unicore

INSTALLATION AND OPERATION

USER MANUAL

UM620 Series

Multi-GNSS Dual-frequency

Positioning Module

Revision History

Version	Revision History	Date
R1.0	First release	Oct. 2022
R1.1	Add notes on the VCC_RF pin Add Chapter 3.6: Power Supply Requirements	Apr. 2023
R2.0	Add the industrial grade module; Update related parameters	Sept. 2023
R2.1	Update the TTFF and velocity accuracy; Modify the voltage range of V_BCKP	Feb. 2024

Legal right notice

This manual provides information and details on the products of Unicore Communication, Inc. ("Unicore") referred to herein.

All rights, title and interest to this document and the information such as data, designs, layouts contained in this manual are fully reserved, including but not limited to the copyrights, patents, trademarks and other proprietary rights as relevant governing laws may grant, and such rights may evolve and be approved, registered or granted from the whole information aforesaid or any part(s) of it or any combination of those parts.

Unicore holds the trademarks of "和芯星通", "Unicore" and other trade name, trademark, icon, logo, brand name and/or service mark of Unicore products or their product serial referred to in this manual (collectively "Unicore Trademarks").

This manual or any part of it, shall not be deemed as, either expressly, implied, by estoppel or any other form, the granting or transferring of Unicore rights and/or interests (including but not limited to the aforementioned trademark rights), in whole or in part.

Disclaimer

The information contained in this manual is provided "as is" and is believed to be true and correct at the time of its publication or revision. This manual does not represent, and in any case, shall not be construed as a commitments or warranty on the part of Unicore with respect to the fitness for a particular purpose/use, the accuracy, reliability and correctness of the information contained herein.

Information, such as product specifications, descriptions, features and user guide in this manual, are subject to change by Unicore at any time without prior notice, which may not be completely consistent with such information of the specific product you purchase.

Should you purchase our product and encounter any inconsistency, please contact us or our local authorized distributor for the most up-to-date version of this manual along with any addenda or corrigenda.

Foreword

This document describes the information of the hardware, installation, specification and the use of Unicore UM620 series 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

UM620 series modules are GNSS dual-frequency modules independently developed by Unicore Communications. Based on the multi-system, dual-frequency and high-performance GNSS SoC – UFirebird II (UC6580), UM620 series modules support multi-system joint positioning and single system standalone positioning. It can output accurate positioning results even in complex scenarios.

The manufacturing process of UM620 series modules is in line with IATF 16949, and the GNSS chip of the automotive grade module conforms to the requirements of AEC-Q100.

Figure 1-1 UM620 Series Modules (Left: Automotive; Right: Industrial)

Main Model	Sub-model	Operating Temperature		Grade		System						Interface				Data Update Rate
		-40°C~+85°C	-40°C~+105°C	Professional	Automotive	GPS	BDS	GLONASS	Galileo	QZSS	SBAS	UART1	UART2	I²C*	SPI*	
UM620A	02	●			●	●	●	●	●	●	●	●	●	●	●	1 Hz/ 5 Hz*/ 10 Hz*
UM620	02	●		●		●	●	●	●	●	●	●	●	●	●	1 Hz/ 5 Hz*/ 10 Hz*

* The default data update rate is 1Hz; specific firmware supports 5 Hz and 10 Hz.

1.2 Key Specifications

Power	
Voltage	+2.7 V ~ 3.6 V DC
Power Consumption	300 mW (automotive grade, typical value) 150 mW (industrial grade, typical value)
RF Input	
Constellations	GPS/GLONASS/BDS/Galileo/QZSS
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 Specifications	
Vibration	UM620A: GB/T 28046.3, ISO 16750.3 UM620: GB/T 2423.43, IEC 60068-6
Shock	UM620A: GB/T 28046.3, ISO 16750.3 UM620: GB/T 2423.43, IEC 60068-5
Input / Output Data Interface	
UART x 2	LVTTL level Supported baud rate: 115200 ~ 460800 bps
* I^{2}C 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, L5 GLONASS G1 BDS B1I, B1C*, B2a Galileo E1, E5a

	QZSS L1, L5	
	SBAS	
Time to First Fix (TTFF)	Cold Start	26 s
	Hot Start	2 s
	Reacquisition	2 s
Horizontal Positioning Accuracy	1.5 m CEP (dual-frequency quad-constellation, open sky)	
Velocity Accuracy (RMS)[1]	0.05 m/s	
Sensitivity	GNSS	
	Tracking	-162 dBm
	Cold Start	-148 dBm
	Hot Start	-158 dBm
	Reacquisition	-160 dBm
GNSS Data Update Rate	1 Hz / 5 Hz* / 10 Hz*	
1PPS Accuracy (RMS)	20 ns	
Data Format	NMEA 0183, Unicore Protocol	

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

---

[1] 68% at 30 m/s for dynamic operation, open sky

1.3 Interfaces
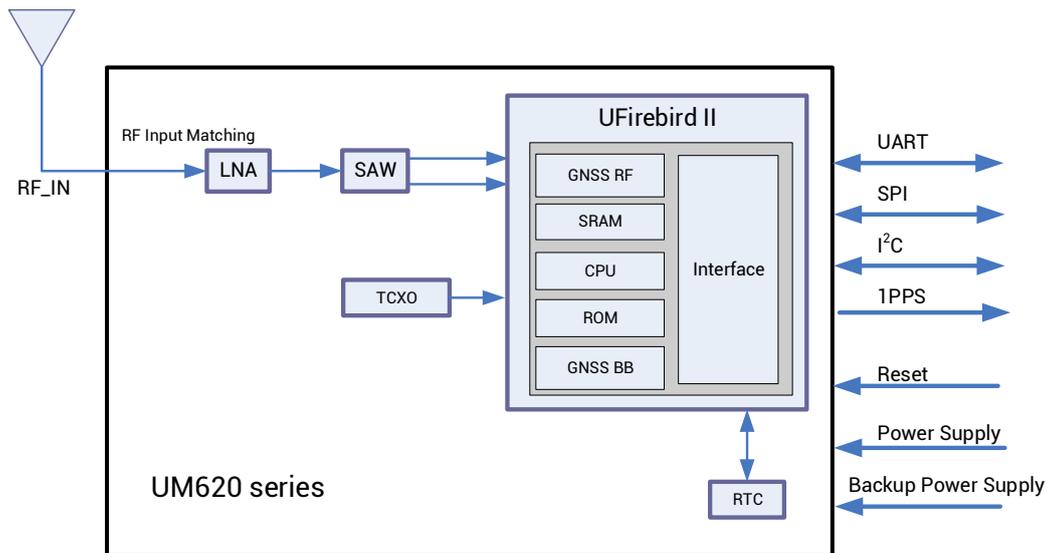
Figure 1-2 UM620 Series Modules Block Diagram

UART

UM620 series modules have two configurable UART ports. UART1 is the main serial port, which supports data transmission and firmware upgrade, and the signal input/output voltage level is LVTTL. The baud rate can be configured up to 460800 bps[2]. **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.

1PPS

UM620 series modules output 1PPS with adjustable pulse width and polarity.

1PPS is not for timing application.

nRESET

Active low, and the active time is required to last at least 10 ms.

---

[2] For more information, see *Unicore FirebirdII Protocol Specification.*

2 Product Installation

2.1 Preparations

UM620 series modules are Electrostatic Sensitive Devices (ESD) and must be installed with special precautions when handling. Please follow the instructions below before opening the anti-static plastic box.

1) Follow the steps in section 2.2 in the correct order.
2) 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 not available, wear an antistatic wrist strap and connect the other end to a metal frame to play the anti-static role.
3) Hold the edge of the module, and DO NOT touch any components of the module.
4) 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 UM620 series evaluation kit (EVK).
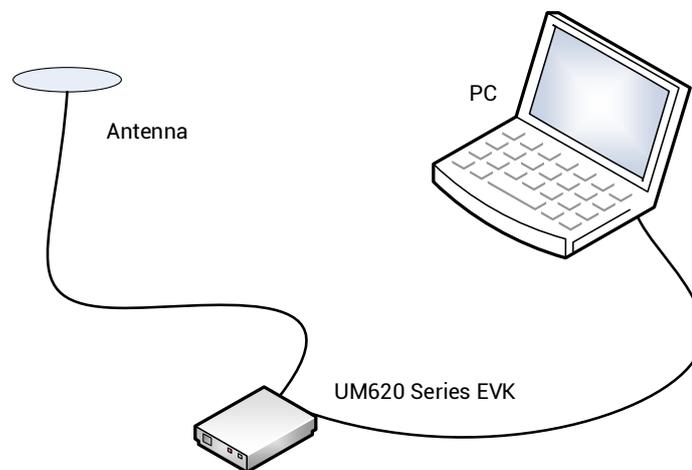
Figure 2-1 Typical Installation of UM620 Series EVK

Please prepare the following items before installing the UM620 series modules.

- UM620 series EVK (with AC Adapter)
- UM620 series modules *User Manual*
- Unicore UPrecise software package
- Accessory 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 the module, which is only for satellite navigation test.

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

Step 2: Open the UM620 series 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 UM620 series evaluation board.

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

Step 5: Open UPrecise software on the PC.

Step 6: Control the receiver through UPrecise 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	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 (Automotive)	I_{ACQ}	90	100	116	mA	VCC=3.0 V
Tracking Average Current (Industrial)	I_{ACQ}	40	50	55	mA	VCC=3.0V
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	

3.3 Dimensions

Symbol	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
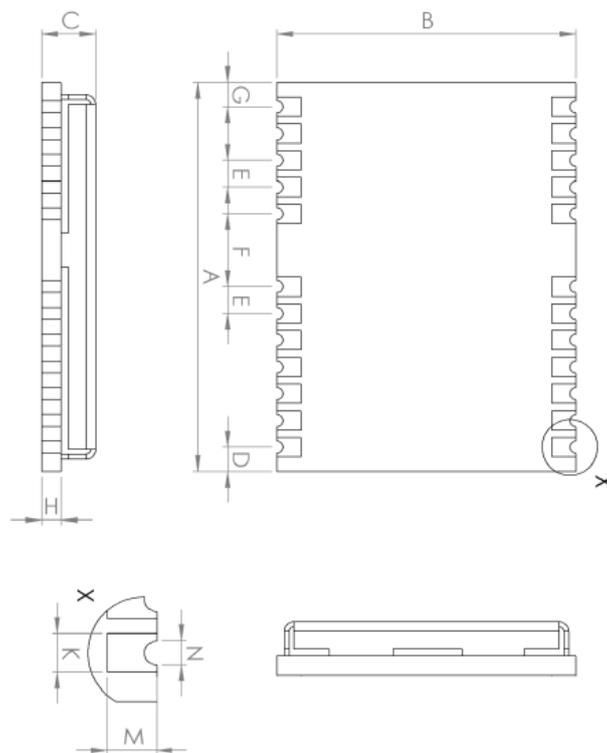
Figure 3-1 Mechanical Layout

3.4 Pin Definition
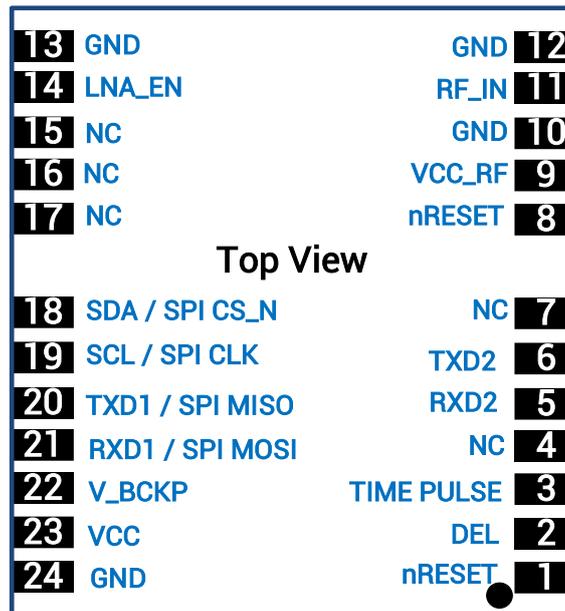
Figure 3-2 Pin Assignment

Pin No.	Name	I/O	Electrical Level	Description
1	nRESET	I	LVTTL	Reset. Active low. Leave 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	Time pulse (1PPS)
4	NC	—	—	Floating
5	RXD2	I	LVTTL	UART 2 receiving data
6	TXD2	O	LVTTL	UART 2 transmitting data
7	NC	—	—	Floating
8	nRESET	I	LVTTL	Reset. Low active. Leave 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 VCC_RF to feed the antenna.[3]
10	GND	—	—	Ground
11	RF_IN	I	—	GNSS signal input
12	GND	—	—	Ground
13	GND	—	—	Ground
14	LNA_EN	O	—	Enable external LNA; high level by default
15	NC	—	—	Floating
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	2.0V~3.6V	Backup voltage supply, applicable for hot start. If you do not use hot start, connect V_BCKP to VCC. Do NOT connect it to ground or leave it floating.
23	VCC	—	2.7V~3.6V	Supply voltage
24	GND	—	—	Ground

* I^2C and SPI are supported by specific firmware

---

[3] 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.

3.5 PCB Packaging
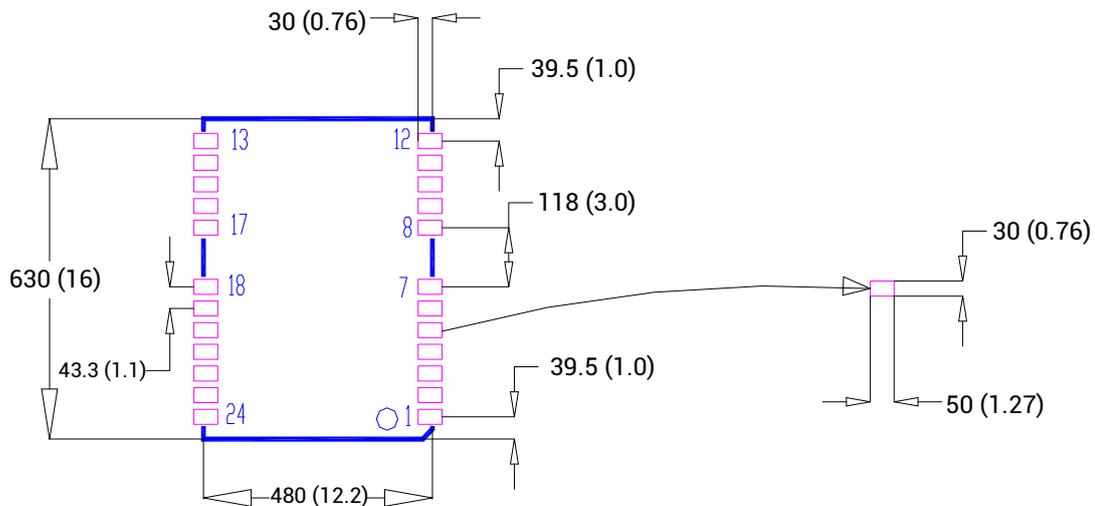
Figure 3-3 UM620 Series Modules Recommended PCB Packaging (unit: mil, in brackets: mm)

☞ When designing PCB solder mask, make sure that the area under the UM620 series module is completely coated with solder mask.

3.6 Power Supply Requirements

Main Supply (VCC)

The voltage range of VCC is 2.7 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.

Backup Supply (V_BCKP)

When using hot start, users should supply backup power to the module. The voltage range of V_BCKP is 2.0 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 Package

4.1 Label Description
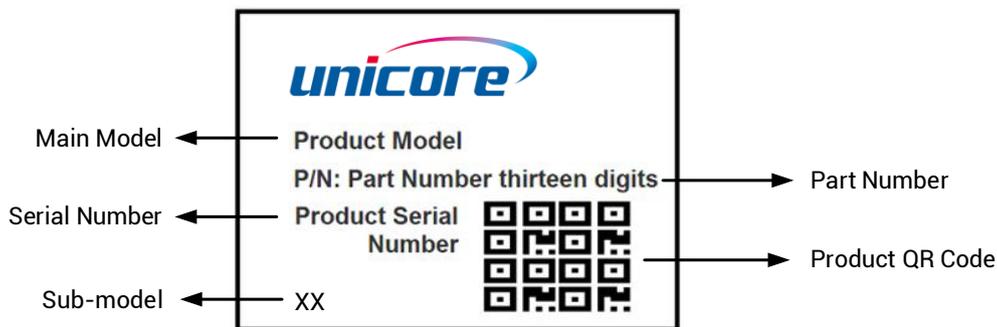
4.2 Ordering Information

Main Model	Sub-model	Description
UM620A	02	Automotive grade dual-frequency navigation module, operating temperature: -40°C ~+85°C, supporting firmware upgrade, 16.0 mm x 12.2 mm, 500 pieces/reel
UM620	02	Industrial grade dual-frequency navigation module, operating temperature: -40°C~+85°C, supporting firmware upgrade, 16.0 mm x 12.2 mm, 500 pieces/reel

4.3 Package Description

The UM620 series modules use carrier tape and reel (suitable for mainstream surface mount devices), packaged in vacuum-sealed aluminum foil antistatic bags, with a 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 UM620 Series Modules Package

Item	Description
Number of Modules	500 pcs/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

UM620 series 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 UM620 series modules packaged in a vacuum-sealed aluminum foil antistatic bags is one year.

5 Clean

DO NOT use alcohol or other organic solvents to clean the module, 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 be soldered only 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
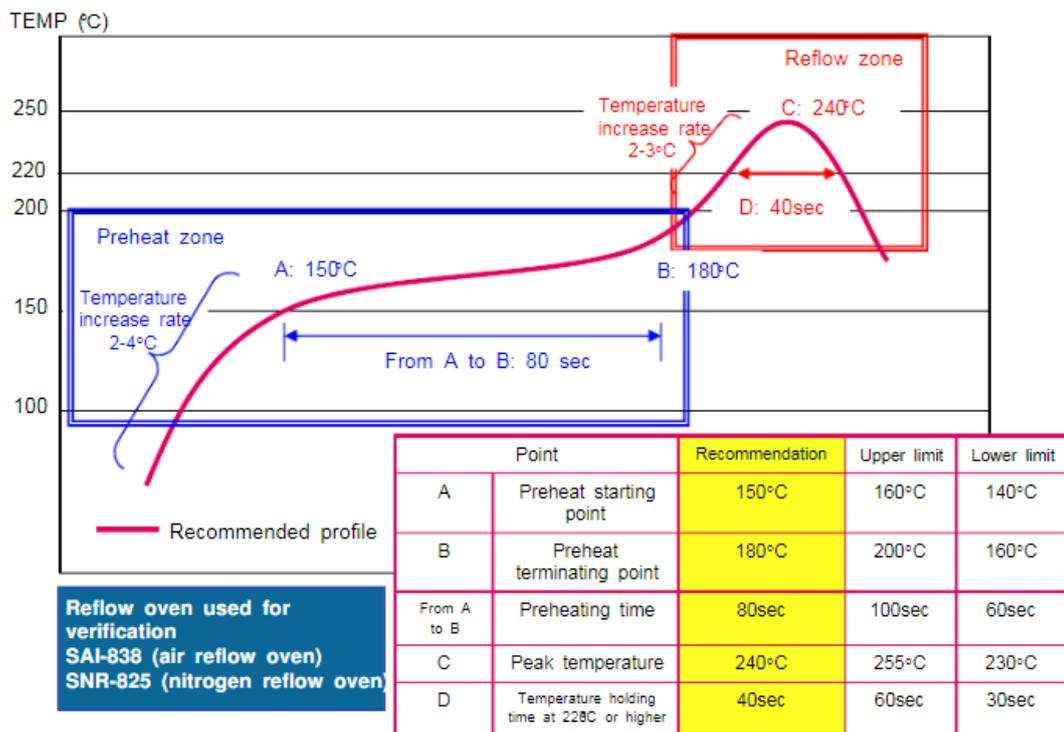
Figure 6-1 Reflow Soldering Temperature Curve

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.

www.unicore.com