

# G7A

## Product Specifications

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This document provides a guide for users to use G7A.

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

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# About This Document

## Scope

This document is applicable to the G7A module. It describes the G7A information, function interface design, and characteristics.

The reference designs in this guide are for reference only. You need to perform designs based on actual scenarios and conditions in the process of application design. If you have any questions, you can contact Neoway technical support.




## Audience

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

## Change History

Issue	Date	Change	Author
1.0	2018-08	Initial draft	Zhuo Jianzheng
1.1	2019-07	<ul style="list-style-type: none"><li>Deleted the I2C function description.</li><li>Updated the bottom dimensions.</li></ul>	Gong Hualiang
1.2	2019-08	<ul style="list-style-type: none"><li>Corrected the label picture.</li><li>Corrected the acquisition and tracking channel quantity.</li></ul>	Gong Hualiang
1.3	2020-11	Corrected the bottom view of the module and adjusted the uniform direction of the picture.	Gong Hualiang
1.4	2021-06	Corrected the known errors to improve the document quality.	Wu Zhenglin
1.5	2022-01	<ul style="list-style-type: none"><li>Updated the variant and bands supported in section <a href="#">2.1 "Product Overview"</a></li><li>Updated the operating voltage in section <a href="#">2.3 "Basic Features"</a></li></ul>	Wu Zhenglin
1.6	2022-03	Updated the block diagram in section <a href="#">2.2 "Block Diagram."</a>	Wu Zhenglin
1.7	2022-10	Updated the timing precision in <a href="#">Table 6-1</a>	Wu Zhenglin

## 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.

## Related Documents

Neoway\_G7A\_Datasheet

Neoway\_G7A\_Hardware\_User\_Guide

Neoway\_G2\_G7A\_Commands\_Manual

Neoway\_G7A\_EVK\_User\_Guide

Neoway\_Reflow\_Soldering\_Guidelines\_For\_Surface-Mounted\_Modules

# 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.



## 2 Product Introduction

The G7A module is a GNSS module that supports BDS, GPS, and GLONASS. G7A adopts a unified chipset that integrates baseband and RF. It is a high-sensitivity, low-power consumption and cost-effective positioning/navigation solution for positioning/navigation products including vehicle, handheld, and wearable terminals.

This guide describes the characteristics and indicators of the G7A module, and provides reference design for various interfaces to guide customers in application design.

### 2.1 Product Overview

Table 2-1 lists the variant and bands that G7A supports.

Table 2-1 Variant and bands

Variant	Region	GPS	BDS	GLNASS	GAGAN
B1	Global	L1 supported	B1 supported	L1 supported	-



G7A-B1 supports BDS third-generation navigation and positioning.

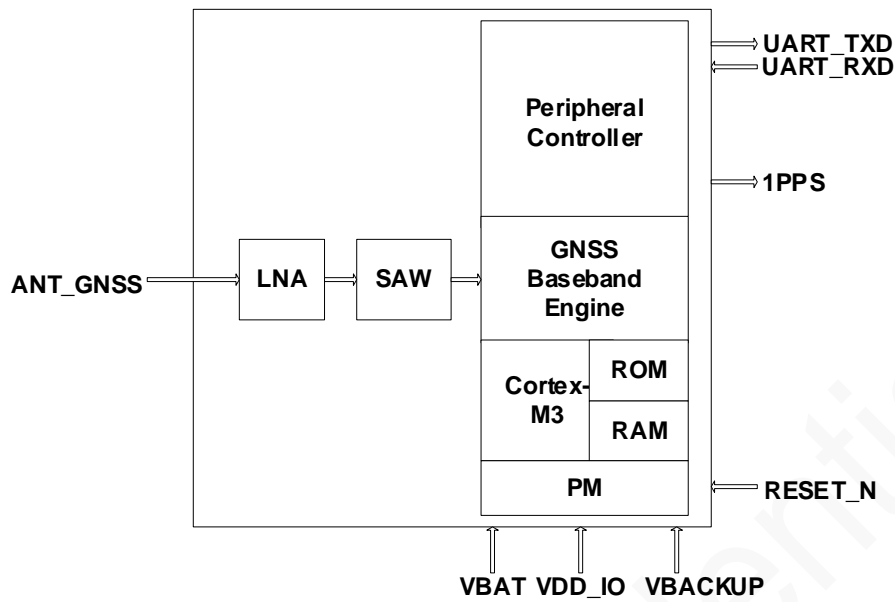
G7A has 18 pins, and pads use the LCC package. G7A has the dimensions of 10.6 mm × 9.7 mm × 2.2 mm. It has industrial-grade high performance and is suitable for positioning/navigation products including vehicle, handheld, and wearable terminals.

### 2.2 Block Diagram

G7A consists of the following functional units:

- GNSS baseband
- 26 MHz crystal
- Power manager
- RF section
- Digital interfaces (UART)

Figure 2-1 Block diagram



## 2.3 Basic Features

Feature	Description						
Physical features	<ul style="list-style-type: none"> <li>• Dimensions: (10.6±0.15) mm × (9.7±0.15) mm × (2.2±0.2) mm</li> <li>• Package: LCC</li> <li>• Weight: about 0.52 g</li> </ul>						
Temperature range	Operating temperature range: -40°C to +85°C Storage temperature range: -45°C to +125°C						
Operating voltage	VBAT: 2.7 V to 3.6 V DC; typical value: 3.3 V DC						
Operating current	Sleep mode <sup>1)</sup> : 10 μA <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Continuous positioning mode<sup>2)</sup>:</td> <td style="width: 33%;">Multi-mode</td> <td style="width: 33%;">30 mA</td> </tr> <tr> <td></td> <td>Single-mode</td> <td>28 mA</td> </tr> </table>	Continuous positioning mode <sup>2)</sup> :	Multi-mode	30 mA		Single-mode	28 mA
Continuous positioning mode <sup>2)</sup> :	Multi-mode	30 mA					
	Single-mode	28 mA					
Application interface	GNSS antenna, 50 Ω characteristic impedance One UART interface, at most 256000 bps						
AT command	3GPP Release 13 Neoway extension commands						
Certification approval	RoHS and CE						



Sleep mode<sup>1)</sup>: The module enters the idle mode after VBAT is shut down, and only the RTC backup part works properly. The power and clocks of all other functions are shut down. After VBAT is supplied power, the module enters the continuous positioning mode. To support hot start and warm start, VBACKUP must be able to continuously supply power after VBAT is shut down. If quick positioning is required, it is recommended that VBACKUP continuously supply power.

Continuous positioning mode<sup>2)</sup>: The acquisition engine is enabled all the time, and it will automatically switch to the tracking status to decrease the operating current after obtaining valid location information and all ephemeris and almanac data. If a command is sent by using UART, the system mode can be switched to BDS, GPS, GLONASS, or any combinations of them, for example, BDS+GPS, GPS+GLONASS, or GPS.

## 3 Reference Standards

G7A module design references the following standards:

- BeiDou Satellite Navigation Terminology, Number: BD110001-2015
- BDS/GNSS Receiver Navigation and Positioning Data Output Format, Number: BD410004-2015
- BDS/GNSS Receiver RF Integrated Circuit General Specifications, Number: BD420001-2015
- BDS/GNSS Signal Simulator Performance Requirements and Test Methods, Number: BD420012-2015

## 4 Module Pins

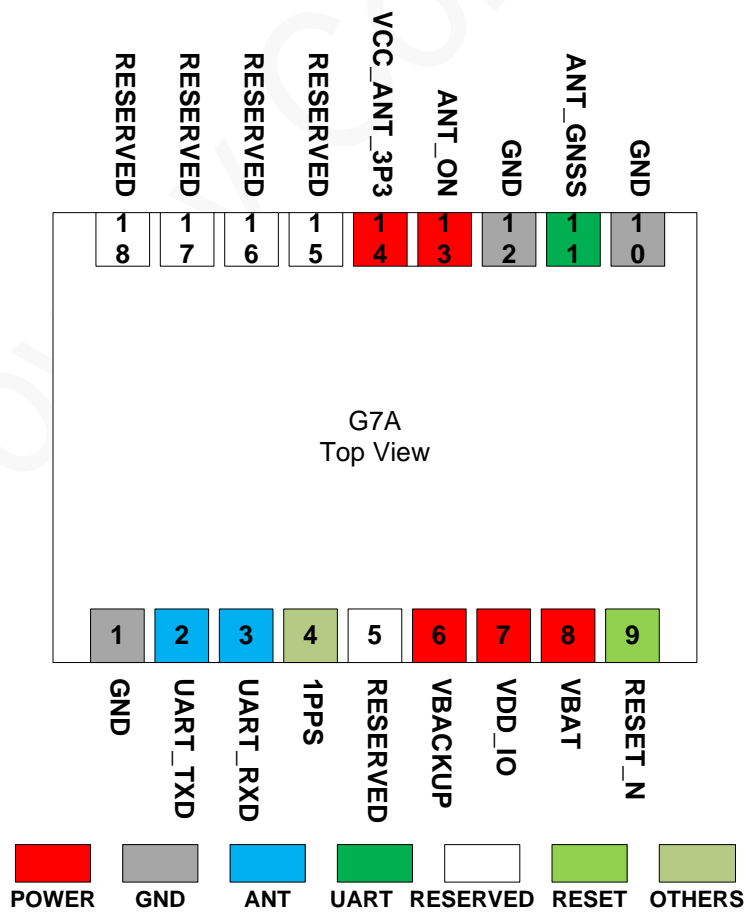
There are 18 pins on G7A, and pads use LCC package. G7A supports the following functional interfaces:

- Power interfaces
- UART interface
- 1PPS

### 4.1 Pin Layout

The following figure shows the pin layout of G7A.

Figure 4-1 Pin layout of G7A (top view)

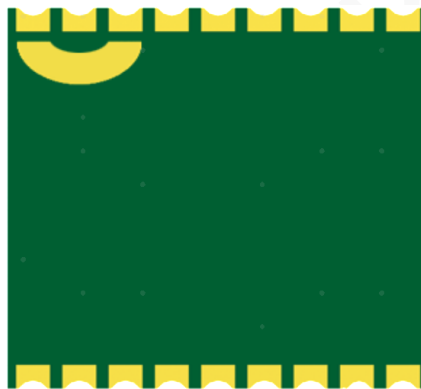


## 4.2 Module Appearance

Figure 4-2 Top view of the G7A module



Figure 4-3 Bottom view of the G7A module



## 5 Electrical Characteristics and Reliability

This chapter describes the electrical characteristics and reliability of the G7A module, including the input voltage and current of the power supply, current consumption in different states, 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 a voltage burst during the startup, the module might be damaged permanently.

Table 5-1 G7A working conditions

Parameter		Minimum Value	Typical Value	Maximum Value
VBAT	$V_{in}$	-0.3 V	3.3 V	4.5 V
	$I_{in}$	-	-	100 mA
VDD_IO	$V_{in}$	-0.3 V	3.3 V	4.5 V
VBACKUP	$V_{in}$	-0.3 V	3.3 V	4.5 V

Table 5-2 G7A working conditions (recommended)

Pin	Description	Minimum Value	Typical Value	Maximum Value
VBAT	Main power supply	2.7 V	3.3 V	3.6 V
VDD_IO	IO power supply	2.7 V	3.3 V	3.6 V
VBACKUP	Backup power supply	1.4 V	3.3 V/3.0 V	3.6 V

Table 5-3 Current consumption of the G7A module (typical)

Module Status		Current Consumption (Typical)
Continuous positioning	Multi-mode	30 mA
	Single-mode	28 mA

## 5.2 Temperature Characteristics



If the module works in an environment where the temperature exceeds the thresholds of the operating temperature range, some RF performance indicators of the module may deteriorate. However, it will not have a large impact on the normal use of the module.

Table 5-4 Temperature characteristics of the G7A module

Parameter	Minimum Value	Typical Value	Maximum Value
Operating temperature	-40°C	25°C	85°C
Storage temperature	-45°C	-	125°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 5-5 ESD protection characteristics of the G7A module

Test Point	Contact Discharge	Air Discharge
VBAT	±8 kV	±15 kV
GND	±8 kV	±15 kV
ANT	±8 kV	±15 kV
Shielding cover	±8 kV	±15 kV
UART	±4 kV	±8 kV
Others	±4 kV	±8 kV



## 6 RF Characteristics

G7A supports GNSS multi-mode positioning. This chapter describes the RF characteristics of G7A.

Table 6-1 GNSS Characteristics

Parameter		Description
GPS L1 operating frequency		1575.42±1.023 MHz
GLONASS operating frequency		1597.5 MHz to 1605.9 MHz
BDS operating frequency		1559.1 MHz to 1563.1 MHz
Sensitivity	Cold start acquisition	-148 dBm (GPS)/-148 dBm (BDS)
	Hot start acquisition	-156 dBm (GPS)/-156 dBm (BDS)
	Re-acquisition	-160 dBm (GPS)/-160 dBm (BDS)
	Tracking	-162 dBm (GPS)/-162 dBm (BDS)
Positioning precision (open sky)	Horizontal	< 3 m (CEP50)
	Vertical	< 4.5 m (CEP50)
Speed precision (open sky)		< 0.1 m/s
TTFF (@-130 dBm <sup>3</sup> )	Hot start	1s
	Cold start	32s
	Re-acquisition	1s
Timing precision		<30 ns
Timing update frequency		Default frequency: 1 Hz; maximum frequency:10 Hz
Baud rate		Default rate: 9600 bps; minimum rate: 4800 bps; maximum rate: 256000 bps
Power consumption (@instrument <sup>4</sup> )	Acquisition	Typical value of 30 mA in the case of 3.3 V power supply
	Tracking	Typical value of 28 mA in the case of 3.3 V power supply
	Idle	Typical value of 10 μA in the case of 3.3 V backup power supply
GNSS data type		NMEA-0183
GNSS antenna type		Passive antenna/active antenna
Certification approval		RoHS and CE



@-130 dBm<sup>3</sup>: initial signal strength that is set on the simulator.

@instrument<sup>4</sup>: power consumption for the test on the simulator.

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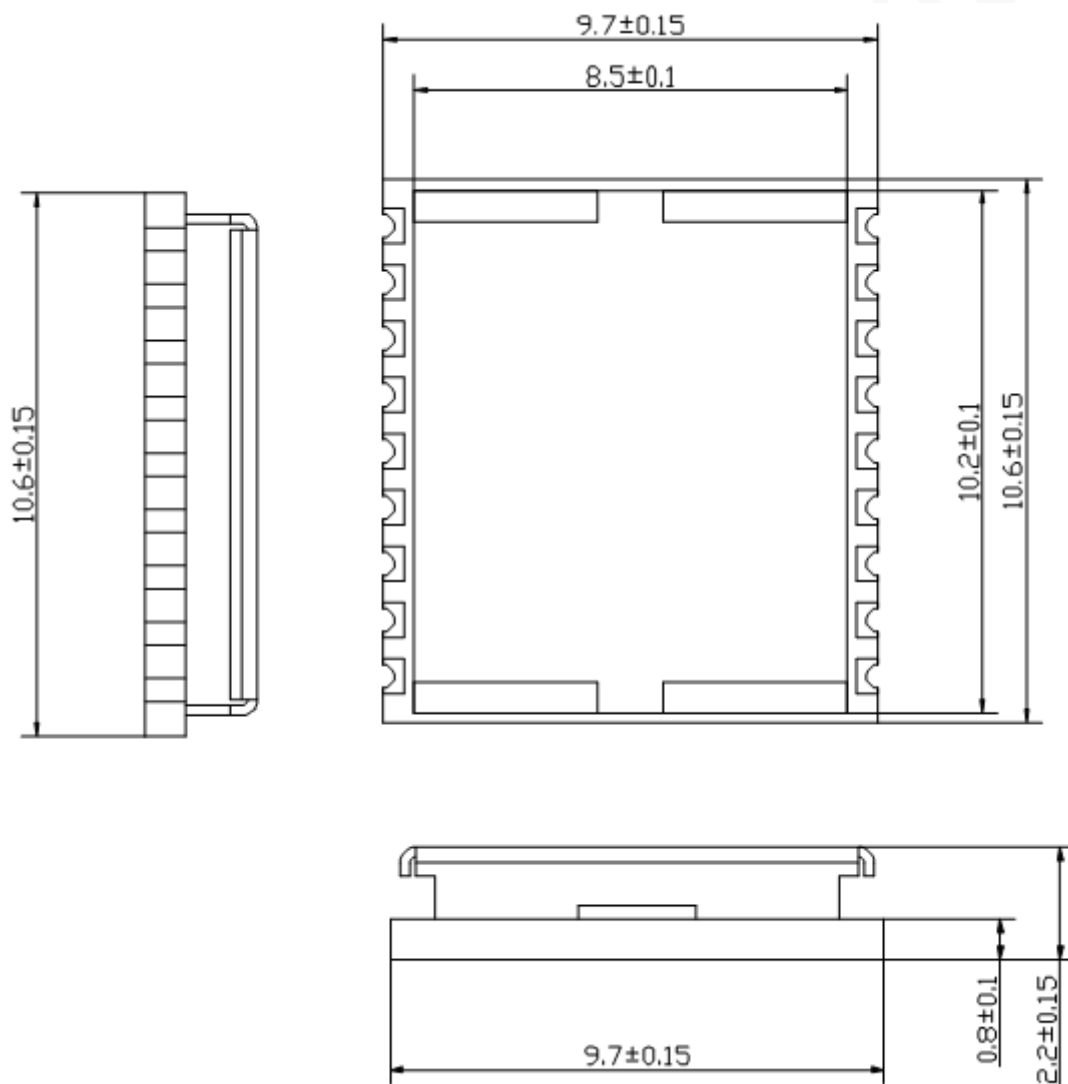
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## 7 Mechanical Characteristics

This chapter describes the mechanical characteristics of the G7A module.

### 7.1 Dimensions

Figure 7-1 G7A top and side view dimensions (unit: mm)



## 7.2 Label

The label is printed using anti-deformation, anti-fading, and high-temperature resistant materials and can withstand a high temperature of 260°C.

Figure 7-2 G7A-B1 label example



Figure 7-3 G7A-D1 label example



- The pictures above are only for reference.
- The silk-screen printing must be clear. No blur is allowed.
- The material and surface finishing must comply with RoHS directives.

## 7.3 Packaging

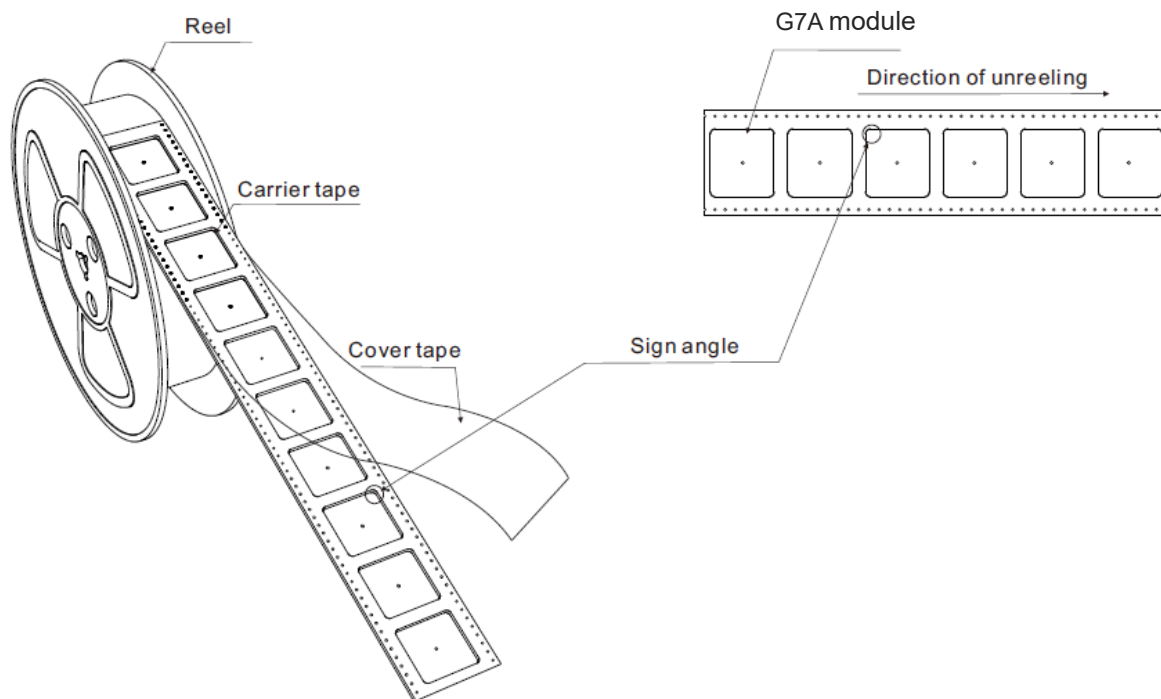
The G7A module uses a surface-mount method for furnace welding. A moisture-proof packaging method prevents the product from being moist from production to customer use. That is, a processing

method, such as using the aluminum foil bag, desiccant, humidity indicator card, or vacuum, is used to ensure the dryness of the product and prolong its lifetime.

### 7.3.1 Reel and Tape

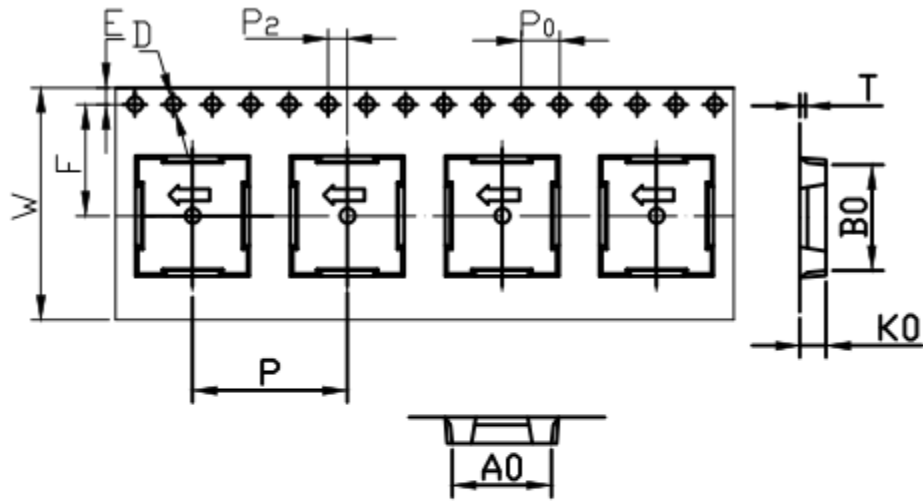
G7A modules in mass production are delivered in the following packaging.

Figure 7-4 Reel and tape package example



Tape details

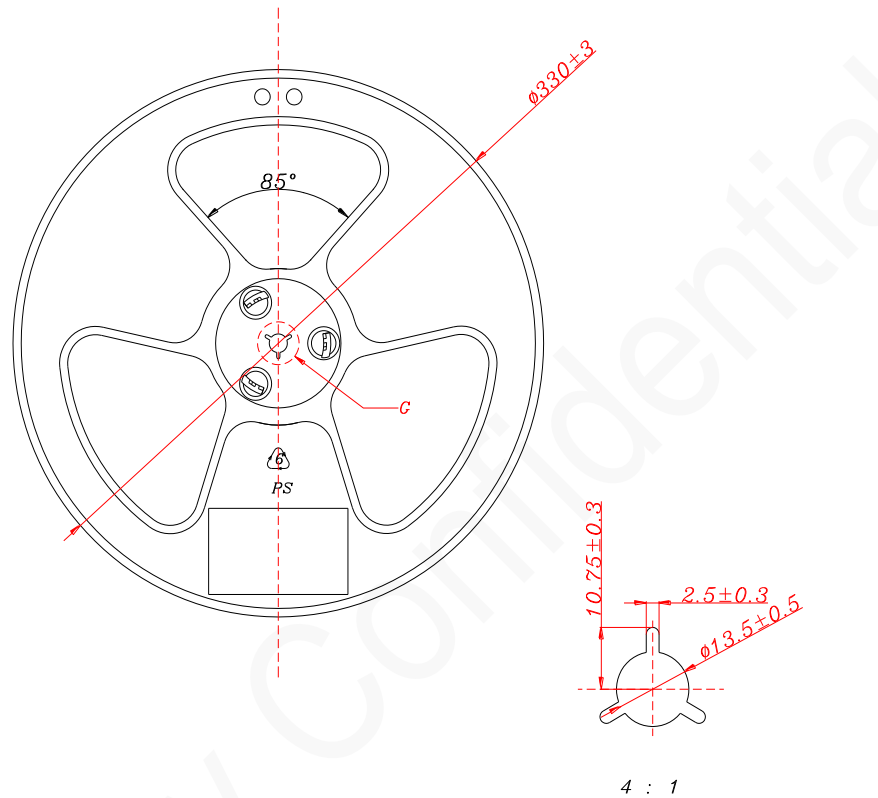
Figure 7-5 Tape details



ITEM	W	A <sub>0</sub>	B <sub>0</sub>	K <sub>0</sub>	K <sub>1</sub>	P	F	E	D	D <sub>1</sub>	P <sub>0</sub>	P <sub>2</sub>
DIM	24.0 <sup>+0.30</sup> <sub>-0.10</sub>	10.1 <sup>+0.10</sup> <sub>-0.10</sub>	11.0 <sup>+0.10</sup> <sub>-0.10</sub>	2.7 <sup>+0.10</sup> <sub>-0.10</sub>	0.00 <sup>+0.10</sup> <sub>-0.10</sub>	16.0 <sup>+0.10</sup> <sub>-0.10</sub>	11.5 <sup>+0.10</sup> <sub>-0.10</sub>	1.75 <sup>+0.10</sup> <sub>-0.10</sub>	1.50 <sup>+0.10</sup> <sub>-0.00</sub>	0.00 <sup>+0.25</sup> <sub>-0.00</sub>	4.00 <sup>+0.10</sup> <sub>-0.10</sub>	2.00 <sup>+0.10</sup> <sub>-0.10</sub>

Reel details

Figure 7-6 Reel details



7.3.2 Moisture

G7A 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 must 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.

## 8 Assembly

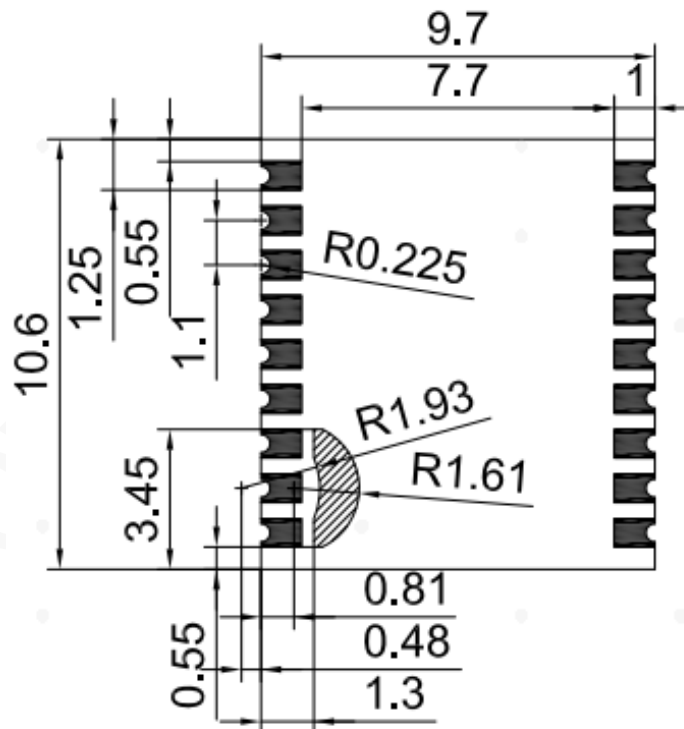
This chapter describes the G7A module PCB package, application PCB package, and technical points related to SMT.

### 8.1 Module PCB Package



Do not route traces, dig holes, or lay copper in the area under the module. Otherwise, print green ink or white ink on the surface.

Figure 8-1 Bottom view of the G7A module PCB package (unit: mm)

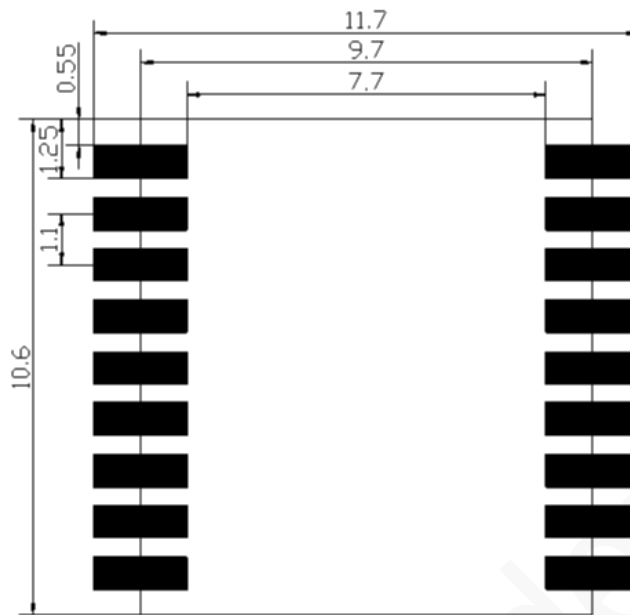


### 8.2 Application PCB Package

G7A uses the 18-pin LCC package. The recommended PCB package is as follows, and the unit is mm.



Figure 8-2 Top view of the recommended G7A application PCB package (unit: mm)



### 8.3 Stencil

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

### 8.4 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.

- 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 in the module to be in the semi-melted state after the second reflow soldering, resulting in poor soldering.
- If customers 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.

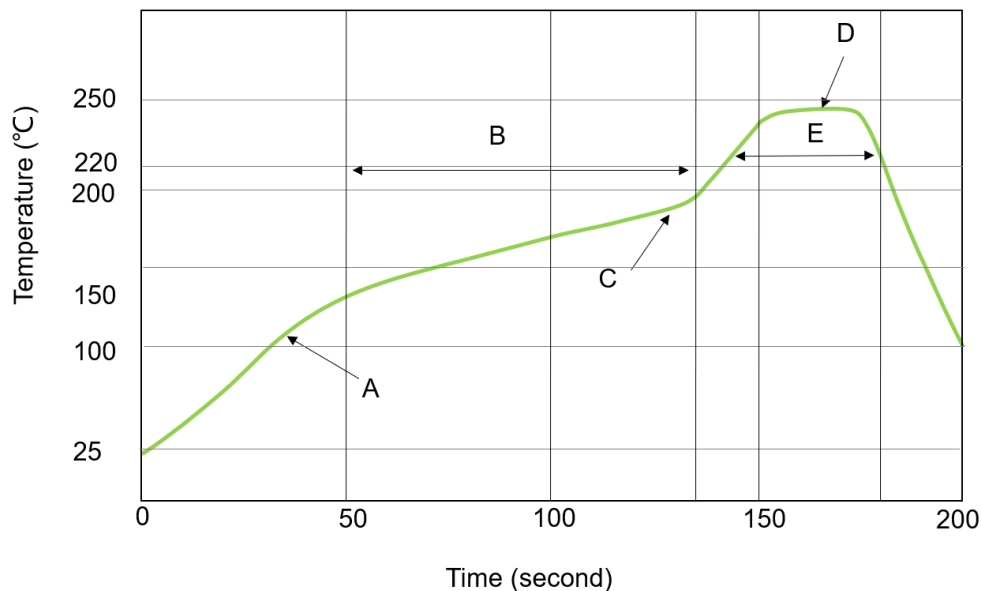
### 8.5 SMT Furnace Temperature Curve



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

For information about important notes in G7A 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.

## A Abbreviations

Abbreviation	Full Name
CEP	Circular Error Probable
DC	Direct Current
ESD	Electronic Static Discharge
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GLONASS	Global Navigation Satellite System
GAGAN	GPS-Aided GEO Augmented Navigation
I/O	Input/Output
LCC	Leadless Chip Carriers
LNA	Low Noise Amplifier
SAW	Surface Acoustic Wave
NMEA	National Marine Electronics Association
PPS	Pulse Per Second
TTFF	Time To First Fix
UART	Universal Asynchronous Receiver-Transmitter