LC79D Hardware Design

GNSS Module Series

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Quectel Wireless Solutions Co., Ltd.
Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Tel: +86 21 5108 6236
Email: info@quectel.com

Or our local office. For more information, please visit:
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About the Document

History

Revision	Date	Author	Description
1.0	2019-11-14	Brooke WANG/ Phil GAO	Initial

Contents

Table Index

Figure Index

1 Introduction

This document provides information on the interface specifications, electrical and mechanical details, as well as other related information of Quectel LC79D GNSS module. To facilitate application designs, it also includes some reference designs for customers' reference. This document, coupled with application notes and user guides, makes it easy to design applications with LC79D module.

1.1. Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any terminal incorporating Quectel LC79D module. Manufacturers of the terminal should notify users and operating personnel of the following safety information by incorporating these guidelines into all manuals supplied with the product. If not so, Quectel assumes no liability for any user's failure to observe these precautions.

	Ensure that the use of the product meets the national safety and environmental regulations, and is allowed in the country and in the environment required.
	Keep away from explosive and flammable materials. The use of electronic products in extreme power supply conditions and locations with potentially explosive atmospheres may cause fire and explosion hazards.
	The product has to be powered by a stabilized voltage source, and the wiring shall conform to security and fire prevention regulations.
	Proper ESD handling procedures must be applied throughout the mounting, handling and operation of any application that incorporates the module to avoid ESD damages.

2 Product Concept

2.1. General Description

LC79D is a dual-band and multi-constellation GNSS module. It supports L1 and L5 bands for GPS, Galileo and QZSS, L1 band for GLONASS and BeiDou as well as L5 band for IRNSS, and more specific information is available in the table below. It can achieve high industrial level of sensitivity and accuracy with the lowest power consumption in an ultra-small footprint.

LC79D is a SMD type module with an ultra-compact form factor of 10.1mm × 9.7mm × 2.4mm. It can be embedded into terminals through its 18 LCC pins and 10 LGA pins. This document provides necessary hardware interfaces for connection with the motherboard of terminals.

The module is fully compliant with EU RoHS directive.

Table 1: Bands and Constellations of LC79D

GPS/QZSS	L1 C/A	L1C	L2C	L5	L6
	●	/	/	●	/
Galileo	E1	E5a	E5b	E6	
	●	●	/	/	
BeiDou	B1I	B1C	B2I	B2a	B3I
	●	/	/	/	/
GLONASS	L1OF	L2OF			
	●	/			
IRNSS	L5				
	●				
SBAS	L1				
	●				

NOTE

"●" means supported.

2.2. Product Variants

Due to supporting of different working modes, LC79D is classified into two variants:

- **LC79D (A)**, supporting standalone mode, has a built-in flash and it boots firmware from the flash, so it can work independently.
- **LC79D (B)**, supporting host mode, does not include a built-in flash, so it cannot work independently and has to boot firmware from an Android device. Through the Quectel UDR (Untethered Dead Reckoning) technology working on Android devices, the positioning information provided by the module and that from a 6-axis sensor will be combined to provide vehicles with continuous and accurate positioning.

Table 2: Key Differences between LC79D (A) and LC79D (B)

Module	Interfaces	Embedded Flash	UDR Technology Working on Android Devices
LC79D (A)	UART, I2C, BOOT	Support	N/A
LC79D (B)	SPI, I2C, BOOT	N/A	Support

2.2.1. UDR Technology

UDR refers to the capability of a GNSS receiver to continuously navigate on a vehicle when there are insufficient GNSS satellite signals available. To realize this function, the receiver uses the information provided by external sensors concerning the state of the vehicle to propagate the navigation solution. With this combined system, the sensor's inputs will help smooth the navigation trace when the satellite signals are partially or completely blocked, while the satellite signals will then provide updates and corrections for sensor drifts. With UDR technology, the system will get continuous and high accuracy positioning in environments such as tunnels and urban canyons.

2.3. Key Features

Table 3: Key Features

Features	Details
Supported Bands[1)]	● GPS L1 C/A (1574.397MHz ~ 1576.443MHz) ● BeiDou B1 C/A (1559.052MHz ~ 1563.144MHz) ● GLONASS L1 OF (1597.781MHz ~ 1605.656MHz) ● Galileo E1 OS (1573.374MHz ~ 1577.466MHz) ● GPS L5 (1166.22MHz ~ 1186.68MHz) ● IRNSS L5 (1175.427MHz ~ 1177.473MHz) ● Galileo E5a (1166.22MHz ~ 1186.68MHz)
Power Supply	● VCC: 1.7V~1.9V, typical 1.8V
Power Consumption (GPS+BeiDou+GLONASS+ Galileo+QZSS+IRNSS)	● Acquisition: 47mA ● Tracking: 43mA ● Sleep mode: 200μA ● Standby mode: 17μA
Sensitivity (GPS+GLONASS)	● Acquisition: -147dBm ● Reacquisition: -158dBm ● Tracking: -163dBm
Sensitivity (IRNSS only)	● Acquisition: -144dBm ● Reacquisition: -151dBm ● Tracking: -155dBm
TTFF (without AGNSS)	● Cold start: <34s ● Warm start: <30s ● Hot start: <2s
TTFF (with AGNSS)	● Cold Start: <5s
Horizontal Position Accuracy (Autonomous)	● <1.2m CEP @-130dBm
Update Rate	● 1Hz
Accuracy of 1PPS Signal	● Typical accuracy: <100ns ● Time pulse width: 5ms
Velocity Accuracy	● Without aid: <0.1m/s
Acceleration Accuracy	● Without aid: <0.1m/s²
Dynamic Performance	● Maximum Altitude: 18000m ● Maximum Velocity: 515m/s ● Acceleration: 4g

UART Interface	● One UART interface for LC79D (A) Support baud rate from 115200bps to 921600bps; 115200bps by default ● UART port is used for NMEA output and firmware upgrade
SPI Interface	● One SPI interface for LC79D (B) ● Operate as a slave ● Fixed data frame size of 8 bits
I2C Interface	● One I2C interface, working on master mode ● Support Standard mode (100kbps), Fast mode (400kbps), Fast mode Plus (1Mbps), and High-Speed mode (3.4Mbps) ● Support 7-bit and 10-bit addresses
Temperature Range	● Operation temperature range: -40°C to +85°C ● Storage temperature range: -40°C to +90°C
Physical Characteristics	● Size: (10.1±0.15)mm × (9.7±0.15)mm × (2.4±0.20)mm ● Weight: approx. 0.42g

NOTE

1) The default GNSS configuration of LC79D is GPS+BeiDou+GLONASS+Galileo+QZSS+IRNSS. For more details about the GNSS configuration, please refer to ***document [1]***.

2.4. Block Diagram

The following figure shows the block diagram of LC79D module. The module includes a single-chip GNSS IC, two LNAs, two SAW filters, a diplexer, a flash (for LC79D (A) only), a TCXO and a crystal oscillator. The diplexer integrates a band-pass filter inside which can improve the out-of-band rejection. Thus the LNAs will have less chance to produce in-band interference in challenging environments (with a cellular module transmitting B13 at the same time for example), and provide LC79D with better performance in anti-jamming.

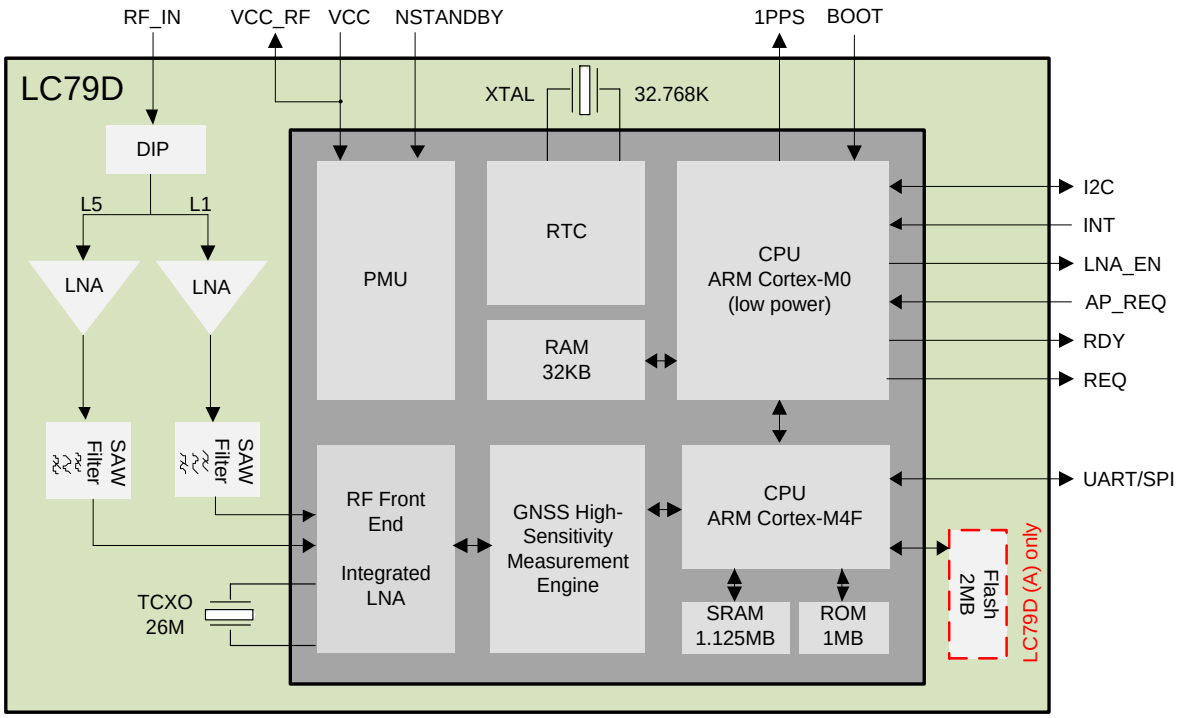

Figure 1: Block Diagram

2.5. Evaluation Board

In order to facilitate application development with LC79D, Quectel supplies an evaluation board (LC79D EVB) with a Micro-USB cable, an active antenna and other peripherals to test the module. For more details, please refer to ***document [2]*** and ***document [3]***.

2.6. Supported Protocols

Table 4: Supported Protocols

Protocol	Type
NMEA	ASCII, 0183, 4.11
PQ	Quectel proprietary protocols

NOTE

Please refer to ***document [1]*** for more details.

3 Application Interfaces

LC79D is designed with 28 pins (18 LCC pins and 10 LGA pins) through which the module can be mounted to the motherboard of any terminal.

3.1. Pin Assignment

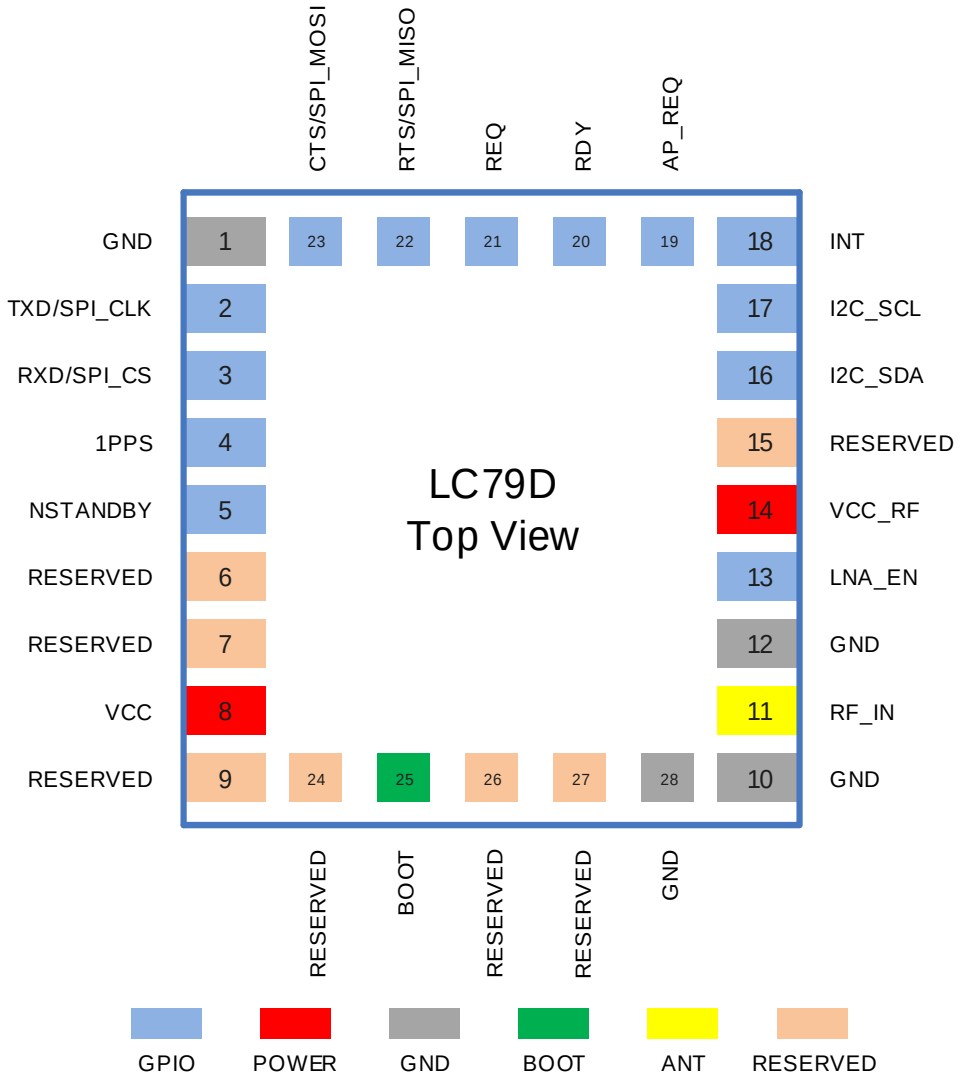

Figure 2: Pin Assignment

NOTES

1. Keep all unused and RESERVED pins open.
2. LC79D (A) does not support RDY feature, please keep this pin open while designing.

3.2. Pin Description

Table 5: I/O Parameters Definition

Type	Description
AI	Analog Input
AO	Analog Output
DI	Digital Input
DO	Digital Output
IO	Bidirectional
OD	Open Drain
PI	Power Input
PO	Power Output

Table 6: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VCC	8	PI	Main power supply	Vmax=1.9V Vmin=1.7V Vnom=1.8V	Ensure the load current not less than 100mA.
VCC_RF	14	PO	Power supply for external RF components	**VCC_RF≈VCC:** Vmax=1.9V Vmin=1.7V Vnom=1.8V	Typically used to supply power for an external active antenna or LNA. If unused, keep this pin open.

Standby Mode Control					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
NSTANDBY	5	DI	Standby mode control	V_{IL}min=-0.3V V_{IL}max=0.35×VCC V_{IH}min=0.65×VCC V_{IH}max=VCC+0.3V	Active low. Pulled up by default.
UART/SPI Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
TXD/ SPI_CLK	2	DO/DI	Transmit data/ SPI clock	V_{OL}max=0.4V V_{OH}min=VCC-0.45V V_{OH}nom=1.8V V_{IL}min=-0.3V V_{IL}max=0.35×VCC V_{IH}min=0.65×VCC V_{IH}max=VCC+0.3V	LC79D (A): UART LC79D (B): SPI
RXD/ SPI_CS	3	DI/DO	Receive data/ SPI chip select		
RTS/ SPI_MISO	22	DO	Request to send/ SPI master in salve out		
CTS/ SPI_MOSI	23	DI	Clear to send/ SPI master out slave in		
RF Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RF_IN	11	AI	RF signal input		50Ω characteristic impedance.
I2C Interface*					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
I2C_SDA	16	OD	I2C serial data	V_{IL}max=0.35×VCC V_{IH}min=0.65×VCC V_{OL}max=0.4V V_{OH}min= VCC-0.45V V_{OH}nom=1.8V	Require external pull-up to 1.8V. If unused, keep these pins open.
I2C_SCL	17	OD	I2C serial clock		
INT	18	DI	External interrupt input	V_{IL}min=-0.3V V_{IL}max=0.35×VCC V_{IH}min=0.65×VCC V_{IH}max=VCC+0.3V	If unused, keep this pin open.
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-0.45V V_{OH}nom=1.8V	Synchronized on rising edge, and the pulse width is 5ms. If unused, keep this pin open.
BOOT	25	DI	Module startup mode control	V_{IL}min=-0.3V V_{IL}max=0.35×VCC V_{IH}min=0.65×VCC V_{IH}max=VCC+0.3V	While keeping the pin floating during startup, the module will enter normal working mode. While keeping the pin at high level for about 100ms during startup, the module will enter host mode.
LNA_EN	13	DO	Active antenna power control in standby mode	V_{OL}max=0.4V V_{OH}min=VCC-0.45V V_{OH}nom=1.8V	If unused, keep this pin open.
GND	1, 10, 12, 28		GND		All GND pins should be connected to ground.
RESERVED	6, 7, 9, 15, 24, 26, 27		RESERVED		Keep them open.
Host Mode Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
REQ	21	DO	Data availability indication, used to indicate whether there is data available for reading	V_{OL}max=0.4V V_{OH}min=VCC-0.45V V_{OH}nom=1.8V	High level: there is data available for reading. Low level: no data is available for reading.
AP_REQ	19	DI	AP request to send	V_{IL}min=-0.3V V_{IL}max=0.35×VCC V_{IH}min=0.65×VCC V_{IH}max=VCC+0.3V	High level: notify the module that the AP has data to be sent. Low level: data transfer has been completed.
RDY	20	DO	Module status indication, used to indicate whether the module is	V_{OL}max=0.4V V_{OH}min=VCC-0.45V V_{OH}nom=1.8V	RDY is used in conjunction with AP_REQ and is a status/ready signal

	ready for communication with the AP	when AP_REQ is driven high. Low level: the module is in sleep mode and is not ready to communicate with the AP. High level: the module is awake and ready to communicate with the AP.

NOTES

1. Please keep unused and RESERVED pins open.
2. "*" means under development.

3.3. Power Supply

VCC supplies power for BB, RF, flash and RTC domains. The load current of VCC varies according to the VCC voltage level, processor load and satellite acquisition.

It is recommended to select an LDO with minimum output current of 100mA as the power supply, and add a decoupling capacitor combination (10μF and 100nF) as well as a TVS near the VCC pin. It is strongly discouraged to use a pulse frequency modulation regulator for power supply.

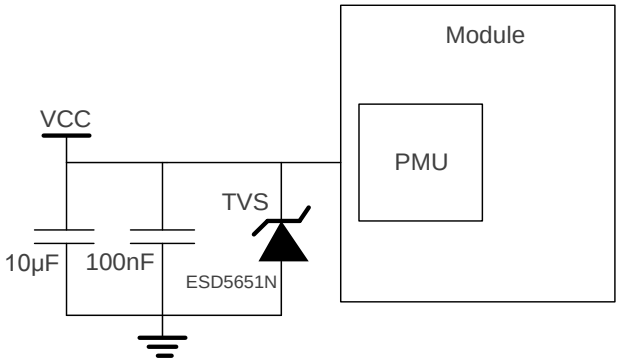

Figure 3: VCC Input Reference Circuit

The construction of the module's internal power system is illustrated as below.

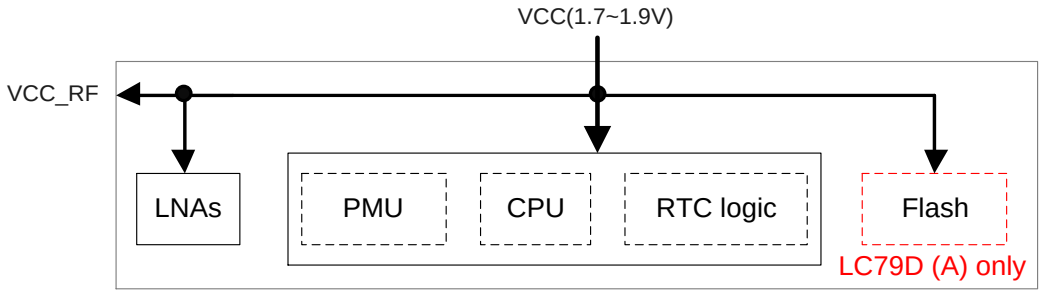

Figure 4: Internal Power System Construction

3.4. Operation Modes

3.4.1. Full on Mode

Full on mode comprises tracking mode and acquisition mode. In acquisition mode, 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. In tracking mode, the module tracks satellites and demodulates the navigation data from specific satellites.

When the module is powered on, it will enter full on mode automatically and follow the default configurations as below.

Table 7: Default Configurations

Item	Configuration	Comment
Baud Rate	115200bps	
Protocol	NMEA	GGA, RMC, GSA, GSV, GLL and VTG
Update Rate	1Hz	
GNSS	GPS+BeiDou+GLONASS +Galileo+QZSS+IRNSS	

NOTE

GGA, RMC, GSA and GSV are the output types of NMEA messages supported by LC79D:

- GGA: Global Positioning System Fix Data
- RMC: Recommended Minimum Specific GNSS Data

- GSA: GNSS DOP and Active Satellites
- GSV: GNSS Satellites in View
- GLL: Geographic Position - Latitude and Longitude
- VTG: Course Over Ground and Ground Speed

For more details, please refer to ***document [1]***.

3.4.2. Sleep Mode

In sleep mode, the module stops acquiring and tracking satellites. UART is not accessible. But the flash and the RTC domain which contains all the necessary GNSS information for quick start-up and a small amount of user configuration variables keep working.

Sleep mode is disabled (**$PQSETSLEEP,0**) by default. Before entering sleep mode, please send **$PQSETSLEEP,1** command to enable sleep mode first and then pull down AP_REQ to make the module enter sleep mode. Driving AP_REQ high will wake up the module from sleep mode, and then the GNSS engine can be started with **$PQSTARTGNSS** command.

NOTE

When sleep mode is used, please keep REQ pin at low level. For the reference design, please refer to ***documents [3]***.

3.4.3. Standby Mode

In standby mode, only RTC domain is active, and other parts are inactive. Driving NSTANDBY low and keeping it at low level will set the module into standby mode, and keeping NSTANDBY float will force the module to exit from standby mode and enter full on mode.

Before entering standby mode, please send **$PQSTOPGNSS** command to save the current time and location information to NVM. After the time is saved into NVM, the RTC will be able to keep the time running in standby mode. If the module has valid time, location and LTO data, the TTFF after exiting from standby mode will be shorter than that in cold start.

An OC driver circuit shown as below is recommended to control NSTANDBY.

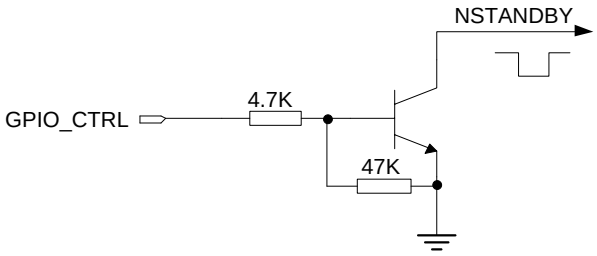

Figure 5: Reference Circuit for NSTANDBY

NOTES

1. NSTANDBY has to remain high during module startup.
2. NSTANDBY has been internally pulled up, therefore external pull-up circuit is not needed.
3. Pulling down NSTANDBY pin for at least 20ms and then releasing it will reset the module.

3.5. UART Interface

LC79D (A) module provides one UART interface. The following are the features of the UART.

- UART is used for NMEA output and firmware upgrade.
- UART supports baud rates: 115200bps, 230400bps, 460800bps, 921600bps.The default baud rate is 115200bps, 8 bits, no parity bit, 1 stop bit.

The UART interface features 1.8V power domain. A voltage-level translator should be used if customers' application is equipped with a 3.3V UART interface. TXS0104EPWR voltage-level translators provided by Texas Instruments are recommended. Please visit http://www.ti.com for more information. The following figure shows a reference design.

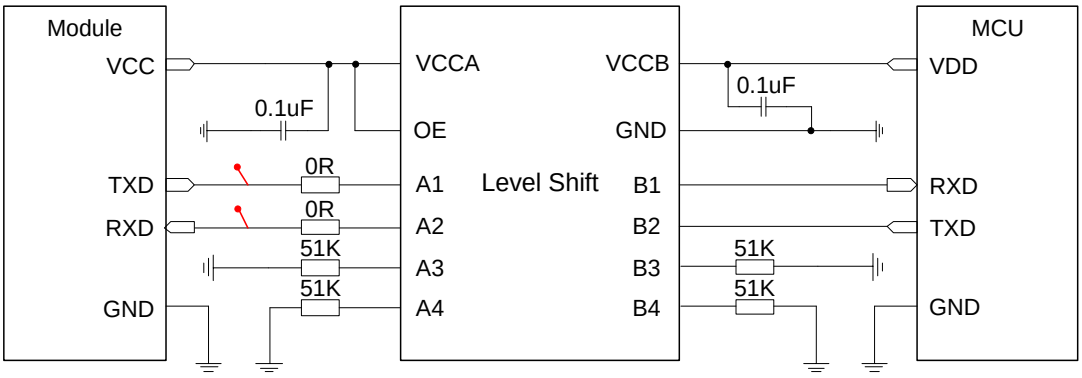

Figure 6: Reference Design of UART Interface

NOTES

1. For data transmission and firmware upgrade, LC79D (A) requires a two-wire UART (TXD and RXD) only. However, when the firmware bootloader needs to be updated, it is necessary to use a four-wire UART (TXD, RXD, CTS and RTS) in host mode for upgrading.
2. "\" represents the test points of UART interface.

3.6. SPI Interface

LC79D (B) provides one SPI interface for connection with an external android device. The following are the features of the SPI interface.

- Operate as a slave.
- Slave interface can operate in full-duplex at 50MHz (max.).
- DMA to minimize processor overhead.
- Fixed data frame size of 8 bits.

The following figure shows a reference design of SPI interface.

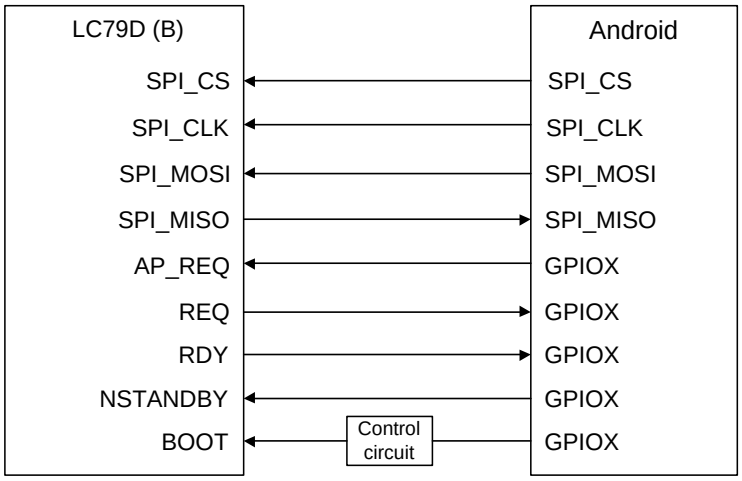

Figure 7: Reference Design of SPI Interface

NOTE

Must keep BOOT pin at high level for 100ms during the startup of LC79D (B) module. For more details about the control circuit, please refer to ***documents [3]***.

3.7. I2C Interface*

LC79D module provides one I2C interface which provides features as listed below:

- Support Standard mode (100kbps), Fast mode (400kbps), Fast mode Plus (1Mbps), and High-Speed mode (3.4Mbps).
- Single-master capability (no multimaster or slave capability).
- Support for both 7-bit and 10-bit addresses.
- Work on master mode.

NOTE

"*" means under development.

3.8. Boot Interface

When the module is powered on, the voltage level of the BOOT pin will be checked to identify its working mode.

Table 8: Working Modes

Voltage Level	Working Mode	Comment
Floating	Normal	While keeping the pin floating during startup, LC79D module will enter normal working mode.
High	Host	While keeping the pin at high level for about 100ms during startup, LC79D module will enter host mode.

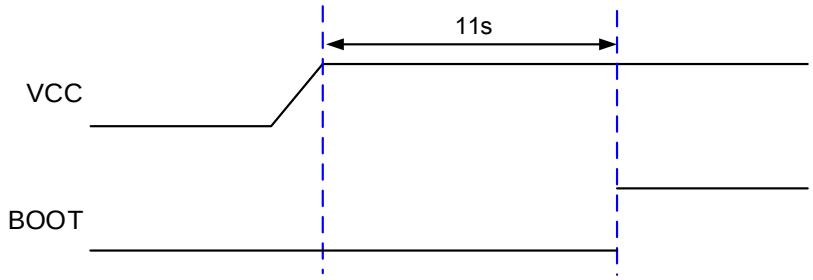

Figure 8: BOOT Pin State (Normal Working Mode)

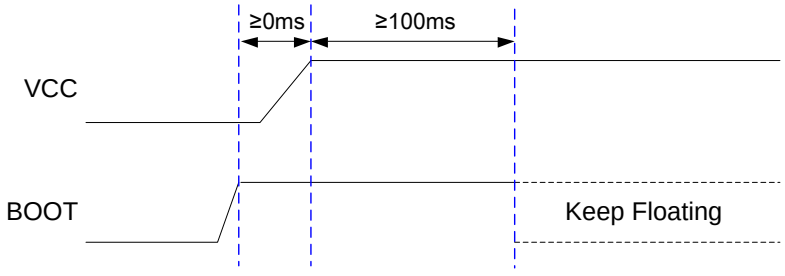

Figure 9: BOOT Pin Control Sequence (Host Mode)

NOTES

1. LC79D (B) must work in host mode.
2. For more details about the reference design of BOOT interface, please refer to ***documents [3]***.

4 Antenna Interfaces

LC79D module supports GPS, BeiDou, GLONASS, Galileo, IRNSS and QZSS systems. The RF signal is obtained from the RF_IN pin and the acceptable input power range should be between -162dBm and -65dBm. The impedance of RF trace should be controlled as 50Ω, and the trace length should be kept as short as possible. For more details about RF trace layout, please refer to ***document [5]***.

4.1. Antenna Requirements

The module can be connected to a dedicated passive or active dual-band (L1+L5) GNSS antenna that supports GPS, BeiDou, GLONASS, Galileo, IRNSS and QZSS satellite signals. The recommended antenna specifications are given in the following table.

Table 9: Recommended Antenna Specifications

Antenna Type	Specifications
Passive Antenna	Frequency Range: 1164MHz~1189MHz & 1559MHz~1609MHz Polarization: RHCP VSWR: <2 (Typ.) Passive Antenna Gain: >0dBi
Active Antenna	Frequency Range: 1164MHz~1189MHz & 1559MHz~1609MHz Polarization: RHCP VSWR: <2 (Typ.) Passive Antenna Gain: >0dBi Active Antenna Noise Figure: <1.5dB Active Antenna Total Gain: <17dB

NOTE

The total gain of the whole antenna is the internal LNA gain minus total insertion loss of cables and components inside the antenna.

4.2. Recommended Antenna Reference Designs

4.2.1. Antenna Selection Guide

Both active and passive dual-band (L1+L5) GNSS antennas can be used for LC79D module. Passive antenna is recommended if the antenna can be placed close to the module, for instance, when the distance between the module and the antenna is less than 1m. Otherwise, please use an active antenna instead, since the insertion loss of RF cable can decrease CNR of GNSS signal.

CNR is an important factor for GNSS receivers, and it is defined as the ratio of the received modulated carrier signal power to the received noise power in one Hz bandwidth. The formula of CNR is as below:

$$\mathrm{CNR} = \text{Power of GNSS signal} - \text{Thermal Noise} - \text{System NF}(\text{dB-Hz})$$

Among all the quantities, “Power of GNSS signal” means GNSS signal level and in practical environment the signal level at the surface of earth is about -130dBm. “Thermal Noise” is -174dBm/Hz at 290K. To improve CNR of GNSS signal, a LNA could be added to reduce “System NF”.

For “System NF”, it is expressed by formula as:

$$\mathrm{NF} = 10 \log \mathrm{F}\,(\mathrm{dB})$$

And “F” denotes noise factor of receiver system:

$$\mathrm{F} = \mathrm{F1} + (\mathrm{F2} - 1)/\mathrm{G1} + (\mathrm{F3} - 1)/(\mathrm{G1} \cdot \mathrm{G2}) + \cdots$$

“F1” denotes first stage noise factor, “G1” denotes first stage gain, etc. This formula indicates that LNA with enough gain can compensate noise factor behind the LNA. In this case, “System NF” depends mainly on noise figure of components and traces before first stage LNA plus noise figure of LNA itself. This explains the need of using an active antenna while antenna connection cable is too long.

4.2.1. Active Antenna Reference Design

The following figure is a typical reference design for active antenna. In this mode, the antenna is powered by the VCC_RF on which the voltage is 1.8V.

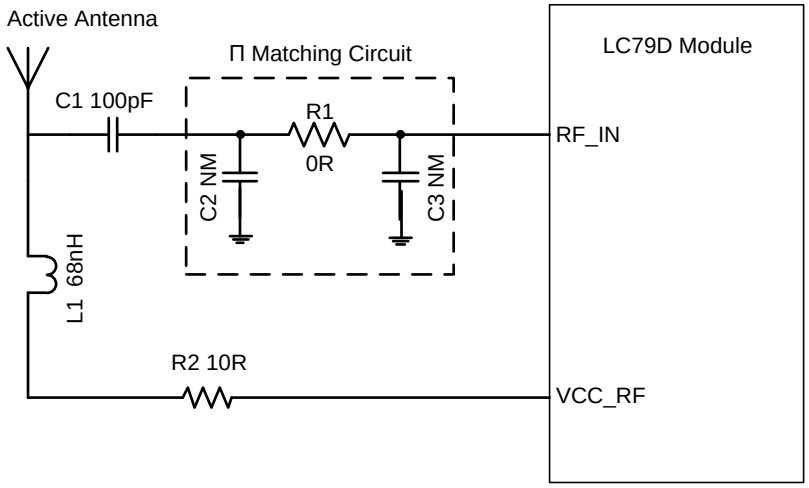

Figure 10: Reference Design for Active Antenna

C1 is used to block DC from VCC_RF. 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 the RF signal from leaking into the VCC_RF and route the bias supply to the active antenna. The recommended value of L1 is no less than 68nH. R2 can protect the whole circuit in case the active antenna is short-circuited to ground.

4.2.2. Passive Antenna Reference Design

The following figure is a typical reference design for passive antenna.

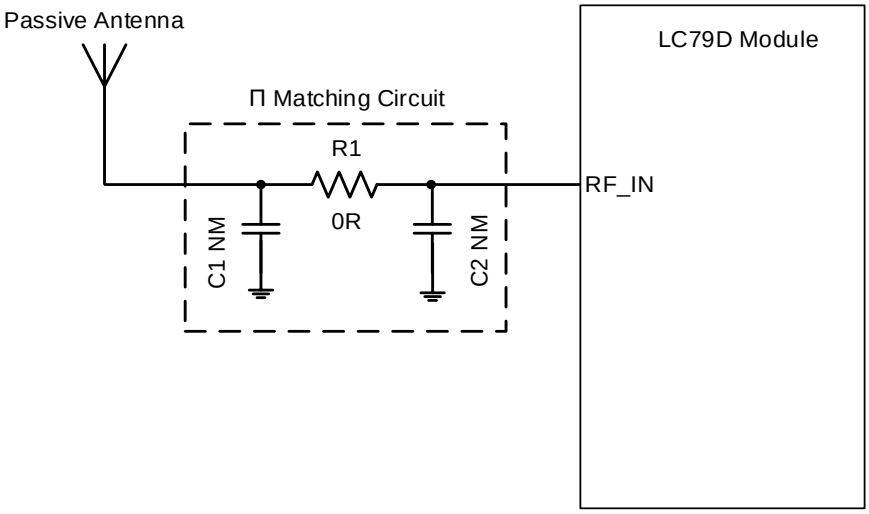

Figure 11: Reference Design for Passive Antenna

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

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 the following table.

Table 10: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
Power Supply Voltage (VCC)	-0.2	2.07	V
Input Voltage at Digital Pins	-0.3	VCC+0.3	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 between the minimum and maximum values given in table above.

5.2. Operating Conditions

Table 11: Power Supply Ratings

Parameter	Description	Operating Conditions	Min.	Typ.	Max.	Unit
VCC	Supply voltage	The actual input voltages must stay between the minimum and maximum values.	1.7	1.8	1.9	V
I_{VCCP}	Peak supply current	VCC=1.8V			100	mA
T_{OPR}	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

Table 12: Current Consumption

Module	Conditions	Acquisition @VCC=1.8V	Tracking @VCC=1.8V	Sleep mode @VCC=1.8V	Standby mode @VCC=1.8V
LC79D	GPS+BeiDou+GLONASS +Galileo+QZSS+IRNSS	47mA	43mA	200μA	17μA

5.4. ESD Protection

LC79D 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 beneficial to ESD protection when LC79D 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.
- When mounting the module onto a motherboard, please make sure the GND is connected first and then 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.
- Be 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), and the dimensional tolerances are ±0.05mm unless otherwise specified.

6.1. Mechanical Dimensions of the Module

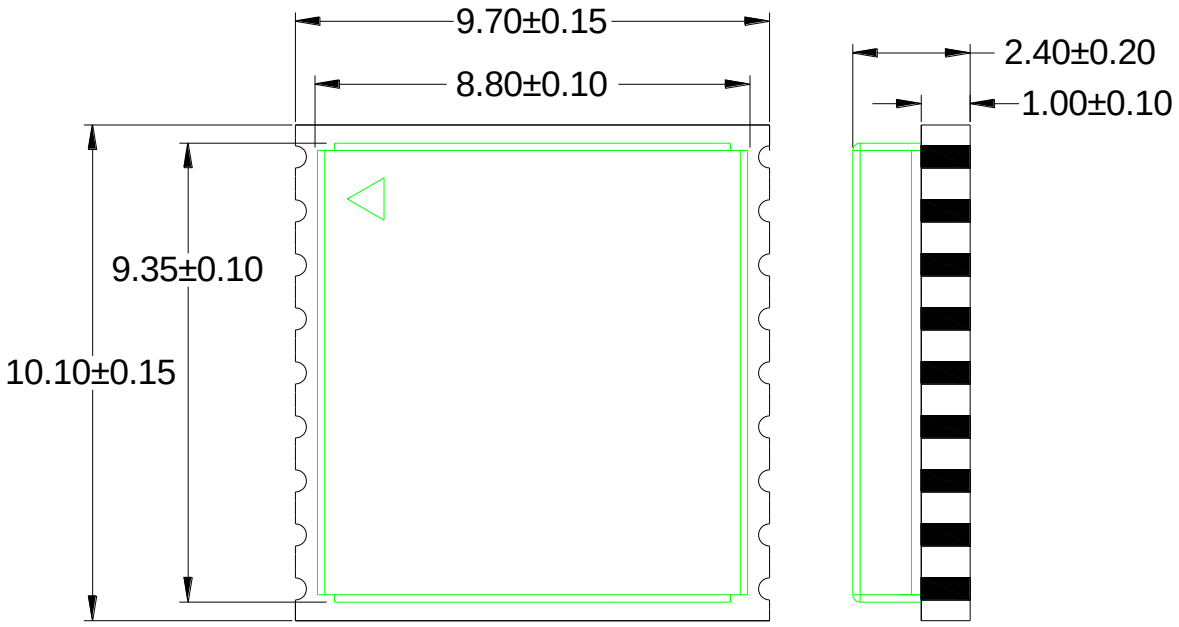

Figure 12: Top and Side Dimensions

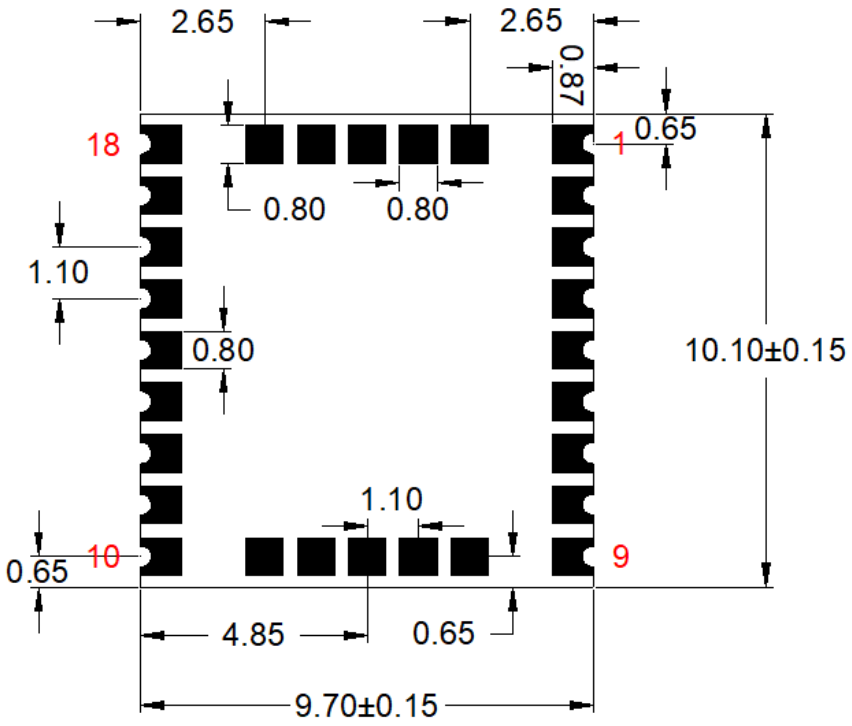

Figure 13: Bottom Dimensions

6.2. Recommended Footprint

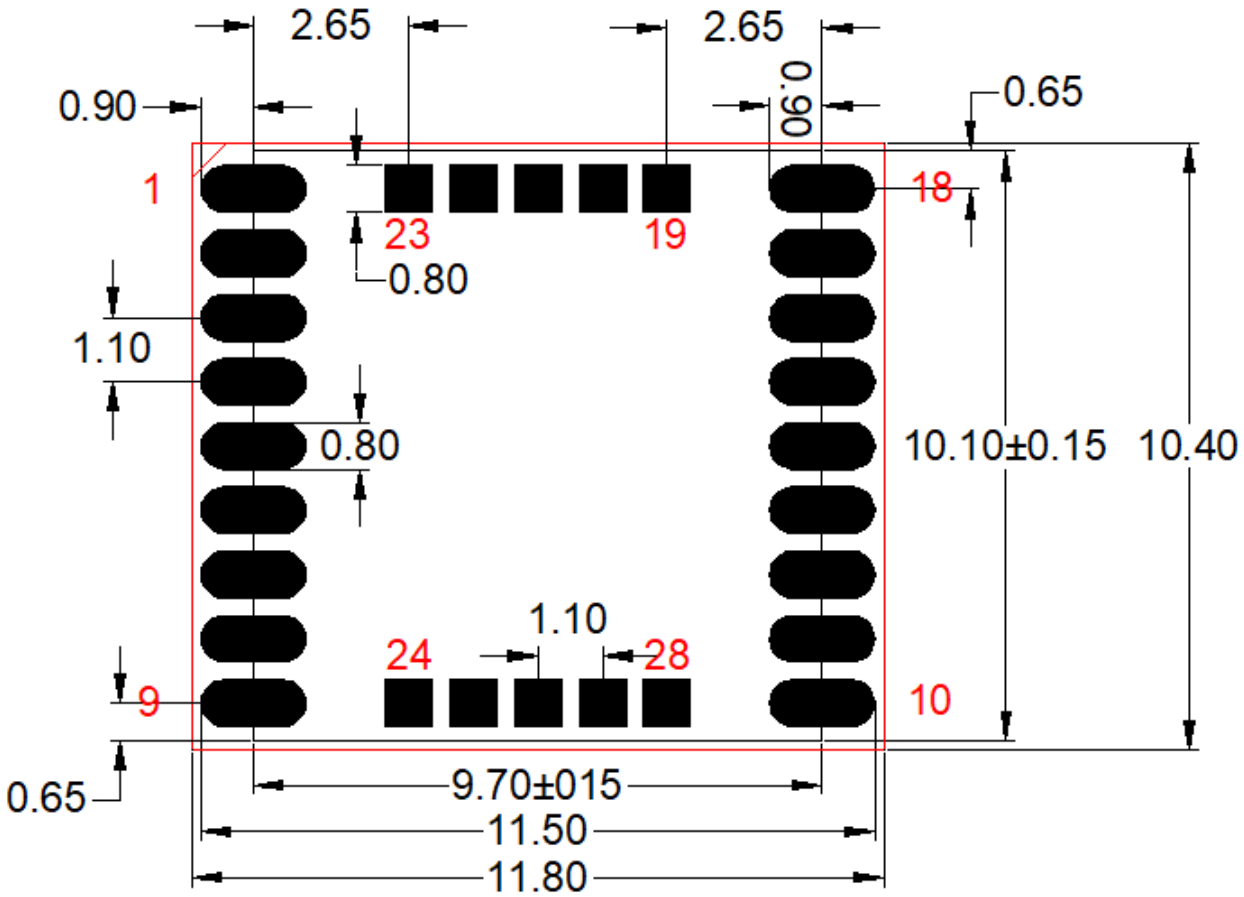

Figure 14: Recommended Footprint

NOTE

For easy maintenance of this module and accessing to these pads, it is recommended to keep a distance of no less than 3mm between the module and other components on a motherboard.

6.3. Top and Bottom Views

Figure 15: Top View of the Module

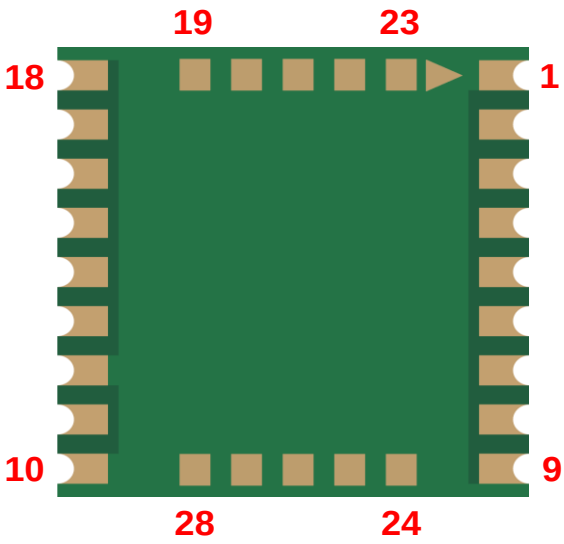

Figure 16: Bottom View of the Module

NOTE

These are renderings of LC79D module. For authentic appearance, please refer to the module that you receive from Quectel.

7 Storage, Manufacturing, and Packaging

7.1. Storage

LC79D 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

Push the squeegee to apply the solder paste on the surface of stencil, thus making the paste fill the stencil openings and then penetrate to the PCB. The force on the squeegee should be adjusted properly so as to produce a clean stencil surface on a single pass. To ensure the module soldering quality, the thickness of stencil for the module is recommended to be 0.13mm-0.15mm. For more details, please refer to ***document [6]***.

It is suggested that the peak reflow temperature is 238~245ºC, 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.

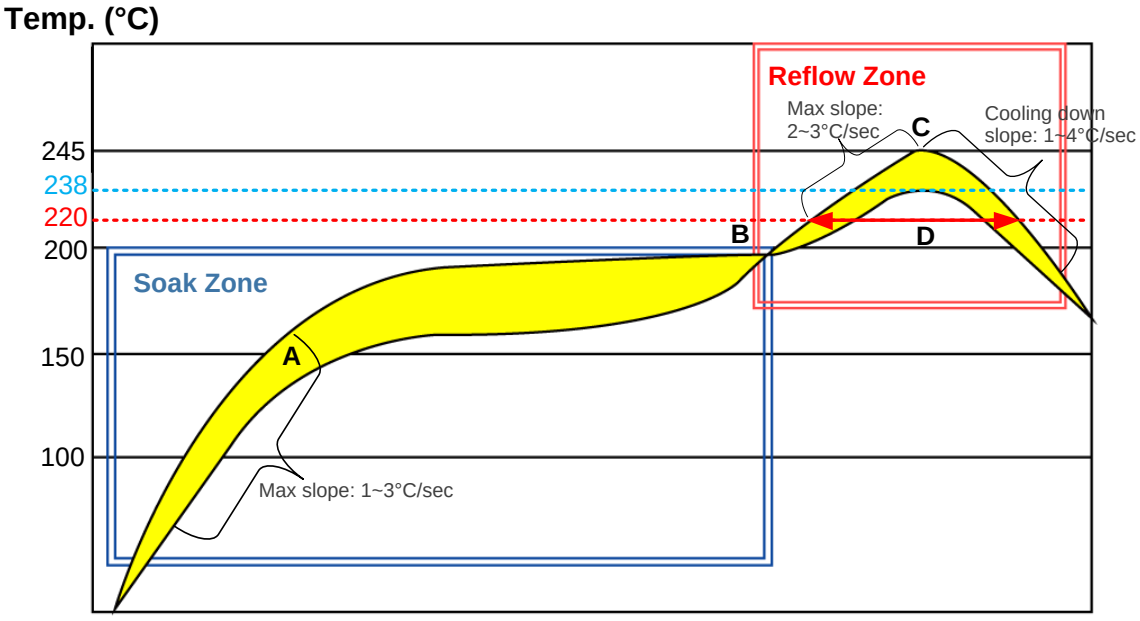

Figure 17: Recommended Reflow Soldering Thermal Profile

Table 13: 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	238°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 label with organic solvents, such as acetone, ethyl alcohol, isopropyl alcohol, trichloroethylene, etc. Otherwise, the label information may become unclear.
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

LC79D is packaged in tape and reel carriers. One reel is 8.64m long and contains 500 modules.

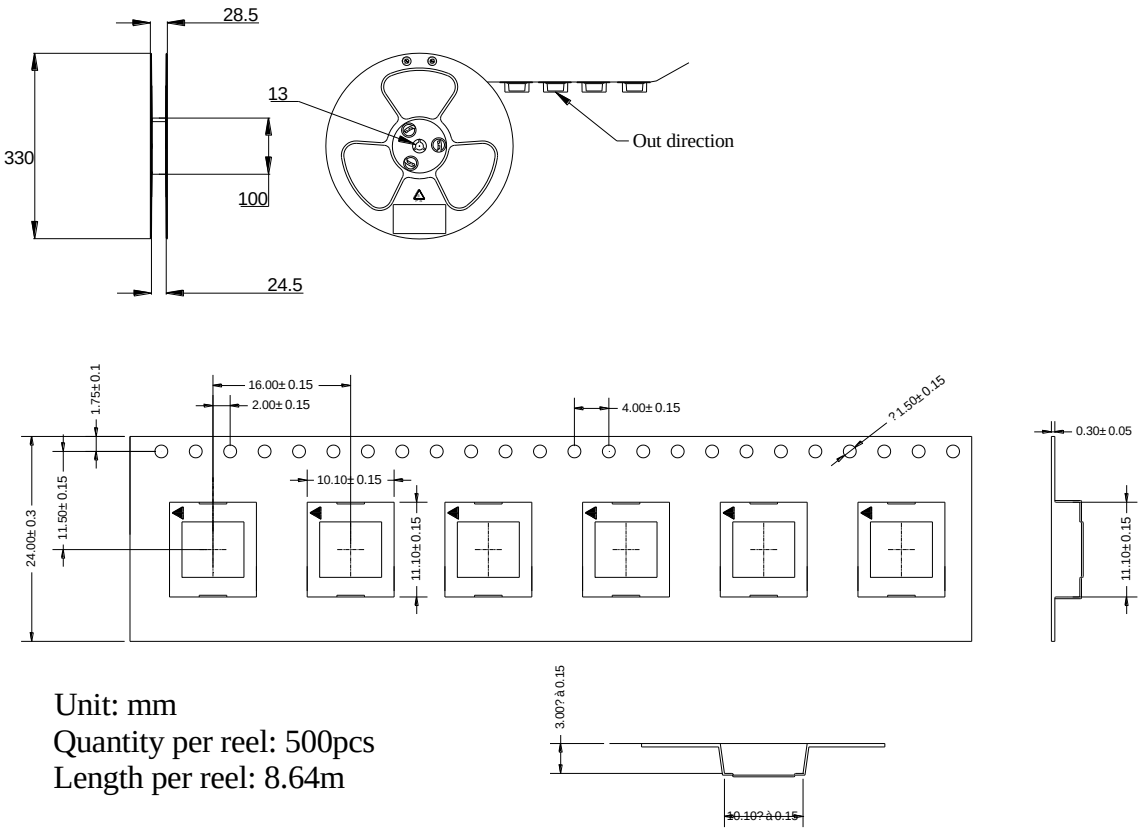

Figure 18: Tape and Reel Specifications

Table 14: Packaging Specifications

Model Name	MOQ for MP	Minimum Package: 500pcs	Minimum Package × 4 = 2000pcs
LC79D	500pcs	Size: 370mm × 350mm × 56mm N.W: 0.65kg G.W: 0.86kg	Size: 380mm × 250mm × 365mm N.W: 2.6kg G.W: 3.44kg

8 Appendix A References

Table 15: Related Documents

SN	Document Name	Remark
[1]	Quectel_LC79D_GNSS_Protocol_Specification	LC79D GNSS Protocol Specification
[2]	Quectel_LC79D(A)_EVB_User_Guide	LC79D (A) EVB User Guide
[3]	Quectel_LC79D(B)_EVB_User_Guide	LC79D (B) EVB User Guide
[4]	Quectel_LC79D_Reference_Design	LC79D Reference Design
[5]	Quectel_RF_Layout_Application_Note	RF Layout Guide
[6]	Quectel_Module_Secondary_SMT_User_Guide	Module Secondary SMT User Guide

Table 16: Terms and Abbreviations

Abbreviation	Description
AGNSS	Assisted Global Positioning System
CEP	Circular Error Probable
CNR	Carrier-to-Noise Ratio
DMA	Direct Memory Access
ESD	Electrostatic Discharge
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
IRNSS	India Regional 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
QZSS	Quasi-Zenith Satellite System
RHCP	Right Hand Circular Polarization
SAW	Surface Acoustic Wave
TTFF	Time to First Fix
UART	Universal Asynchronous Receiver & Transmitter
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
$V_{OH}min$	Minimum Output High Level Voltage Value
$V_{OL}max$	Maximum Output Low Level Voltage Value