L76C Hardware Design

GNSS Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2018-07-30	Brooke WANG/ Riley XU	Initial

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1 Introduction

This document defines and specifies L76C GNSS module. It describes the hardware interfaces, external application reference circuits, mechanical size and air interface of L76C module.

This document helps customers quickly understand module interface specifications, electrical and mechanical details of this module. Associated with the application note and user guide, customers will be able to use L76C module to design and set up mobile applications easily.

1.1 Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating L76C. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel, and incorporate these guidelines into all manuals supplied with the product. If not so, Quectel assumes no liability for customers' failure to comply with these precautions.

	Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.
	Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If the device offers an Airplane Mode, then it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on boarding the aircraft.
	Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.

	Cellular terminals or mobiles operating over radio signals and cellular network cannot be guaranteed to connect in all possible conditions (for example, with unpaid bills or with an invalid (U)SIM card). When emergent help is needed in such conditions, please remember using emergency call. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength.
	The cellular terminal or mobile contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV set, radio, computer or other electric equipment.
	In locations with potentially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potentially explosive atmospheres include fueling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as grain, dust or metal powders, etc.

2 Product Concept

2.1. General Description

L76C is a single receiver module integrating GPS, BeiDou, GLONASS*, Galileo* and QZSS* systems. It is able to achieve the highest industrial level of sensitivity, accuracy and TTFF with the lowest power consumption in a small-footprint lead-free package. The embedded flash memory provides capacity for storing user-specific configurations and allows for future updates.

The L76C module supports multiple positioning and navigation systems including autonomous GPS, GLONASS*, Galileo*, BeiDou, SBAS* (including WAAS, EGNOS, MSAS and GAGAN), QZSS*, DGPS, and AGPS.

L76C module is an SMD type module with a compact 10.1mm × 9.7mm × 1.8mm form factor. It can be embedded in customers' applications through the 18-pin pads with 1.1mm pitch. It provides necessary hardware interfaces for the connection to the main PCB.

The module is fully compliant with EU RoHS directive.

2.2. Key Features

Table 1: Key Features

Features	
Receiver Type [1)]	● GPS L1 C/A (1575.42MHz) ● BeiDou B1 C/A (1561.098MHz) ● GLONASS* L1 C/A (1598.0625MHz~1605.375MHz) ● Galileo* L1 C/A (1575.42MHz C/A Code)
Power Supply	● VCC: 2.8V~3.6V Typical: 3.3V
Power Consumption (GPS+BeiDou)	● Tracking: 15mA @-130dBm, VCC=3.3V ● Acquisition: 25mA @-130dBm, VCC=3.3V ● Backup: 30uA @-130dBm, V_BCKP=3.3V

Sensitivity	● Acquisition: -147dBm ● Reacquisition: -158dBm ● Tracking: -162dBm
TTFF@-130dBm (Autonomous without AGPS)	● Cold Start < 29s ● Warm Start < 29s ● Hot Start < 2s
TTFF@-130dBm (with AGPS)	● Cold Start: < 10s ● Warm Start: < 5s ● Hot Start: < 1s
Horizontal Position Accuracy (Autonomous)	● <2.5m CEP @-130dBm
Update Rate	● 1Hz by default, maximally up to 10Hz*
Accuracy of 1PPS Signal	● Typical accuracy: 20ns ● Time pulse width: 100ms
Velocity Accuracy	● Without aid: 0.1m/s
Acceleration Accuracy	● Without aid: 0.1m/s²
Dynamic Performance	● Maximum Altitude: 50000m ● Maximum Velocity: 600m/s ● Acceleration: 4G
UART Interface	● UART port: TXD and RXD ● Support baud rate from 4800bps to 115200bps; 9600bps by default ● UART port is used for NMEA output, and UNICORE/PQ* commands input and firmware upgrade
I2C Interface*	● Supports fast mode, with bit rate up to 400kbps
Temperature Range	● Normal operation temperature range: -40°C ~ +85°C ● Storage temperature range: -40°C ~ +90°C
Physical Characteristics	● Size: (10.10±0.15) mm × (9.70±0.15) mm × (1.80±0.20) mm ● Weight: Approx. 0.4g

NOTES

1. [1)] The default GNSS configuration of L76C is GPS+BeiDou. For more details about the GNSS configuration, please refer to ***document [2]***.
2. "*" means under development.

2.3. Block Diagram

The following figure shows the block diagram of L76C module. It consists of a single chip GNSS IC including RF/Baseband parts, an LNA, a SAW filter, a TCXO and a crystal oscillator.

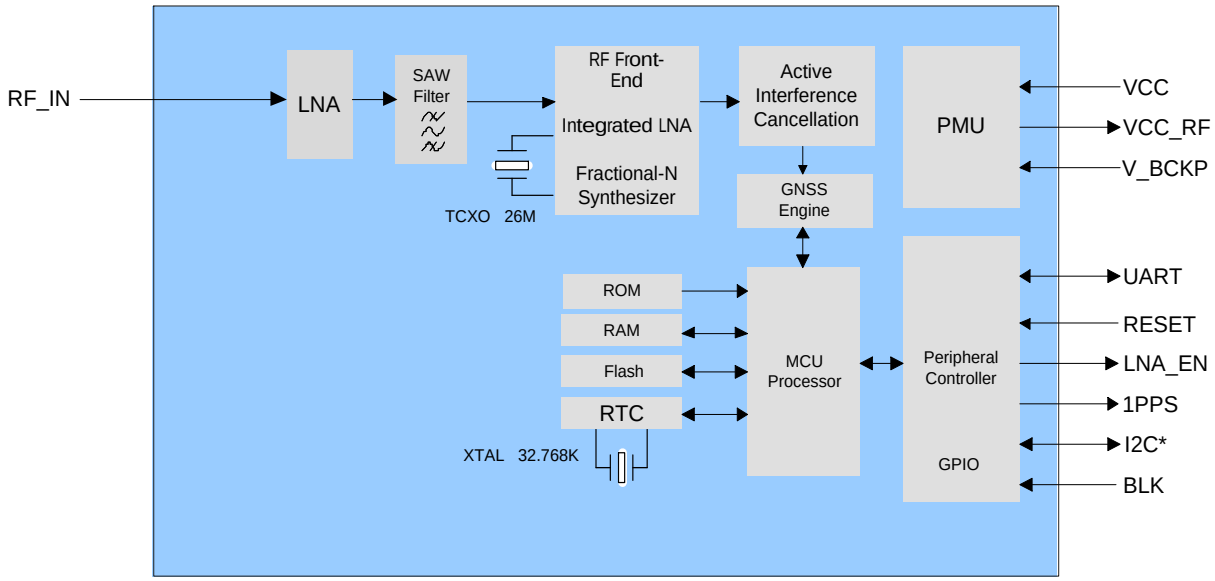

Figure 1: Block Diagram

2.4. Evaluation Board

In order to assist customers to use L76C module on their applications, Quectel offers the evaluation board (EVB), Micro-USB cable, active antenna and other peripherals to test the module. For more details, please refer to ***document [1]***.

2.5. Protocols Supported by the Module

Table 2: Supported Protocols

Protocol	Type
NMEA	ASCII, 0183, 4.1
UNICORE	UNICORE proprietary protocols
PQ*	Quectel proprietary protocols

NOTES

1. Please refer to ***document [2]*** for details about supported protocols.
2. "*" means under development.

3 Application Interfaces

The module is equipped with 18 LCC pins (1.1mm pitch) that can be connected to customers' application platforms. Sub-interfaces included in the pad are described in details in the following chapters.

3.1. Pin Assignment

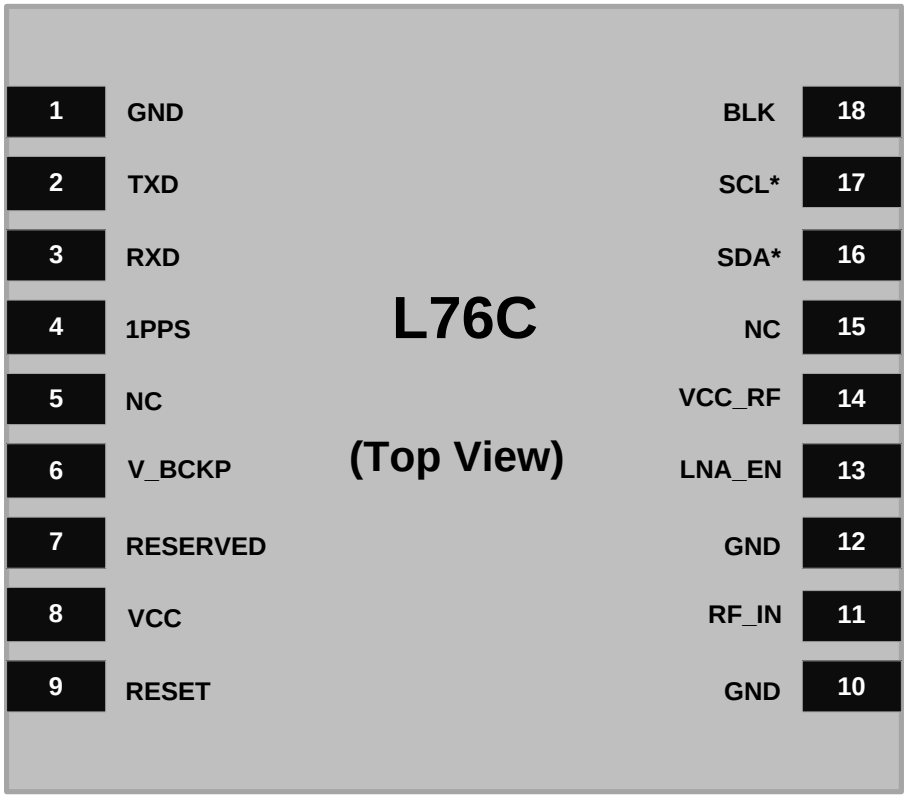

Figure 2: Pin Assignment

NOTE

"*" means under development.

3.2. Pin Description

Table 3: I/O Parameters Definition

Type	Description
IO	Bidirectional
DI	Digital input
DO	Digital output
PI	Power input
PO	Power output
AI	Analog input
AO	Analog output

Table 4: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
V_BCKP	6	PI	Backup power supply	Vmax=4.3V Vmin=1.4V Vnom=3.3V I_{V_BCKP} ≈ 30uA @Backup mode	Supply power for RTC domain when VCC is powered off.
VCC	8	PI	Main power supply	Vmax=3.6V Vmin=2.8V Vnom=3.3V	Assure load current not less than 150mA.
Reset					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RESET	9	DI	Reset the module	V_{IL}min=-0.2V V_{IL}max=0.7V V_{IH}min=2.6V V_{IH}max=3.6V	Active low. If unused, connect it to VCC or keep this pin open.

UART Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
TXD	2	DO	Transmit data	V_{OL}max=0.4V V_{OH}min=VCC-0.4V V_{OH}nom=VCC	UART port is used for NMEA output, and UNICORE/PQ* commands input and firmware upgrade.
RXD	3	DI	Receive data	V_{IL}min=-0.2V V_{IL}max=0.2*VCC V_{IH}min=0.7*VCC V_{IH}max=VCC	
RF Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VCC_RF	14	PO	Power supply for external RF components	Vmax=3.6V Vmin=2.8V Vnom=3.3V	Usually supply power for external active antenna or LNA. VCC_RF≈VCC. If unused, keep this pin open.
RF_IN	11	AI	RF signal input		50Ω characteristic impedance.
I2C Interfaces*					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
SDA*	16	IO	I2C serial data	V_{IL}min=-0.2V V_{IL}max=0.2*VCC V_{IH}min=0.7*VCC V_{OL}max=0.4V V_{OH}min=VCC-0.4V V_{OH}nom=VCC	If unused, keep these pins open.
SCL*	17	IO	I2C serial clock		
Other Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
1PPS	4	DO	One pulse per second	V_{OL}max=0.4V V_{OH}min=VCC-0.4V V_{OH}nom=VCC	Synchronized at rising edge, and the pulse width is 100ms. If unused, keep this pin open.
BLK	18	DI	Interferential signal remove function enable control	V_{IL}min=-0.2V V_{IL}max=0.2*VCC V_{IH}min=0.7*VCC V_{IH}max=VCC	Active high. If unused, keep this pin open.

LAN_EN	13	PO	Used for external LNA control and active antenna power control in backup mode	V_{OH}nom=1.9V	If unused, keep this pin open.
GND	1,10, 12		GND		
NC	5, 15				Keep these pins open.
RESERVED	7				Keep this pin open.

NOTE

"*" means under development.

3.3. Power Supply

VCC supplies power for BB, RF and RTC domains. The load current of VCC varies according to the VCC voltage level, processor load and satellite acquisition. It is important to supply sufficient current and make the power clean and stable. It is recommended for customers to choose LDO with minimum output current of 150mA and add a 10uF and a 100nF decoupling capacitor combination of capacitor as well as a TVS near the VCC pin.

V_BCKP supplies power for RTC domain. A cell battery with combination of 4.7uF and 100nF capacitors nearby V_BCKP pin is recommended. The voltage of RTC domain ranges from 1.4V to 4.3V. In order to achieve better Time to First Fix (TTFF), RTC domain should be valid all the time. which can supply power for SRAM memory in RTC domain which contains all the necessary GNSS information for quick start-up and a small amount of user configuration variables.

Internal power construction of the module is illustrated as below.

VCC not only supplies power for PMU but also for VCC_RF and RTC domain, while V_BCKP supplies power for RTC domain only. When the power supply voltage of VCC is within the normal range, use VCC, otherwise, use V_BCKP.

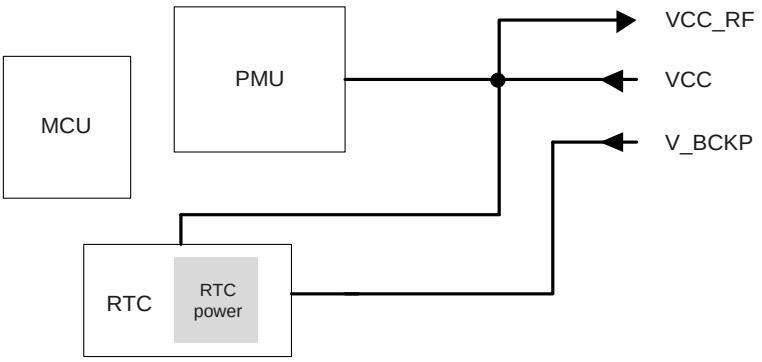

Figure 3: Internal Power Construction

3.4. Operation Modes

The table below briefly exhibits the relationship among different operation modes of L76C module.

Table 5: Module State Switch

Current Mode	Backup	Full on	GSE
Backup	/	Refer to ***Chapter 3.4.3***	N/A
Full on	Refer to ***Chapter 3.4.3***	/	TBD
GSE*	TBD	TBD	/

3.4.1. Full on Mode

Full on mode comprises tracking mode and acquisition mode. Acquisition mode is defined as the mode in which the module starts to search satellites, and to determine the visible satellites, coarse carrier frequency as well as code phase of satellite signals. When the acquisition is completed, it will automatically switch to tracking mode. Tracking mode is defined as the module tracking satellites and demodulating the navigation data from specific satellites.

When both VCC and V_BCKP pins are valid or only VCC is valid, the module will enter full on mode automatically and follow the default configuration as below. Please refer to ***Chapter 3.3*** about internal power construction for better comprehension.

Table 6: Default Configuration

Item	Configuration	Comment
Baud Rate	9600bps	
Protocol	NMEA	RMC, VTG, GGA, GSA, GSV and GLL
Update Rate	1Hz	
SBAS*		
GNSS	GPS+BeiDou	

In full on mode, the consumption complies with the following rules:

When the module is powered on, the average current will rush to 25mA and last for a few seconds; then the consumption decreases to the acquisition current listed in ***Table 10***, and this state is defined acquisition state, which will last for several minutes until switching to tracking state automatically. The consumption in tracking state is less than that in acquisition state. The value is also listed in ***Table 10***.

The following commands can be used to switch among multiple positioning systems:

- $CFGSYS,h01: Search GPS satellites only
- $CFGSYS,h10: Search BeiDou satellites only
- $CFGSYS,h11: Search GPS and BeiDou satellites

NOTES

1. "*" means under development.
2. Currently, L76C supports single GPS, single BeiDou, or dual system configuration which is composed of both GPS and BeiDou.
3. RMC, VTG, GGA, GSA, GSV and GLL refer to output types of NMEA, which stand for functions as: RMC (Recommended Minimum Specific GNSS Data), VTG (Course over Ground and Ground Speed, Horizontal Course and Horizontal Velocity), GGA (GPS Fix Data), GSA (GNSS DOP and Active Satellites), GSV (GNSS Satellites in View), GLL (Geographic Position – Latitude/Longitude).

3.4.2. GSE Mode* (GNSS Smart Engine)

Under the intermittent operation mode, the L76C mode will enable high-performance prediction and scenario discriminating algorithm to reduce the power consumption significantly through intermittently switching on/off the engine and ensure stable signal tracking and positioning effects.

NOTE

"*" means under development.

3.4.3. Backup Mode

In backup mode, the module stops acquiring and tracking satellites. UART is also not accessible. But the backup memory in RTC domain which contains all the necessary GNSS information for quick start-up and a small amount of user configuration variables is alive. With only the backup memory working, the current consumption in this mode is about 30uA.

The only one way to enter into backup mode from full on mode is through cutting off VCC and keeping V_BCKP powered. As soon as VCC is powered, the module will enter into full on mode immediately.

For a better understanding, please refer to ***Chapter 3.3*** to see details about the internal power construction. V_BCKP can be directly powered by an external capacitor or battery (rechargeable or non-chargeable). The following figure illustrates the RTC backup reference design.

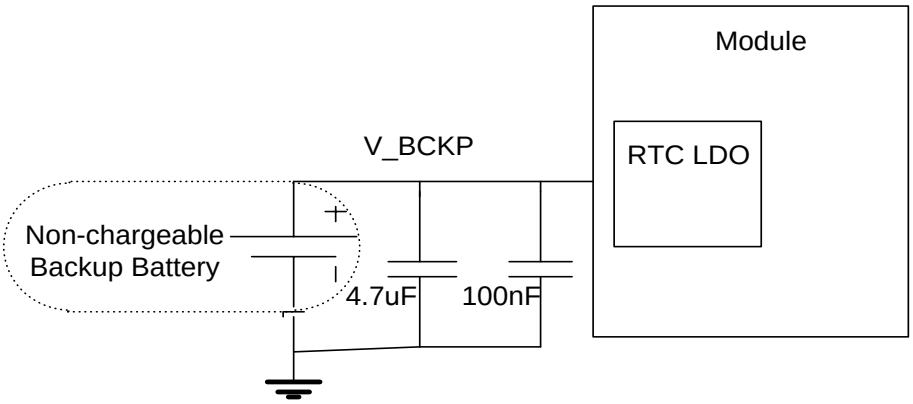

Figure 4: RTC Supply from Non-chargeable Battery

With a charging circuit, V_BCKP will support battery charging function. Please see the reference charging circuit in the figure below.

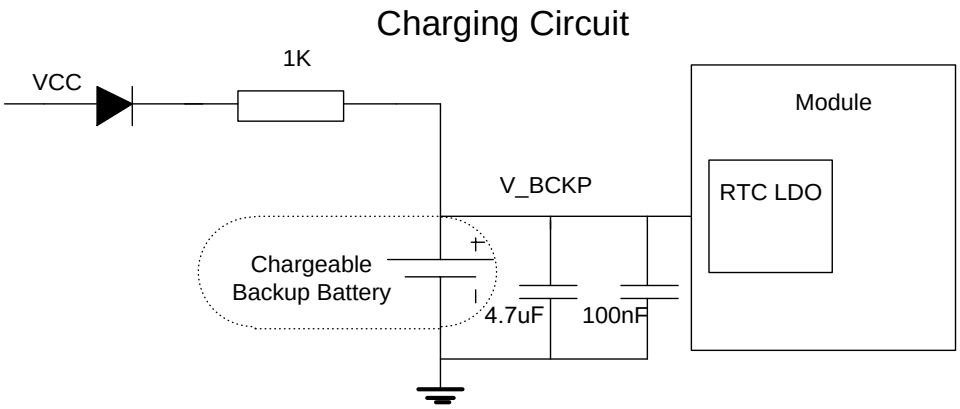

Figure 5: Reference Charging Circuit for Rechargeable Batteries

Coin-type rechargeable capacitors from Seiko (http://www.sii.co.jp/en) is recommended and Schottky diode from ON Semiconductor (http://www.onsemi.com) is also recommended for its low voltage drop.

3.5. Reset

L76C module can be reset by driving RESET to a low-level voltage for at least 10ms and then releasing it. Please note that the resetting will possibly force the loss of volatile RAM data, while non-volatile backup RAM content is not cleared so that fast TTFF is still possible. To control RESET, an OC driver circuit shown below is recommended.

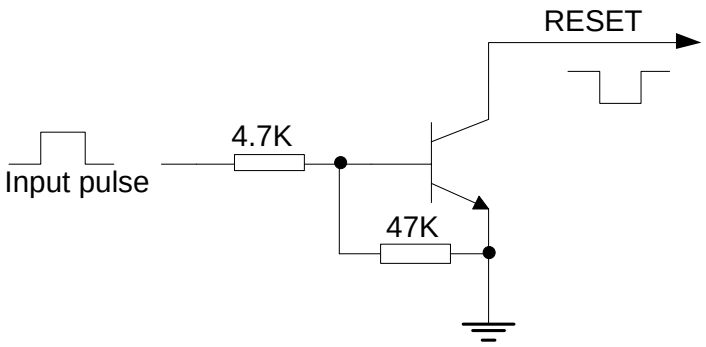

Figure 6: Reference Reset Circuit using OC Circuit

The following figure shows the reset timings of L76C module.

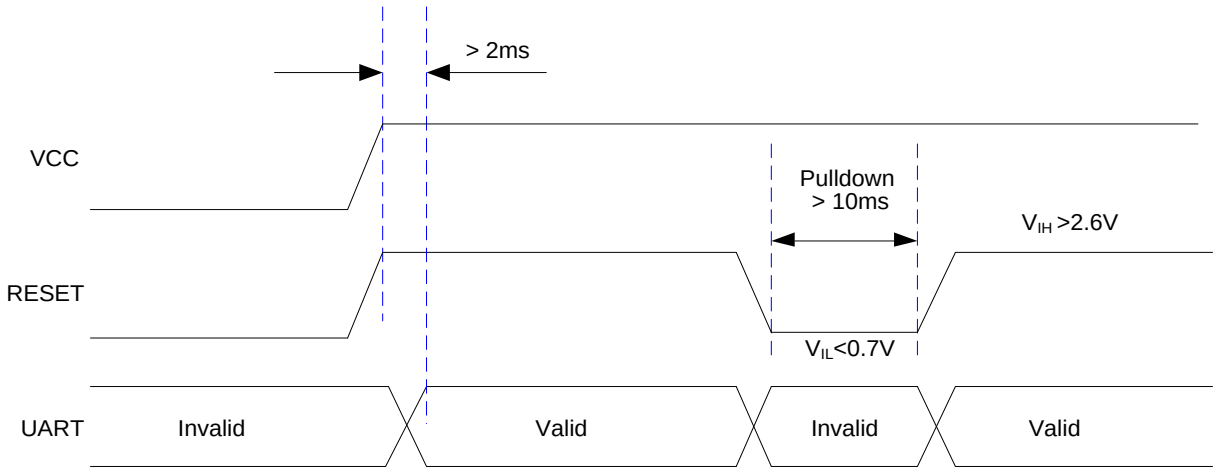

Figure 7: Reset Timing

3.6. UART Interface

The module provides one universal asynchronous receiver & transmitter serial port. It is designed as DCE (Data Communication Equipment) following the traditional DCE-DTE (Data Terminal Equipment) connection. The module and the DTE (Data Terminal Equipment) are connected through the signals shown in the following figure. It supports data baud-rate from 4800bps to 115200bps, 9600bps by default.

UART port:

- TXD: Send data to the RXD signal line of DTE
- RXD: Receive data from the TXD signal line of DTE

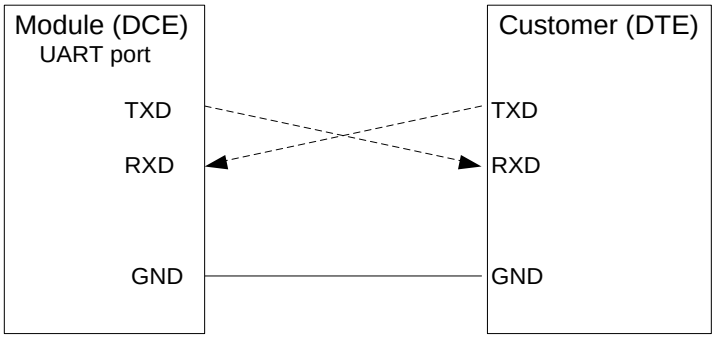

Figure 8: Reference Design for UART Port

This UART port has the following features:

- UART port is used for NMEA output and UNICORE/PQ* command input and firmware upgrade.
- The default NMEA output type setting is RMC, VTG, GGA, GSA, GSV and GLL.
- UART port supports data rates: 4800bps, 9600bps, 14400bps, 19200bps, 38400bps, 57600bps, 115200bps.
  The default is 9600bps, 8 bits, no parity bit, 1 stop bit.
- Hardware flow control and synchronous operation are not supported.

The UART port does not support the RS-232 level but only CMOS level. If the module's UART port is connected to that of a computer, it is necessary to add a level shift circuit in between. Please refer to the following figure.

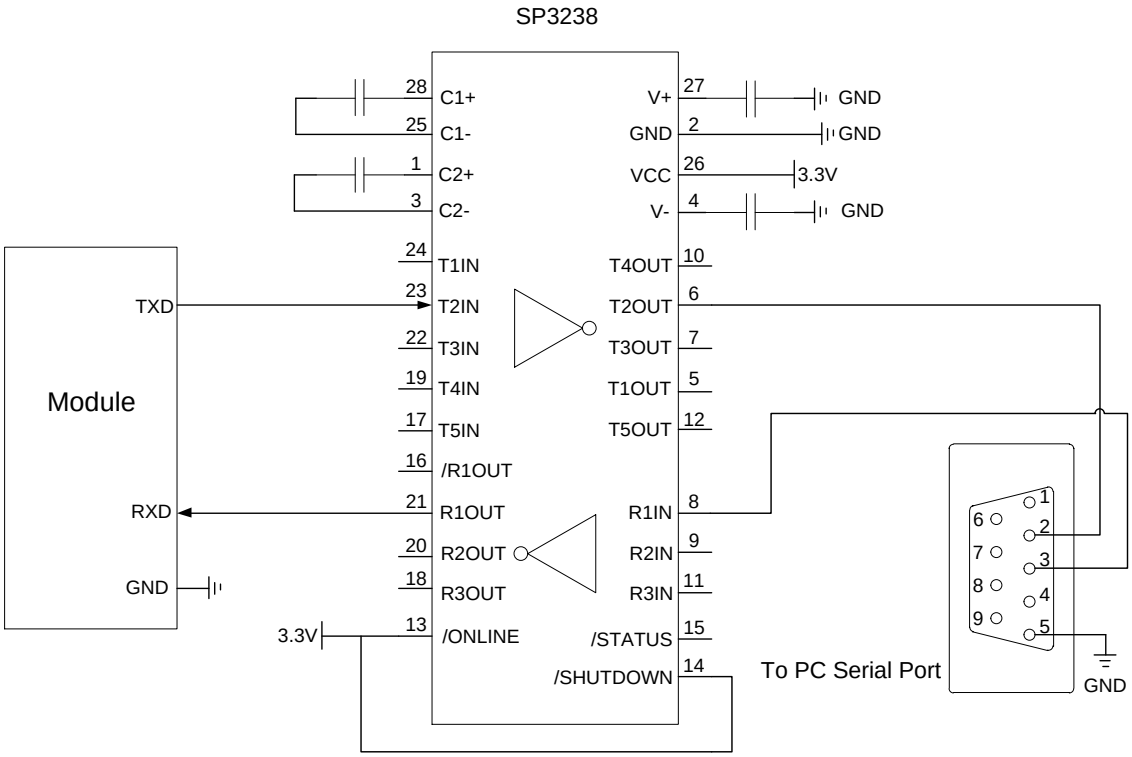

Figure 9: RS-232 Level Shift Circuit

NOTES

1. "*" means under development.
2. GNSS modules output more data than single GPS systems. The default baud rate (9600bps) of L76C is enough to transmit GNSS NMEA. If the baud rate has to be set to 4800bps, then it is recommended to decrease NMEA output types so as to avoid possible data loss.

3.7. I2C Interface*

L76C module provides a I2C interface. The interface can be operated in either master mode or slave mode. I2C protocol and electrical interface are fully compatible with Fast mode (Fast I2C), the maximum transfer rate is 400kbps.

The following circuit is an example of connection.

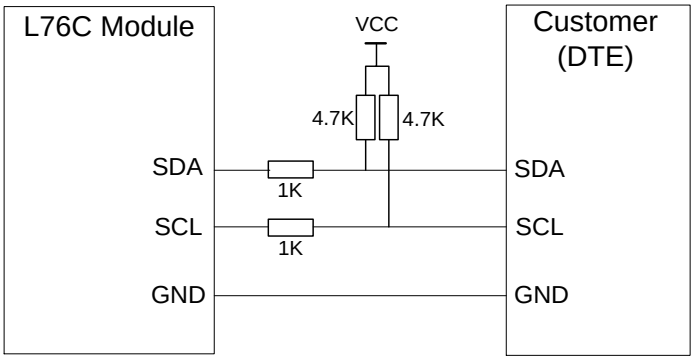

Figure 10: Reference Design for I2C Interface

NOTES

1. "*" means under development.
2. SDA and SCL should be externally pulled up to VCC.

4 Antenna Interfaces

L76C module supports GPS/BeiDou/GLONASS*/Galileo* systems. The RF signal is obtained through the RF_IN pin. The impedance of RF trace should be kept to 50Ω, and the trace length should be kept as short as possible.

NOTE

"*" means under development.

4.1. Antenna Specifications

The L76C module can be connected to a dedicated passive or active GNSS antenna to receive GPS/GLONASS*/Galileo*/BeiDou satellite signals. The recommended antenna specifications are given in the following table.

Table 7: Recommended Antenna Specifications

Antenna Type	Specification
GNSS	Frequency range: 1559MHz ~ 1609MHz Polarization: RHCP or linear VSWR: < 2 (Typ.) Passive antenna gain: > 0dBi Active antenna noise figure: < 1.5dB Active antenna gain: > 0dBi Active antenna embedded LNA gain: < 17dB

4.2. Recommended Circuits for Antenna

Both active and passive GNSS antennas can be used for L76C module.

4.2.1. Active Antenna Reference Designs

4.2.1.1. Reference Design of Active Antenna without LNA_EN

The following figure is a typical reference design for active antenna without LNA_EN. In this mode, the antenna is powered by the VCC_RF.

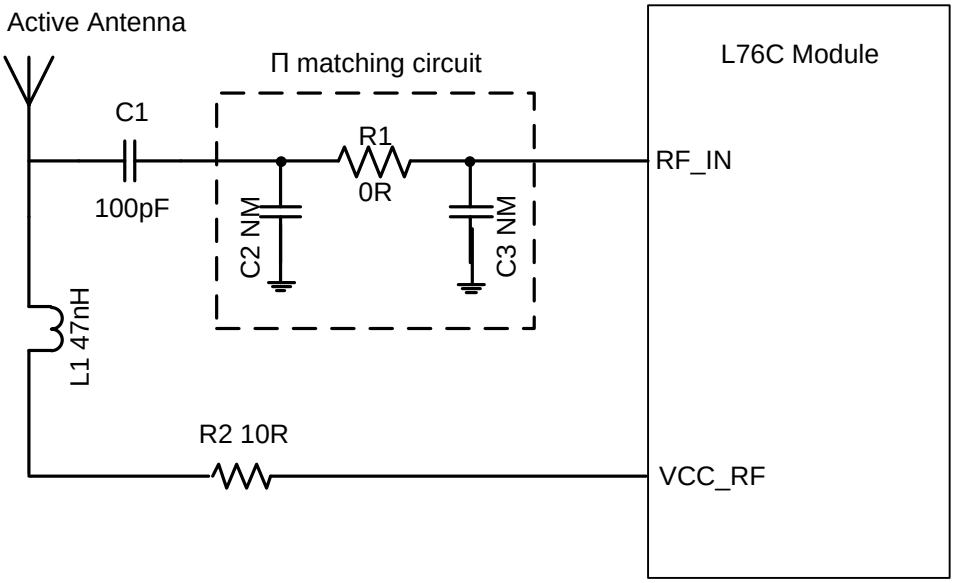

Figure 11: Reference Design for Active Antenna without LNA_EN

C1, C2, C3 and R1 are reserved matching circuits for antenna impedance modification. By default, R1 is 0Ω, C1 is 100pF, while C2 and C3 are not mounted.

The inductor L1 is used to prevent RF signals from leaking into the VCC_RF and route the bias supply to the active antenna. The recommended value of L1 is no less than 47nH. R2 can protect the whole circuit in case that the active antenna is short-circuited to ground.

4.2.1.2. Reference Design of Active Antenna with LNA_EN

L76C module can also reduce power consumption by controlling the power supply of active antenna through LNA_EN.

A reference circuit for active antenna with LNA_EN function is given as below.

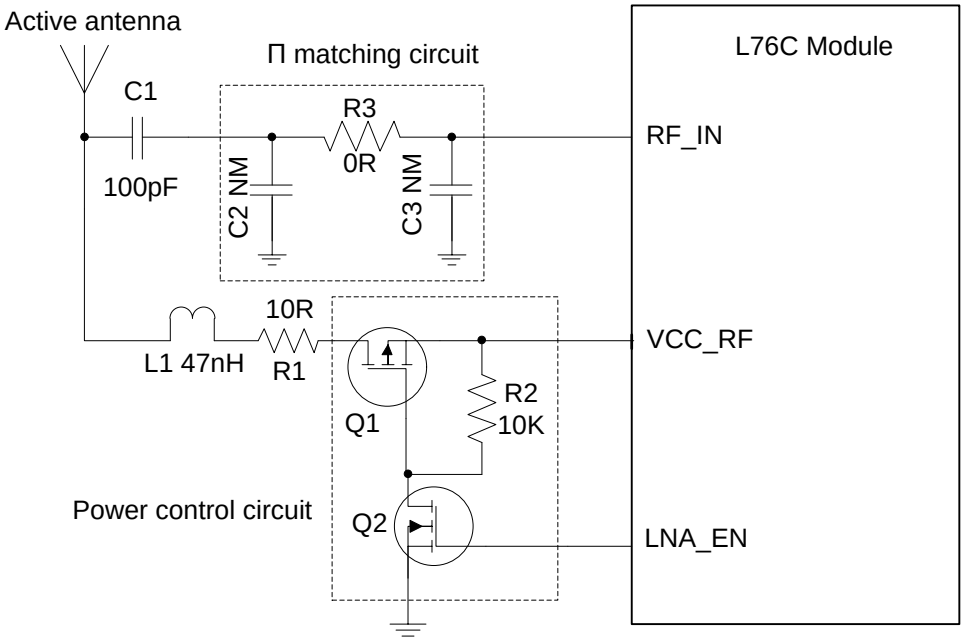

Figure 12: Reference Design for Active Antenna with LNA_EN

C1, C2, C3 and R3 are reserved matching circuits for antenna impedance modification. By default, R3 is 0Ω, C1 is 100pF, while C2, and C3 are not mounted.

LNA_EN is optional and can be used to control the power supply of the active antenna. When LNA_EN is pulled low, MOSFET Q1 and Q2 are in high impedance state and the power supply for antenna is cut off. When LNA_EN is pulled high, Q1 and Q2 are turned on, and VCC_RF will start to provide power supply for the active antenna. The high and low level of LNA_EN pin is determined by the module's state. If unused, please keep LNA_EN pin open.

To minimize the current consumption, the value of resistor R2 should not be too small, and the recommended value is 10KΩ.

4.2.2. Passive Antenna Reference Designs

4.2.2.1. Reference Design of Passive Antenna without External LNA

The following figure is a typical reference design for passive antenna without LNA.

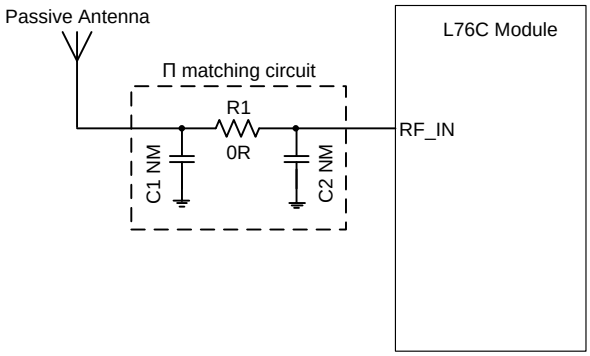

Figure 13: Reference Design for Passive Antenna without LNA

C1, R1, C2 are reserved matching circuit for antenna impedance modification. By default, C1 and C2 are not mounted, while R1 is 0Ω. Impedance of RF trace should be set to 50Ω and the trace length should be kept as short as possible.

4.2.2.2. Reference Design of Passive Antenna with External LNA

In order to improve the receiver sensitivity and reduce the TTFF, an external LNA between the passive antenna and the L76C module is recommended. A reference design is shown as below.

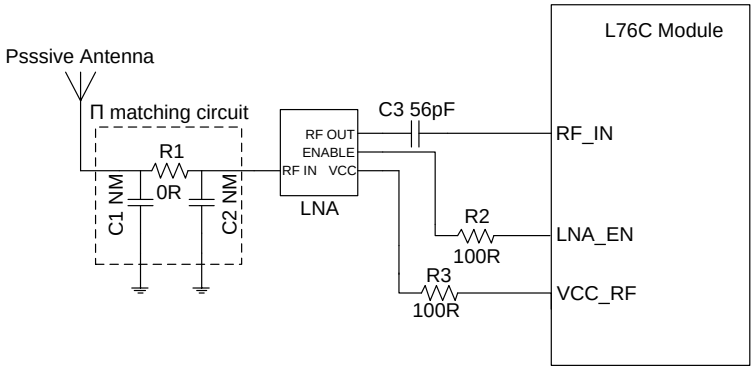

Figure 14: Reference Design for Passive Antenna with LNA

C1, R1, C2 are reserved matching circuit for antenna impedance modification. By default, R1 is 0Ω, while C1 and C2 are not mounted.

5 Electrical, Reliability and Radio Characteristics

5.1. Absolute Maximum Ratings

Absolute maximum rating for power supply and voltage on digital pins of the module are listed in following table.

Table 8: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
Power Supply Voltage (VCC)	-0.2	3.6	V
Backup Battery Voltage (V_BCKP)	-0.2	4.3	V
Input Voltage at Digital Pins	-0.2	3.6	V
Input Power at RF_IN (P_{RF}_IN)		15	dBm

NOTE

Stressing the device beyond the “Absolute Maximum Ratings” may cause permanent damage. The product is not protected against over-voltage or reversed voltage. Thus, it is necessary to utilize appropriate protection diodes to keep voltage spikes within the parameters given in table above.

5.2. Operating Conditions

Table 9: Power Supply Ratings

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
VCC	Supply voltage	The actual input voltages must stay between the minimum and maximum values.	2.8	3.3	3.6	V
I_{VCCP}	Peak supply current	VCC=3.3V			150	mA
V_BCKP	Backup voltage supply		1.4	3.3	4.3	V
TOPR	Full on mode operating temperature		-40	25	85	°C

NOTES

1. The values in the table above can be used to determine the maximum current capability of power supply.
2. Operation beyond the "Operating Conditions" is not recommended and extended exposure beyond the "Operating Conditions" may affect the device reliability.

5.3. Current Consumption

The values of current consumption are listed in the following table.

Table 10: Current Consumption

Module	Conditions	Acquisition @3.3V	Tracking @3.3V	Backup @V_BCKP=3.3V
L76C	@-130dBm GPS	25mA	15mA	30uA
	@-130dBm GPS+BeiDou	25mA	15mA	

NOTE

The tracking current is tested in the following conditions:

- In Cold Start, 35 seconds after First Fix.
- In Hot Start, 2 seconds after First Fix.

5.4. Reliability Test

Table 11: Reliability Test

Test Item	Conditions	Standard
Thermal Shock	-30°C...+80°C, 144 cycles	GB/T 2423.22-2002 Test Na IEC 68-2-14 Na
Damp Heat, Cyclic	+55°C; >90% Rh 6 cycles for 144 hours	IEC 68-2-30 Db Test
Vibration Shock	5~20Hz, 0.96m^2/s3; 20~500Hz, 0.96m^2/s3-3dB/oct, 1hour/axis; no function	2423.13-1997 Test Fdb IEC 68-2-36 Fdb Test
Heat Test	85°C, 2 hours, operational	GB/T 2423.1-2001 Ab IEC 68-2-1 Test
Cold Test	-40°C, 2 hours, operational	GB/T 2423.1-2001 Ab IEC 68-2-1 Test
Heat Soak	90°C, 72 hours, non-operational	GB/T 2423.2-2001 Bb IEC 68-2-2 Test B
Cold Soak	-45°C, 72 hours, non-operational	GB/T 2423.1-2001 A IEC 68-2-1 Test

5.5. ESD Protection

L76C GNSS module is an ESD sensitive device. ESD protection precautions should be emphasized. Proper ESD handling and packaging procedures must be applied throughout processing, handling and operation of any application that incorporates the module.

Please note that the following measures are helpful for ESD protection when L76C module is handled.

- The first contact point shall always be between the local GND and PCB GND when handling the PCB, unless there is a galvanic coupling between the local GND and the PCB GND.
- While mounting the module onto a motherboard, please make sure the GND is connected before the RF_IN pad.
- Do not contact any charged capacitors or materials which may easily generate or store charges (such as patch antenna, coaxial cable, soldering iron, etc.) when handling the RF_IN pad.
- Make sure to use an ESD safe soldering iron (tip) when soldering the RF_IN pin.

6 Mechanical Dimensions

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeter (mm). The tolerances for dimensions without tolerance values are ±0.05mm.

6.1. Top and Side Dimensions of the Module

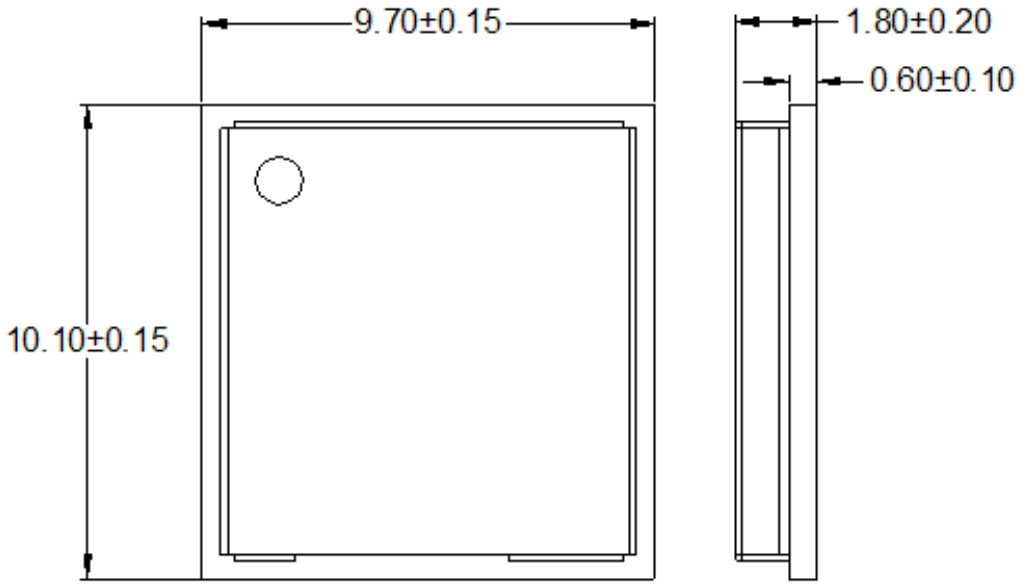

Figure 15: Top and Side Dimensions

6.2. Bottom Dimensions and Recommended Footprint

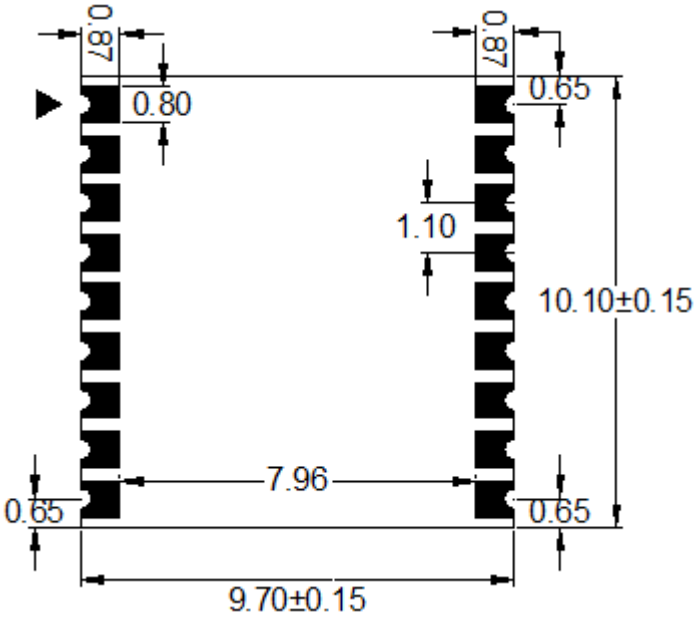

Figure 16: Bottom Dimensions

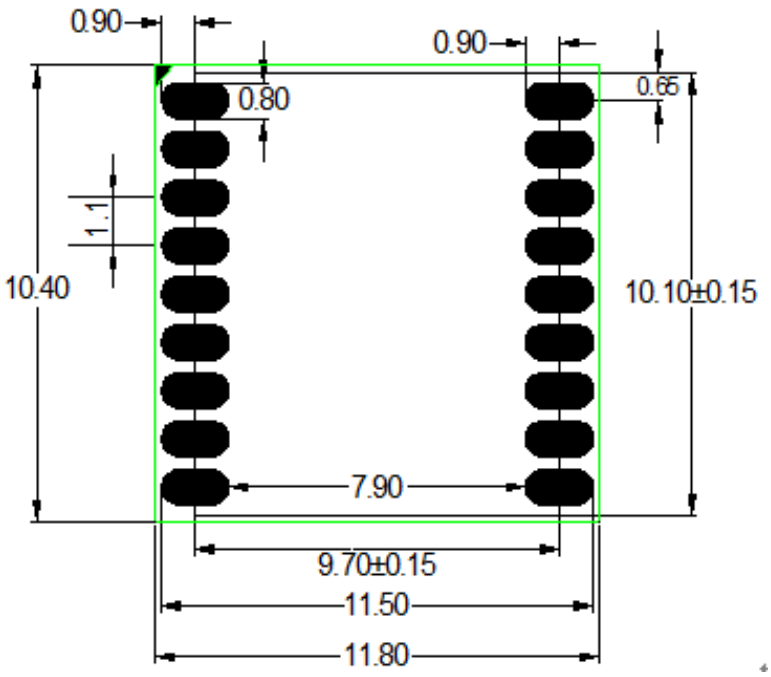

Figure 17: Recommended Footprint

NOTE

For easy maintenance of this module and accessing to these pads, please keep a distance of no less than 3mm between the module and other components on host boards.

6.3. Top and Bottom Views of the Module

Figure 18: Top View of the Module

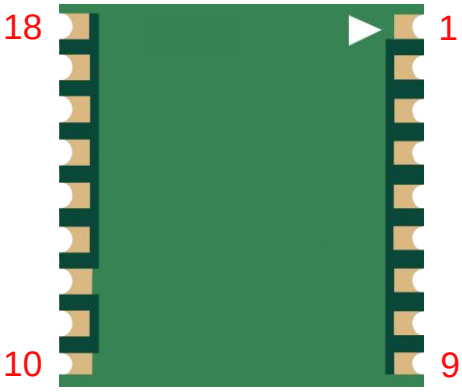

Figure 19: Bottom View of the Module

NOTE

These are renderings of L76C module. For authentic dimension and appearance, please refer to the module that you receive from Quectel.

7 Storage, Manufacturing, and Packaging

7.1. Storage

L76C is stored in a vacuum-sealed bag. It is rated at MSL 3, and its storage restrictions are shown as below.

1. Shelf life in the vacuum-sealed bag: 12 months at <40ºC/90%RH.

2. After the vacuum-sealed bag is opened, devices that will be subjected to reflow soldering or other high temperature processes must be:
   - Mounted within 168 hours at the factory environment of ≤30ºC/60%RH.
   - Stored at <10%RH.
3. Devices require baking before mounting, if any circumstance below occurs.
   - When the ambient temperature is 23ºC±5ºC and the humidity indication card shows the humidity is >10% before opening the vacuum-sealed bag.
   - Device mounting cannot be finished within 168 hours at factory conditions of ≤30ºC/60%.

4. If baking is required, devices may be baked for 8 hours at 120ºC±5ºC.

NOTE

As the plastic package cannot be subjected to high temperature, it should be removed from devices before high temperature (120ºC) baking. If shorter baking time is desired, please refer to *IPC/JEDECJ-STD-033* for baking procedure.

7.2. Manufacturing and Soldering

L76C GNSS module is intended for SMT assembly and soldering in a Pb-free reflow process on the top side of the PCB. It is suggested that the minimum height of solder paste stencil should be 130um to

ensure sufficient solder volume. The force on the squeegee should be adjusted properly so as to produce a clean stencil surface on a single pass. For more details, please refer to ***document [4]***.

It is suggested that the peak reflow temperature is 240~245ºC, and the absolute maximum reflow temperature is 245ºC. To avoid damage to the module caused by repeated heating, it is strongly recommended that the module should be mounted after reflow soldering for the other side of PCB has been completed. The recommended reflow soldering thermal profile (lead-free reflow soldering) and related parameters are shown below.

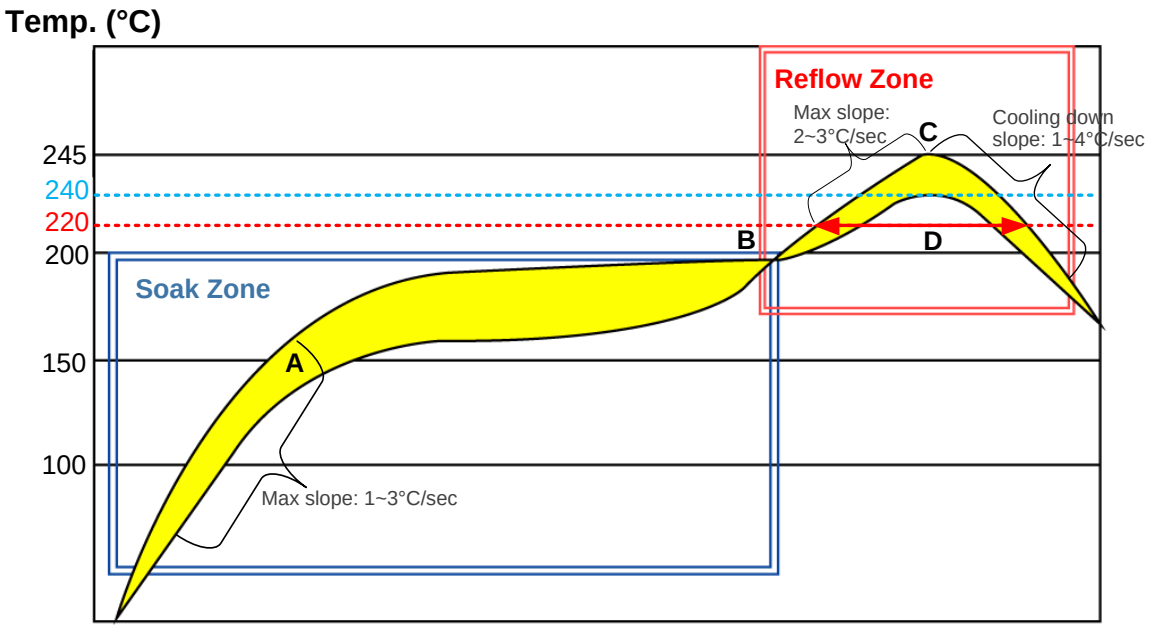

Figure 20: Recommended Reflow Soldering Thermal Profile

Table 12: Recommended Thermal Profile Parameters

Factor	Recommendation
Soak Zone	
Max slope	1 to 3°C/sec
Soak time (between A and B: 150°C and 200°C)	60 to 120 sec
Reflow Zone	
Max slope	2 to 3°C/sec
Reflow time (D: over 220°C)	40 to 60 sec
Max temperature	240°C ~ 245°C

Cooling down slope	1 to 4°C/sec
Reflow Cycle	
Max reflow cycle	1

NOTES

1. During manufacturing and soldering, or any other processes that may contact the module directly, NEVER wipe the module's shielding can with organic solvents, such as acetone, ethyl alcohol, isopropyl alcohol, trichloroethylene, etc. Otherwise, the shielding can may become rusted.
2. The shielding can for the module is made of Cupro-Nickel base material. It is tested that after 12 hours' Neutral Salt Spray test, the laser engraved label information on the shielding can is still clearly identifiable and the QR code is still readable, although white rust may be found.

7.3. Tape and Reel Packaging

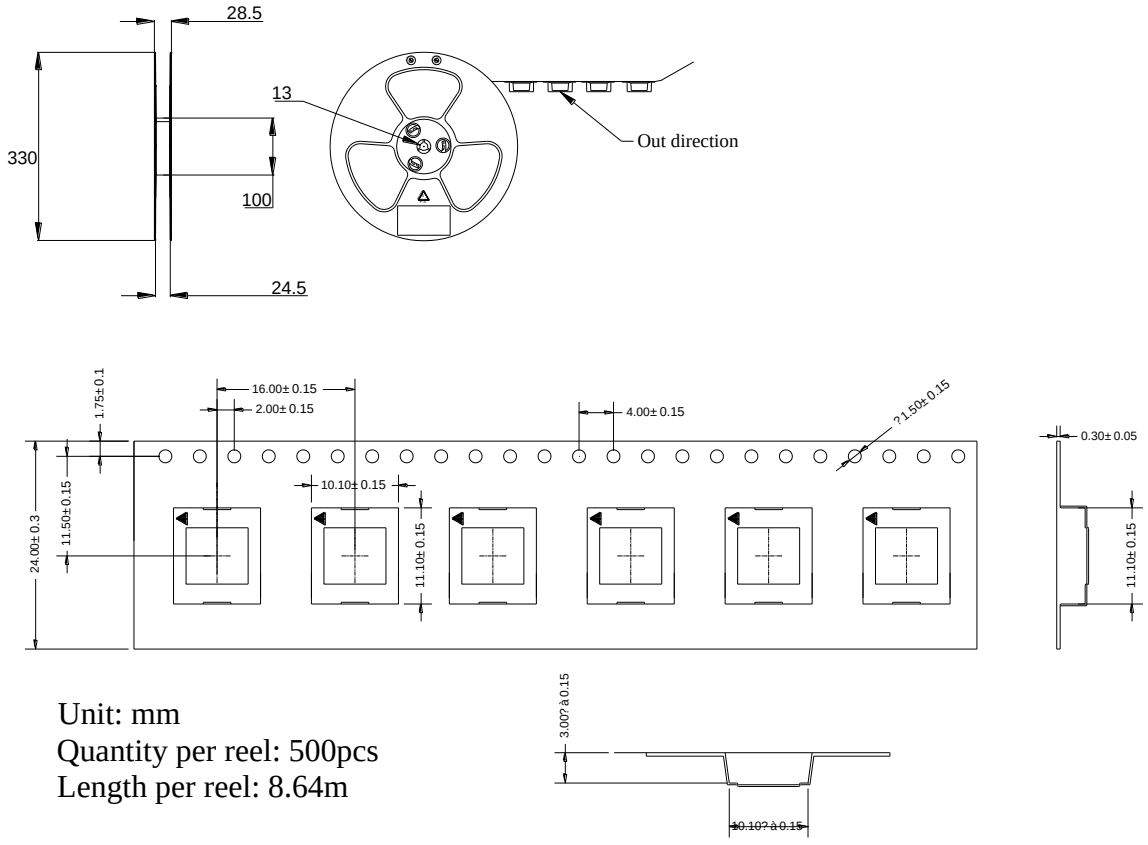

Figure 21: Tape and Reel Specifications

Table 13: Reel Packaging

Model Name	MOQ for MP	Minimum Package: 250pcs	Minimum Package x 4 = 1000pcs
L76C	500pcs	Size: 370mm × 350mm × 56mm N.W: 0.25kg G.W: 1.00kg	Size: 380mm × 250mm × 365mm N.W: 1.1kg G.W: 4.4kg

8 Appendix A References

Table 14: Related Documents

SN	Document Name	Remark
[1]	Quectel_L76C_EVB_User_Guide	L76C EVB User Guide
[2]	Quectel_L26C&L76C_GNSS_Protocol_Specification	L26C & L76C GNSS Protocol Specification
[3]	Quectel_L76C_Reference_Design	L76C Reference Design
[4]	Quectel_Module_Secondary_SMT_User_Guide	Module Secondary SMT

Table 15: Terms and Abbreviations

Abbreviation	Description
AGPS	Assisted Global Positioning System
CEP	Circular Error Probable
DGPS	Differential Global Positioning System
EGNOS	European Geostationary Navigation Overlay Service
ESD	Electrostatic Discharge
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
GLONASS	Global Navigation Satellite System (the Russian GNSS)
IC	Integrated Circuit
I/O	Input /Output
Kbps	Kilo Bits Per Second
LNA	Low Noise Amplifier
MSAS	Multi-Functional Satellite Augmentation System

MOQ	Minimum Order Quantity
NMEA	National Marine Electronics Association
PPS	Pulse Per Second
PQ	Quectel Proprietary Protocol
QZSS	Quasi-Zenith Satellite System
RHCP	Right Hand Circular Polarization
RTCM	Radio Technical Commission for Maritime Services
SBAS	Satellite-based Augmentation System
SAW	Surface Acoustic Wave
TTFF	Time to First Fix
UART	Universal Asynchronous Receiver & Transmitter
WAAS	Wide Area Augmentation System
Inom	Nominal Current
Imax	Maximum Load Current
Vmax	Maximum Voltage Value
Vnom	Nominal Voltage Value
Vmin	Minimum Voltage Value
V_{IH}max	Maximum Input High Level Voltage Value
V_{IH}min	Minimum Input High Level Voltage Value
V_{IL}max	Maximum Input Low Level Voltage Value
V_{IL}min	Minimum Input Low Level Voltage Value
$V_I$max	Absolute Maximum Input Voltage Value
$V_I$min	Absolute Minimum Input Voltage Value
V_{OH}max	Maximum Output High Level Voltage Value
V_{OH}min	Minimum Output High Level Voltage Value
V_{OL}max	Maximum Output Low Level Voltage Value
V_{OL}min	Minimum Output Low Level Voltage Value