices such as a magnetic coil

➢ UART interfaces: Ensure that the signals and baud rate of main equipment match that of UM220-IV NV module

➢ Antenna interface: Make sure the antenna impedance matches, and the cable is short and smooth, try to avoid acute angles

➢ Antenna position: In order to ensure a good signal-to-noise ratio, the antenna should be well isolated from any electromagnetic radiation source, especially the electromagnetic radiation in the frequency range of 1559 ~ 1607MHz

➢ Try to avoid designing in any circuits underneath UM220-IV NV-GN

➢ This module is a temperature sensitive device, dramatic changes in temperature will result in reduced performance. Keep it away as far as possible from any high-power high-temperature air and heating devices.

4.2　Power Supply Requirements

4.2.1　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.

4.2.2　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.

4.3 Avoid Power Leakage

Module input ports of UM220-IV NV-GN include RXD and GPIO. When the module is not powered on, if there is data input in the above ports, it will cause power leakage on the module VCC. When the leakage voltage is higher than 1.6 V, it may cause failure of starting up when the module is powered on.

Solution：

When the module is not powered on, make sure that the IO ports connected on the module is in a high-resistance state or a low level to avoid power leakage.

4.4 Reset

If the reset pin nRESET of UM220-IV NV-GN module needs to be used, the following timing requirements must be met between the nRESET and the power supply VCC. During normal operation of the module, pulling down the nRESET pin over the 5ms can also reset the UM220-IV NV-GN.
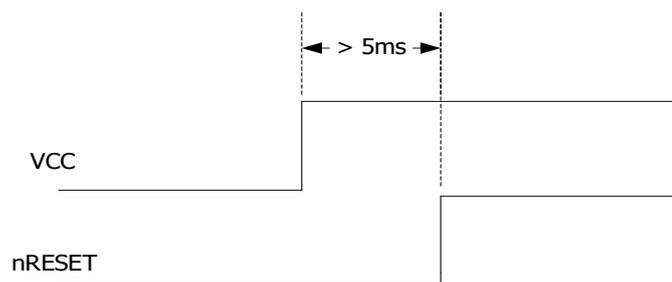

Figure 4-1 UM220-IV NV-GN Reset Requirement

4.5 Antenna

If the UM220-IV NV-GN uses an active antenna, the bias voltage V_BIAS is supplied to the antenna through a feed inductor. It's recommended to use an independent power as V_BIAS to supply the antenna.

☞ 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.
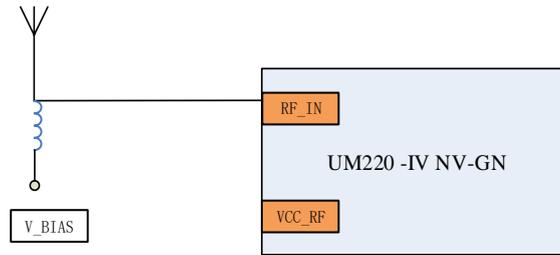
Figure 4-2 UM220-IV NV-GN Active Antenna Solution

If UM220-IV NV-GN uses a passive antenna, the antenna can be directly connected to the RF_IN pin. It should be noted that the use of passive antennas may cause a decrease in GNSS performance compared to active antennas.
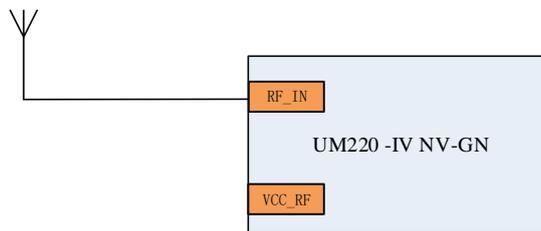

Figure 4-3 UM220-IV NV-GN Passive Antenna Solution

4.6 Serial Port

UM220-IV NV-GN has two LVTTL serial ports, for PC connection, please use a RS232 voltage level converter.
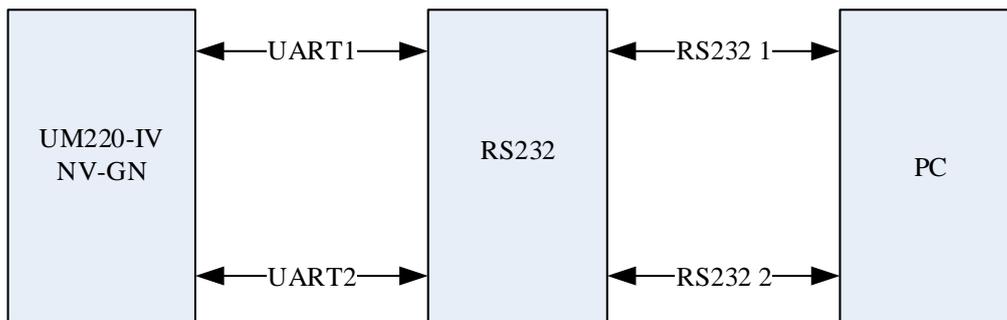

Figure 4-4 Connect COM to PC

5 Disassembly

When it is necessary to remove the module, it is recommended to melt the soldering tin of the pins on both sides of the module with an electric soldering iron and remove the module with tweezers. Do not use other means to remove the module (such as using a hot air gun to blow module), or it may lead to module damage.

6 Package

6.1 Product Label Description

6.2 Package Description

The UM220-IV NV-GN module is packaged in vacuum sealed aluminum foil anti-static bag with desiccant and moisture-proof agent. When using reflow welding process to weld modules, please strictly comply with IPC standard to conduct humidity control on modules. As packaging materials such as carrier belt can only withstand the temperature of 65 degrees Celsius, modules should be removed from the packaging during baking.

Figure 6-1 Module Package

Item	description
Module	500pics/reel
Reel Size	workpiece tray:13″ external diameter 330mm, internal diameter 100mm, wide 24mm, thickness 2.0mm
Carrier Tape	Space between:20mm

Check the humidity indicator card before soldering. The 30% indication is blue for normal conditions, as shown in figure 6-2. Bake modules firstly before soldering if the 30% indication turns pink, as shown in figure 6-3. The UM220-IV NV-GN modules are rated at MSL level 3. For more MSL information, please visit www.jedec.org.
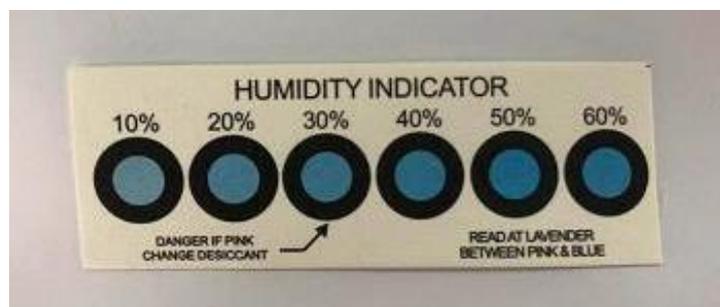

Figure 6-2 The 30% Indication Is Blue
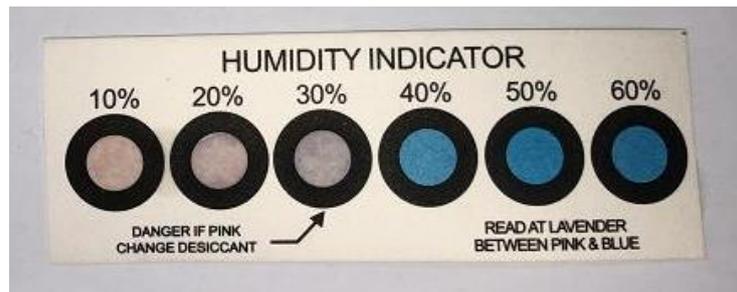
Figure 6-3 The 30% Indication Is Pink

The shelf life of UM220-IV NV-GN is one year.

7 Clean

Do not use alcohol or other organic solvents to clean, or it may lead to flux residues seeping into the shielding shell, causing mildew and other problems.

8 Reflow Soldering

In order to avoid device falling off, the module should be placed on the top of the main board during welding. Reflow soldering temperature curve is recommended as shown in figure 8-1 below (M705-GRN360 is recommended for solder paste).


	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
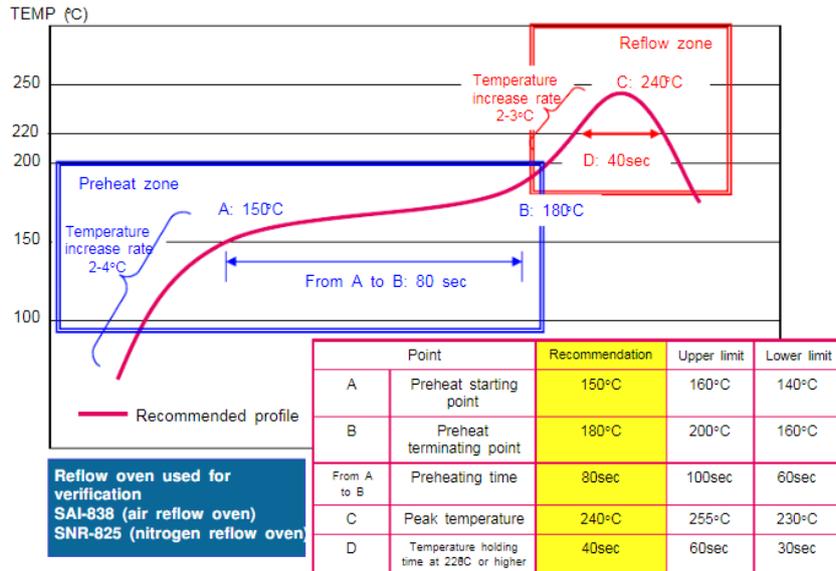
Figure 8-1 Reflow Soldering Profile

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 0.15mm, and 0.18mm is recommended.