L26-DR

Hardware Design

GNSS Module Series

Rev. L26-DR_Hardware_Design_V1.1

Date: 2019-10-19

Status: Released

Our aim is to provide customers with timely and comprehensive service. For any assistance, please contact our company headquarters:

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:
http://www.quectel.com/support/sales.htm

For technical support, or to report documentation errors, please visit:
http://www.quectel.com/support/technical.htm
Or email to: support@quectel.com

GENERAL NOTES

QUECTEL OFFERS THE INFORMATION AS A SERVICE TO ITS CUSTOMERS. THE INFORMATION PROVIDED IS BASED UPON CUSTOMERS' REQUIREMENTS. QUECTEL MAKES EVERY EFFORT TO ENSURE THE QUALITY OF THE INFORMATION IT MAKES AVAILABLE. QUECTEL DOES NOT MAKE ANY WARRANTY AS TO THE INFORMATION CONTAINED HEREIN, AND DOES NOT ACCEPT ANY LIABILITY FOR ANY INJURY, LOSS OR DAMAGE OF ANY KIND INCURRED BY USE OF OR RELIANCE UPON THE INFORMATION. ALL INFORMATION SUPPLIED HEREIN IS SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.

COPYRIGHT

About the Document

History

Revision	Date	Author	Description
1.0	2019-04-28	Brooke WANG/ Phil GAO	Initial
1.1	2019-10-19	Phil GAO/ Brooke WANG	1. Updated RF path in Figure 1; 2. Updated Chapter 2.1; 3. Updated power consumption in Table 1; 4. Updated the comment of CAN, FWD, WHEELTICK interfaces in Table 4; 5. Added TVS diode model in Figure 3; 6. Updated the update rate in Table 5; 7. Updated Chapter 3.5. 8. Added reference document for RF layout guide in Chapter 4; 9. Modified the description for recommended antenna specifications; 10. Deleted the reference design for external LNA and relevant description; 11. Updated Figure 4, 14, 15 and 16; 12. Updated Table 13; 13. Modified the description for module mounting and added content about the installation of L26-DR (UDR) Chapter 6.4.

Contents

Table Index

Figure Index

1 Introduction

This document defines L26-DR GNSS module and describes its hardware interfaces, external application reference circuits, physical characteristics and air interface.

This document helps customers to quickly understand module interface specifications, electrical and mechanical details, as well as other related information of L26-DR module. Other documents such as L26-DR software application notes and user guides are also provided. Associated with application notes and user guides, customers can use L26-DR 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 terminal incorporating Quectel L26-DR 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 customers' failure to comply with these precautions.

	Be assure the use of the product conforms to 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 potentially with 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

L26-DR comprises three models: L26-DR (ADR), L26-DR (ADRA) and L26-DR (UDR).

Industrial-grade module L26-DR (ADR) and automotive-grade module L26-DR (ADRA) both support Automotive Dead Reckoning (ADR) technology. They combine information from GNSS, 6-axis sensor and speed information from the vehicle to provide continuous and accurate positioning for vehicles.

Industrial-grade module L26-DR (UDR) supports Untethered Dead Reckoning (UDR) technology and, without requiring speed information from the vehicle, only combines information from GNSS and 6-axis sensor to provide continuous and accurate positioning for vehicles.

L26-DR module is equipped with a powerful GNSS IC and a 6-axis MEMS sensor which integrates a 3-axis gyroscope and a 3-axis accelerometer. It supports multiple positioning and navigation systems including GPS, BeiDou, GLONASS, Galileo, SBAS (including WAAS, EGNOS, MSAS and GAGAN), QZSS, DGPS, and AGPS.

L26-DR module is an SMD type module with a compact profile of 12.2mm × 16.0mm × 2.3mm. It can be embedded in customers' applications through the 24-pin pads with 1.1mm pitch. It provides necessary hardware interfaces for connection with the main PCB.

The module is fully compliant with EU RoHS directive.

2.2. Key Features

Table 1: Key Features

Features	Details
Receiver Type [1)]	● GPS L1 C/A (1574.397MHz ~ 1576.443MHz) ● Galileo E1 C/A (1573.374MHz ~ 1577.466MHz) ● GLONASS L1 C/A (1597.5MHz ~ 1605.8MHz) ● BeiDou B1 (1559.052MHz ~ 1563.144MHz)
Power Supply	● Supply voltage: 3.0V~3.6V ● Typical: 3.3V
Power Consumption	● Refer to ***Table 10***
Sensitivity (GPS+GLONASS)	● Acquisition: -145dBm ● Reacquisition: -152dBm ● Tracking: -162dBm
TTFF @-130dBm (Autonomous without AGPS)	● Cold Start: <32s ● Warm Start: <25s ● Hot Start: <2s
TTFF @-130dBm (with AGPS)	● Cold Start: <13s
Horizontal Position Accuracy (Autonomous)	● <1.5m CEP @-130dBm
Accuracy of TIMEPULSE Signal	● Typical accuracy: <100ns CEP ● Time pulse width: 500ms
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	● Support baud rates from 115200bps (default) to 921600bps ● Used for NMEA/PSTM transmission, firmware upgrade and speed information obtaining
CAN Interface	● Support 50kbps, 100kbps, 125kbps, 250kbps, 500kbps and 1Mbps baud rates ● 500kbps by default ● Used for obtaining the speed information of a vehicle
Temperature Range	● Operation temperature range: -40°C ~ +85°C ● Storage temperature range: -40°C ~ +90°C

Physical Characteristics	● Size: (12.2±0.15)mm × (16.0±0.15)mm × (2.3±0.20)mm ● Weight: Approx. 0.9g

NOTE

1) The default GNSS configuration of L26-DR is GPS + GLONASS + Galileo. For more details about the GNSS configuration, please refer to ***document [1]***.

2.3. Block Diagram

The following figure shows a block diagram of L26-DR module. The module includes a single-chip GNSS IC, a 6-axis MEMS sensor chip, an LNA, two SAW filters, a TCXO and a crystal oscillator. The first stage SAW improves out-band rejection and prevent the LNA behind from producing in-band interference signal in harsh environment, which makes L26-DR perform better in anti-jamming.

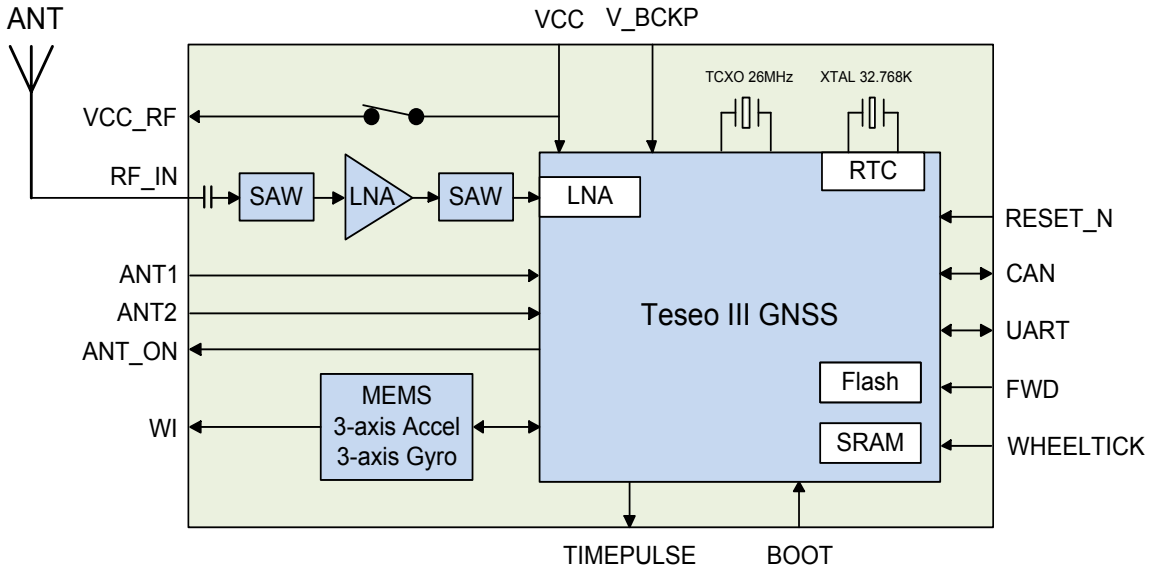

Figure 1: Block Diagram

2.4. Evaluation Board

To help customers to develop applications with L26-DR module, Quectel supplies an evaluation board (EVB), Micro-USB cable, active antenna and other peripherals to test the module. For more details, please refer to ***document [2]***.

2.5. Protocols Supported by the Module

Table 2: Supported Protocols

Protocol	Description
NMEA	ASCII, 0183, 3.01(default)/4.10
PSTM	ST proprietary protocols

NOTE

Please refer to ***document [1]*** for details of supported protocols.

2.6. Dead Reckoning Function

Dead Reckoning (DR) refers to the capability of a GNSS receiver to continuously navigate on an automotive platform when there is an insufficient number of GNSS satellite signals available. To realize this function, the receiver uses the information provided by external sensors concerning the state of the vehicle in order 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 drift. With this technology, the system will get continuous and high accurate positioning in environments such as tunnels and urban canyons. To provide optimal solution, sensor parameters should be calibrated. For more details about the calibration of MEMS sensor, please refer to ***document [6]***.

Additionally, the module supports to output raw data of the sensor through UART, which is used to realize applications such as driving behavior analysis. For more details about configuration of raw data output, please refer to ***document [1]***.

3 Application Interfaces

The module is equipped with 24 LCC pins that can be connected to customers' application platforms. The following chapters will provide a detailed introduction on the module interfaces.

3.1. Pin Assignment

Figure 2: Pin Assignment

NOTE

L26-DR (UDR) does not support WHEELTICK, FWD, CAN features, please keep these pins open when designing.

3.2. Pin Description

Table 3: I/O Parameters Definition

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

Table 4: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VCC	23	PI	Main power supply	Vmax=3.6V Vmin=3.0V Vnorm=3.3V	Assure the load current is not less than 150mA.
V_BCKP	22	PI	RTC domain power supply	Vmax=3.6V Vmin=2.0V Vnorm=3.3V	Supply power for RTC domain when VCC is powered off. If VCC is powered continuously, the V_BCKP can be left open.
Reset					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RESET_N	8	DI	Reset the module	V_{IL}min=-0.3V V_{IL}max=0.35V V_{IH}min=0.65V V_{IH}max=1.3V	Active low. Please do not reserve any p ull-up circuit for this pin. If unused, keep this pin open.

UART Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
UART_TX	20	DO	Transmit data	V_{OL}max=0.4V V_{OH}min=VCC-0.4V Vnorm=VCC-0.2V	Used for NMEA/PSTM transmission, firmware upgrade and speed information obtaining.
UART_RX	21	DI	Receive data	V_{IL}min=-0.3V V_{IL}max=0.8V V_{IH}min=2.0V V_{IH}max=VCC+0.3V	
CAN Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
CANTX	18	DO	CAN bus transmit data	V_{OL}max=0.4V V_{OH}min=VCC-0.4V Vnorm=VCC	Used for requesting speed information of the vehicle. L26-DR (UDR) does not support this feature.
CANRX	19	DI	CAN bus receive data	V_{IL}min=-0.3V V_{IL}max=0.8V V_{IH}min=2.0V V_{IH}max=VCC+0.3V	
RF Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VCC_RF	9	PO	Power supply for external RF components	Vmax=3.6V Vmin=3.0V Vnorm=3.3V	Usually supply power for the external active antenna or the LNA. In standby mode, VCC_RF will be turned off. VCC_RF≈VCC
RF_IN	11	AI	GNSS antenna interface		50Ω characteristic impedance.
ANT2	16	AI	Antenna detection 2	V_{IH}min=0V V_{IH}max=VCC	If unused, keep these pins open.
ANT1	17	AI	Antenna detection 1		
ANT_ON	14	DO	Power control for active antenna detection	V_{OL}max=0.4V V_{OH}min=VCC-0.4V Vnorm=VCC	If unused, keep this pin open.

Other Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
BOOT	6	DI	Force the module to enter boot download	V_{IH}min =VCC-0.4V V_{IH}max=VCC	Pull up the pin to VCC with a 10KΩ resistor during start up, the module will enter boot download.
WAKE_UP	1	DI	Wake up the module from standby mode	V_{IL}min=-0.3V V_{IL}max=0.8V V_{IH}min=2.1V V_{IH}max=VCC	Keep this pin at low voltage level in full on mode. It has been pulled down internally with a 47KΩ resistor. Drive the pin to a high voltage level to make the module exit from standby mode. If unused, keep this pin open.
TIMEPULSE	3	DO	One pulse per second	V_{OL}max=0.4V V_{OH}min=VCC-0.4V Vnorm=VCC	Synchronized at rising edge, and the pulse width is 500ms. This pin must be at low level at startup for normal operation. It has been internally pulled down with a 47KΩ resistor. If unused, keep this pin open.
WI	2	DO	Warning indicator	V_{OL}max=0.4V V_{OH}min=VCC-0.4V Vnorm=VCC	VCC must be valid to ensure the interrupt signal output.
FWD	15	DI	Forward/ backward status signal input	V_{IL}min=-0.3V V_{IL}max=0.8V V_{IH}min=2.0V V_{IH}max=VCC+0.3V	L26-DR (UDR) does not support this feature. If unused, keep this pin open.
WHEELTICK	4	DI	Odometer/ wheel-tick signal input	V_{IL}min=-0.3V V_{IL}max=0.8V V_{IH}min=2.0V V_{IH}max=VCC+0.3V	L26-DR (UDR) does not support this feature. If unused, keep this pin open.
GND	10,12, 13, 24		Ground		
NC	7		Not connected		
RESERVED	5		Reserved		Keep this pin unconnected.

NOTE

Please keep unused, NC, and RESERVED pins unconnected.

3.3. Power Supply

VCC supplies power for BB, RF, MEMS sensor and RTC domain. The load current of VCC pin varies according to the VCC voltage level, processor load and satellite acquisition. So, it is important to supply sufficient current and make the power clean and stable. It is recommended to choose an LDO regulator with minimum output current of 150mA as the power supply. The LDO regulator should be placed close to the module, and a decoupling capacitor combination (10uF and 100nF) as well as a TVS should be added near VCC pin.

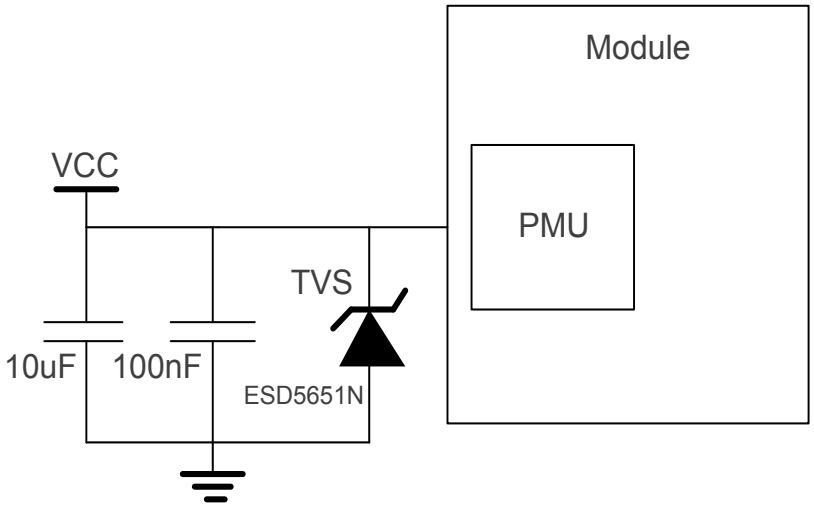

Figure 3: VCC Input Reference Circuit

VCC can be used as the power supply for RTC domain when its power supply voltage is within the normal range, otherwise, V_BCKP will be used. A cell battery and a capacitor combination (4.7uF and 100nF) are recommended to be placed nearby V_BCKP pin. The voltage of RTC domain ranges from 2.0V to 3.6V. In order to achieve better Time to First Fix (TTFF), RTC domain should be valid all the time so as to supply power for SRAM memory which contains all the necessary GNSS information for quick start-up and a small amount of user configuration variables.

The module's internal power construction is shown below.

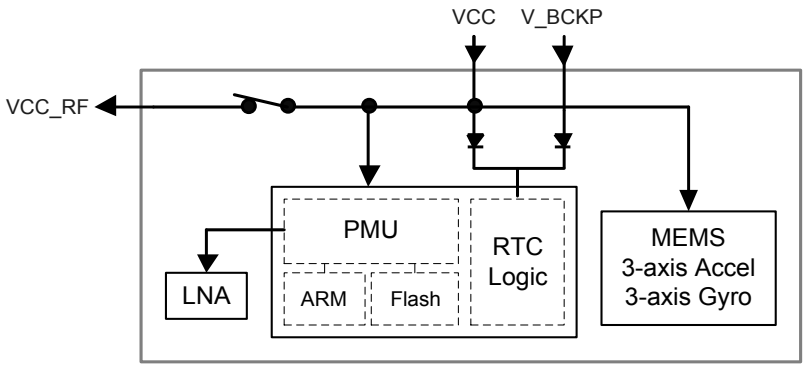

Figure 4: Internal Power Construction

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. Tracking mode is defined as the module tracking satellites and demodulating the navigation data from specific satellites.

When the module is powered on, it will enter into full on mode automatically and follow the default configurations as below. Please refer to ***Chapter 3.3*** about internal power construction for better comprehension.

Table 5: Default Configurations

Item	Configuration	Comment
Baud Rate	115200bps	
Protocol	NMEA, Sensor raw data	RMC, VTG, GGA, GSA, GSV, GLL and Sensor raw data
Update Rate	NMEA: 1Hz Sensor raw data: 15Hz	
SBAS	Enable	
GNSS	GPS + GLONASS + Galileo	

NOTE

RMC, VTG, GGA, GSA, GSV and GLL are the output NMEA message types, which stand for functions as:

- RMC: Recommended Minimum Specific GNSS Data
- VTG: Course Over Ground and Ground Speed
- GGA: Global Positioning System Fix Data
- GSA: GNSS DOP and Active Satellites
- GSV: GNSS Satellites in View
- GLL: Geographic Position in Latitude and Longitude

3.4.2. Standby Mode

Standby mode is a low-power-consuming mode. In this mode, the internal core and I/O power domain, RF and TCXO are powered off. UART is not accessible and the module stops acquiring and tracking satellites. But the MEMS sensor and RTC domain keep working.

There is one approach to enter standby mode and two approaches to exit from standby mode.

- Sending "$PSTMFORCESTANDBY,<duration>" command to enter standby mode.
- Two approaches to exit from standby mode: driving WAKE_UP pin to high voltage level to trigger interrupt wakeup or waiting for the command duration to end.

Table 6: Command Duration

Parameter	Format	Description
<duration>	Decimal, 5 digits	Duration of the standby time in seconds

For a better understanding, please refer to ***Chapter 3.3*** for 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 reference design for RTC domain supply.

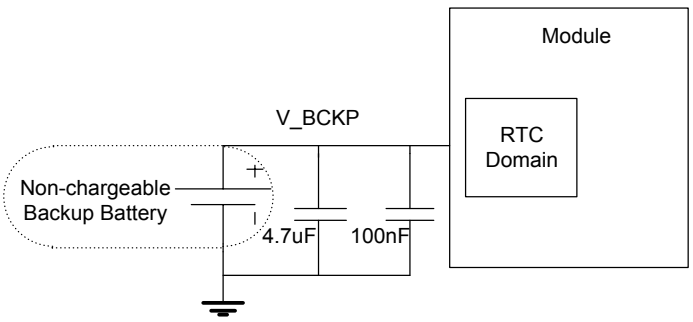

Figure 5: RTC Powered by Non-chargeable Battery

If designed with a charging circuit, V_BCKP will be able to support battery charging function. Please refer to the reference charging circuit below.

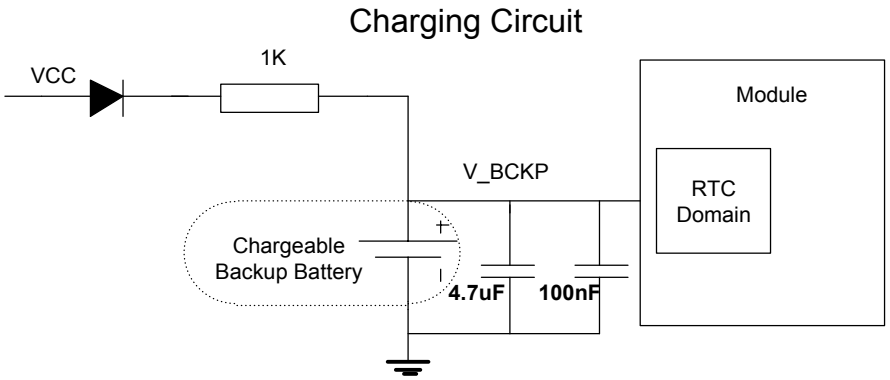

Figure 6: Reference Charging Circuit for Rechargeable Batteries

The coin-type rechargeable capacitor from Seiko (http://www.sii.co.jp/en) can be used as an alternative to the chargeable backup battery. And the Schottky diode from ON Semiconductor (http://www.onsemi.com) is recommended to be the choice of diode because of its low voltage drop.

3.5. Reset

As RESET is in 1.0V voltage domain, please do not reserve any pull-up circuit for this pin.

L26-DR module can be reset by releasing RESET after driving it to a low-level voltage for at least 10ms. To control RESET pin, an OC driver circuit as shown below is recommended.

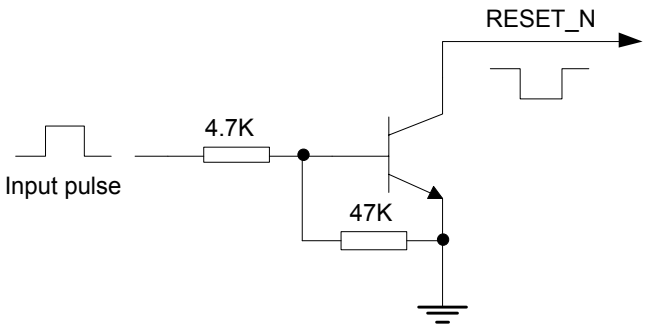

Figure 7: Reference OC Circuit for Module Reset

The following figure shows the reset timing of L26-DR module.

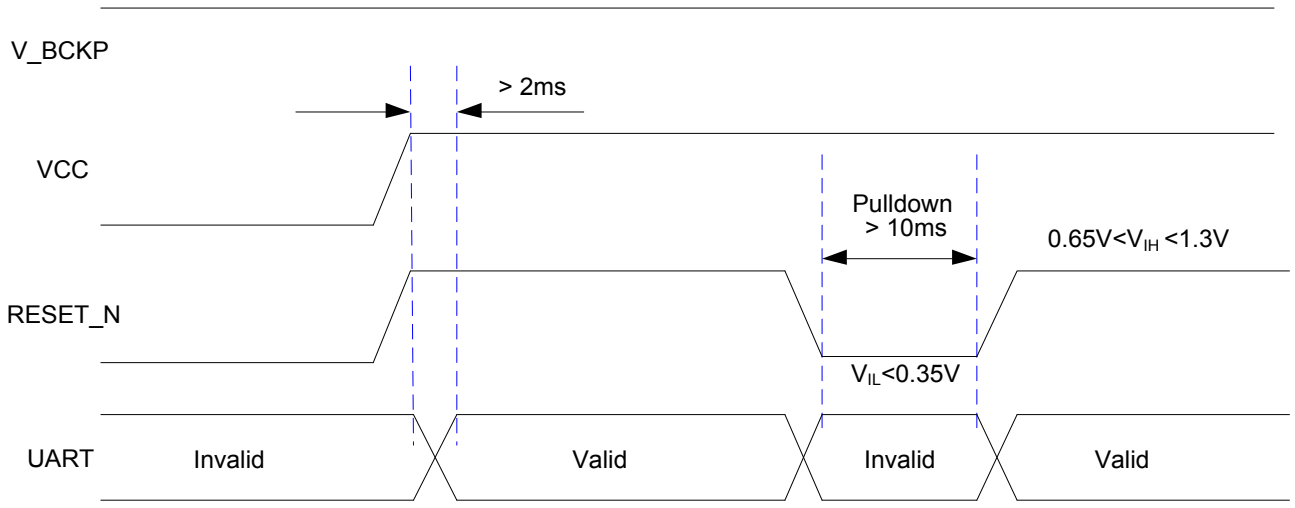

Figure 8: Reset Timing

NOTES

1. The module resetting will possibly force the loss of volatile RAM data. But the NVM data will not be cleared after resetting, so that fast TTFF is still possible and command settings that have been saved into NVM will not be cleared.
2. RESET pin can be used to reset the module to resolve crashes.

3.6. UART Interface

L26-DR provides one universal asynchronous receiver & transmitter (UART) serial port. The module is designed as DCE (Data Communication Equipment), following the traditional DCE-DTE (Data Terminal Equipment) connection. It supports 115200bps, 230400bps, 460800bps, and 921600bps baud rates, and the default baud rate is 115200bps.

UART interface comprises two pins:

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

The module and the client (DTE) are connected through the signals shown in the following figure.

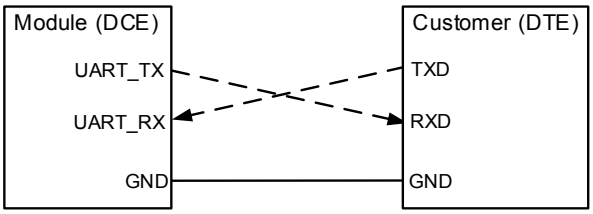

Figure 9: Reference Design for UART Port

The UART port has the following features:

- The default output NMEA type setting is RMC, VTG, GGA, GSA, GSV and GLL.
- The default setting is 115200bps, 8 bits, no parity bit, 1 stop bit.
- Hardware flow control and synchronous operation are not supported.
- UART port can be used for NMEA/PSTM transmission, firmware upgrade and speed information obtaining.

The UART port does not support the RS-232 level. If the module's UART port is connected to the UART port of a computer, it is necessary to add a level shift circuit in between, as illustrated below.

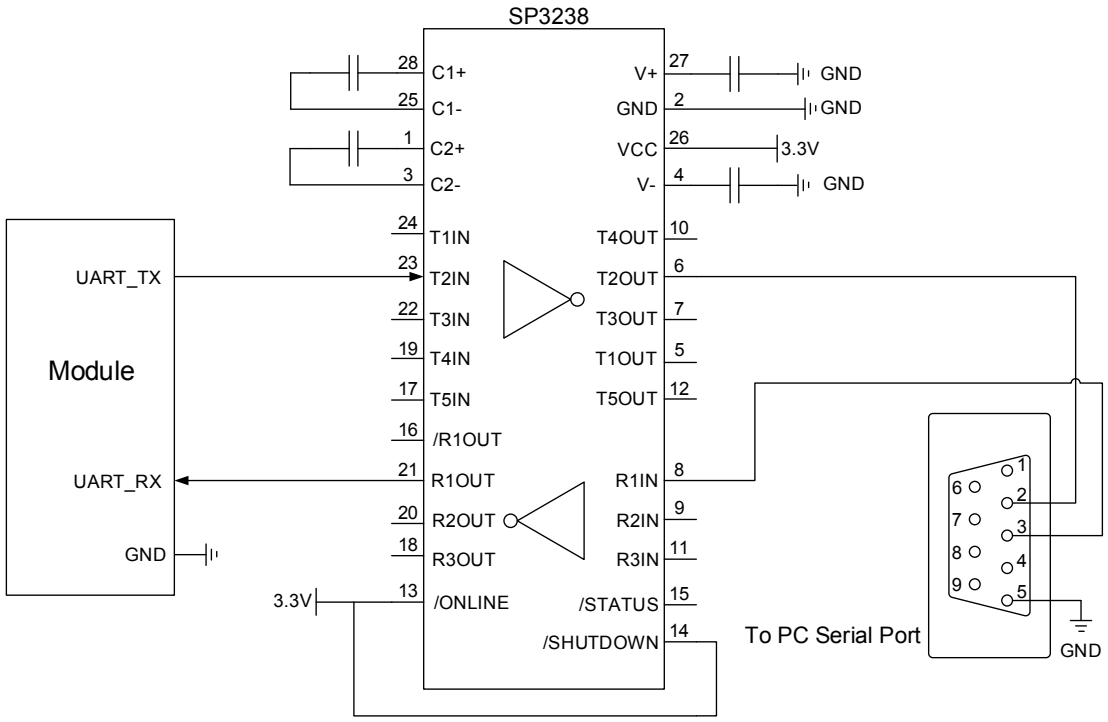

Figure 10: RS-232 Level Shift Circuit

Please visit the (http://www.maxlinear.com) for more information.

3.7. CAN Interface

The module provides one CAN bus interface, supporting 50kbps, 100kbps, 125kbps, 250kbps, 500kbps (default) and 1Mbps baud-rates. Its main function is to obtain speed information of a vehicle. A CAN transceiver is needed between L26-DR module and the CAN bus of the vehicle.

3.8. FWD Interface

FWD is used to input vehicle forward/backward status signals. When it is at low voltage level, the vehicle is moving forward, and when it is at high level, it is moving backward. For more details about the reference circuit design, please refer to ***document [3]***.

3.9. WHEELTICK Interface

WHEELTICK is used to input odometer signals from a vehicle. It can be sampled from the wheel revolution sensors or the transmission of the vehicle. For more details about the reference circuit design, please refer to ***document [3]***.

3.10. BOOT Interface

BOOT pin is used to make the module enter into bootloader download mode. When it is pulled up to VCC with a 10KΩ resistor during startup, the module will enter into bootloader download mode. For more details about the reference circuit design, please refer to ***document [3]***.

3.11. WI Interface

WI signal is an interrupt output to wake up the host when the sensor's value is bigger than the threshold value. L26-DR module cannot determine what causes the vehicle to have an inclination angle. It needs the MCU to judge whether the vehicle is towed by a trailer or is running normally on an uphill road.

NOTE

To ensure the interrupt signal output, the VCC of the module cannot be powered off.

4 Antenna Interfaces

L26-DR module supports GPS/Galileo/GLONASS/BeiDou/QZSS systems. The RF signal is obtained from the RF_IN pin. The impedance of RF trace should be controlled as 50Ω, and the trace length should be as short as possible. For more details about RF trace layout please refer to ***document [4].***

4.1. Antenna Specifications

The module can be connected to a dedicated passive or active GNSS antenna to receive GPS/Galileo/GLONASS/BeiDou/QZSS 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 total gain: <17dB

4.2. Recommended Antenna Reference Designs

Both active and passive GNSS antennas can be used for L26-DR module. Passive antenna is recommended if the antenna can be placed close to L26-DR module (that is, the distance between module and antenna is less than 1m). Otherwise, it is recommended to use an active antenna instead.

4.2.1. Active Antenna Reference Designs

4.2.1.1. Reference Design of Active Antenna without Antenna Detection

The following figure is a typical reference design for active antenna without Antenna Detection. In this case, the antenna is powered by the VCC_RF. In standby mode, VCC_RF will be automatically powered off.

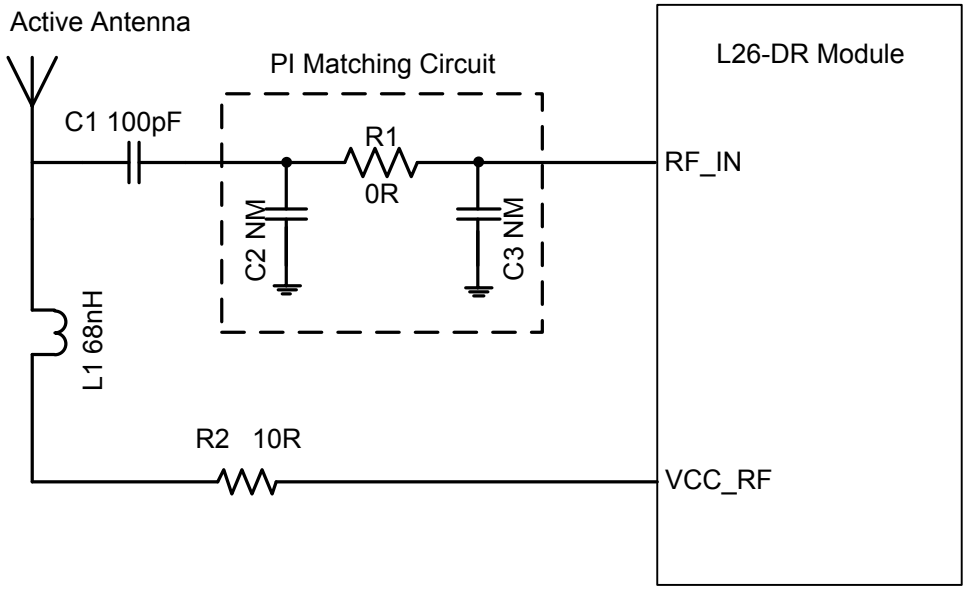

Figure 11: Reference Design for Active Antenna without Antenna Detection

C1 is used to block DC from VCC_RF. C2, R1 and C3 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.

4.2.1.2. Reference Design of Active Antenna with Antenna Detection

The following figure is a typical reference design for active antenna with Antenna Detection.

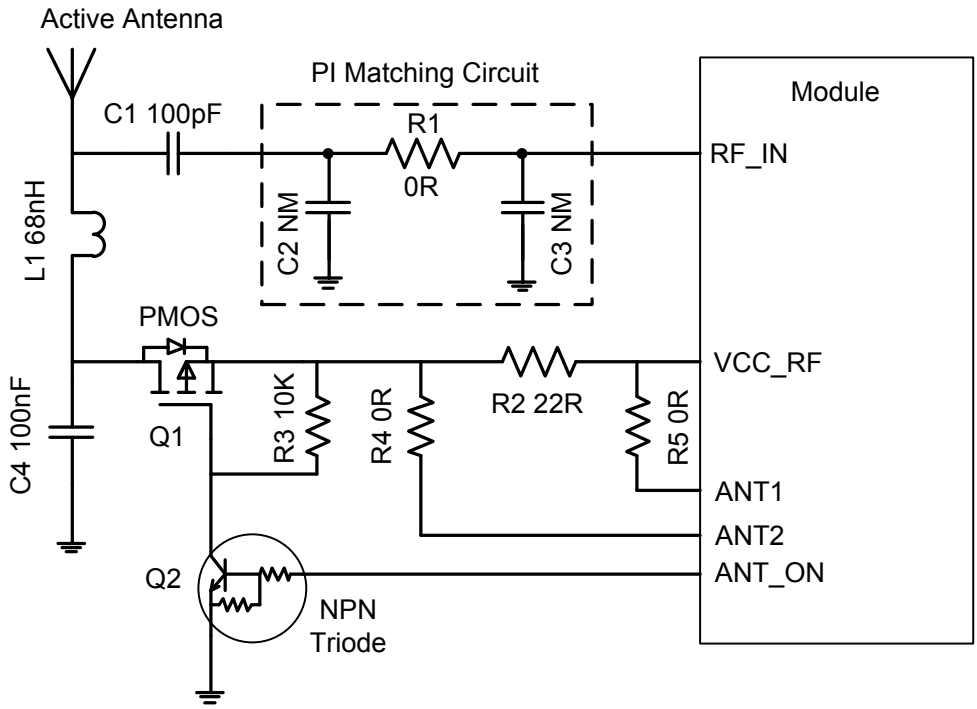

Figure 12: Reference Design for Active Antenna with Antenna Detection

L26-DR module reads the voltage at the R2 resistor ends (22Ω recommended) by two analog inputs ANT1 and ANT2. Through the antenna detection circuit, the state of antenna (normal/open/short) can be judged by comparing the voltages at the two ends of R2 resistor. The ANT_ON pin controls the power supply to the antenna.

When ANT_ON is high, both transistors Q1 and Q2 will be switched ON and the external antenna will be powered by VCC_RF. When ANT_ON is at low level, both Q1 and Q2 will be switched OFF and thus the external antenna will be disabled. In standby mode, VCC_RF will be automatically powered off.

Please guarantee current consumption of the antenna falls within the range of 7mA~30mA, otherwise the active antenna may not work. The status of the antenna supervisor will be reported in an NMEA ($PSTMANTENNASTATUS) message at start-up and on every change, for more details, please refer to ***document [1]***.

4.2.2. Passive Antenna Reference Designs

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

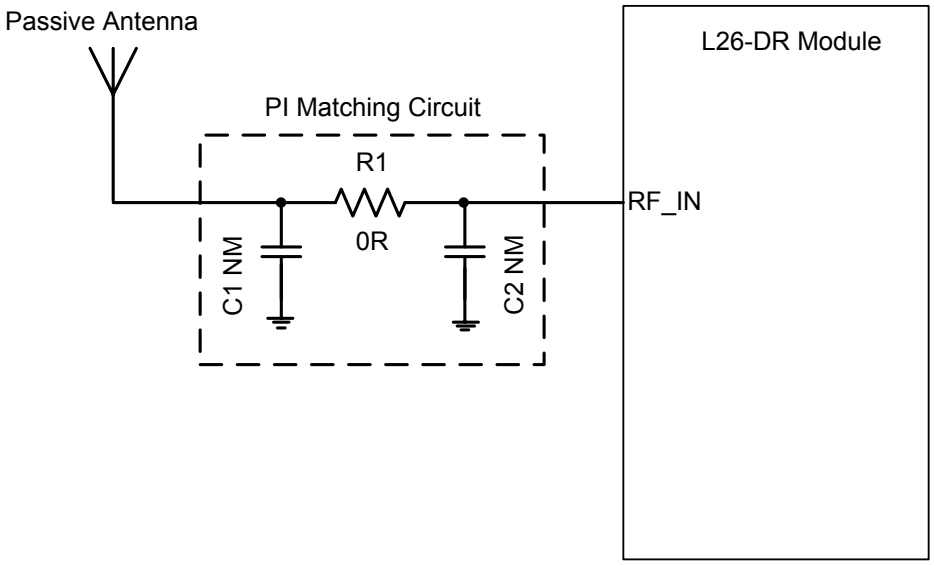

Figure 13: Reference Design for Passive Antenna

C1, R1 and C2 are reserved matching circuit for antenna impedance modification. By default, R1 is 0Ω, while C1 and C2 are not mounted. Impedance of RF trace should be controlled to 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 following table.

Table 8: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
Power Supply Voltage (VCC)	-0.3	4.8	V
Backup Battery Voltage (V_BCKP)	-0.3	4.8	V
Input Voltage at Digital Pins	-0.2	VCC+0.3V	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 the 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.	3.0	3.3	3.6	V
I_{VCCP}	Peak supply current	VCC=3.3V			150	mA
V_BCKP	Backup voltage supply		2.0	3.3	3.6	V
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 device reliability.

5.3. Current Consumption

Table 10: Current Consumption

Module	Conditions	Acquisition @VCC=3.3V	Tracking @VCC=3.3V	Standby @VCC=3.3V V_BCKP=0V
L26-DR	@-130dBm GPS	72mA	58mA	17uA
	@-130dBm GPS + Beidou	79mA	67mA	
	@-130dBm GPS + GLONASS	79mA	69mA	
	@-130dBm GPS + GLONASS + Galileo	79mA	74mA	

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/s^3; 20~500Hz, 0.96m^2/s^3-3dB/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

L26-DR GNSS module is an ESD sensitive device. ESD protection precautions should be emphasized. Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates the module.

Please note the following measures are beneficial to ESD protection when L26-DR 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 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.
- 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 are ±0.05mm unless otherwise specified.

6.1. Top and Side Dimensions of the Module

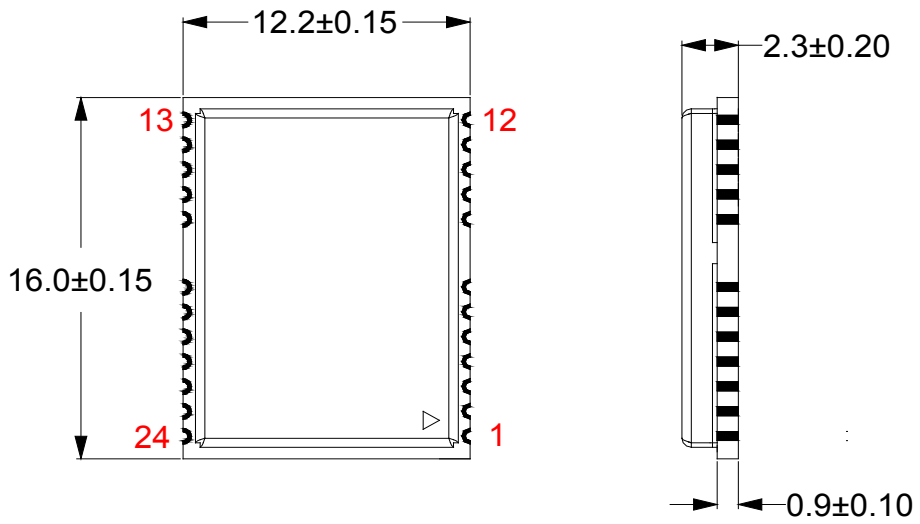

Figure 14: Top and Side Dimensions

6.2. Bottom Dimensions and Recommended Footprint Design

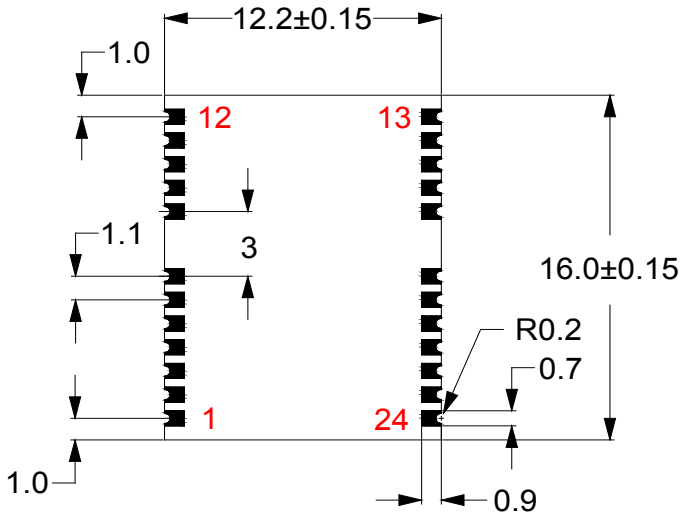

Figure 15: Bottom Dimensions

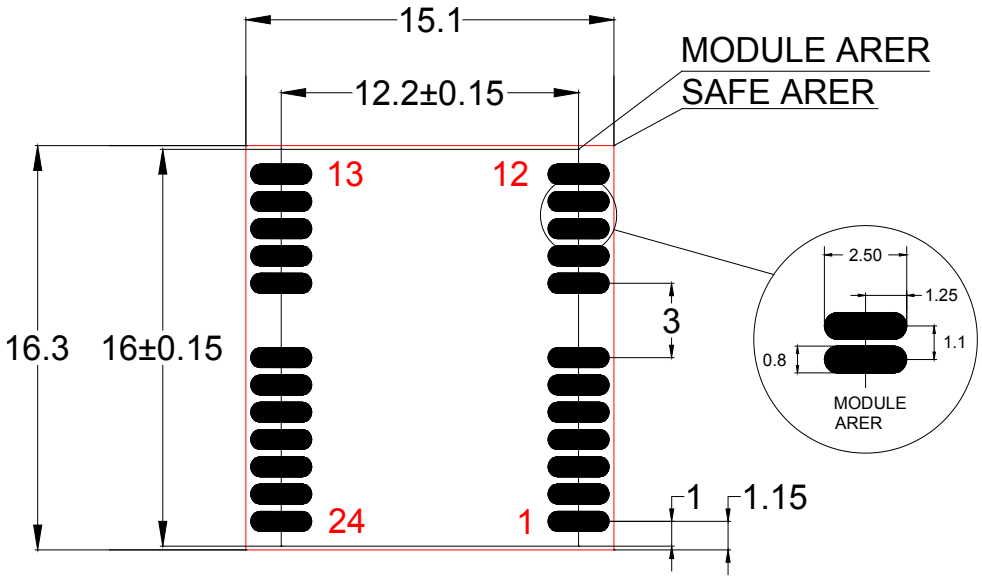

Figure 16: Recommended Footprint Design

NOTE

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

6.3. Top and Bottom Views of the Module

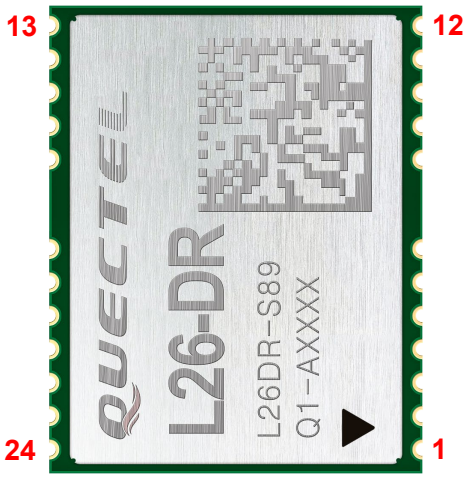

Figure 17: Top View of the Module

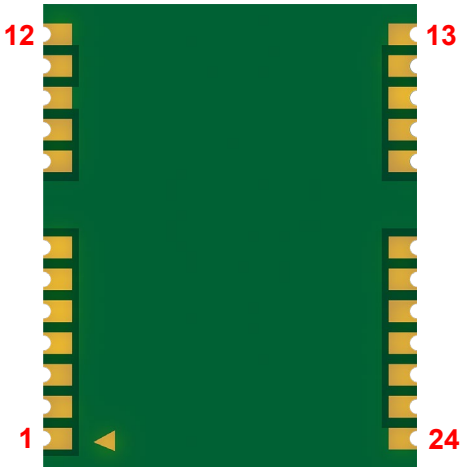

Figure 18: Bottom View of the Module

NOTE

These are renderings of L26-DR module. For authentic appearance, please refer to the module that you receive from Quectel.

6.4. Recommended Mounting

L26-DR (ADR) and L26-DR (ADRA) module allow for flexible installation without constraint on angle and direction. The modules will automatically recognize the mounting angle deviation and compensates the deviation by algorithmic calculations.

The installation of L26-DR (UDR) is relatively more demanding, one of the x, y and z axis, shown in the following figure, should be perpendicular to the horizontal plane, and the deviation should be less than 20°. In this case, there is no limit to the placement direction on the plane formed by the other two axes. For instance, if axis z is perpendicular to the horizontal plane, there is no limit to the mounting direction of the module on the module plane (i.e. the plane formed by x and y axis).

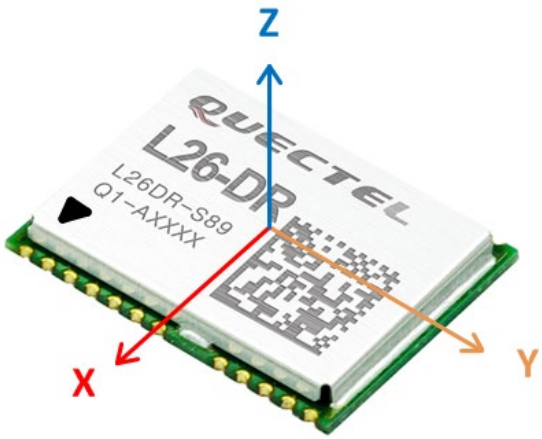

Figure 19: Axis of L26-DR Module

To ensure the performance, L26-DR module must be fixed tightly on the vehicle without movement or shaking during positioning.

7 Storage, Manufacturing and Packaging

7.1. Storage

L26-DR is stored in a vacuum-sealed bag. It is rated at MSL 3, and its storage restrictions are shown 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%RH.

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 [5]***.

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

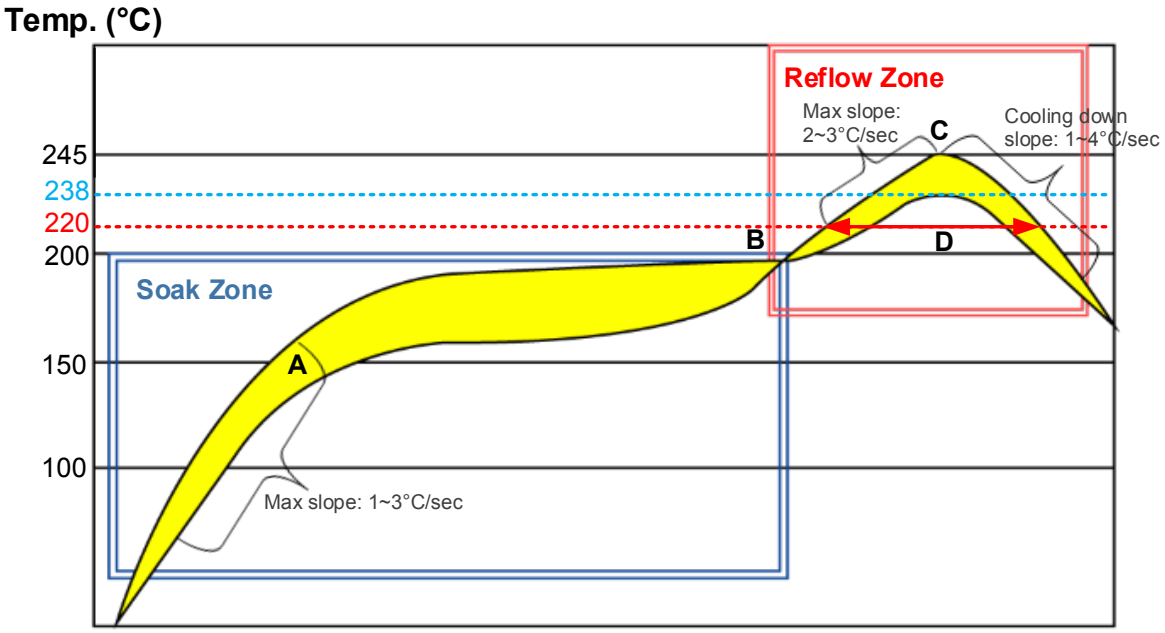

Figure 20: Recommended Reflow Soldering Thermal Profile

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 sec to 120 sec

Reflow Zone	
Max slope	2 to 3°C/sec
Reflow time (D: over 220°C)	40 sec 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'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

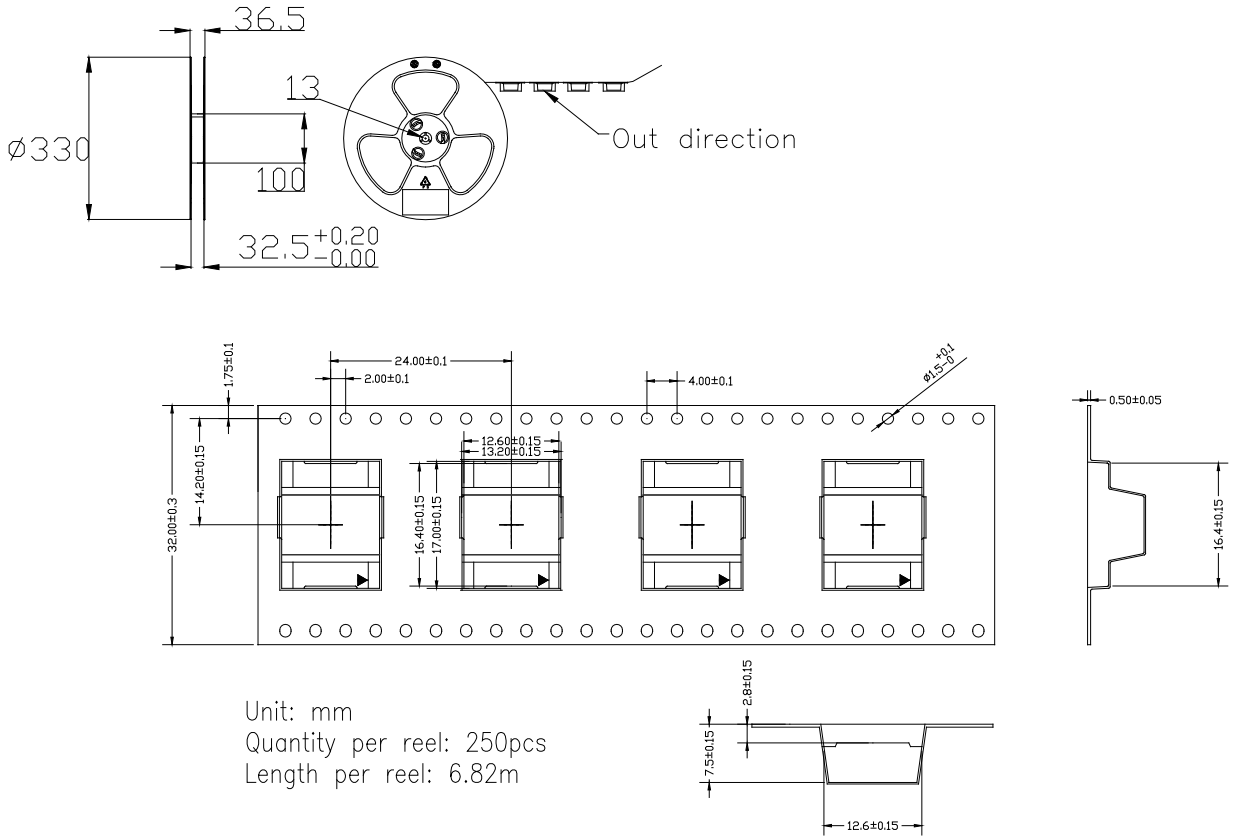

Figure 21: Tape and Reel Specifications

Table 13: Reel Packaging

Model Name	MOQ for MP	Minimum Package: 250pcs	Minimum Package x 4 = 1000pcs
L26-DR	250pcs	Size: 370mm × 350mm × 56mm N.W: 0.225kg G.W: 1.0kg	Size: 380mm × 250mm × 365mm N.W: 0.9kg G.W: 4.3kg

8 Appendix A References

Table 14: Related Documents

SN	Document Name	Remark
[1]	Quectel_L26-DR_GNSS_Protocol_Specification	L26-DR GNSS Protocol Specification
[2]	Quectel_L26-DR_EVB_User_Guide	L26-DR EVB User Guide
[3]	Quectel_L26-DR_Reference_Design	L26-DR Reference Design
[4]	Quectel_RF_Layout_Application_Note	RF Layout Guide
[5]	Quectel_Module_Secondary_SMT_User_Guide	Module Secondary SMT User Guide
[6]	Quectel_L26-DR_Application_Note	L26-DR Application Note

Table 15: Terms and Abbreviations

Abbreviation	Description
AGPS	Assisted GPS
CAN	Controller Area Network
CEP	Circular Error Probable
DGPS	Differential GPS
EGNOS	European Geostationary Navigation Overlay Service
ESD	Electrostatic Discharge
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
GGA	GPS Fix Data
GLL	Geographic Position – Latitude/Longitude

GLONASS	Global Navigation Satellite System (the Russian GNSS)
GSA	GNSS DOP and Active Satellites
GSV	GNSS Satellites in View
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
OC	Open Collector
QZSS	Quasi-Zenith Satellite System
RAM	Random-Access Memory
RHCP	Right Hand Circular Polarization
RMC	Recommended Minimum Specific GNSS Data
RTCM	Radio Technical Commission for Maritime Services
SBAS	Satellite-based Augmentation System
SAW	Surface Acoustic Wave
SMD	Surface Mounted Device
ST	STMicroelectronics
TTFF	Time To First Fix
T_{OPR}	Operating Temperature
UART	Universal Asynchronous Receiver & Transmitter
VTG	Course over Ground and Ground Speed, Horizontal Course and Horizontal Velocity
Imax	Maximum Load Current
Vmax	Maximum Voltage Value

Vnorm	Normal 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
WAAS	Wide Area Augmentation System