# G2

## Product Specifications

Issue 2.1 Date 2019-08-20

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## Notice

This document provides guide for users to use G2.

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 G2 series.

It defines the features, indicators, and test standards of the G2 module and provides reference for the hardware design of each interface.

## Audience

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

## Change History

| Issue | Date | Change | Changed By |
|-------|------|--------|------------|
| 1.0 | 2018-08 | Initial draft | Zhuo Jianzheng |
| 2.0 | 2019-01 | • Modified some parameters<br>• Changed pin names of I2C function<br>• Deleted sleep mode | Zhuo Jianzheng |
| 2.1 | 2019-08 | • Deleted I2C<br>• Modified the channel quantity of capturing and tracking | Gong Hualiang |

## Conventions

| Symbol | Indication |
|--------|------------|
| ! | This warning symbol means danger. You are in a situation that could cause fatal device damage or even bodily damage. |
| ! | Means reader be careful. In this situation, you might perform an action that could result in module or product damages. |
| i | Means note or tips for readers to use the module |

## Related Documents

*Neoway_G2_Datasheet*

*Neoway_G2_HW_User_Guide*

*Neoway_G2_AT_Command_Mannual*

*Neoway_G2_EVK_User_Guide*

# 1 About G2

G2 is a GNSS module that supports BDS B1, GPS L1, and GLONASS L1. It adopts a unified chipset integrating baseband and RF and embeds LNA and ceremic patch antenna. This architecture facilitates the application design and reduces the cost. It is an optimal navigation solution to demands for high sensitivity, low power consumption, and low cost in different navigation devices

## 1.1 Overview

G2 series including the following variants and band configurations.

Table 1-1 Version and bands

| Module | Variants | GPS | BDS | GLONASS | Support GAGAN |
|--------|----------|-----|-----|---------|---------------|
| G2 | G2-B1 | √ | √ | | |
| | G2-D1 | √ | | √ | √ |

## 1.2 Block Diagram

G2 consists of the following functional units:

- GNSS baseband

- RF front end components

- RTC

- Peripheral interfaces

Figure 1-1 Block diagram
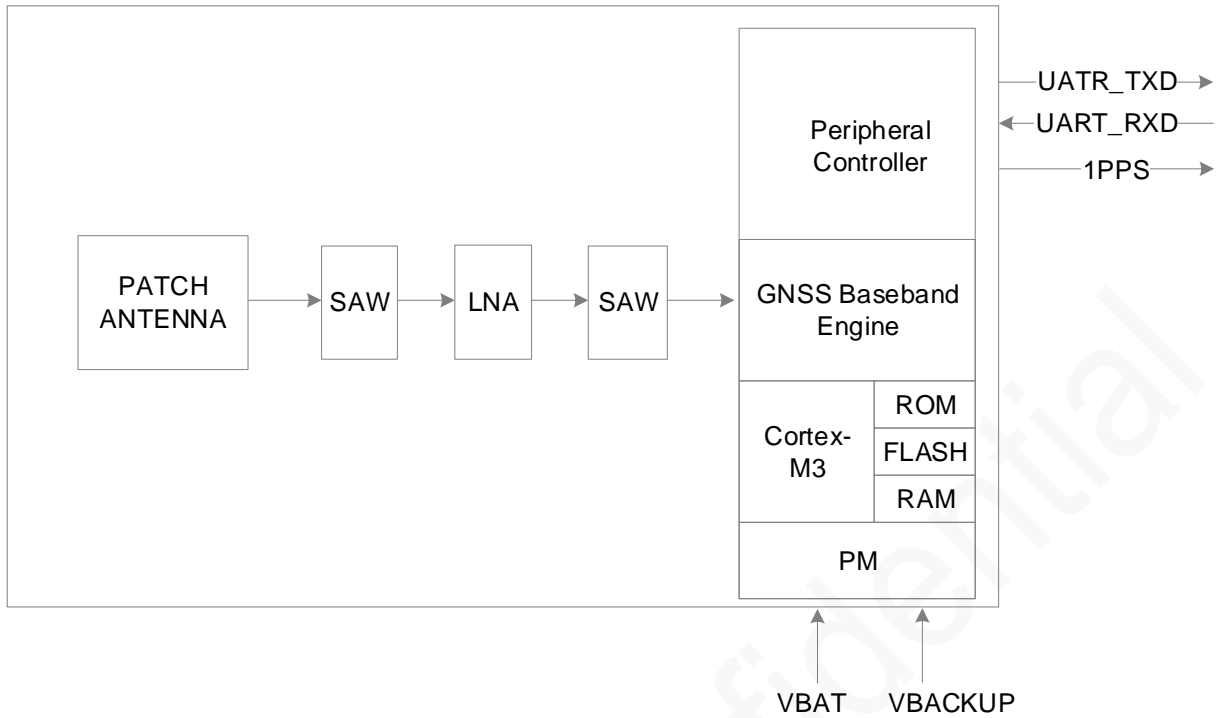


## 1.3 Specifications

| Parameter | Description | Min. | Typ. | Max | Unit | Remarks | |
|---|---|---|---|---|---|---|---|
| Positioning precision (open air) | Horizontal | | <2 | | m | | |
| | Elevation | | <4.5 | | m | | |
| Speed precision | | | <0.1 | | m/s | | |
| Channel quantity | Capturing | | 32 | | | | |
| | Tracking | | 32 | | | | |
| TTFF (@-130dBm) | Cold start | | <32 | | s | | |
| | Hot start | | 1 | | s | | |
| | Recapture | | 1 | | s | | |
| Sensitivity | Cold start | | -148 | | dBm | | |
| | Hot start | | -156 | | dBm | | |
| | Recapture | | -160 | | dBm | | |
| | Tracking | | -162 | | dBm | | |
| Baud rate | | 4800 | 9600 | 2560400 | bps | 9600bps | by |

| | | | | | | default |
|---|---|---|---|---|---|---|
| Update frequency | | | 1 | 10 | Hz | 1Hz by default |
| Operating voltage | VBAT | 2.7 | 3.3 | 3.6 | V | |
| | VBCKUP | 1.4 | 3.3/3.0 | 3.6 | V | |
| Current (@instrument) | Capturing | | 30 | | mA | 3.3 V |
| | Tracking | | 28 | | mA | 3.3 V |
| | Idle | | 10 | | μA | 3.3 V |

# 2 Pad Layout and Pin Definition

There are 13 pins on G2 and their pads are in LCC package.

## 2.1 Pad Layout

Figure 2-1 shows the pad layout of G2.

Figure 2-1 G2 pin definition (top view)
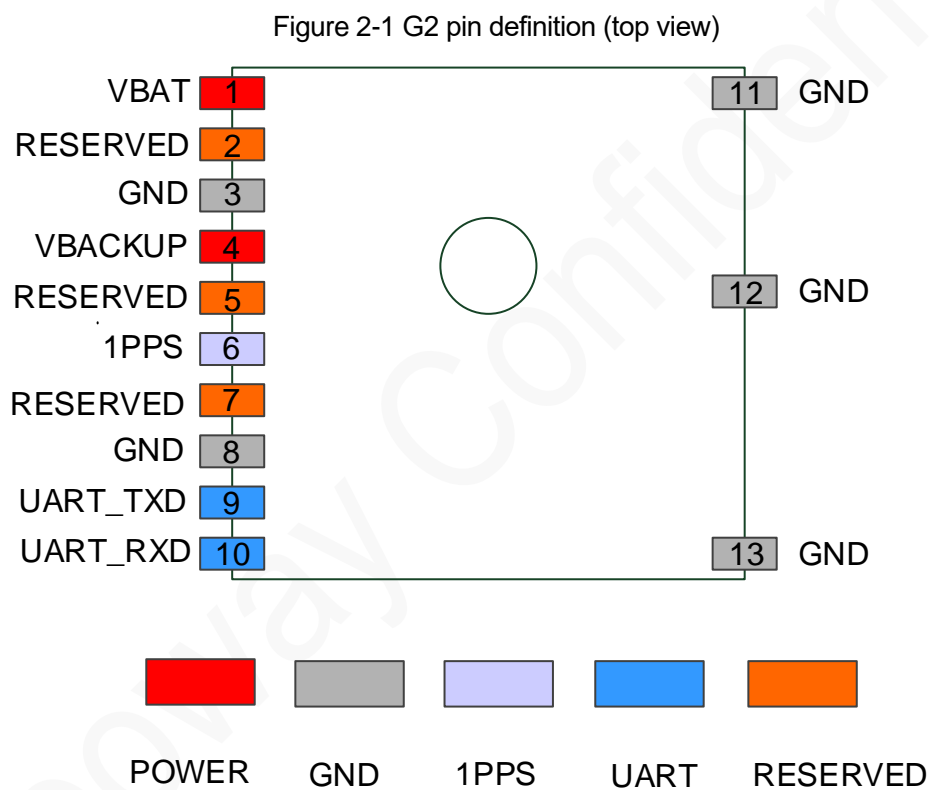
# 2.2 Pin Definition

Table 2-1 lists the IO types

Table 2-1 IO types

| IO types | |
|---|---|
| DO | Digital output, COMS logic level |
| DI | Digital input, COMS logic level |
| PI | Power input |
| **DC feature description** | |
| P1 | Power type of digital IO interface | 3.3V:<br>$V_{IH}$=2.6V~3.6V,<br>$V_{IL}$= -0.3V~0.6V<br>$V_{OH}$=2.9V~3.3V,<br>$V_{OL}$=0V~0.4V |

Table 2-2 Pin definition

| Signal | Pin | I/O | Function | DC Feature | Remarks |
|---|---|---|---|---|---|
| **Power** | | | | | |
| VBAT | 1 | PI | Main power supply | 2.7V~3.6V (Typ:3.3V) | Supply a maximum current of 100 mA |
| VBACKUP | 4 | PI | Backup power supply input | 1.4V~3.6V (Typ:3.3/3.0V) $I_{norm}$=10µA | Supply power to RTC and backup RAM.<br>Leave it floating if not used. |
| GND | 3,8,11,12,13 | | | | Ensure that all GND pins are grounded. |
| **GPIO** | | | | | |
| 1PPS | 6 | DO | Pulse per second | P1 | Pulled up by default.<br>Leave it floating if not used. |
| **UART** | | | | | |
| UART_TXD | 9 | DO | Data transmitting | P1 | Used for data transmission. |
| UART_RXD | 10 | DI | Data receiving | P1 | Leave it floating if not used. |
| **Others** | | | | | |
| RESERVED | 2, 5, 7 | | Reserved pins | | Leave it floating if not used. |

# 2.3 Label/Apperance

Figure 2-2 and sFigure 2-3 show the top and bottom views of G2.
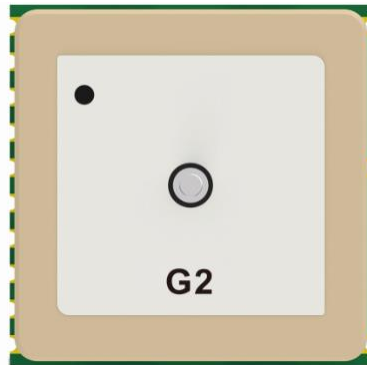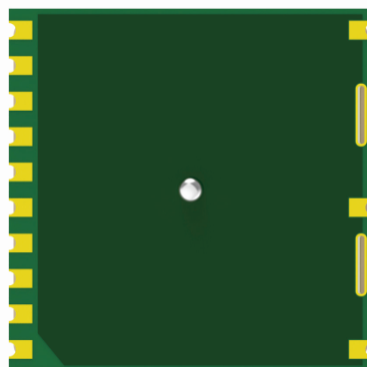
Figure 2-2 Top view of G2



Figure 2-3 Bottom view of G2

# 3 Electrical Feature and Reliability

This chapter describes the electrical features and reliability of G2.

## 3.1 Electrical Features

To ensure that G2 functions properly, operate it in recommended operationg conditions.

### 3.1.1 Extreme Operating Voltage

Table 3-1 G2 extreme operating voltage

| Parameter | Description | Minimum Value | Maximum Value | Unit |
|-----------|-------------|---------------|---------------|------|
| VBAT | Power supply | -0.3 | 4.1 | V |
| VBACKUP | Backup power supply | -0.3 | 4.1 | V |
| VIO | IO voltage | -0.3 | 4.1 | V |

⚠ If the input voltage is lower than the minimum value, the module might fail to start. If the voltage exceeds the high threshold or there is a voltage burst during the startup, the module might be damaged permanently.

### 3.1.2 Recommended Operating Voltage

Table 3-2 G2recommended operating voltage

| Parameter | Minimum Value | Typical Value | Maximum Value | Unit |
|-----------|---------------|---------------|---------------|------|
| VBAT | 2.7 | 3.3 | 3.6 | V |
| VBACKUP | 1.4 | 3.3/3.0 | 3.6 | V |

## 3.2 Temperature

Table 3-3 Temperature feature

| Module Status | Minimum Value | Typical Value | Maximum Value |
|---|---|---|---|
| Operating | -40°C | 25 °C | 85°C |
| Storage | -50°C | / | 125°C |

> If the module works in an environment where the temperature exceeds the thresholds of the operating temperature range, some of its RF performance indicators might be worse but it can still work properly.

## 3.3 ESD Protection

Humidity: 45%  Temperature: 25 °C

Table 3-4 G2 ESD feature

| Testing Point | Contact Discharge | Air Discharge |
|---|---|---|
| VBAT | ±8 kV | ±15 kV |
| GND | ±8 kV | ±15 kV |
| ANT | ±8 kV | ±15 kV |
| Cover | ±8 kV | ±15 kV |
| Others | ±2 kV | ±4 kV |

# 4 Mechanical Features

This chapter describes the mechanical features of G2.

## 4.1 Dimensions

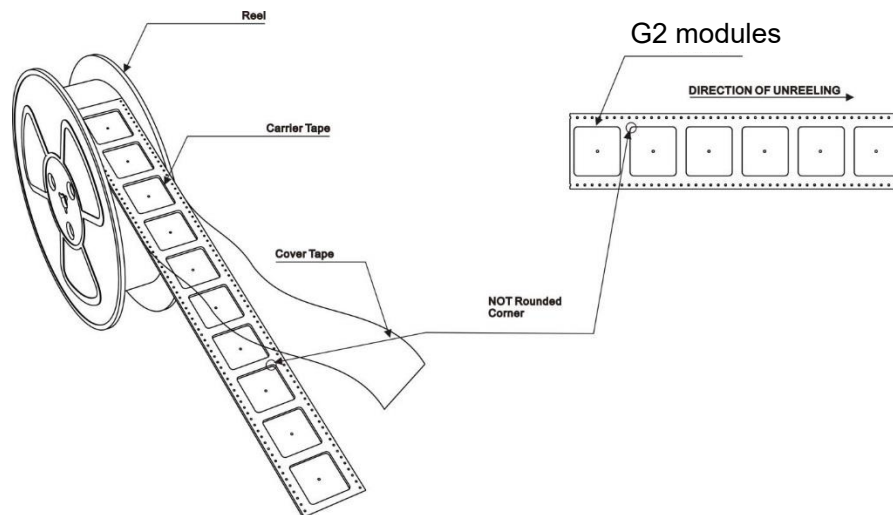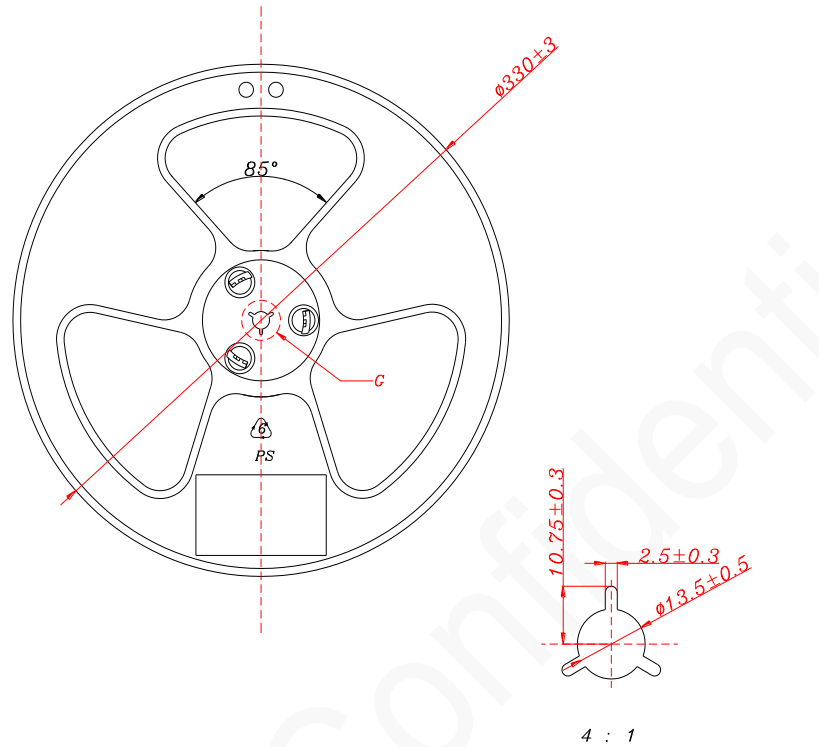Figure 4-1 G2 dimensions (Unit: mm)
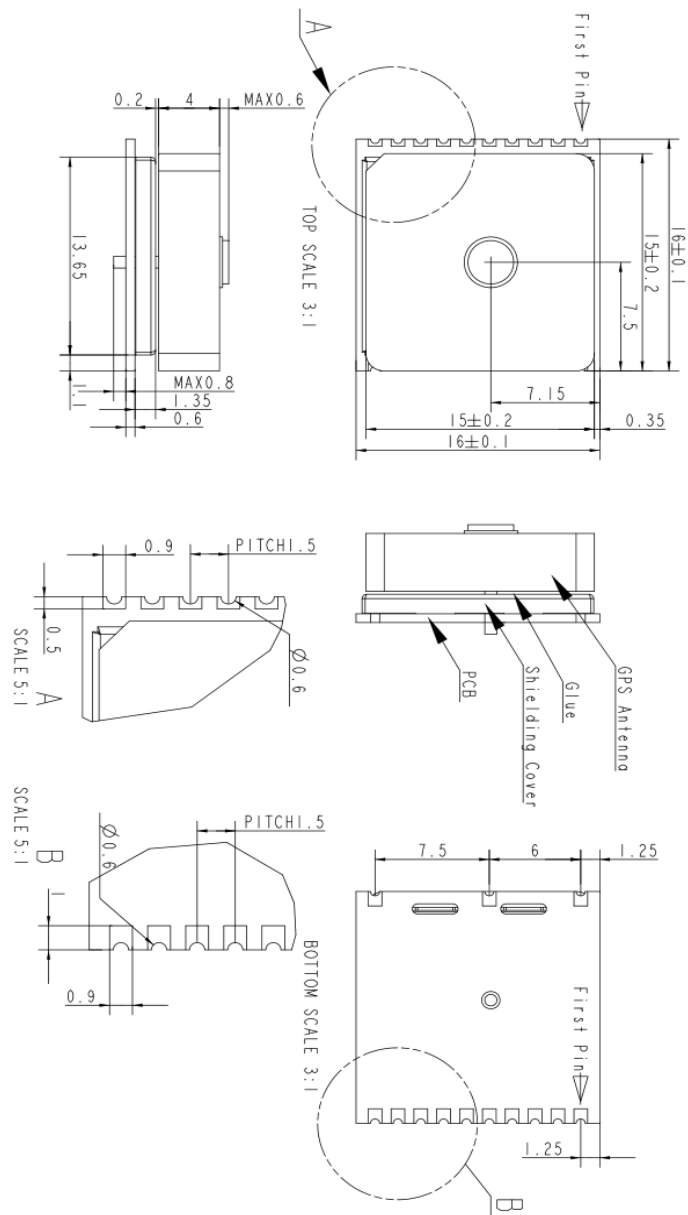
## 4.2 Packaging

G2 modules are packed in sealed bags on delivery to guarantee a long shelf life. Follow the same package of the modules again in case of opened for any reasons.

### 4.2.1 Tape & Reel Packaging

G2 in mass production are shipped in the following package.

Tape



| W | A₀ | B₀ | K₀ | K₁ | P | F | E | D₀ | D₁ | P₀ | P₂ | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $32.00^{\pm0.30}$ | $16.43^{\pm0.10}$ | $16.43^{\pm0.10}$ | $7.22^{\pm0.10}$ | / | $24.00^{\pm0.10}$ | $14.2^{\pm0.10}$ | $1.75^{\pm0.10}$ | $1.50^{+0.10}_{-0.00}$ | $0.00^{+0.10}_{-0.00}$ | $4.00^{\pm0.10}$ | $2.00^{\pm0.10}$ | $0.40^{\pm0.05}$ |

Reel



## 4.2.2 Mositure-Sensitive

G2 is a level 3 moisture-sensitive electronic elements, in compliance with IPC/JEDEC J-STD-020 standard.

If the module is exposed to air for more than 48 hours at conditions not worse than 30°C/60% RH, bake it at a temperature higher than 90 degree for more than 12 hours before SMT.Or, if the indication card shows humidity greater than 20%, the baking procedure is also required.Do not bake modules with the package tray directly.

# 5 Application Design and SMT

G2 is introduced in LCC package. This chapter provides G2foot print, recommended PCB design and SMT information to guide users how to mount the module onto application PCB board.
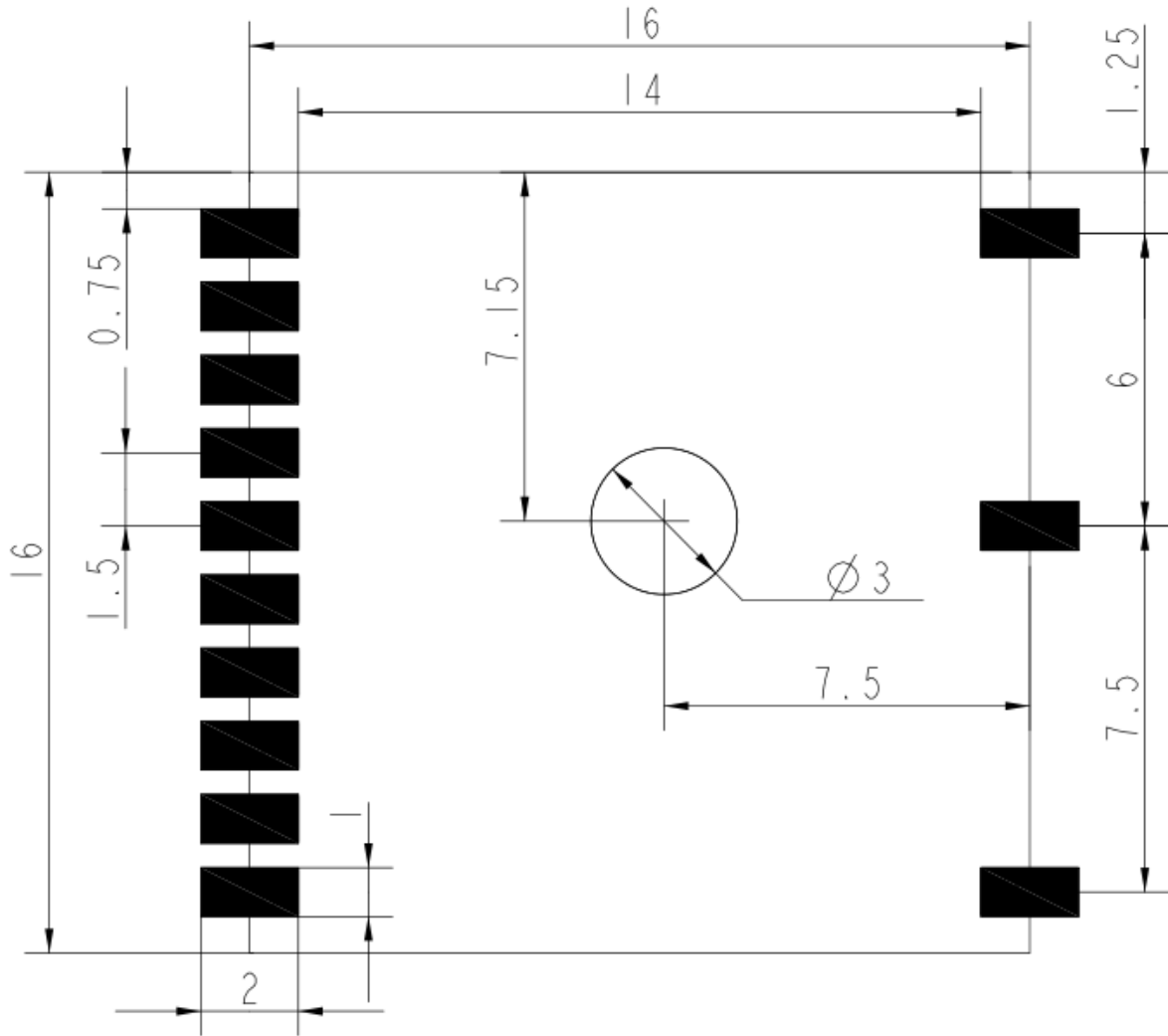
## 5.1 G2 Foot Print

Figure 5-1 G2 foot print (bottom view)
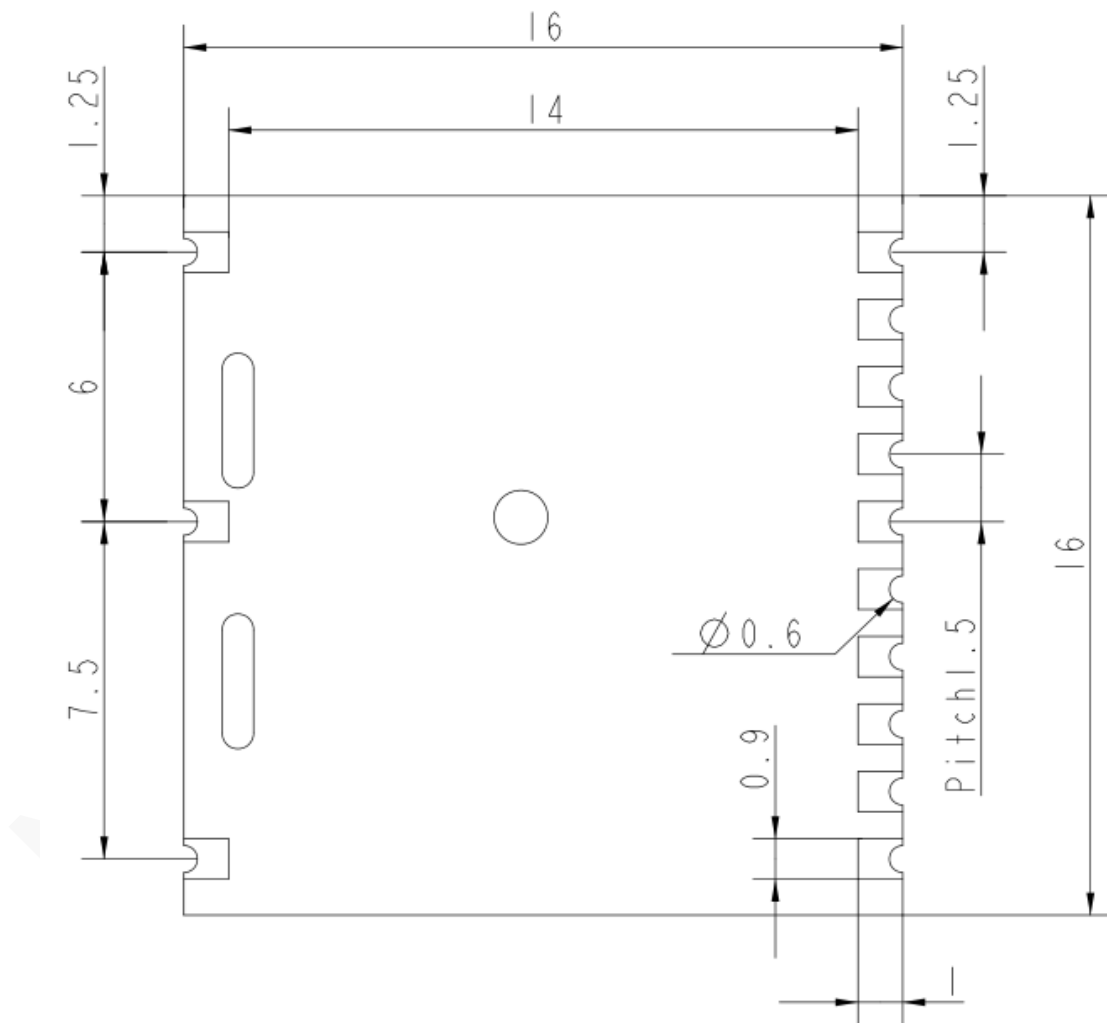
## 5.2 Recommended Footprint

Figure 5-2 shows the recommended application PCB footprint. (Unit: mm)

Figure 5-2 Recommended PCB footprint (top view)



## 5.3 Stencil

The recommended stencil thickness is at least 0.12 mm to 0.15 mm.

## 5.4 Solder Paste

Do not use a kind of solder paste different from our module technique.

- The melting temperature of solder paste with lead is 35°C lower than that of solder paste without lead. It is easy to cause faulty joints for LCC inside the module after second reflow soldering.

- When using only solder pastes with lead, please ensure that the reflow temperature is kept at 220 °C for more than 45 seconds and the peak temperature reaches 240 °C.


# 5.5 Reflow Profile

G2 is compatible with industrial standard reflow profile for lead-free SMT process.

The reflow profile is process dependent, so the following recommendation is just a start point guideline:

- Only one flow is supported.

- Quality of the solder joint depends on the solder paste volume. Minimum of 0.12 mm to 0.15 stencil thickness is recommended.

- Use bigger aperture size of the stencil than actual pad size.

- Use a low-residue, no-clean type solder paste.

Figure 5-3 Temperature curve
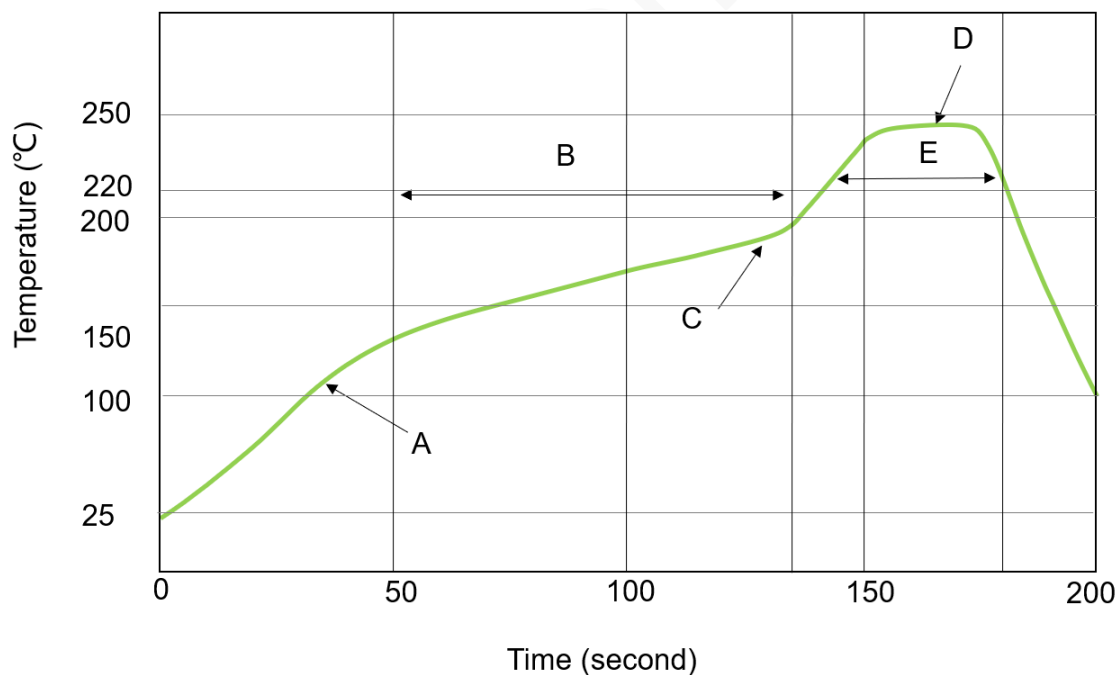


X: Time (s) Y: Temperature (°C）

Technical parameters:

- Ramp up rate: 1 to 4°C/sec

- Ramp down rate: -3 to-1°C/sec

- Soaking zone: 150-180°C for 60-100 seconds

- Reflow zone: >220°C for 40-90 seconds

- Peak temperature: 235-245°C

> ⚠ Neoway will not provide warranty for heat-responsive element abnormalities caused by improper temperature control.

For information about cautions in G2 storage and mounting, refer to *Neoway Module Reflow Manufacturing Recommendations*.

To maintain and manually desolder it, use heat guns with great opening, adjust the temperature to 245 degrees (depending on the type of the solder paste), and heat the module till the solder paste is melt. Use tweezers to remove the module. Do not shake the module in high temperature while removing it. Otherwise, the components inside the module might be misplaced.

# 6 Safety Recommendations

Ensure that this product is used in compliant with the requirements of the country and the environment. Please read the following safety recommendations to avoid body hurts or damages of product or work place:

- Do not use this product at any places with a risk of fire or explosion such as gasoline stations, oil refineries, etc.

- Do not use this product in environments such as hospital or airplane where it might interfere with other electronic equipment.

Please follow the requirements below in application design:

- Do not disassemble the module without permission from Neoway. Otherwise, we are entitled to refuse to provide further warranty.

- Please design your application correctly by referring to the HW design guide document and our review feedback on your PCB design.

- Please avoid touch the pins of the module directly in case of damages caused by ESD.

# A Abbreviation

| Abbr | Full Name |
| --- | --- |
| AGPS | Assisted GPS |
| CEP | Circular Error Probable |
| DGPS | Differential GPS |
| EASY | Embedded Assist System |
| EGNOS | European Geostationary Navigation Overlay Service |
| EPO | Extended Prediction Orbit |
| EMI | Electro Magnetic Interference |
| ESD | Electronic Static Discharge |
| GPS | Global Positioning System |
| GNSS | Global Navigation Satellite System |
| GGA | GPS Fix Data |
| GLONASS | Global Navigation Satellite System |
| GSV | GNSS Satellites in View |
| I/O | Input/output |
| LNA | Low Noise Amplifier |
| MSAS | Multi-Functional Satellite Augmentation System |
| NMEA | National Marine Electronics Association |
| PPS | Pulse Per Second |
| PRN | Pseudo Random Noise Code |
| QZSS | Quasi-Zenith Satellite System |
| RHCP | Right Hand Circular Polarization |
| RMC | Recommended Minimum Specific GNSS Data |
| SBAS | Satellite-based Augmentation System |
| SAW | Surface Acoustic Wave |
| TTFF | Time To First Fix |
| UART | Universal Asynchronous Receiver & Transmitter |