

# G7 Hardware User Guide

Version 1.0



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## Revision Record

Version	Changes	Revised By	Date
V1.0	Initial draft	Tian	2017-06

# 1 G7 Introduction

## 1.1 Overview

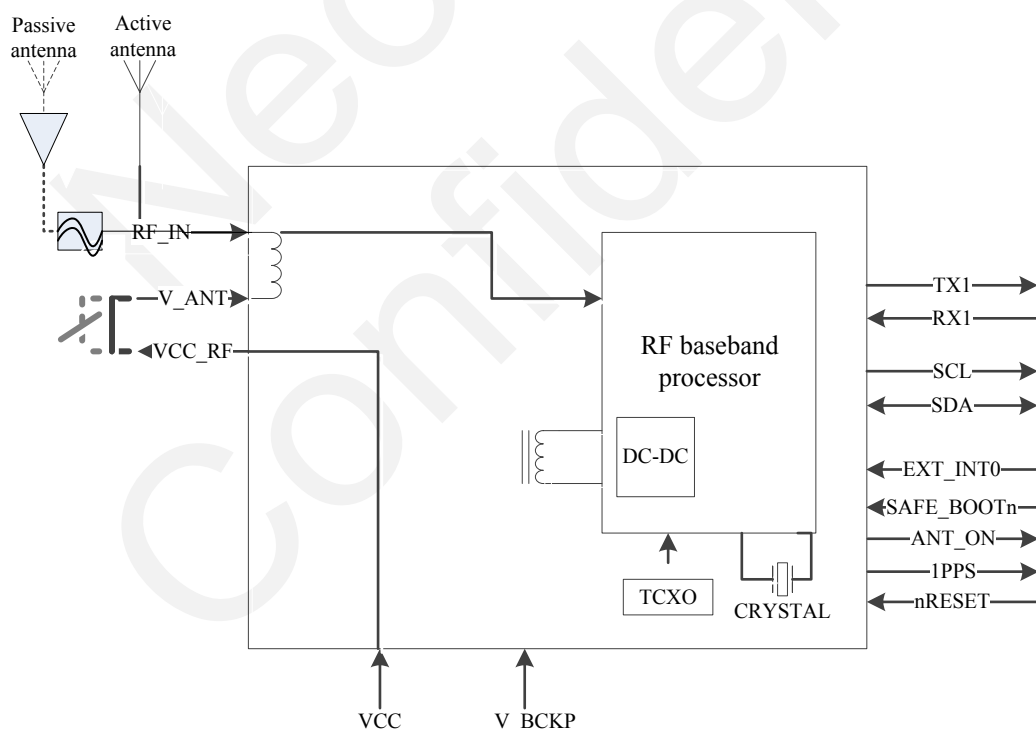
G7 is a dual-mode positioning module that supports BDS B1/GPS L1/GLONASS L1 (two of three). It integrates a SOC+RF chipset that supports BDS B1/GPS L1/GLONASS L1 spot frequency. It is used in IoV, handheld devices, and smart wearables requiring high-sensitivity, low power consumption, and cost-effective positioning/navigation.

The dimensions of G7 are 10.1 mm x 9.7 mm x 2.2 mm. This module adopts 18-pin LCC package to meet requirements for fast SMT during product manufacturing.

## 1.2 Block Diagram

Figure 1-1 shows the block diagram of G7.

**Figure 1-1** G7 Block Diagram



## 1.3 Features

Product features are:

- 18-Pin LCC, 10.1 mm x 9.7 mm x 2.2 mm
- Supports BDS B1/GPS L1/GLONASS L1
- Supports the following six working modes that are switchable by commands:
  - BDS B1 mode
  - GPS L1 mode
  - GLONASS mode
  - BDS B1/GPS L1 dual-mode (default)
  - GLONASS L1/BDS B1 dual-mode
  - GLONASS L1/GPS L1 dual-mode
- Provides input interface for backup power supply and supports hot start
- Embedded power reset and low-voltage check, supports external reset during operation
- Average power consumption 25mA@3.3V
- Wide input voltage range: 2.7~3.6 V
- High tracking/capturing sensitivity
- High positioning precision
- High integrity and simple external application circuit

**Table 1-1** G7 baseband and wireless features

Parameter	Description	Performance Indicator				Remarks
		Minimum Value	Typical Value	Maximum Value	Unit	
Positioning precision Open air	Horizontal		<3		m	
	Elevation		<4.5		m	
Speeding precision			<0.1		m/s	
Time to first fix TTFF	Cold start		<28		s	
	Hot start		1		s	
	Recapture		1		s	
Sensitivity	Capture		-147		dBm	
	Tracking		-163		dBm	
Output baud rate at UART		4800	9600	230400	bps	9600Bps by default

Data update rate			1	10	Hz	1Hz by default
Operating voltage	VCC		3.3		V	
	V_BCKP		3.3		V	
Average power consumption			25		mA	3.3 V at the main power supply VCC pin
Power consumption in sleep mode			20		uA	3.3 V at backup power supply pin
Antenna gain				30	dB	
Temperature	Work	-40		85	°C	
	Storage	-40		125	°C	
Weight			<6		g	

G7 supports both active and passive antenna. It is recommended to add a grade one LNA and SAW to peripheral if a passive antenna is used. The antenna receives satellite signals and transmits the signals to RF baseband processor, in which LNA amplifies and mixes the signals and transmits them to medium filter for VGA and AGC, and finally the signals are transmitted to baseband processor after converting to digital signals by AD. Upon receiving the digital medium signals, the baseband processor performs a series of algorithms including capturing, tracking, and fixing solution, and outputs NMEA data through UART and provides 1PPS signal.

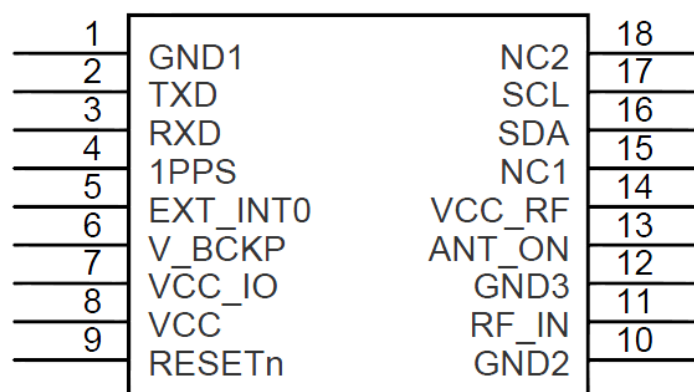
## 2 Application Interfaces

G7 provides 18 pins, of which pads are packaged in LCC. The following chapter provides detailed description of the pins.

### 2.1 Specifications and Pin Definition

Table 2-1 G7 Dimensions

Specifications	G7
Dimensions	10.1 mm x 9.7 mm x 2.2 mm (H*W*D)
Weight	4.0g
Package	18-Pin LCC

**Figure 2-1** G7 pin description (Top View)

## 2.2 Pin Description

Pin	Signal	I/O	Level	Description
1	GND	—		Ground
2	TXD	O	0-3.5 V	UART1 transmitting: NMEA data output, status output
3	RXD	I	0-3.5 V	UART1 receiving: command receiving
4	1PPS	O	0-3.5 V	Pulse per second
5	EXT_INT0	I	0-3.5 V	External interrupt
6	V_BCKP	I	2.5-3.5 V	Backup power supply input
7	VCC_IO	—	3.0-3.5 V	IO power supply
8	VCC	—	3.0-3.5 V	Main power supply
9	nRESET	I	0-3.5 V	External reset, triggered by low level. Do not connect the nRESET pin to any grounding inductor.
10	GND	—		Ground
11	RF_IN	I		Antenna input
12	GND	—		Ground
13	ANT_ON	O	0-3.5 V	Enable signal of external antenna or LNA, controlled by high level
14	VCC_RF	O	VCC	3.3V output. The module can supply power for the antenna directly. The operating current should not exceed 20 mA.
15	NC	—	—	Backup pin, not connected to the internal circuit of the module
16	SDA	IO	0-3.5 V	Two lines of data signals at DDC interface
17	SCL	I	0-3.5 V	Two lines of clock signals at DDC interface
18	NC	—	—	Backup pin, not connected to the internal circuit of the module



## 2.3 Power Supply and Control Interfaces

The module provides three power supply input pins (VCC, V\_BCKP, and VDD\_IO) and one power supply output pin (VCC\_RF). VCC is the main power supply of the module, VCC\_IO is the IO power supply, and V\_BCKP is the backup input power supply. When the main power supply does not work, it supplies power for RTC circuit to protect key information for hot start. VCC\_RF outputs a voltage of 3.3 V, which can be used to supply power for antenna or external LNA.

## 2.4 Antenna Interface

RF\_IN can connect to multi-mode antenna directly. This interface adopts 50Ω impedance matching.

The module embeds antenna status detection, which reports antenna status through NMEA sentences every second by default. Antenna status includes OK, OPEN, and SHORT. When the antenna encounters short circuit, the module will start the automatic protection by limit the current supplied to the antenna to avoid overheat or damage caused by high current. After the short circuit is removed, the module restores to proper operation automatically.

## 2.5 Reset Interface

The module embeds power reset circuit and supports external reset by using the nRESET pin. Do not connect the nRESET pin to any grounding inductor. Otherwise, the module cannot hot start after resetting. If users do not use external reset, leave nRESET unconnected. If users use external reset, reset the module only after the VCC voltage is steady for 50 ms and the reset level should be kept for more than 1 ms.



## 2.6 1PPS Signal Interface

1PPS signal is output several seconds after the module fixes position.

## 2.7 UART Interfaces

UART1 outputs NMEA data at UTC second boundary. Users can also switch the work mode and baud rate through UART on the host. The module supports baud rate ranging from 4800bps to 230400bps. The default baud rate is 9600bps. Data format: 1 start bit, 8 data bits, 1 stop bit, no checksum bit.

UART2 is the backup serial port, used to output data in custom format.

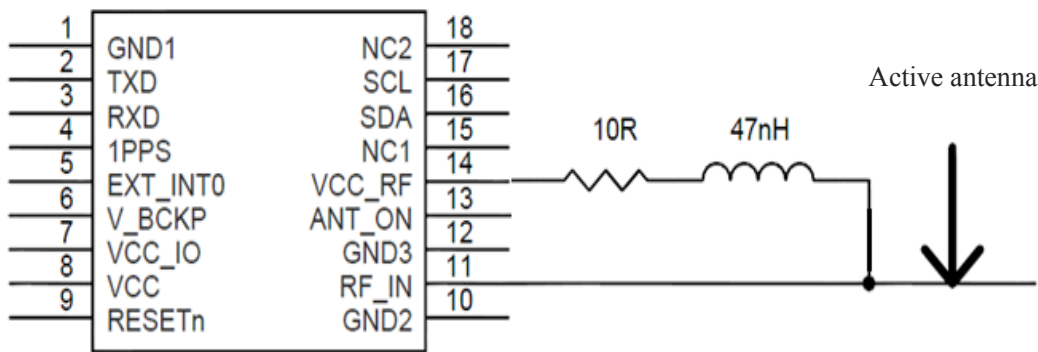
## 2.8 Recommended Antenna Indicators

Item		Active Antenna	Passive Antenna
Frequency range	BDS	1561.098±2.046 MHz	1561.098±2.046 MHz
	GPS	1575.42±1.023 MHz	1575.42±1.023 MHz
	GLONASS	1602.0±4 MHz	1602.0±4 MHz
Input impedance		50Ω	50Ω
Gain		≥30 dB	-
Inband gain flatness:		≥1.5 dB	-
Noise reduction coefficient		≥1.5 dB	-
Input VSWR		≥1.5	≥1.5
Output VSWR		≥2	≥2
Outband rejection: 1568±30MHz		≥30 dB	-
Recommended operating voltage		3.0V±0.3	-
Temperature range		-40~85°C	-40~85°C

## 2.9 Antenna Power Supply

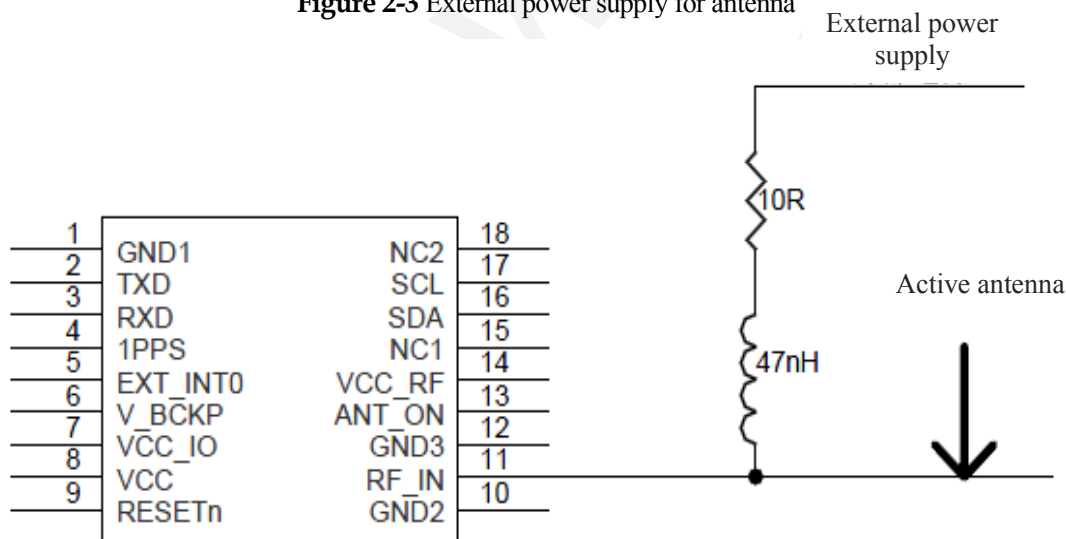
If an active antenna is used as the signal receiver of the module, power supply for the antenna is required. VCC\_RF or external power supply can be used as the output of antenna power supply as shown in the following figure. A 10Ω resistor is used to protect the power supply in short circuit.

Figure 2-2 Internal antenna power supply



Add a serial 10Ω resistor to avoid damage to external circuit caused by short circuit if users adopt external power supply.

Figure 2-3 External power supply for antenna



## 3 Electric Feature and Reliability

### 3.1 Electric Feature

Table 3-1 G7 electric feature

Module Status		Minimum Value	Typical Value	Maximum Value
Main power supply	Vin	2.7 V	3.3V	3.6V
	Iin	/	/	25mA
Input voltage of backup power supply	Vin	2.7 V	3.3V	3.6V



#### CAUTION

If the voltage is too low, the module might fail to start. If the voltage is too high or there is a voltage burst during the startup, the module might be damaged permanently.

### 3.2 Temperature

Table 3-2 G7 temperature feature

Module Status	Minimum Value	Typical Value	Maximum Value
Work	-40°C	25°C	85°C
Storage	-40°C		125°C



#### CAUTION

If the module works in temperature exceeding the thresholds, its RF performance might be worse but it can still work properly.

### 3.3 ESD Protection

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

Testing environment: humidity 45%; Temperature 25℃

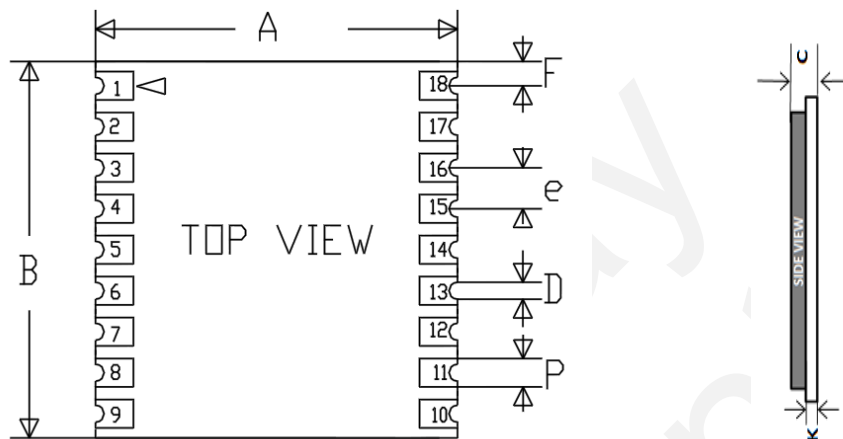
**Table 3-3** G7 ESD protection

Testing Point	Contact Discharge	Air Discharge
VCC	±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

### 4.1 Dimensions

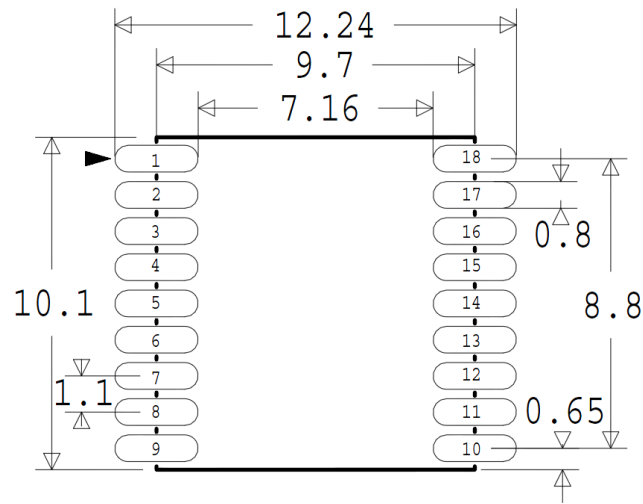
Figure 4-1 G7 packaging (Top View)



Marks	Dimension (mm)
A	9.7±0.1
B	10.1±0.1
C	2.2±0.1
D	0.46±0.1
e	1.1±0.1
F	0.65±0.1
P	0.76±0.1
K	0.8±0.1
Note: the module adopts LCC package.	

## 4.2 Recommended PCB Foot Print

Figure 4-2 Recommended G7 PCB foot print (Boot View)



## 5 Mounting and Packaging

### 5.1 Mounting the Module onto the Application Board

G7 adopts 18-pin LCC package. It 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:

- Make stencils with a thickness ranging from 0.12 mm to 0.15 mm, which can be adjusted according to the actual mounting conditions.
- The quality of the solder joint depends on the solder paste volume and the PCB flatness.
- Thin or long PCB might bend during SMT. So, use loading tools during the SMT and reflow soldering process to avoid poor solder joint caused by PCB bending.

For information about cautions in G7 storage and mounting, refer to *Neoway Module Reflow Manufacturing Recommendations*.

When manually desoldering the module, use heat guns with great opening, adjust the temperature to 250 degrees (depending on the type of the solder paste), and heat the module till the solder paste is melt. Then 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.

### 5.2 Package

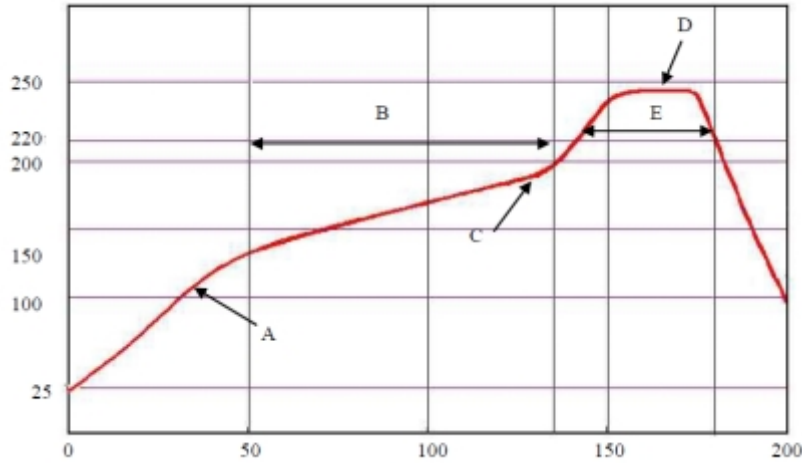
G7 modules are packaged in sealed vacuum bags with dryer, humidity card, and tray on delivery to guarantee a long shelf life. Follow the same package method in case of opened for any reasons.

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.



## 6 SMT Furnace Temperature Curve

Figure 6-1 SMT furnace temperature curve



Parameters:

- Ramp up rate: 1 to 4 °C/sec  
Ramp down rate: -3 to -1 °C/sec
- Soaking zone: 150-180 °C, Time: 60-100 s
- Reflow zone: >220 °C, Time: 40-90 s
- Peak temperature: 235-250 °C

Do not use the 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 BGA 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.



### WARNING

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

## 7 Abbreviations

ADC	Analog-Digital Converter
CPU	Central Processing Unit
DTR	Data Terminal Ready
EGSM	Enhanced GSM
ESD	Electronic Static Discharge
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
IMEI	International Mobile Equipment Identity
LED	Light Emitting Diode
PCB	Printed Circuit Board
RF	Radio Frequency
SIM	Subscriber Identification Module
UART	Universal asynchronous receiver-transmitter