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Get connected Get smart

S720

Product Specifications

Issue 1.1

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Notice

This document provides a guide for users to use S720.

This document is intended for system engineers (SEs), development engineers, and test engineers.

THIS GUIDE PROVIDES INSTRUCTIONS FOR CUSTOMERS TO DESIGN THEIR APPLICATIONS. PLEASE FOLLOW THE RULES AND PARAMETERS IN THIS GUIDE TO DESIGN AND COMMISSION. NEOWAY WILL NOT TAKE ANY RESPONSIBILITY OF BODILY HURT OR ASSET LOSS CAUSED BY IMPROPER OPERATIONS.

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About This Document

Scope

This document is applicable to the S720 module. It describes the S720 basic information, key indicators, appearance, dimensions, assembly, packaging, storage, and other information.

Audience

This document is intended for system engineers (SEs), development engineers, and test engineers.

Change History

Issue	Change	Author
1.0	Initial issue.	Yin Xiaoliang
1.1	• Added the EA variant and frequency bands. • Updated the operating bands, TX power, and RX sensitivity. • Changed the typical value of VBAT to 3.6 V. • Updated the pin layout and the caution in electrical characteristics.	Yin Xiaoliang

Conventions

Symbol	Description
	Indicates danger or warning. This information must be followed. Otherwise, a catastrophic module or user device failure or bodily injury may occur.
	Indicates caution. This symbol alerts the user to important points about using the module. If these points are not followed, the module or user device may fail.
	Indicates instructions or tips. This symbol provides advices or suggestions that may be useful when using the module.

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Related Documents

Neoway_S720_Datasheet

Neoway_S720_Hardware_User_Guide

Neoway_S720_EVK_User_Guide

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1 Safety Recommendations

Ensure that this product is used in compliance with the requirements of the country and environment. Read the following safety recommendations to avoid bodily injuries or damages of the product or workplace:

- Do not use this product at any places with a risk of fire or explosion.

  If this product is used in a place with flammable gas or dust, such as propane gas, gasoline, and flammable spray, it will cause an explosion or a fire.

- Disable the wireless communication function in places where wireless communication is prohibited.

  Do not use this product that can interfere with other electronic devices in environments, such as hospitals and airplanes.

Follow the requirements below during the application design and use of this product:

- Do not disassemble this product without permission from Neoway. Otherwise, we are entitled to refuse to provide further warranty.
- Design your application correctly based on the hardware user guide. Connect this product to a stable power supply and route traces following fire safety standards.
- Avoid touching the pins of this product to prevent damages caused by ESD.
- Do not insert or remove a USIM card or mobile memory card if it is not powered off.

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2 About S720

S720 is an LTE smart module based on the UNISOC quad-core SOC platform. It supports FDD-LTE, TDD-LTE, WCDMA, and GSM network modes, and supports GNSS, Bluetooth4.2, and Wi-Fi2.4G. It supports display, camera, SD, MIC, speaker, headset, USB2.0, and more.

2.1 Product Overview

Table 2-1 lists the variant and frequency bands supported by the S720 module.

Table 2-1 Variants and frequency bands supported

Variant	Region	Category	Frequency Band	GNSS	Wi-Fi	BT
S720-CA	China	Cat4	LTE-FDD: B1/B3/B5/B8 LTE-TDD: B34/B38/B39/B40/B41 WCDMA: B1/B5/B8 GSM:900/1800 MHz	Supported	Supported	Supported
S720-EA	Europe	Cat4	LTE-FDD: B1/B3/B5/B7/B8/B20/B28 LTE-TDD: B38/B40/B41 WCDMA: B1/B5/B8 GSM: 850/900/1800 MHz	Supported	Supported	Supported

The S720 module has 274 pins and uses the 146-pin LCC+128-pin LGA package. Its dimensions are (40.50±0.1) mm × (40.50±0.1) mm × (2.85±0.2) mm. This module supports running of the Android10 system. It is suitable for smart POS, smart gateway, video surveillance, event data recorder, DVR, in-vehicle payment equipment, law enforcement equipment, smart handheld equipment, smart wearable, vending machine, logistics cabinet, and other terminals. It can meet the needs of users for high rate and multimedia functions in industrial, in-vehicle, and consumer applications.

2.2 Block Diagram

S720 consists of the following functional units:

- Baseband

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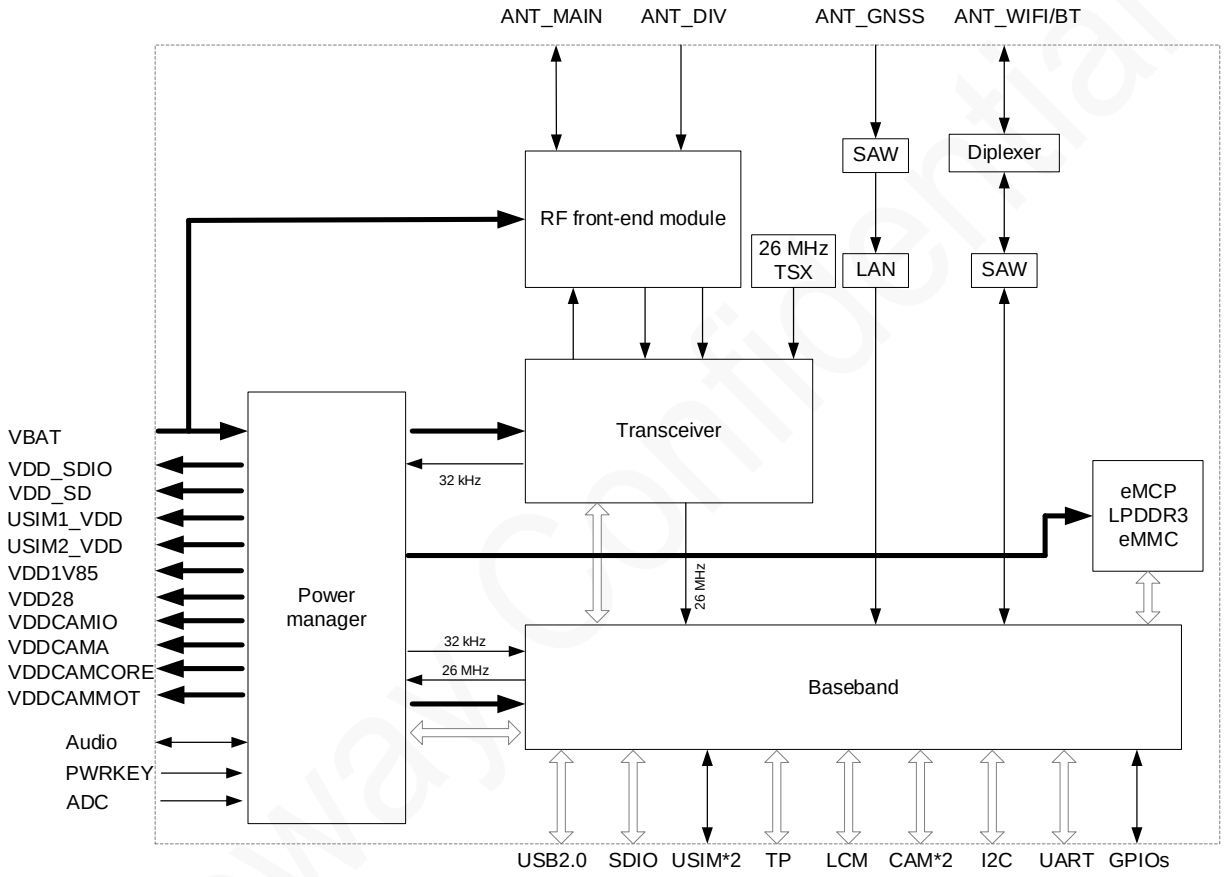
- Crystal
- Power manager
- LPDDR3+eMMC memory
- Digital interfaces (USB/USIM/UART/I2C/camera/SDIO3.0/LCD/TP)
- Analog interfaces (audio/ADC)
- RF part (2G/3G/4G antenna, GNSS antenna, 2.4G Wi-Fi&Bluetooth antenna)

Figure 2-1 Block diagram



2.3 Basic Features

Table 2-2 Basic features of the S720 module

Parameter	Description
Physical features	• Dimensions: (40.50±0.1) mm × (40.50±0.1) mm × (2.85±0.2) mm • Weight: about 10.4 g • Package: 146-pin LCC+128-pin LGA
Temperature range	Operating temperature range: -30°C to +75°C Storage temperature range: -40°C to +90°C

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Operating voltage (DC)	VBAT: 3.5 V to 4.2 V, typical value: 3.6 V
Operating current (DC)	Sleep mode[1]: TBD
	Idle mode[2]: TBD
Certification approval	CCC*, SRRC*
Platform features	
Application processor	Quad-core 64-bit ARM Cortex-A53 processor, main frequency up to 1.4 GHz.
GPU	Mali-T820 MP1 GPU, frequency up to 680 MHz.
Operating system	Android 10
Memory	1 GB LPDDR3+8 GB eMMC (default) 2 GB LPDDR3+16 GB eMMC (optional)
RF features	
Wireless rate	GPRS: Max 107 kbps (DL)/Max 85.6 kbps (UL) EDGE: Max 296 kbps (DL)/Max 236.8 kbps (UL) WCDMA: HSDPA, Max 42 Mbps (DL)/Max 11.2 Mbps (UL) FDD-LTE: Cat4, Max 150 Mbps (DL)/Max 50 Mbps (UL) TDD-LTE: Cat4, Max 130 Mbps (DL)/Max 35 Mbps (UL)
Power class	EGSM900: 33 dBm+1/-3 dB (Power Class 4) DCS1800: 30 dBm+1/-3 dB (Power Class 1) EDGE 900 MHz: 27 dBm±3 dB (Power Class E2) EDGE 1800 MHz: 26 dBm±3 dB (Power Class E2) WCDMA: 24 dBm+1/-3 dB (Power Class 3) FDD-LTE: 23 dBm+1/-3 dB (Power Class 3) TDD-LTE: 23 dBm+1/-3 dB (Power Class 3)
Satellite positioning	GPS/BDS/GLONASS
Antenna interface	2G/3G/4G antenna, 4G diversity reception antenna, GNSS antenna, 2.4G Wi-Fi/BT antenna. The characteristic impedance of each antenna is 50 Ω.
Multimedia	
Display interface	Support for one 4-lane MIPI_DSI with a maximum rate of 1.5 Gbps/lane. The highest resolution supports HD+(1440x720)@60fps.
Camera interface	Two MIPI_CSI, with a maximum rate of 1.5 Gbps/lane. The rear-facing camera uses 2-lane MIPI and supports up to 8 MP. The front-facing camera uses 1-lane MIPI and supports up to 2 MP.
Video coding and decoding	Coding: H.264/H.263/MPEG4 - 1080p@30fps Decoding: H.264/H.263/MPEG4/VP8 - 1080p@30fps
Graphics engine	Mali-T820 MP1 GPU, up to 680 MHz 3D high-performance graphics engine.
Audio	
Audio format	GSM-FR, GSM-EFR, GSM-HR, AMR, AMR-NB, AMR-WB, EVS-NB, EVS-WB, EVS-SWB, MP3, AAC, AAC+, PCM.

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Audio input	Three MICs: one main MIC, one auxiliary MIC, one headset MIC.
Audio output	Class AB stereo headset output. Class AB differential earpiece output. Class D differential speaker power amplifier output.
Connectivity features	
UART	One 4-wire UART interface, support for hardware flow control. Two 2-wire UART interfaces, of which the debug UART interface is only used for debugging. Rate up to 2 Mbps.
I2C	Four I2C interfaces, used for peripherals such as cameras, touch screens, and sensors.
USIM	Two (U)SIM card interfaces. Support for (U)SIM cards: 1.8 V and 3.0 V. Support for dual SIM dual standby.
USB	One USB2.0 high-speed interface. Support for USB2.0 high speed mode and USB OTG, used for data transfer, software commissioning, and software upgrade.
SDIO	One SDIO interface, support for the SD3.0 protocol, and support for 1.8 V or 3.0 V SD cards.
ADC	One ADC interface, support for up to 12-bit sampling precision. Voltage detection range: 0 V to 1.2 V.
WLAN	Support for the AP mode and STA mode. 2.4 GHz band: support for 802.11b/g/n, with a maximum rate of 72.2 Mbps.
Bluetooth	BT4.2 or earlier.
Commissioning interface	
Forced download mode	Forced USB boot control.

* indicates in development.

Sleep mode[1)]: indicates that the module enters the airplane mode, and all radio frequency functions are disabled.

Idle mode[2)]: indicates that the module enters the low power consumption state. In this state, the peripheral interface of the module is disabled, but radio frequency functions are normal. The module will exit the idle mode when there is an incoming call or an SMS message, and will re-enter the idle mode when the incoming call and voice end.

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3 Reference Standards

The S720 module design references the following standards:

- 3GPP TS 36.521-1 V10.0.0 User Equipment (UE) conformance specification; Radio transmission and reception;
- 3GPP TS 21.111 V9.0.0 USIM and IC card requirements
- 3GPP TS 31.102 V9.19.0 Characteristics of the Universal Subscriber Identity Module (USIM) application
- 3GPP TS 31.111 V9.12.2 Universal Subscriber Identity Module (USIM) Application Toolkit (USAT)

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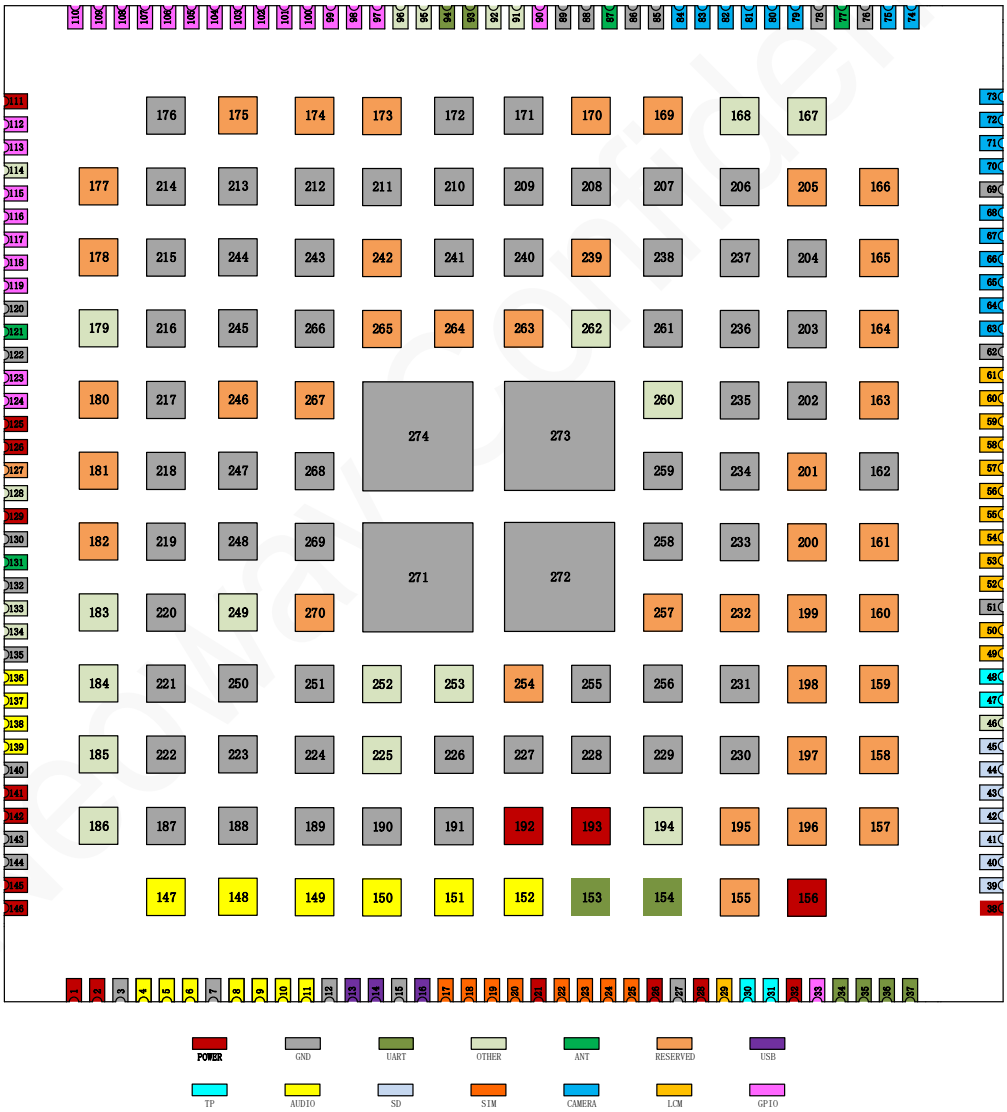
4 Module Pins

The S720 module has 274 pins and uses the 146-pin LCC+128-pin LGA package.

4.1 Pin Layout

Figure 4-1 Pin layout of the S720 module



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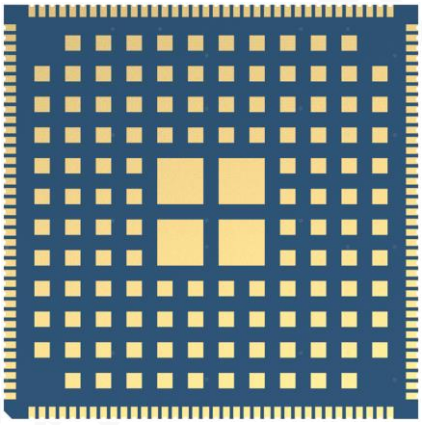
4.2 Module Appearance

Figure 4-2 Top view of the S720 module

Figure 4-3 Bottom view of the S720 module



These are renderings of the S720 module. For the actual appearance, see the module that you receive from Neoway.

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5 Electrical Characteristics and Reliability

This chapter describes the electrical characteristics and reliability of the S720 module, including the input voltage and current of the power supply, the operating and storage temperature ranges, and the ESD protection characteristics.

5.1 Electrical Characteristics

- If the voltage is excessively low, the module might fail to start. If the voltage is excessively high or there is an instantaneous voltage burst during the startup, the module might be damaged permanently.
- If you use LDO or DC-DC to supply power to the module, ensure that the output current is at least 3 A. The 3 A current occurs when the module is working at the maximum power level of the GSM mode. The peak current during burst transmission has a short duration. Placing a large capacitor on the VBAT pin of the module can effectively enhance the freewheeling capability of the power supply and prevent excessive voltage drops that cause exceptions, such as module shutdown.

Table 5-1 Electrical characteristics of the S720 module

Parameter		Minimum Value	Typical Value	Maximum Value
VBAT	V_{in}	3.5 V	3.6 V	4.2 V
	I_{in}	-	-	3 A
USB_VBUS	V_{in}	4.5 V	5.0 V	9.2 V

5.2 Temperature Characteristics

If the ambient temperature is not in the operating temperature range of the module, certain RF performance indicators of the module may deteriorate.

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Figure 5-1 Temperature characteristics of the S720 module

Parameter	Minimum Value	Typical Value	Maximum Value
Operating temperature	-30°C	25°C	75°C
Storage temperature	-40°C	25°C	90°C

5.3 ESD Protection Characteristics

Electronic products need to pass ESD tests. The following table shows the ESD capability of key pins of the module. It is recommended to add ESD protection based on the application industry of the product to ensure product quality when designing a product.

Test environment: humidity 45%; temperature 25°C

Table 5-2 ESD protection characteristics

Test Point	Contact Discharge	Air Discharge
GND	TBD	TBD
ANT	TBD	TBD
Shielding cover	TBD	TBD
Others	TBD	TBD

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6 RF Characteristics

The S720 module supports 2G/3G/4G network modes and frequency bands, as well as GNSS positioning and Wi-Fi&BT connectivity. This chapter describes the RF characteristics, such as the operating bands, TX power, RX sensitivity, and GNSS parameters of the S720 module.

6.1 Operating Bands

Table 6-1 Operating bands of the S720 module

Operating Band	Uplink	Downlink
GSM850	824–849 MHz	869–894 MHz
EGSM900	880–915 MHz	925–960 MHz
DCS1800	1710–1785 MHz	1805–1880 MHz
WCDMA B1	1920–1980 MHz	2110–2170 MHz
WCDMA B5	824–849 MHz	869–894 MHz
WCDMA B8	880–915 MHz	925–960 MHz
FDD-LTE B1	1920–1980 MHz	2110–2170 MHz
FDD-LTE B3	1710–1785 MHz	1805–1880 MHz
FDD-LTE B5	824–849 MHz	869–894 MHz
FDD-LTE B7	2500–2570 MHz	2620–2690 MHz
FDD-LTE B8	880–915 MHz	925–960 MHz
FDD-LTE B20	791–821 MHz	832–862 MHz
FDD-LTE B28	703–748 MHz	758–803 MHz
TDD-LTE B34	2010–2025 MHz	2010–2025 MHz
TDD-LTE B38	2570–2620 MHz	2570–2620 MHz
TDD-LTE B39	1880–1920 MHz	1880–1920 MHz
TDD-LTE B40	2300–2400 MHz	2300–2400 MHz
TDD-LTE B41	2535–2655 MHz	2535–2655 MHz

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6.2 TX Power and RX Sensitivity

Table 6-2 S720 TX power and RX sensitivity

Band	Conducted TX Power	Conducted RX Sensitivity
GSM850	33 dBm+1/-3 dB	< -108 dBm
EGSM900	33 dBm+1/-3 dB	< -108 dBm
DCS1800	30 dBm+1/-3 dB	< -107 dBm
WCDMA B1	24 dBm+1/-3 dB	< -109 dBm
WCDMA B5	24 dBm+1/-3 dB	< -109 dBm
WCDMA B8	24 dBm+1/-3 dB	< -109 dBm
FDD-LTE B1 (10 MHz)	23 dBm+1/-3 dB	< -98 dBm
FDD-LTE B3 (10 MHz)	23 dBm+1/-3 dB	< -98 dBm
FDD-LTE B5 (10 MHz)	23 dBm+1/-3 dB	< -98 dBm
FDD-LTE B7 (10 MHz)	23 dBm+1/-3 dB	< -97 dBm
FDD-LTE B8 (10 MHz)	23 dBm+1/-3 dB	< -98 dBm
FDD-LTE B20 (10 MHz)	23 dBm+1/-3 dB	< -98 dBm
FDD-LTE B28 (10 MHz)	23 dBm+1/-3 dB	< -98 dBm
TDD-LTE B34 (10 MHz)	23 dBm+1/-3 dB	< -98 dBm
TDD-LTE B38 (10 MHz)	23 dBm+1/-3 dB	< -97 dBm
TDD-LTE B39 (10 MHz)	23 dBm+1/-3 dB	< -99 dBm
TDD-LTE B40 (10 MHz)	23 dBm+1/-3 dB	< -98 dBm
TDD-LTE B41 (10 MHz)	23 dBm+1/-3 dB	< -97 dBm

All values above were obtained in labs. The LTE frequency band indicators are tested under the conditions of 10 MHz bandwidth. In actual use, there will be some deviations under different network environments.

TDD-LTE B41 band frequency is 120 MHz, with the channel range of 40040-41240.

6.3 GNSS Parameters

Table 6-3 GNSS parameters

Parameter	Description
GPS L1 operating frequency	1575.42±1.023 MHz

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GLONASS operating frequency	1598.5–1606.5 MHz
BDS operating frequency	1559.1–1563.1 MHz
Tracking sensitivity	TBD
Acquisition sensitivity	TBD
Positioning precision (in an open environment)	TBD
Hot start time (in an open environment)	< TBD
Cold start time (in an open environment)	< TBD (@-130 dBm)
Noise coefficient (CNRin/CNRout)	TBD (@-130 dBm)
GNSS antenna type	Passive antenna

6.4 WLAN/BT Characteristics

Table 6-4 WLAN/BT TX power and RX sensitivity

Operating Band	Rate	TX Power	RX Sensitivity
802.11b (2.4 GHz)	1 Mbps	TBD	TBD
	11 Mbps	TBD	TBD
802.11g (2.4 GHz)	6 Mbps	TBD	TBD
	54 Mbps	TBD	TBD
802.11n (2.4 GHz, 20 MHz)	MCS0	TBD	TBD
	MCS7	TBD	TBD
802.11n (2.4 GHz, 40 MHz)	MCS0	TBD	TBD
	MCS7	TBD	TBD
Bluetooth	1 Mbps	TBD	TBD

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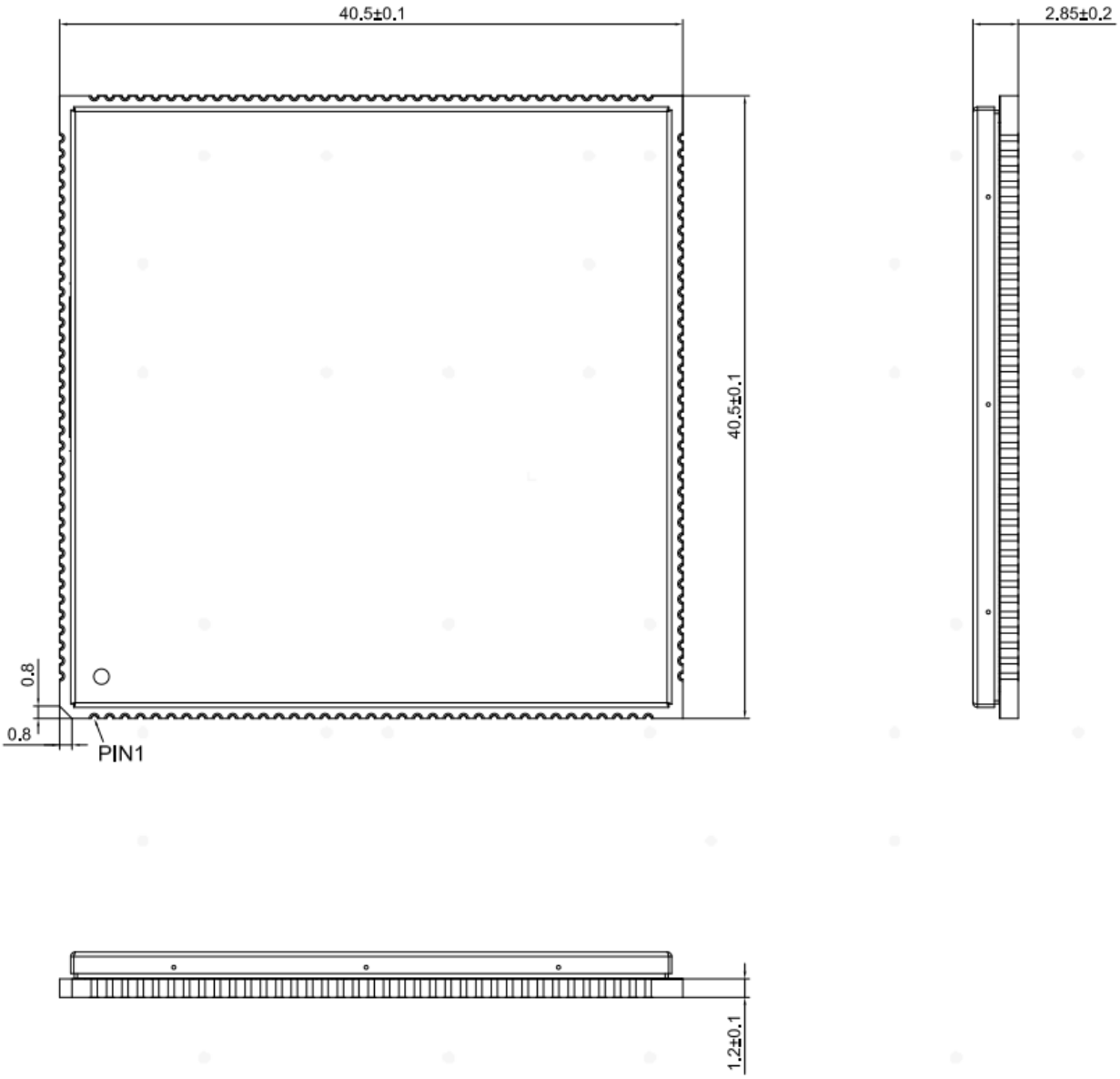
7 Mechanical Characteristics

This chapter describes the mechanical characteristics of the S720 module.

7.1 Dimensions

Figure 7-1 S720 top and side dimensions (unit: mm)



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7.2 Label

The label uses laser engraving and can withstand a high temperature up to 260°C.

Figure 7-2 S720 label example

The picture above is only for reference.

7.3 Packaging

The S720 module uses a surface-mount method for furnace welding. A moisture-proof packaging method is used to prevent the product from being moist from production to users' use. That is, a processing method, such as using the aluminum foil bag, desiccant, humidity indicator card, tray, or vacuum, is used to ensure the dryness of the product and prolong the lifetime.

7.3.1 Tray

The mass-produced S720 will be packaged and delivered in the following manner:

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Figure 7-3 Tray package

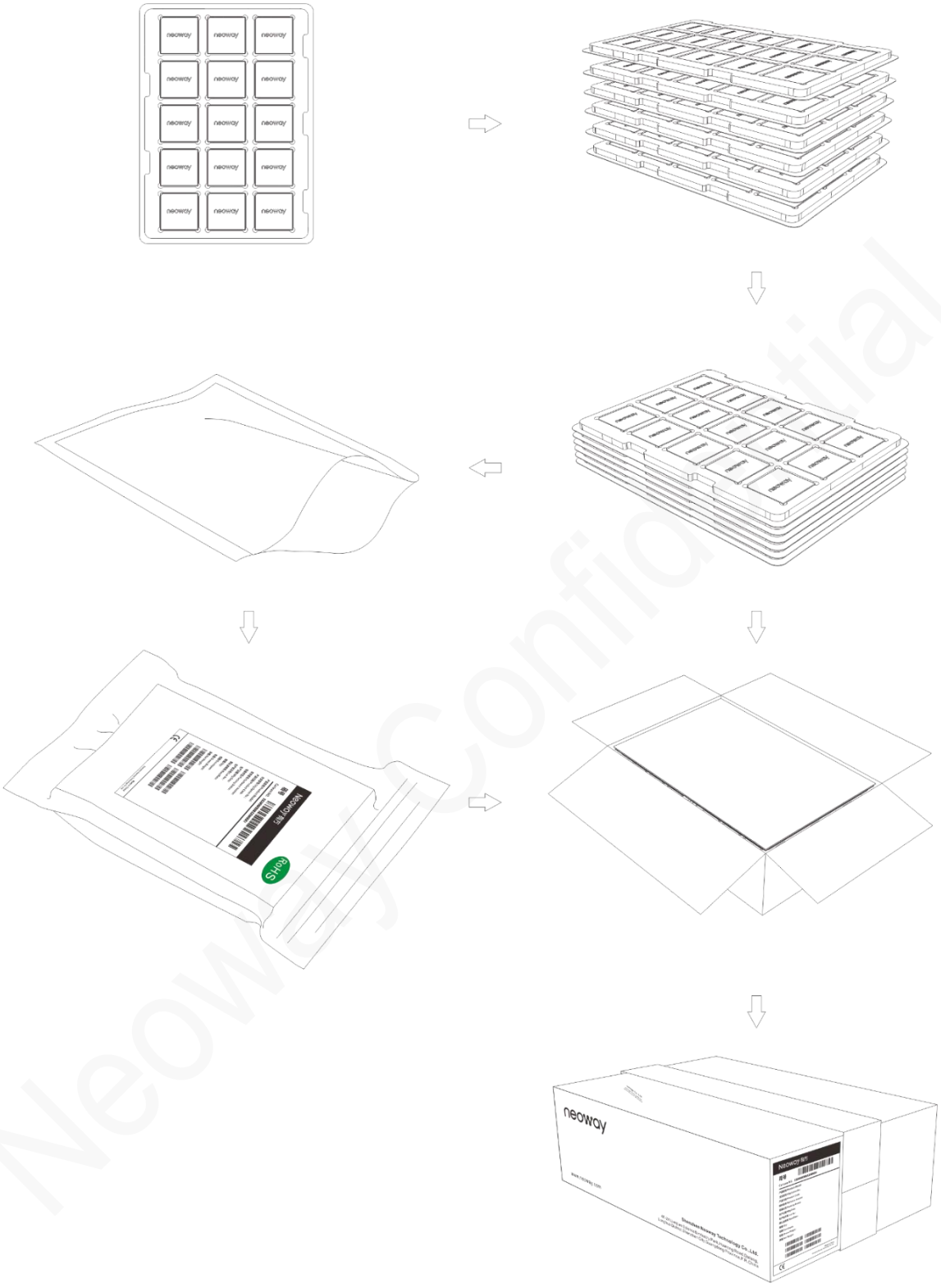

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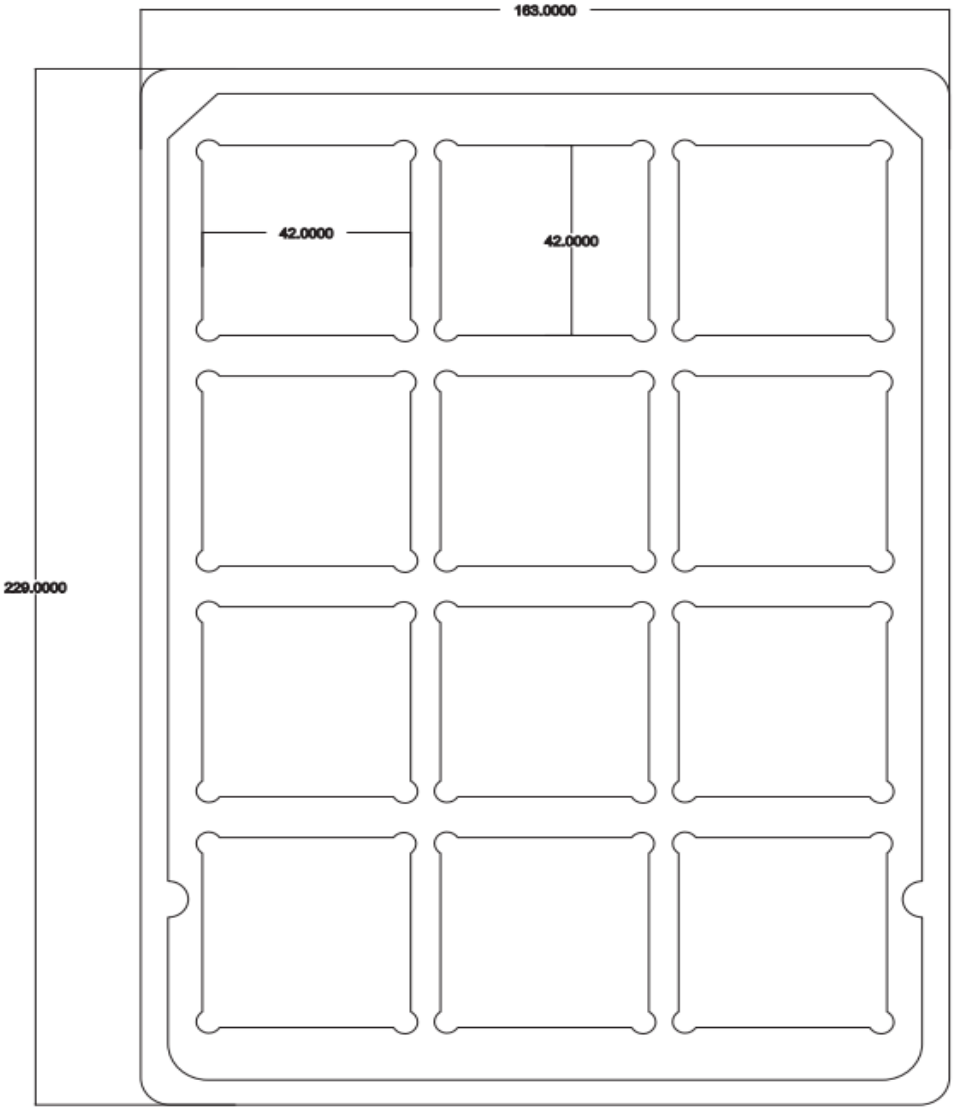
Figure 7-4 Tray



7.3.2 Moisture

S720 is a level-3 moisture sensitive device, in compliance with standard IPC/JEDEC J-STD-020. Pay attention to all the related requirements for using this kind of components.

After the module is unpacked, if it is exposed to the air for a long time, the module will be moist, and the module may be damaged during reflow soldering or welding in a lab. It is recommended that the module exposed to the air for a long time should be baked before it can be used again. The baking conditions are determined based on the moisture condition. It is recommended to bake the module at a temperature higher than 90 degrees for more than 12 hours. In addition, since the tray is of non-high temperature resistant material, the module cannot be baked directly on the plastic tray.

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7.4 Storage

- Storage temperature range: 20°C to 26°C
- Storage humidity: 40% to 60%
- Storage period: 120 days

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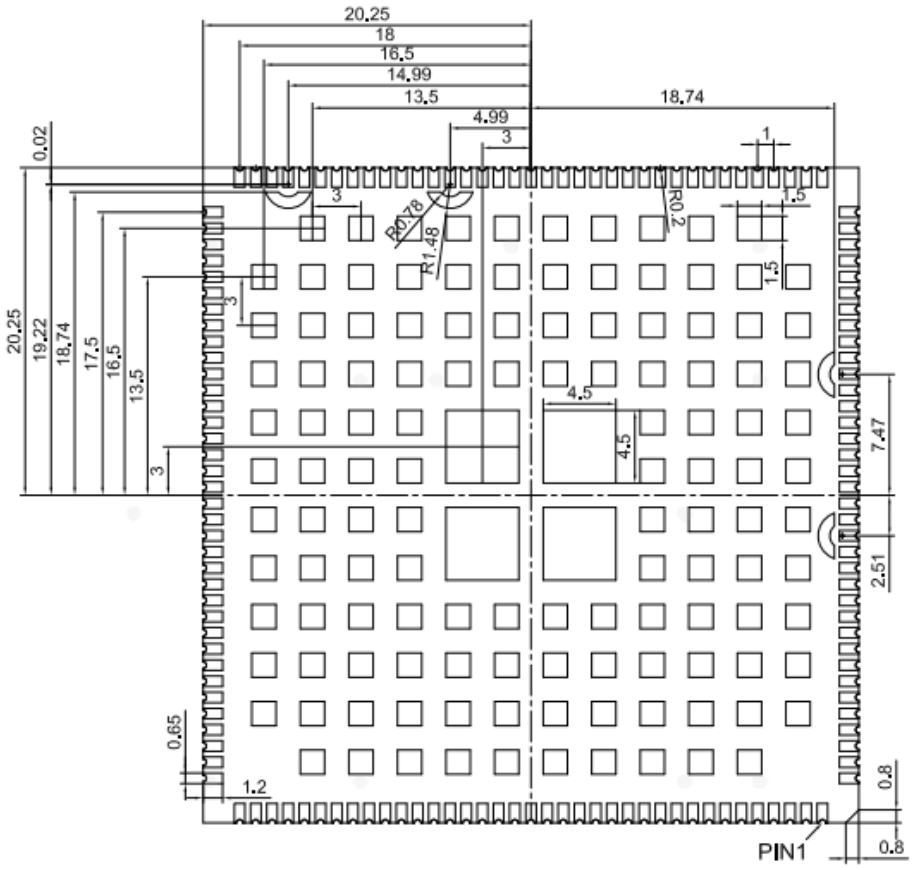
8 Assembly

The S720 module is assembled by using 146-pin LCC+128-pin LGA and SMD welding.

8.1 Module PCB Package

Figure 8-1 Bottom view of the S720 module PCB package (unit: mm)



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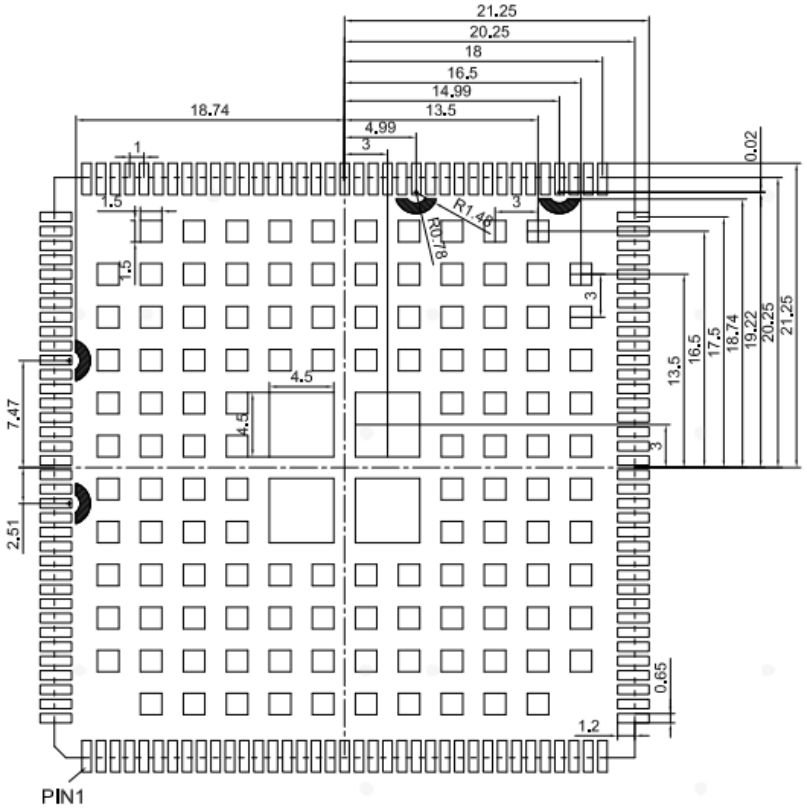
To ensure the normal operation of the module, it is prohibited to route traces, punch holes, pour copper (if any, green oil or white oil must be added to the surface), or make pads under the module keepout area (the semicircle in Figure 8-2).

Figure 8-2 Top view of the recommended S720 module PCB package (unit: mm)



8.2 Stencil

The recommended stencil thickness is at least 0.15 mm to 0.20 mm.

8.3 Solder Paste

The solder paste volume and the PCB flatness play key roles in the production yield.

Do not use solder pastes with lead that use a module technique that is different from Neoway module technique.

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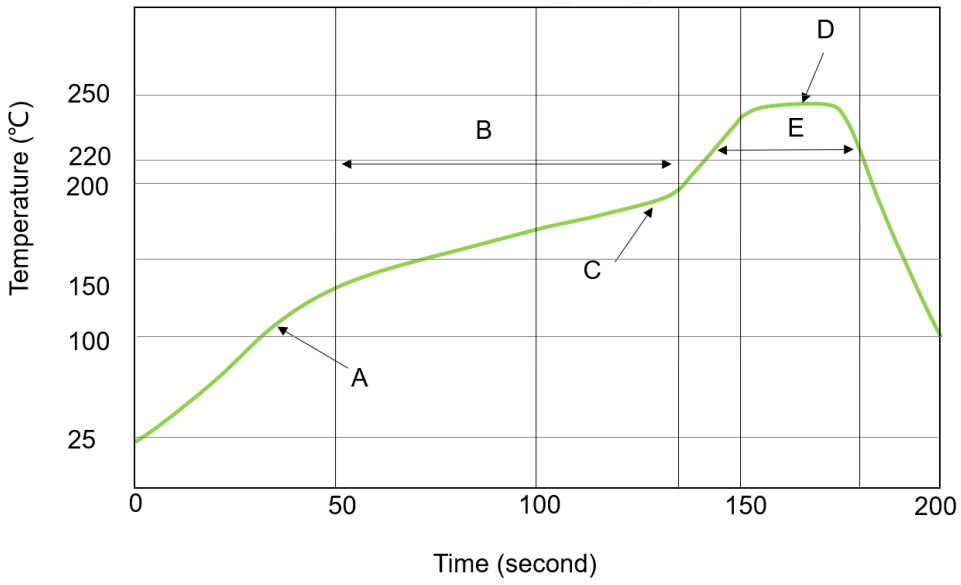
- The melting temperature of solder pastes with lead is 35°C lower than that of solder pastes without lead. The temperature in the reflow process parameters is also lower than that of solder pastes without lead, and less time is consumed correspondingly. It is easy to cause the LCC/LGA in the module to be in the semi-melted state after the second reflow soldering, resulting in poor soldering.
- If users must use solder pastes with lead, ensure that the reflow temperature is kept at 220°C for more than 45 seconds and the peak temperature reaches 240°C.

8.4 SMT Furnace Temperature Curve

Neoway will not provide a warranty for thermal component exceptions caused by improper temperature control.

Thin or long PCB might bend during SMT. Therefore, use loading tools during the SMT and reflow soldering process to avoid poor solder joint caused by PCB bending.

Figure 8-3 SMT furnace temperature curve



Technical parameters:

- Ramp-up rate: 1°C/sec to 4°C/sec
- Ramp-down rate: -3°C/sec to -1°C/sec
- Soaking zone: 150–180°C, time: 60–100s
- Reflow zone: > 220°C, time: 40–90s
- Peak temperature: 235–245°C

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For information about important notes in S720 storage and mounting, refer to *Neoway_Reflow_Soldering_Guidelines_For_Surface-Mounted_Modules*.

When manually desoldering the module, use heat guns with great opening, adjust the temperature to about 245°C (depending on the type of the solder paste), and heat the module till the solder paste is melt. Then gently remove the module using tweezers. Do not shake the module in high temperatures while removing it. Otherwise, the components inside the module might get misplaced and cannot be repaired.

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A Abbreviations

Abbreviation	Full Name
AAC	Advanced Audio Coding
ADC	Analog-Digital Converter
AMR	Adaptive Multi-Rate
ANT	Antenna
AP	Access Point
ARM	Advanced RISC Machine
BDS	BeiDou Navigation Satellite System
BLE	Bluetooth Low Energy
BT	Bluetooth
CNR	Carrier to Noise Rate
DCS	Digital Cellular System
DL	Downlink
DSI	Display Serial Interface
EDGE	Enhanced Data Rate for GSM Evolution
EGSM	Enhanced GSM
ESD	Electronic Static Discharge
FDD	Frequency Division Duplexing
GLONASS	GLOBAL NAVIGATION SATELLITE SYSTEM
GND	Ground
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HSDPA	High Speed Downlink Packet Access
I2C	Inter-Integrated Circuit
LCC	Leadless Chip Carriers

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LCD	Liquid Crystal Display
LGA	Land Grid Array
LPDDR	Low Power Double Data Rate
LTE	Long Term Evolution
MIC	Microphone
MIPI	Mobile Industry Processor Interface
MP3	Moving Picture Experts Group Audio Layer III
PCB	Printed Circuit Board
PCS	Personal Communications Service
PWM	Pulse Width Modulation
QVGA	Quarter Video Graphics Array
QZSS	Quasi-Zenith Satellite System
RF	Radio Frequency
SD	Secure Digital
SDIO	Secure Digital Input Output
SIM	Subscriber Identification Module
SPI	Serial Peripheral Interface
TDD	Time Division Duplex
UART	Universal Asynchronous Receiver-Transmitter
UL	Uplink
USB	Universal Serial Bus
USIM	Universal Subscriber Identity Module
VBAT	Battery Voltage
WCDMA	Wideband Code Division Multiple Access
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network
WVGA	Wide Video Graphics Array

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