L16

Quectel GNSS Engine

Hardware Design

L16_Hardware_Design_V1.2

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0. Revision history

1 Revision	2 Date	3 Author	4 Description of change
5 1.0	6 2012-06-13	Mountain ZHOU	Initial
7 1.1	8 2012-06-21	Mountain ZHOU	1. Modified Table 14. 2. Added V_ANT in Table 11. 3. The resistor R202 is modified to R205 in the note below Figure11. 4. Added Figure 10 and UART2 port to upgrade firmware. 5. Modified the RTC mode in Table 7. 6. Modified Figure 8 and Figure 20.
1.2	2012-11-15	Mountain ZHOU	1. Added Chapter 2.5: AGPS function. 2. Added Chapter 2.6: Anti-jamming. 3. Modified description of chapter 3.3.1, modified NMOS to PMOS. 4. Modified definition of 1PPS, and added Chapter 2.7: 1PPS. 5. Modified antenna specification. 6. Modified the description of UART update rate and baud rate. 7. Updated power consumption. 8. Updated tape and reel information.

1. Introduction

This document defines and specifies L16 GNSS module. It describes L16 hardware interface and its external application reference circuits, mechanical size and air interface.

This document can help customer quickly understand module interface specifications, electrical and mechanical characteristics. Associated with this document and other application notes, customer can use L16 module to design and set up application quickly.

1.1. Related documents

Table 1: Related documents

SN	Document name	Remark
[1]	L16_Reference_Design	L16 Reference Design
[2]	L16_EVB_UGD	L16 EVB User Guide
[3]	L16_GNSS_Protocol	L16 GNSS Protocol Specification

1.2. Terms and abbreviations

Table 2: Terms and abbreviations

Abbreviation	Description
bps	bits per second
CEP	Circular Error Probable
DTE	Date Terminal Equipment
ESD	Electro-static Discharge
EVB	Evaluation Board
GGA	NMEA: Global Positioning System Fix Data
GLL	NMEA: Geographic Position Latitude/Longitude
GLONASS	Global Navigation Satellite System (The Russian GNSS)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GSA	NMEA: GNSS DOP and Active Satellites
GSV	NMEA: GNSS Satellites in View
I_{BCKP}	V_BCKP Supply Current
I_{max}	Maximum Load Current
I_{VCC}	VCC Supply Current
I/O	Input / Output

LDO	Low Dropout Regulator
NMEA	National Marine Electronics Association
PPS	Pulse Per Second
PSTM	ST Proprietary Message
RMC	NMEA: Recommended Minimum Specific GPS/TRANSIT Data
RTC	Real Time Clock
TTFF	Time To First Fix
UART	Universal Asynchronous Receiver & Transmitter
VI_{max}	Absolute Maximum Input Voltage Value
VI_{min}	Absolute Minimum Input Voltage Value
VIH_{max}	Maximum Input High Level Voltage Value
VIH_{min}	Minimum Input High Level Voltage Value
VIL_{max}	Maximum Input Low Level Voltage Value
VIL_{min}	Minimum Input Low Level Voltage Value
V_{max}	Maximum Voltage Value
V_{min}	Minimum Voltage Value
V_{norm}	Normal Voltage Value
VOH_{max}	Maximum Output High Level Voltage Value
VOH_{min}	Minimum Output High Level Voltage Value
VOL_{max}	Maximum Output Low Level Voltage Value
VOL_{min}	Minimum Output Low Level Voltage Value

2. Product concept

Based on the STMicroelectronics Teseo II positioning engine, L16 is a single GNSS receiver module integrated with GPS, GALILEO, GLONASS and QZSS system. It accomplishes simultaneous GNSS open service L1 reception. With 32 tracking channels and 2 fast acquisition channels, L16 can acquire and track any mix of GNSS signals. Compared with using GPS only, enabling both GPS and GLONASS generally doubles the number of visible satellites, reduces the time to first fix and increases positioning accuracy, especially when driving in rough urban environments. Its super performance is perfectly suitable for automotive, consumer and other industrial applications.

The L16 is an SMD type module with the compact 22.4mm × 17.0mm × 3.0 mm form factor, which can be embedded in customer applications through the 28-pin pads.

The module is fully RoHS compliant to EU regulation.

2.1. Key features

Table 3: Module key features

Feature	Description
Power Supply	Single supply voltage: 3.0V ~ 3.6V typical : 3.3V
Power Consumption (passive antenna)[1]	● Acquisition 120mA ● Tracking 85mA ● Backup 75uA
Receiver Type	● GPS L1 1575.42 MHz C/A Code ● GLONASS L1 1598.0625~1605.375 MHz C/A Code ● 32 tracking channels, 2 fast acquisition channels
Sensitivity	● Cold start -146dBm ● Reacquisition -148dBm ● Hot start -160dBm ● Tracking -162dBm
TTFF[1]	● Cold Start (Autonomous) <35s average@-130dBm ● Warm Start (Autonomous) <24s average@-130dBm ● Warm Start (AGPS Enable) <5s average@-130dBm ● Hot Start (Autonomous) <2.5s average@-130dBm
Position Accuracy	● CEP (SBAS ON) <1.5m
Update Rate	● Up to 5Hz[2], 1Hz by default
Accuracy of 1PPS Signal	● Typical accuracy <15 ns ● Pulse width 500ms
Dynamic Performance	● Maximum Altitude 18,000 m ● Maximum Velocity 515 m/s ● Maximum Acceleration 4 G

UART Port	● UART Port1: ● Two lines TXD1 and RXD1 ● UART Port1 supports baud rate from 4800bps[3] to 115200bps ● UART Port1 is used for NMEA output, ST proprietary messages input/output and firmware upgrade ● UART Port2: ● Two lines TXD2 and RXD2 ● UART Port2 can be used for debug output and firmware upgrade
Temperature Range	● Normal operation: -40°C ~ +85°C ● Storage: -45°C ~ +125°C
Physical Characteristics	● Size: 22.4 (± 0.15) × 17 (± 0.15) × 3.0 (± 0.15) mm ● Weight: approximately 2.2g
Firmware Upgrade	Firmware upgrade via UART port1 or UART port2

1. Power consumption and TTFF are both tested under the GPS+GLONASS system.

2. The higher baud rate or less NMEA messages output is needed to support higher update rate. E.g. 5Hz update rate with 57600bps at least, 2Hz update rate with 19200bps at least, 1Hz with 9600bps.

3. It should decrease the output messages (e.g. disable GSV message) to support 4800bps. Please refer to the document [3] for more details about note 2 and 3.

2.2. Block diagram

The following figure shows block diagram of module.

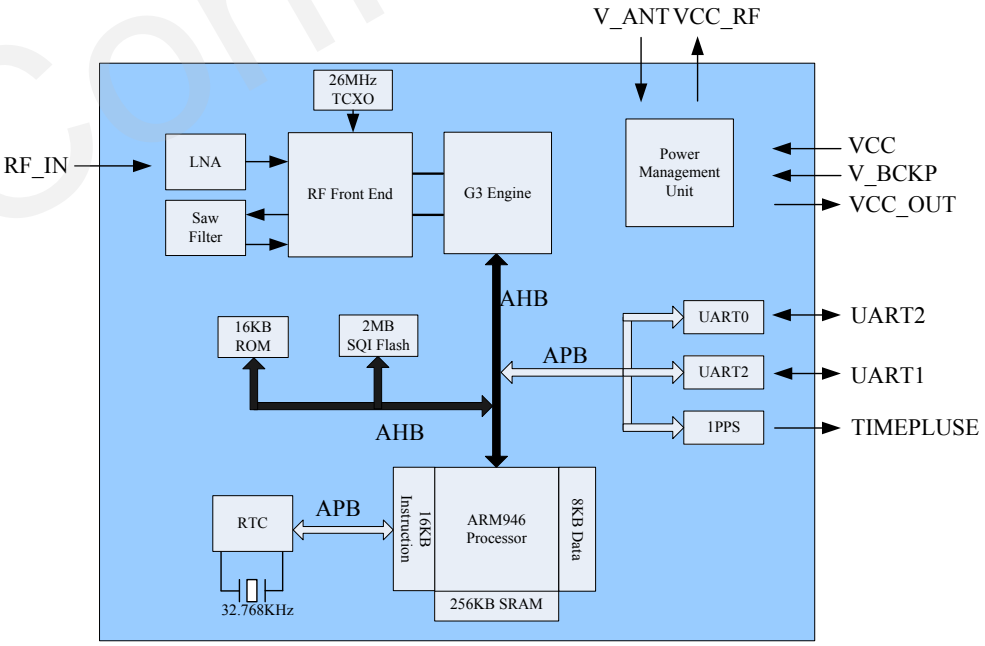

Figure 1: Module block diagram

2.3. Evaluation board

In order to help customer to develop applications with L16, Quectel provides an Evaluation Board (EVB) with appropriate power supply, USB to RS232 converter cable, Driver CD, antenna and the module. For more details, please refer to the ***document [2]***.

2.4. Protocol

L16 supports standard NMEA-0183 protocol and ST proprietary protocol (PSTM messages) that can be used to provide extended capabilities for many applications. The module is capable of supporting the following NMEA formats: ***GGA, GSA, GSV, RMC, and GLL.*** Please refer to the ***document [3]*** about NMEA standard protocol and ST proprietary protocol.

Table 4: The protocol module supports

Protocol	Type
NMEA	Output, ASCII, 0183, V3.01
ST	Input/output, ST proprietary protocol

2.5. AGPS

ST-AGPS firmware is able to provide predicted ephemeris to the GPS engine in a time frame less than the usual time (about 30 seconds) needed to download real ephemeris from the sky. This reduces considerably the time to get fix especially in critical environments when the ephemeris download time could be very long.

ST-AGPS works using the past real ephemeris (downloaded from the sky and stored in its internal database) to extrapolate the parameter of future ephemeris (up to 5 days of prediction). This function can reduce TTFF to 5s for warm start. In this case, the backup power which supplied power for RTC circuit is necessary.

The expiration time and the accuracy of GPS position based on predicated ephemeris are dependent on the real ephemeris (number of ephemeris per satellite and time distance between the ephemeris) used for prediction. To obtain the best performance of ST-AGPS, the 24hours of real satellite database is strongly recommended.

Note: The AGPS function is enabled by default.

2.6. Anti-jamming

GNSS system relies on extremely weak signals from orbiting satellites and, as a result, is very vulnerable to jamming. This constitutes a significant threat for the GNSS application.

As the jamming sources, external transmitters (e.g. cell phones, electronics in vehicle, spread spectrum) and internal sources (e.g. clocks, oscillators and memory buses) will couple into the signal path and reduce the navigation performance.

The firmware enables GPS and GLONASS RF path filter in auto-insertion mode. It is an adaptive notch filter capable of 'self-tune', through a proper adaptation algorithm, to the position of the jammer frequency, searching autonomously for the eventual presence of the Narrow Band Interferer (NBI). It's able to identify and to eliminate an eventual NBI without affecting the incoming signal.

2.7. 1PPS

The TIMEPULSE pin provides 1PPS signal for timing purposes. It outputs 1PPS signal when the system works normally, and will be maintained in the high level when cold or warm start command is executed before fixing.

Pulse width is 500ms (from pulse rising edge and pulse falling edge) and can be configured by command CDB-ID301. For more details, please refer to the ***document [3]***.

3. Application interface

L16 is equipped with a 28-pin 1.1mm pitch SMT pads that connects to customer application platform.

3.1. Pin description

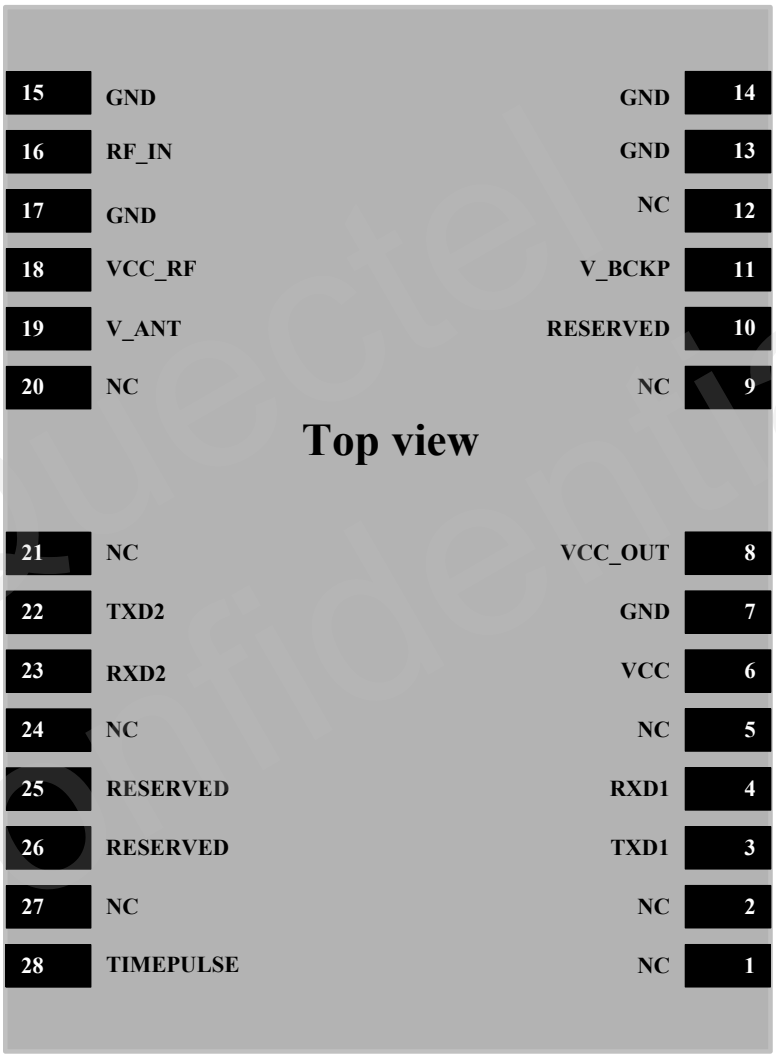

Figure 2: Pin assignment

Table 5: Pin assignment

PIN NO.	PIN NAME	I/O		PIN NO.	PIN NAME	I/O
1	NC			15	GND	
2	NC			16	RF_IN	I
3	TXD1	O		17	GND	
4	RXD1	I		18	VCC_RF	O
5	NC			19	V_ANT	I
6	VCC	I		20	NC	
7	GND			21	NC	
8	VCC_OUT	O		22	TXD2	O
9	NC			23	RXD2	I
10	RESERVED			24	NC	
11	V_BCKP	I		25	RESERVED	
12	NC			26	RESERVED	
13	GND			27	NC	
14	GND			28	TIMEPULSE	O

Note: Please keep all NC and RESERVED pins floating.

Table 6: Pin description

Power supply					
PIN NAME	**PIN NO.**	**I/O**	**DESCRIPTION**	**DC CHARACTERISTICS**	**COMMENT**
VCC	6	I	Power supply for module	V_{max} = 3.6V V_{min} = 3.0V V_{norm} = 3.3V	It should be able to provide sufficient current which typically rises to 200mA.
V_BCKP	11	I	Power supply for RTC backup	V_{max} = 3.6V V_{min} = 2.0V V_{norm} = 3.3V I_{BCKP} = 75uA	Power supply for RTC backup when VCC is not applied for the system.
VCC_OUT	8	O	3.3V voltage output	V_{max} = 3.6V V_{min} = 3.0V V_{norm} = 3.3V I_{max} = 20mA	This pin is internally connected to VCC. If unused, keeps this pin floating.
VCC_RF	18	O	Optional voltage output for external active antenna	V_{max} = 3.6V V_{min} = 3.0V V_{norm} = 3.3V I_{max} = 30mA	If unused, keeps this pin floating.
V_ANT	19	I	Power supply for external active antenna	V_{max} = 5.5V V_{min} = 2.7V	If unused, keeps this pin floating.
Specific purpose input/output					
PIN NAME	**PIN NO.**	**I/O**	**DESCRIPTION**	**DC CHARACTERISTICS**	**COMMENT**
TIME PULSE	28	O	1 pulse per second (1PPS).	VOL_{max} = 0.4V VOH_{min} = VCC - 0.4V	Synchronized at rising edge, pulse length 500ms. If unused, keeps this pin floating.
UART port					
PIN NAME	**PIN NO.**	**I/O**	**DESCRIPTION**	**DC CHARACTERISTICS**	**COMMENT**
RXD1	4	I	Receive data	VIL_{min} = - 0.3V VIL_{max} = 0.8V VIH_{min} = 2.0V VIH_{max} = VCC + 0.3V VOL_{max} = 0.4V VOH_{min} = VCC - 0.4V	Used to output NMEA messages and upgrade firmware[1].
TXD1	3	O	Transmit data		
RXD2	23	I	Receive data		Used to output debug messages and upgrade firmware. If unused, keep these pins floating.
TXD2	22	O	Transmit data		
RF interface					

PIN NAME	PIN NO.	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
RF_IN	16	I	GPS/GLONASS signal input	Impedance of 50Ω	Refer to Chapter 4.

1. The TXD1 pin needs to be pulled down with 1K resistor in the upgrading mode, and it is needed to remove this 1K resistor in the working mode.

3.2. Operating modes

The table below briefly summarizes the different operating modes.

Table 7: Overview of operating modes

Mode	Function
Acquisition mode	The module starts to search satellite, determine visible satellites and coarse carrier frequency and code phase of satellite signals. When the acquisition is performed, it switches to tracking mode automatically.
Tracking mode	The module refines acquisition's message, as well as keeps tracking and demodulating the navigation data from the specific satellites.
Backup mode	When L16 is only powered through the V_BCKP pin, the system will be in the Backup mode. The RTC provides a high resolution clock which can be used for GPS. It keeps the time when the system is inactive. It has a clock trimming feature to compensate for the accuracy of the 32.768 kHz crystal and a secured time update.

3.3. Power supply

The main power supply is fed through the VCC pin. It is important that the system power supply circuit is able to support the peak power. So the power supply must be able to provide sufficient current up to 200mA.

3.3.1. Turn on and turn off

With one GPIO to control the enable function of transistor circuit, the module can be turned on and off by the following way.

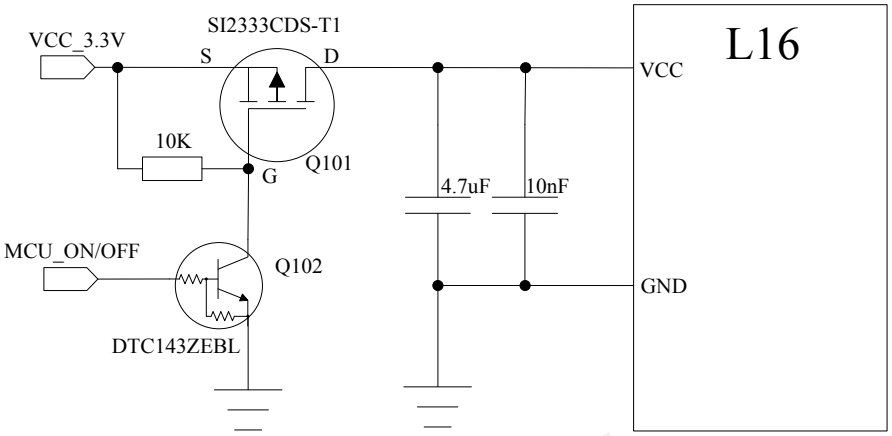

Figure 3: Reference turn on/off circuit

P-channel power MOSFET Q101 works as an analog switch. Use the MOSFET channel as a low-on-resistance switch to pass analog signals when on and as a high impedance when off.

To turn on L16, the base of the Q102 is driven to the high voltage level and the gate of the Q101 is driven to the low voltage level, so the MOSFET channel is on and the power is supplied to L16.

Similarly, to turn off L16, when the base of the Q102 is driven to the low voltage level, the gate of Q101 will be pulled up to high voltage level and MOSFET works in the high impedance state.

Note:
To ensure the stability, Q102 is recommended to apply digital transistor, and some parameters of P-channel power MOSFET Q101 are listed below:

The Gate-Source Threshold Voltage $V_{GS(th)}$ is in the range of -1V and -3V.
The Drain-Source On-State Resistance is less than 0.1Ω when V_{GS} = -2.5V.
The absolute value of Continuous Drain Current is more than 200mA.

3.3.2. RTC backup

The RTC (backup system) provides a high resolution clock which can be used for GPS with 8Kbyte SRAM. It keeps the time when the system is inactive. It has a clock trimming feature to compensate for the accuracy of the 32.768 kHz crystal and a secured time update.

Table 8: Pin definition of the V_BCKP pin

Name	Pin No.	Function
V_BCKP	11	Power supply for RTC backup

The V_BCKP pin powers for the backup system which contains the necessary GNSS information for quick start-up and the database used for AGPS. The internal circuit will supply power for it when the module is powered on, and the circuit can be directly provided by an external capacitor or battery (rechargeable or non-chargeable) through the V_BCKP pin when the module is powered off, thus the system will be in the Backup mode. Please refer to the following figure for RTC backup power supply.

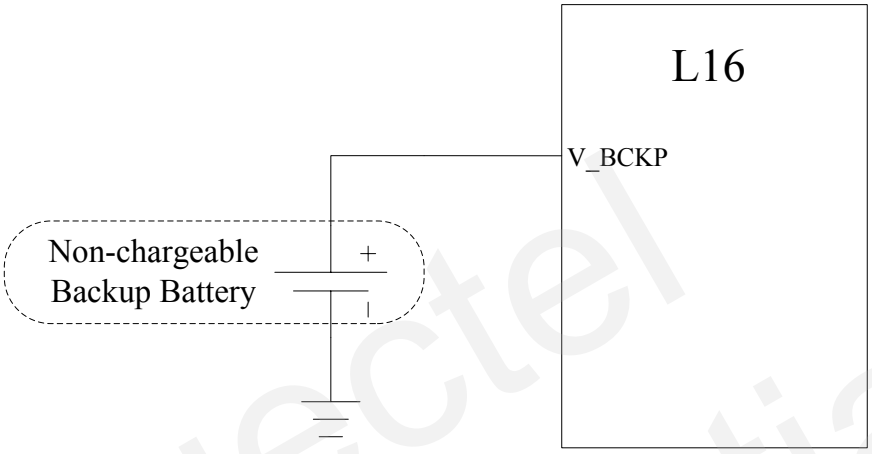

Figure 4: Backup power supply from non-chargeable battery

The V_BCKP pin does not implement charging for rechargeable battery. It is necessary to add a charging circuit for rechargeable battery, shown as the following figure:

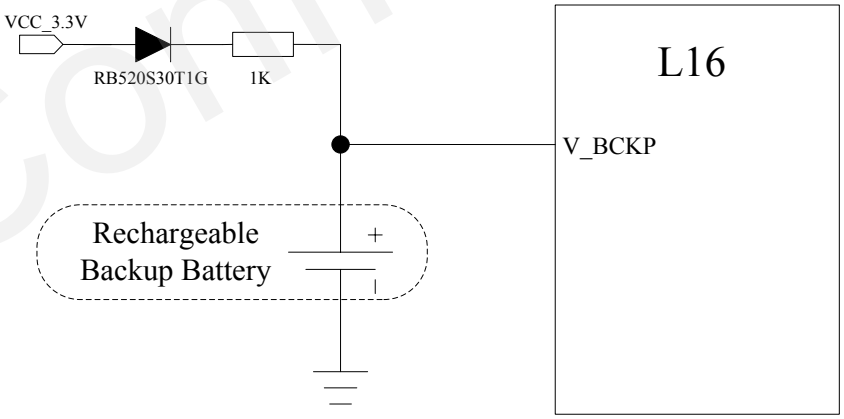

Figure 5: Reference charging circuit for rechargeable battery

Coin-type rechargeable capacitor such as XH414H-IV01E from Seiko can be used and schottky diode such as RB520S30T1G from ON Semiconductor is recommended for its low voltage drop. The charging and discharging characteristic of XH414H is shown in the following figure.

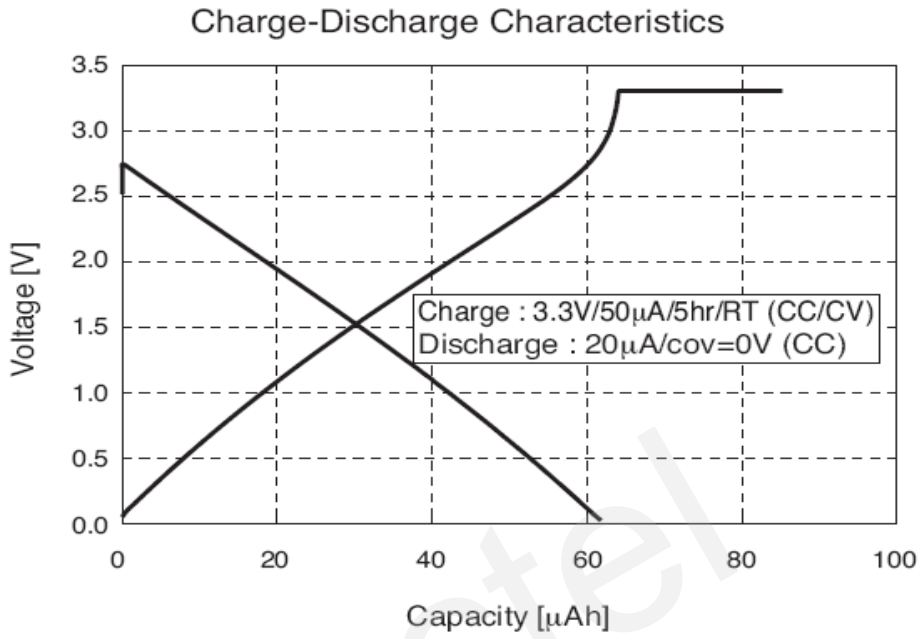

Figure 6: Seiko XH414H charging and discharging characteristics

3.4. UART interfaces

The module provides two universal asynchronous receiver & transmitter serial ports. The UARTx (x=1|2) performs serial-to-parallel conversion on data asynchronously received from a peripheral device on RXDx pin, and parallel-to-serial conversion on data written by CPU for transmission on TXDx pin. The transmit and receive paths are buffered with internal FIFO memories allowing up to 64 data byte for transmission, and 64 data byte with 4-bit status (break, frame, parity, and overrun) for receiving.

The table below shows the pin definition of the UART interfaces.

Table 9: Pin definition of the UART interfaces

Interface	Name	Pin No.	Function
UART Port1	TXD1	3	Transmit data
	RXD1	4	Receive data
UART Port2	TXD2	22	Transmit data
	RXD2	23	Receive data

UART port1:

- UART port1 can be used for firmware upgrade, NMEA messages output and ST proprietary messages input and output.
- UART port1 supports the following baud rates:

4800, 9600, 14400, 19200, 38400, 57600, 115200.

- Hardware flow control and synchronous operation are not supported.

The command CDB-ID102 allows setting the baud rate of NMEA messages. For more details, please refer to the ***document [3]***.

The default configuration is 9600bps, 8 bits, no parity bit, 1 stop bit, no hardware flow control, and the default output NMEA messages are RMC, GGA, GSA, GSV, and GLL.

UART port2:

UART port2 can be used for firmware upgrade and debug messages output. The command CDB-ID103 allow enabling/disabling the GNSS debug messages. For more details, please refer to the ***document [3]***.

The output of debug messages is disabled by default. The higher baud rate (e.g. 115200bps) or less NMEA messages output is needed to avoid the message lost when enable the debug output.

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

In order to prevent the current leakage influence from the external device to module which maybe leads to the unsuccessful boot, the relevant solutions are suggested to be adopted. The following figure is the recommended circuit, and the R101 and D101 circuit is just reserved. Generally, choose 0R to replace D101 and keep R101 unmounted.

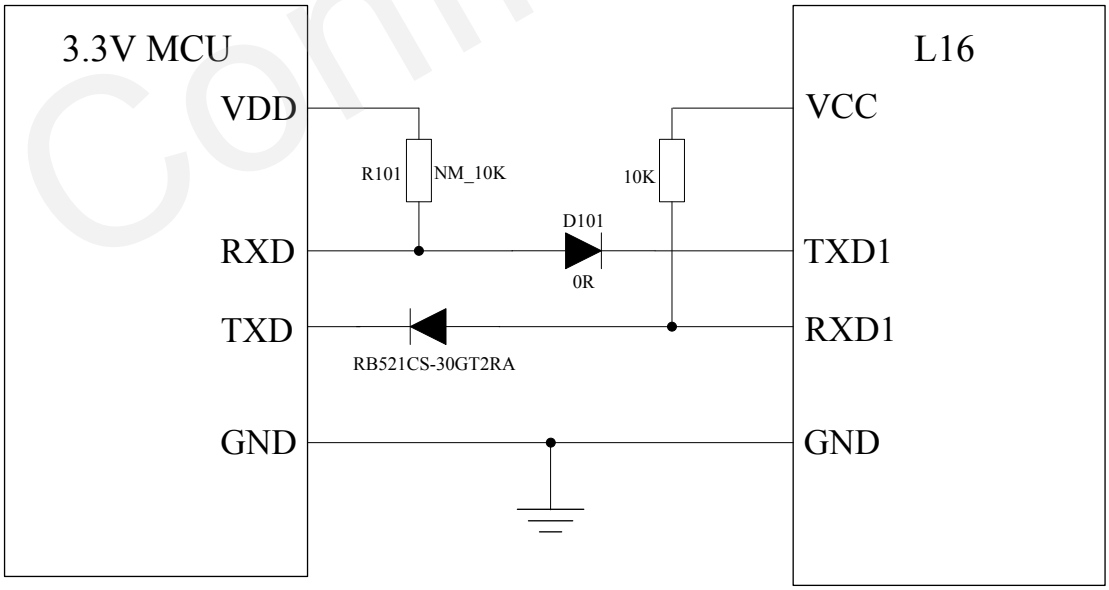

Figure 7: UART circuit of 3.3V MCU

And below circuit is recommended to realize the voltage level shifting and avoid the current leakage

influence when the customer device belonged to 5V voltage domain.

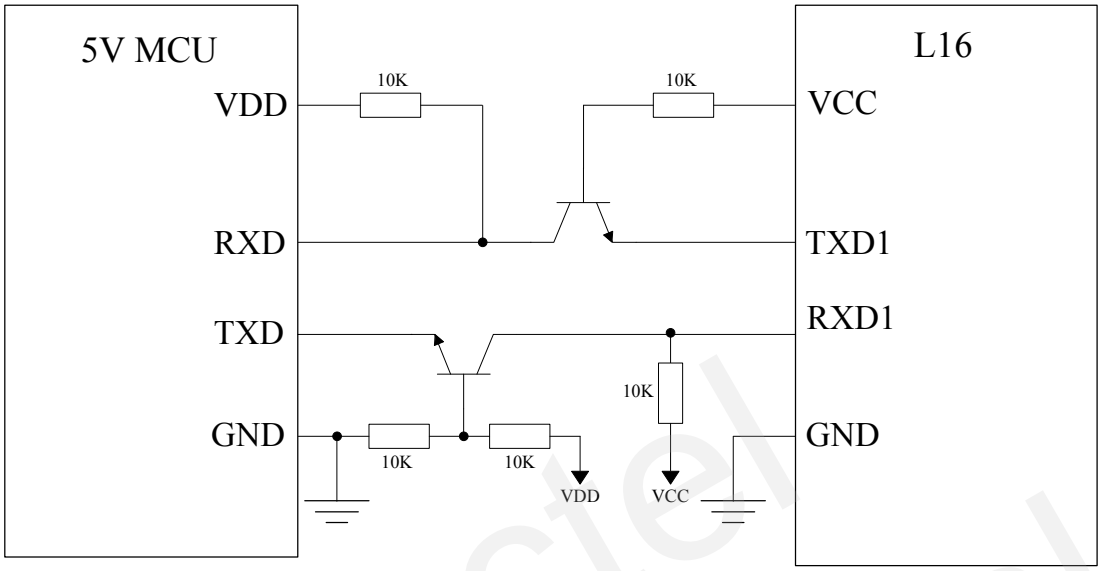

Figure 8: UART circuit of 5V MCU

3.5. Firmware upgrade

Quectel will provide X-Loader tool for customer to upgrade firmware shown as below. Please take the options as shown in the following figure.

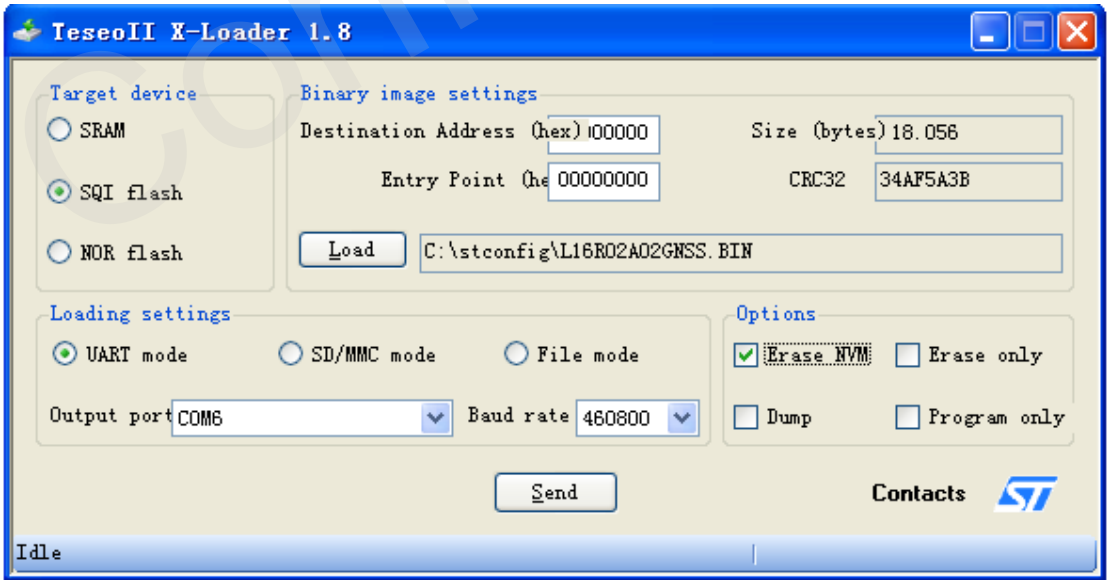

Figure 9: Upgrade tool

X-Loader is able to write firmware file via UART port1 or UART port2. Baud rate 921600 is not

supported, and flag “Erase NVM” is recommended to choose to erase NVM memory during firmware upgrade process. Before upgrading firmware, the TXD1 pin must be pulled down with 1K resistor, and then turn on the module to start the upgrade process. In the working mode, please keep this 1K resistor removed. To realize this transform, the switch button is recommended to be added between 1K resistor and the TXD1 pin shown as below. For more details about the firmware upgrade, please refer to the ***document [2].***

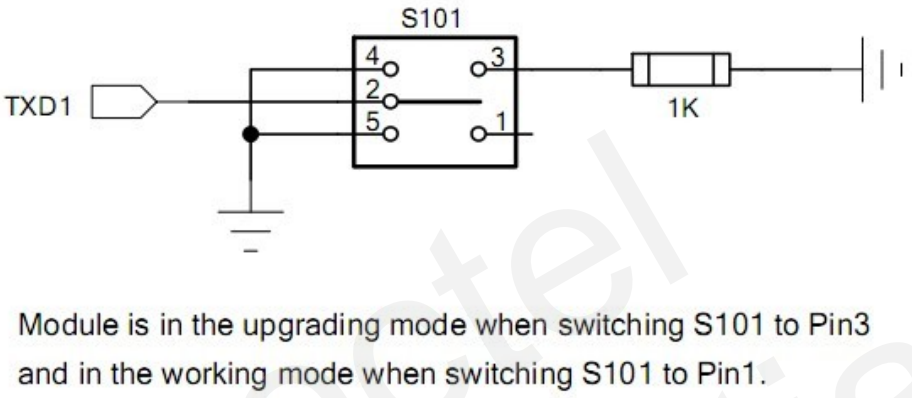

Figure 10: Additional upgrade circuit

4. Antenna interface

L16 module supports both GPS and GLONASS systems. The RF signal is received from antenna to RF_IN pin. Impedance of RF trace line should be designed to match 50 ohm.

4.1. Antenna specification

The L16 module can be connected to a dedicated GPS/GLONASS passive or active antenna in order to receive both GPS and GLONASS satellite signals. The recommended antenna specification is given in table 10 below.

Table 10: Antenna specification

Antenna type	Specification	
Passive antenna	GPS frequency:	1575.42±2 MHz
	GLONASS frequency:	1602±4 MHz
	Recommended frequency:	1575~1610 MHz
	Gain:	>2 dBi
	Polarization:	RHCP (AR<3dB)
Active antenna	GPS frequency:	1575.42±2 MHz
	GLONASS frequency:	1602±4 MHz
	Recommended frequency:	1575~1610 MHz
	Maximum noise figure:	1.5 dB
	Typical gain:	30 dBi
	Polarization:	RHCP (AR<3dB)

4.2. Antenna reference design

4.2.1. Passive antenna

Passive antenna does not require a DC bias voltage and can be connected to RF_IN directly. It is always beneficial to reserve a “PI” type matching network between the antenna and the RF_IN pin of the module. Figure 11 is the reference design. And ESD protection device is still recommended to be added in the front-end of interface to improve the ESD performance, the equivalent capacitance of the ESD should be less than 0.3pF.

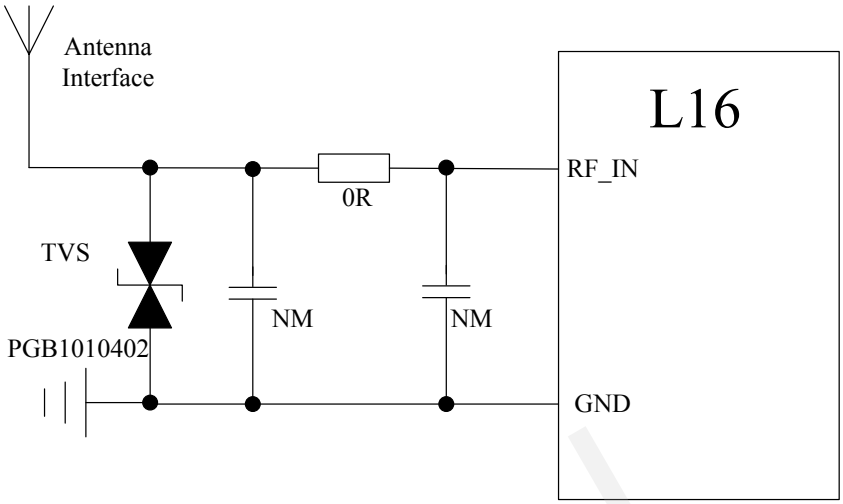

Figure 11: Reference design for passive antenna

4.2.2. Active antenna

The power for active antenna is supplied by the pin V_ANT.

If the power supply required by active antenna is in the range from 3.0V to 3.6V, VCC_RF can be used as a power supply for active antenna. In this condition, VCC_RF pin can be connected with V_ANT through a 10ohm resistor, the reference circuit is shown below.

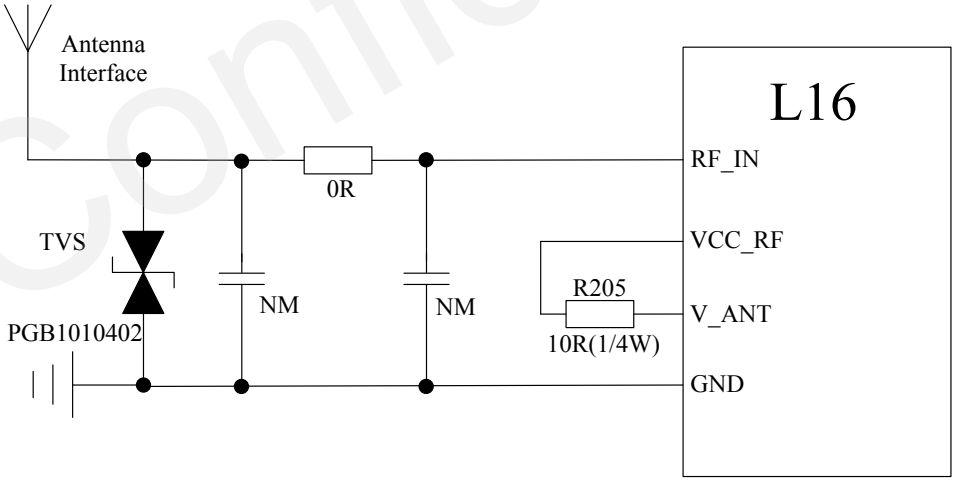

Figure 12: Active antenna supplied with VCC_RF

Note: The resistor R205 here is to prevent antenna short-circuit from damaging the module.

If the VCC_RF voltage does not meet the power range requirement of the active antenna, an external voltage source should be used. The output of the external voltage source can be connected to the V_ANT pin. A reference circuit is shown below.

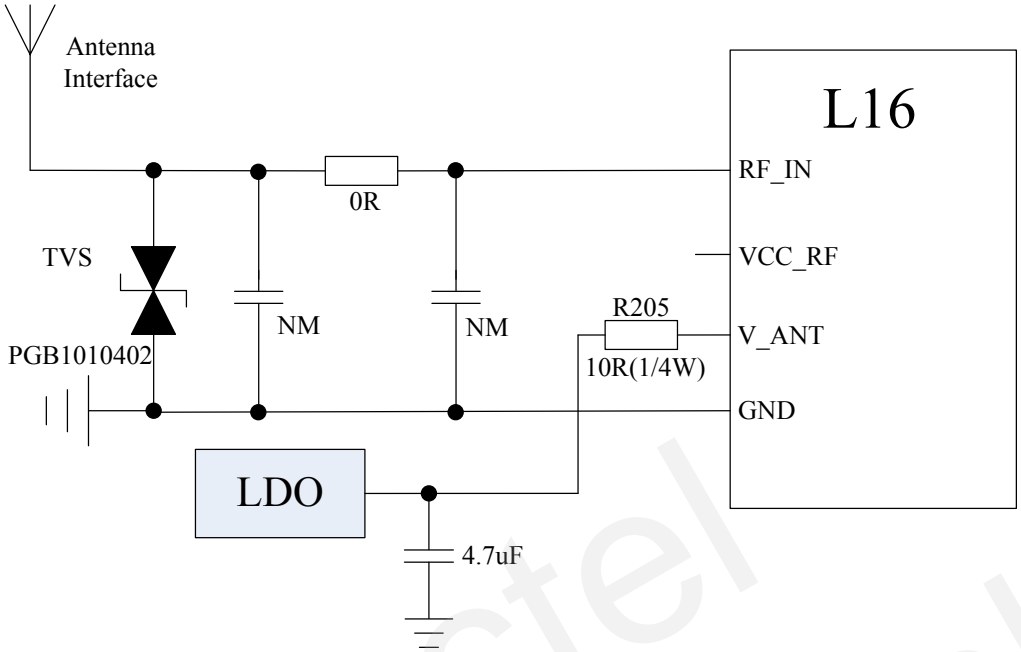

Figure 13: Active antenna supplied with external LDO

5. Electrical and reliability characteristics

5.1. Absolute maximum ratings

Absolute maximum rating for power supply and voltage on digital pins of module are listed in Table 11.

Table 11: Absolute maximum ratings

Parameter	Min	Max	Unit
Module power supply (VCC)	- 0.3	+ 3.63	V
Backup power supply (V_BCKP)	- 0.3	+ 3.8	V
Antenna power supply (V_ANT)	0	+6	V
Input voltage at digital pins	- 0.3	+ 3.63	V
Storage temperature	- 45	+ 125	℃

Note: Stressing the device beyond the "Absolute maximum ratings" may cause permanent damage. These are stress ratings only. The product is not protected against over voltage or reversed voltage. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection diodes.

5.2. Operating conditions

Table 12: Recommended operating conditions

Parameter	Description	Conditions	Min	Typ.	Max	Unit
VCC	Module power supply	Voltage must stay within the min/max values, including voltage drop, ripple, and spikes.	3.0	3.3	3.6	V
V_BCKP	Backup power supply		2.0	3.3	3.6	V
V_ANT	Antenna power supply		2.7		5.5	V
VCC_RF	Optional output voltage for external active antenna			VCC	VCC	V
T_{OPR}	Normal Operating temperature		-40	25	85	℃

Note: Operation beyond these values of this table is not recommended and extended exposure beyond these values may affect device reliability.

5.3. Current consumption

The values of current consumption are shown in Table 13.

Table 13: Current consumption (passive antenna)

Parameter	Condition	Min	Typ.	Max	Unit
I_{VCC} Acquisition	Passive antenna@-130dBm		120		mA
I_{VCC} Tracking	For Cold Start, 15 minutes after First Fix.		85		mA
I_{BCKP} Backup	VCC is powered off and battery supplies power for V_BCKP		75		uA

5.4. Electro-static discharge

Although the module is protected against ESD strike, ESD protection precautions should still be emphasized. Proper ESD handing and packaging procedures must be applied throughout the processing, handing and operation of any application.

The ESD bearing capability of the module is listed in Table 14.

Table 14: ESD characteristics (Temperature: 25℃, Humidity: 45 %)

Pin	Contact discharge	Air discharge
VCC, GND	±5KV	±10KV
VCC_OUT	±5KV	±10KV
V_BCKP	±5KV	±10KV
V_ANT	±5KV	±10KV
VCC_RF	±5KV	±10KV
TXD1	±4KV	±8KV
RXD1	±4KV	±8KV
TXD2	±4KV	±8KV
RXD2	±4KV	±8KV
RF_IN	±4KV	±8KV
TIMEPULSE	±3KV	±6KV

5.5. Reliability test

Table 15: Reliability test

Test term	Condition	Standard
Thermal shock	-30°C for harf an hour +80°C for harf an hour 144 cycles for 144 hours	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,0.96m2/s3;20~500Hz,0.96m2/s3-3dB/oct, 1hour/axis;	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

6. Mechanics

This chapter describes the mechanical dimensions of the module.

6.1. Mechanical dimensions of the module

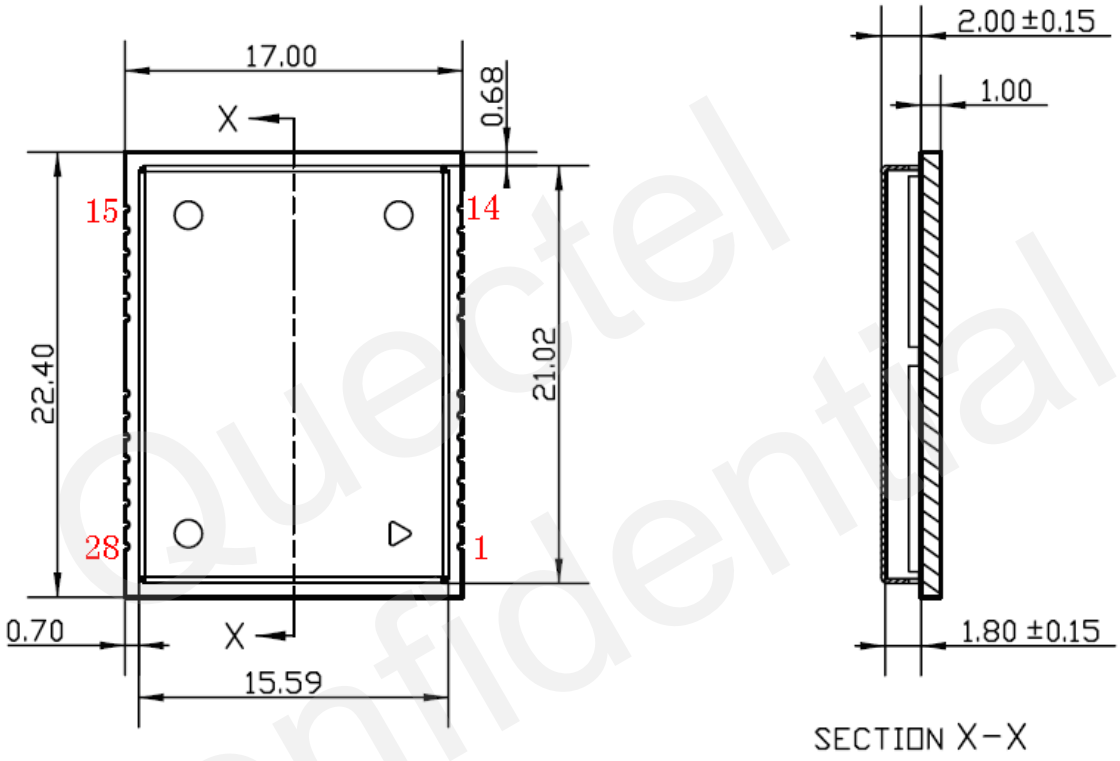

Figure 14: Top and side dimensions (Unit: mm)

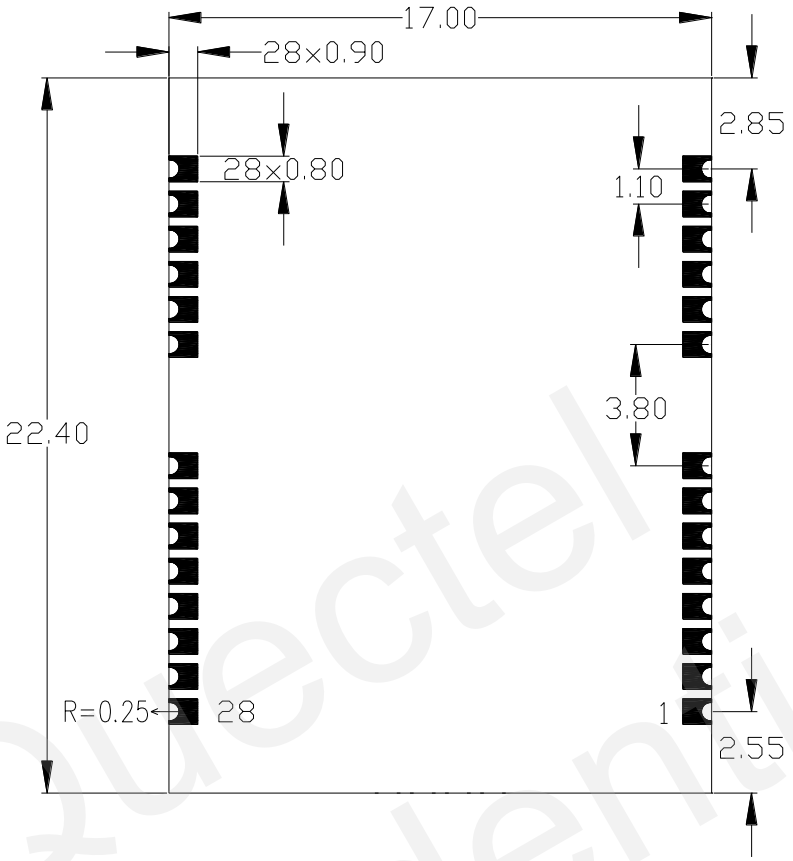

Figure 15: Bottom dimensions (Unit: mm)

6.2. Recommended pad layout

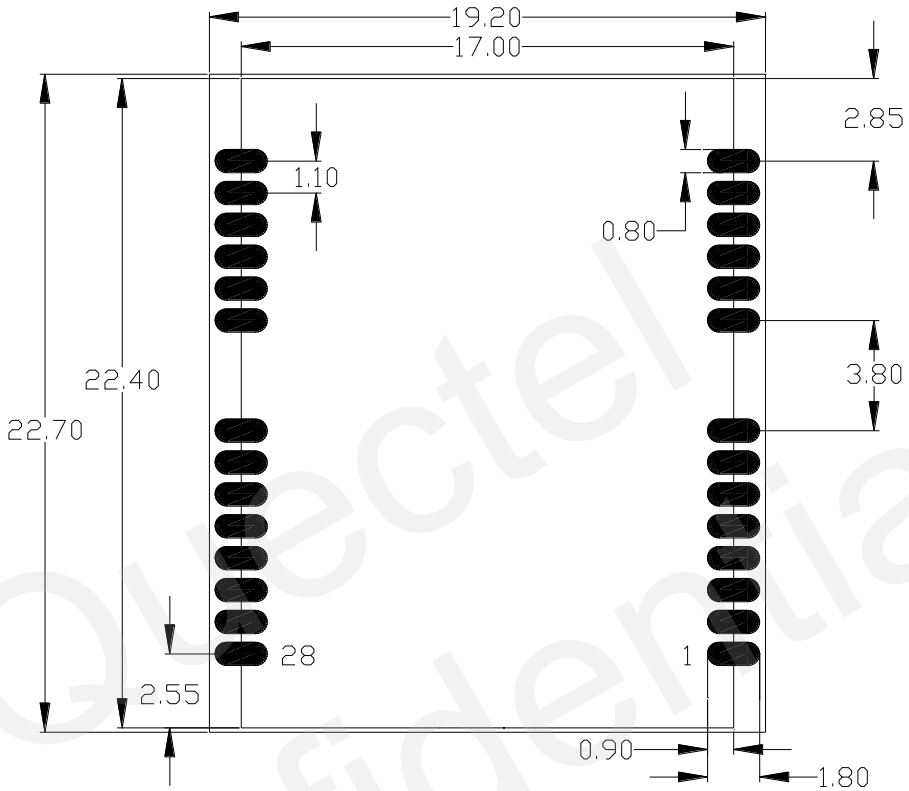

Figure 16: Recommended pad layout (Unit: mm)

6.3. Top view of the module

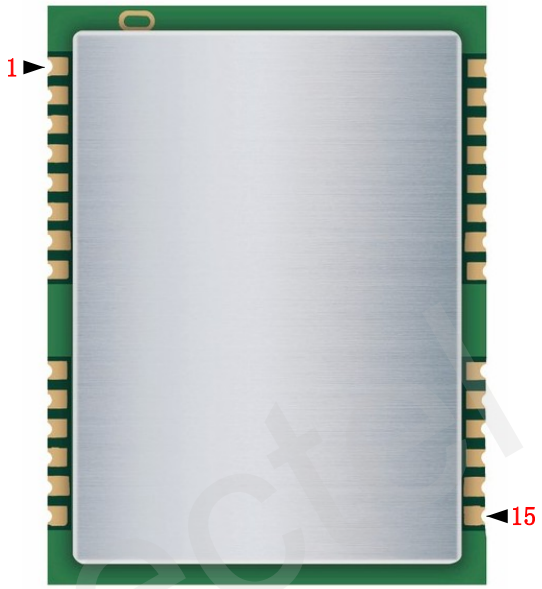

Figure 17: Top view of the module

6.4. Bottom view of the module

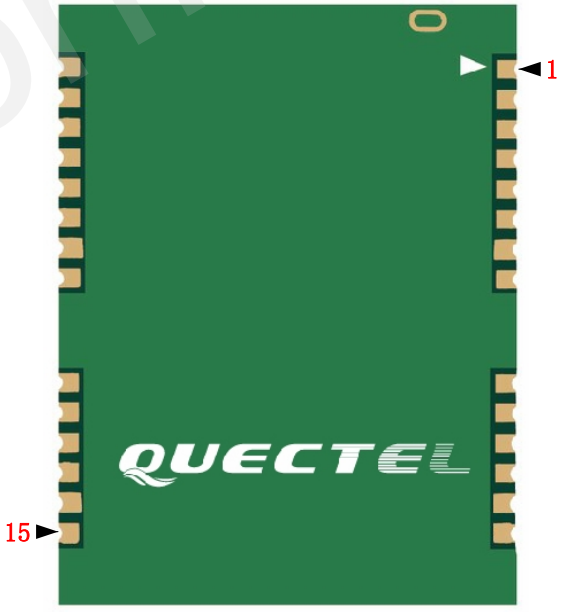

Figure 18: Bottom view of the module

7. Manufacturing

7.1. Assembly and soldering

L16 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 is 130um to ensure sufficient solder volume. Pad openings of paste mask can be increased to ensure proper soldering and solder wetting over pads. It is suggested that peak reflow temperature is 235~245ºC (for SnAg3.0Cu0.5 alloy). Absolute max reflow temperature is 260ºC. To avoid damage to the module when it is repeatedly heated, it is suggested that the module should be mounted after the first panel has been reflowed. The following picture is the actual diagram which we have operated.

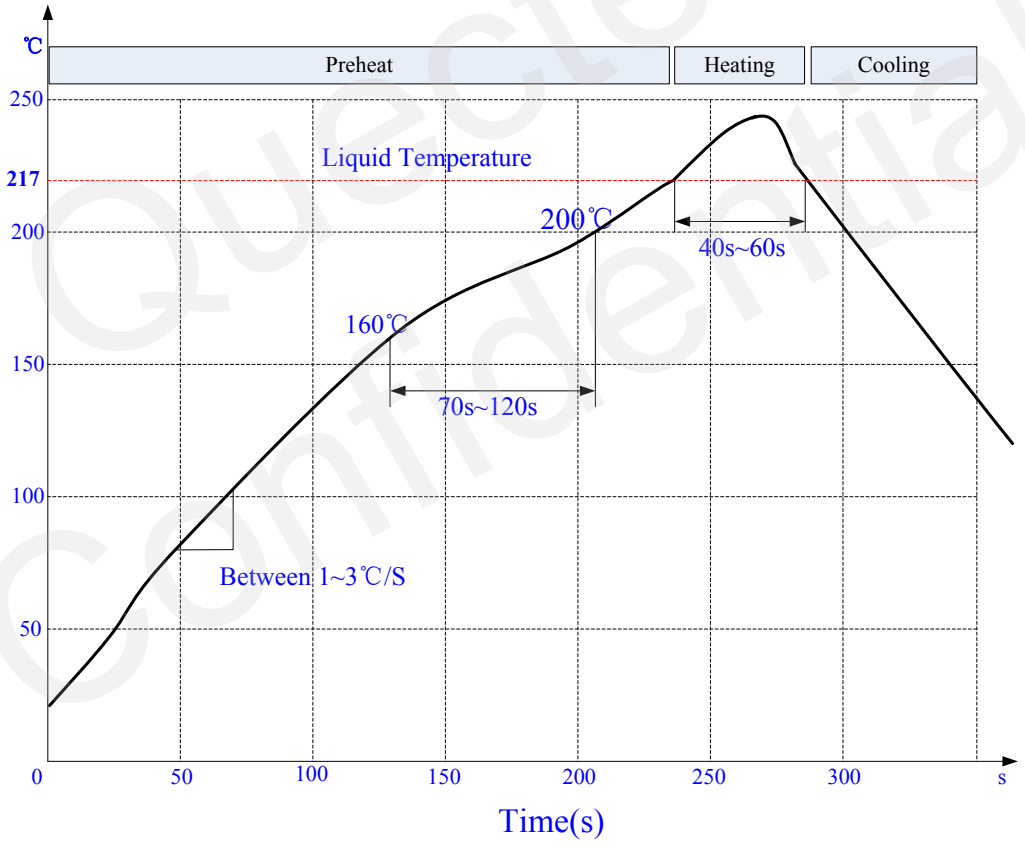

Figure 19: Ramp-soak-spike-reflow of furnace temperature

7.2. Tape and reel

One reel contains 250 modules.

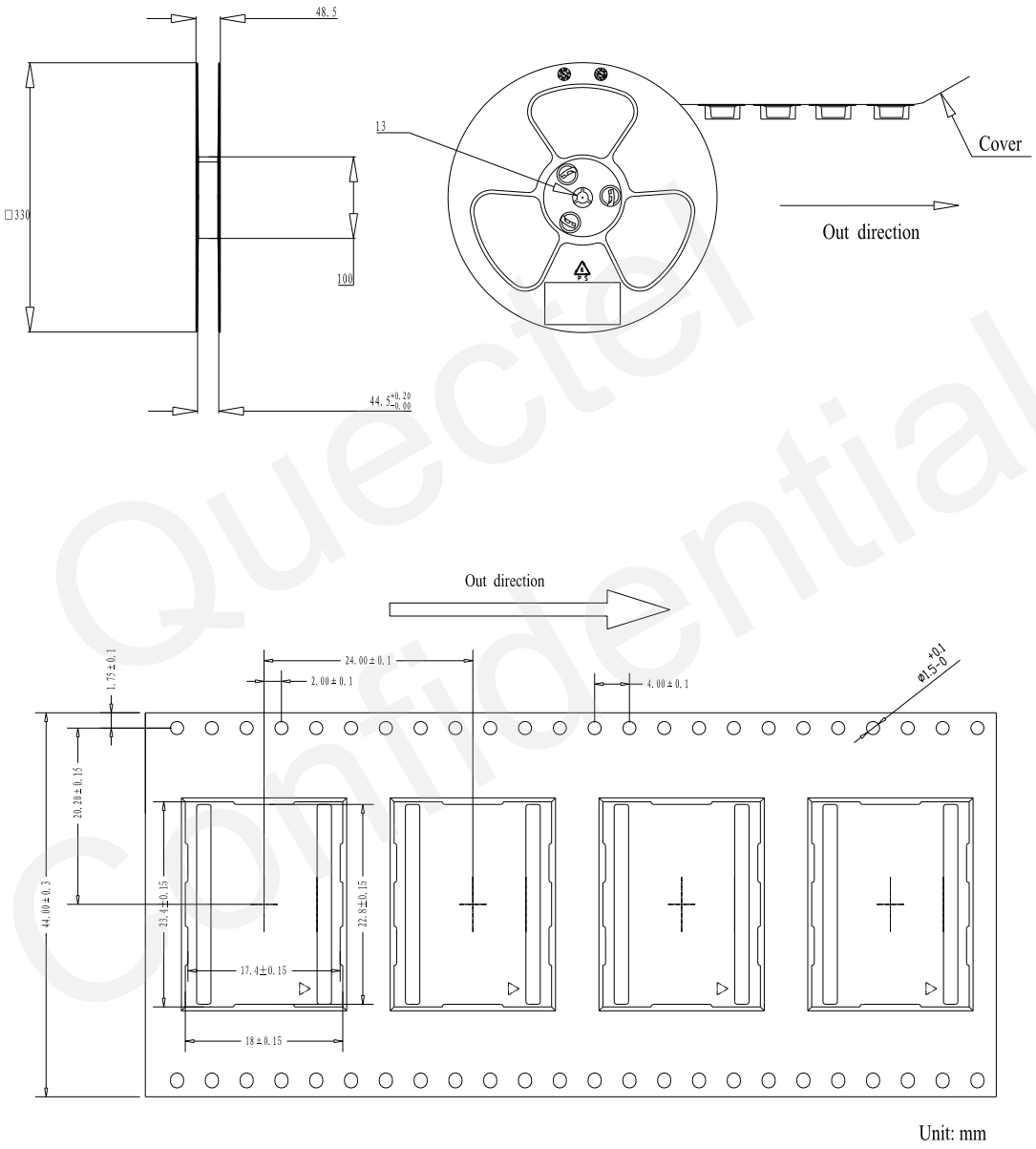

Figure 20: Tape and reel specification

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