Accurate
positioning
22°39'48.37"N 114°02'10.91"E

JS-A56U9D

PRODUCT SPECIFICATION

Data Sheet

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Change History of Revision

Revision	Date	Contents of Revision Change	Remark
V1.0	2019-01-18	First release	Wangzhi
V1.1	2019-05-06	Increase the magnetic compass direction	LPF
V1.2	2021-02-21	Added new magnetic compass	LPF
V1.3	2021-12-16	Added temperature description for farad capacitors	Wang Wei
V1.4	2022-5-5	Firmware 1.13 upgraded to 1.30	Wang Wei

1 Functional description

1.1 Overview

The JS-A56U9D are concurrent GNSS receivers that can receive and track multiple GNSS systems. Owing to the multi-band RF front-end architecture, all four major GNSS constellations (GPS, QZSS ,SBAS, Galileo, GLONASS and BDS) can be received concurrently. All satellites in view can be processed to provide an RTK navigation solution when used with correction data. The JS-A56U9D receiver can be configured for concurrent GPS, GLONASS, Galileo and BDS plus QZSS,SBAS reception, to provide a high performance position reporting and navigation solution. Based on the high performance JS-A56U9D position engine, these receivers provide exceptional sensitivity and acquisition times and interference suppression measures enable reliable positioning even in difficult signal conditions.

1.2 Product features

- Build on high performance GNSS single chip
- 192 search channels and 60 trace channels
- Cold start acquisition sensitivity of -148dBm and -167dBm tracking sensitivity
- Default 1Hz navigation update rate
- Supports GPS,BDS, GLONASS, Galileo and QZSS,SBAS
- Integrated TCXO, LNA, SAW, RTC
- Configurable peripheral IO pins
- Integrated high gain antenna
- Low power consumption and it has intelligent power control mechanism
- Single supply with wide voltage range
- Compact size (56.0*56.0*17.2mm±0.3mm) suitable for space-sensitive application
- Rich hardware interface to support multiple configurations. UART, I2C, RS232, USB
- This module can be equipped with VCM5883 (IST8310) Address(8-bit)=1EH

1.3 Performance

Parameter	Specification	
Receiver type	Multi-band GNSS high precision receiver	
Accuracy of time pulse signal	RMS	30 ns
	99%	60 ns
Frequency of time pulse signal		0.25 Hz to 10 MHz(configurable)
Operational limits[1]	Dynamics	≤4g
	Altitude	80,000m
	Velocity	500 m/s
Velocity accuracy[2]		0.05 m/s
Dynamic heading accuracy		0.3deg

JS-A56U9D performance in different GNSS modes

GNSS[3]	Parameter	GPS+GLO +GAL+BDS	GPS+GLO +GAL	GPS+GLO	GPS +GAL	GPS+BDS	GPS
Acquisition[3]	Cold start	25 s	25 s	25 s	30 s	30 s	30 s
	Hot Start	2 s	2 s	2 s	2 s	2 s	2 s
	Aided Starts[4]	2 s	2 s	2 s	2 s	2 s	2 s
Nav update rate[5]	RTK	7 Hz	10 Hz	14 Hz	15 Hz	13 Hz	20 Hz
	PVT	9 Hz	10 Hz	20 Hz	20 Hz	16 Hz	25 Hz
	RAW	15 Hz	18 Hz	25 Hz	25 Hz	25 Hz	25 Hz
Convergence Time[6]	RTK	< 10 s	< 10 s	< 10 s	< 10 s	< 10 s	< 30 s
Horizontal pos. accuracy	PVT[7]	1.5m CEP	1.5m CEP	1.5m CEP	1.5m CEP	1.5m CEP	1.5m CEP
	SBAS[7]	1.0m CEP	1.0m CEP	1.0m CEP	1.0m CEP	1.0m CEP	1.0m CEP
	RTK[8]	0.01 m + 1 ppm CEP	0.01 m + 1 ppm CEP	0.01 m + 1 ppm CEP	0.01 m +1 ppm CEP	0.01 m + 1 ppm CEP	0.01 m +1 ppm CEP

- 1 Assuming airborne 4g platform
- 2 50% @ 30 m/s for dynamic operation
- 3 GPS used in combination with QZSS and SBAS. All satellites at -130dBm. Measured at room temperature.
- 4 Dependent on the speed and latency of the aiding data connection, commanded starts
- 5 Measured with primary output only, secondary output disabled (default)
- 6 Depends on atmospheric conditions, baseline length, GNSS antenna, multipath conditions, satellite visibility and geometry
- 7 24 hours static
- 8 Measured using 1 km baseline and patch antennas with good ground planes. Does not account for possible antenna phase center offset errors. ppm limited to baselines up to 20 km

1.4 Supported GNSS constellations

The JS-A56U9D GNSS modules are concurrent GNSS receivers that can receive and track multiple GNSS systems. Owing to the multi-band RF front-end architecture, all four major GNSS constellations (GPS, Galileo, GLONASS and BDS) can be received concurrently. All satellites in view can be processed to provide an RTK navigation solution when used with correction data. The JS-A56U9D receiver can be configured for concurrent GPS, GLONASS, Galileo and BDS plus QZSS,SBAS reception. If power consumption is a key factor, then the receiver can be configured for a sub-set of GNSS constellations.

The QZSS system shares the same L1 and L2 frequency bands as GPS and can always be processed in conjunction with GPS.

To take advantage of multi-band signal reception, dedicated hardware preparation must be made during the design-in phase.

The JS-A56U9D supports the GNSS and their signals as shown in Table

GPS	GLONASS	BDS	Galileo
L1C/A (1575.42 MHz)	L1OF (1602 MHz + k*562.5 kHz, k = –7,..., 5, 6)	B1I (1561.098 MHz)	E1-B/C (1575.42 MHz)
L2C (1227.60 MHz)	L2OF (1246 MHz + k*437.5 kHz, k = –7,..., 5, 6)	B2I (1207.140 MHz)	E5b (1207.140 MHz)

1.5 RTK operation

1.5.1 Rover navigation modes

In its default configuration the JS-A56U9D Rover will attempt to provide the best positioning accuracy dependant on the received correction data. It will enter RTK Float mode as soon as it receives an input stream of RTCM messages. Once the Rover has resolved the carrier phase ambiguities it will enter RTK Fixed mode. It is when the Rover is in RTK Fixed mode that the relative accuracies can be expected to be correct to the cm-level.

The reference frame of the reference receiver (or base) must be transformed by the user into the required system being used by their application and mapping system. If comparing the rover position with a reference system the same RTCM stream should be used to ensure the reference and rover are outputting the same position. If doing post processing of a reference system its output must be transformed to same ITRF and datum being used by the rover.

RTK is a differential system where the rover uses the reference datum of the reference station. The

International Terrestrial Reference Frame (ITRF) must be obtained from the reference network and then used to transform the rover position output to match the required reference frame. The rover will not output the position in the local receiver WGS84 (based on ITRF2008) datum, it will match the reference receiver (or base) reference frame. The user application will need to do the transformation for use in a mapping application if it does not use the same reference frame. An offset can occur if this is not done.

If RTCM corrections become unavailable, the cover will run as a standalone precision receiver.

The command of UBX-CFG-DGNSS can be used to specify that the receiver should stay in RTK Float mode and that it should not attempt to fix integer ambiguities.

The current operation mode is indicated by relevant NMEA and UBX-NAV messages.

1.5.2 Base station mode

The RTK rover needs RTCM corrections in order to achieve high precision results. These corrections come from a local receiver (the base), or via a reference receiver. If the two receivers are local to each other they are called the base and rover. If the rover is provided its corrections from a system such as VRS/CORS it is provided its corrections from a service or reference receiver.

The corrections can be supplied to the JS-A56U9D using several interfaces: UART, I2C, RS232, USB.

The link between the rover and the source of the corrections can be any form of wireless link: Cellular,WIFI, Bluetooth, proprietary radio, ISM etc. The user only needs to ensure the RTCM messages arriveat the I/O port selected on the JS-A56U9D. This link will be bi-directional for a VRS services as the rover has to provide its position usually every 30 seconds at least.

Instead of using two local receivers in a base and rover configuration you can use a correction service that can be accessed over the internet. The rover receives corrections in RTCM format that are provided over the internet via a NTRIP service. This requires that an NTRIP client processes the corrections from an NTRIP server on the internet. This client will be implemented on a host application connected to the rover. There are many open source variants of NTRIP clients available that can be implemented on embedded or Windows, Linux, Android systems.

The configuration of the RTCM 3x correction stream must be done according to the following rules:

- All observation messages must be broadcast at the same rate.
- The reference station ID field in the GPS, GLONASS, Galileo, BDS observation messages must be consistent with the reference station ID field in the reference station message otherwise the rover will not be able to

compute its position.

- The RTCM 3x stream must contain the "GLONASS code-phase biases" message (type 1230) or the "R eceiver and Antenna Description" message (type 1033) otherwise the GLONASS ambiguities can only be estimated as float, even in RTK fixed mode. If using a JS-A56U9D as a base, "GLONASS code-phase biases" message (type 1230) must be enabled to be output. For a JS-A56U9D being used as a rover if no RTCM 1230 message is received, or if the reference receiver type reported in RTCM 1033 message is unknown to the JS-A56U9D receiver, the JS-A56U9D rover will only be able to estimate GLONASS ambiguities as float, even in RTK fixed mode. This will result in degraded performance, especially in challenging environments.
- The static reference station message (type 1005 or type 1006) does not need to be broadcast at the same rate as the observation messages however the rover will not be able to compute its position until it has received a valid reference station message.
- The RTCM 3x stream should only contain one type of observation messages per constellation. When using a multi-constellation configuration, all constellations should use the same type of observation messages. Mixing RTK and MSM messages will result in undefined rover behavior.
- If the receiver is configured to output RTCM messages on several ports, they must all have the same RTCM configuration otherwise the MSM multiple message bit might not be set properly.

✌ If you want to use base station mode, please contact us.

1.6 Product Application

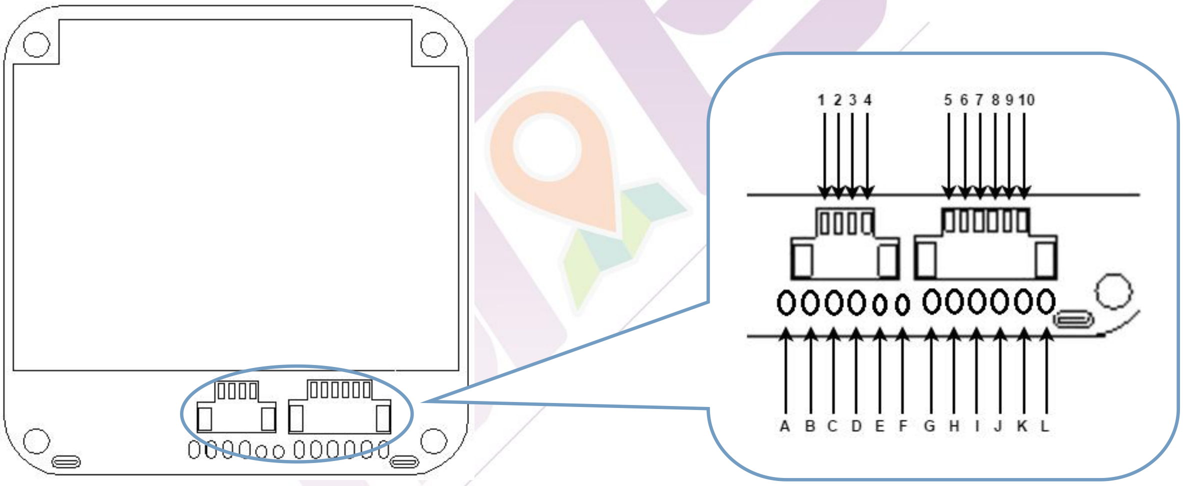
- UAV
- Automotive application
- Precision agriculture
- AVL and Location-Based Services
- Marine Navigation, Fleet Management
- Intelligent logistics scheduling
- Measurement of surveying and mapping
- Personnel protective
- Driving test
- Car navigation and tracking
- Geographic Surveying
- Intelligent robot

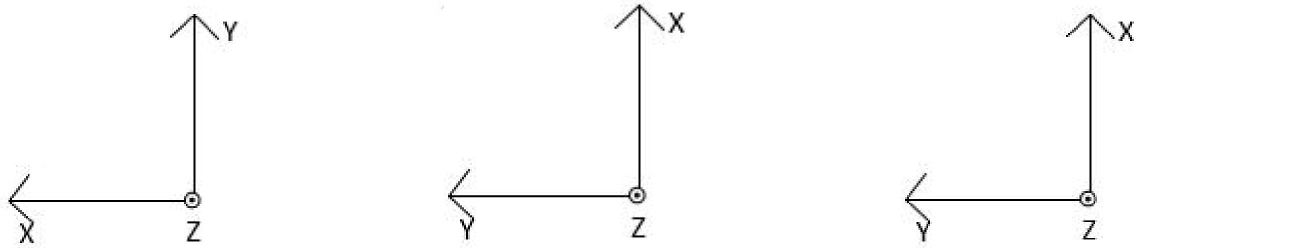
1.7 Protocols

Protocol	Type
NMEA 0183 V4.11/ V4.0/V4.1	Input/output, ASCII
RTCM 3.3	Input/output, binary
UBX	Input/output, binary, u-blox proprietary

2 Pin definition

2.1 Pin assignment





IST8310(Default)
Magnetic compass direction

QMC5883L
Magnetic compass direction

VCM5883
Magnetic compass direction

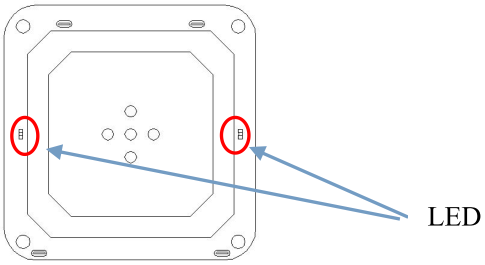
No.		Name	I/O	Description
A	1	RX2	I	Serial Port(UART 2: dedicated for RTCM3 corrections and NMEA. No UBX protocol is supported)
B	2	TX2	O	Serial Port(UART 2: dedicated for RTCM3 corrections and NMEA. No UBX protocol is supported)
C	3	GND	G	Ground
D	4	G-ST	O	Geofence status, user defined
E	--	RX	I	GPS RX Test
F	--	TX	O	GPS TX Test
G	5	SCL	I/O	I2C Clock (keep open if not used)
H	6	RX/P	I	Serial Port(UART 1:primary host communications)
I	7	TX/M	O	Serial Port(UART 1:primary host communications)
J	8	GND	G	Ground
K	9	VCC	P	Main Supply
L	10	SDA	I/O	I2C Data (keep open if not used)

✌1 H(6),I(7) support UBX,RTCM,NEMA communication

✌2 A(1),B(2) only support RTCM communication

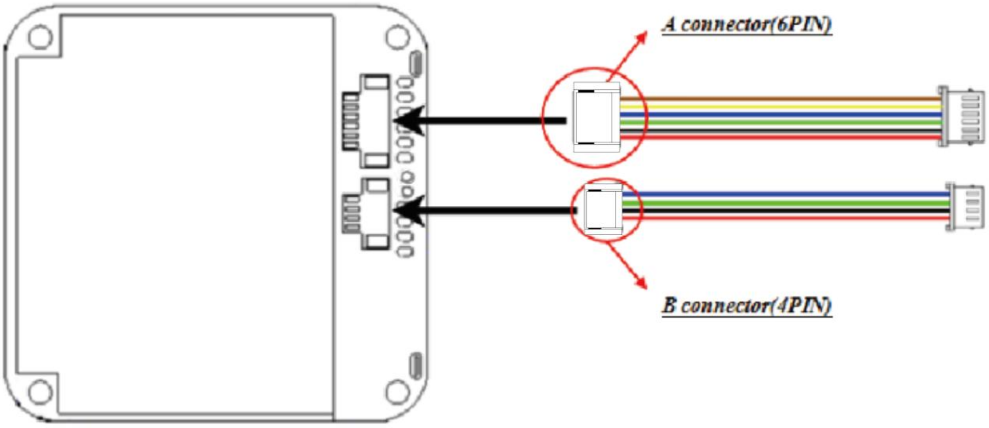
✌3 Magnetic compass model: The geomagnetic model is VCM5883(Default), VCM5883_MS_ADDRESS 0x0C, The geomagnetic model is IST8310(Default) , IST8310_MS_ADDRESS 0x0F ,The geomagnetic model is QMC5883L ,QMC5883L_MS_ADDRESS 0x0D(Discontinued)

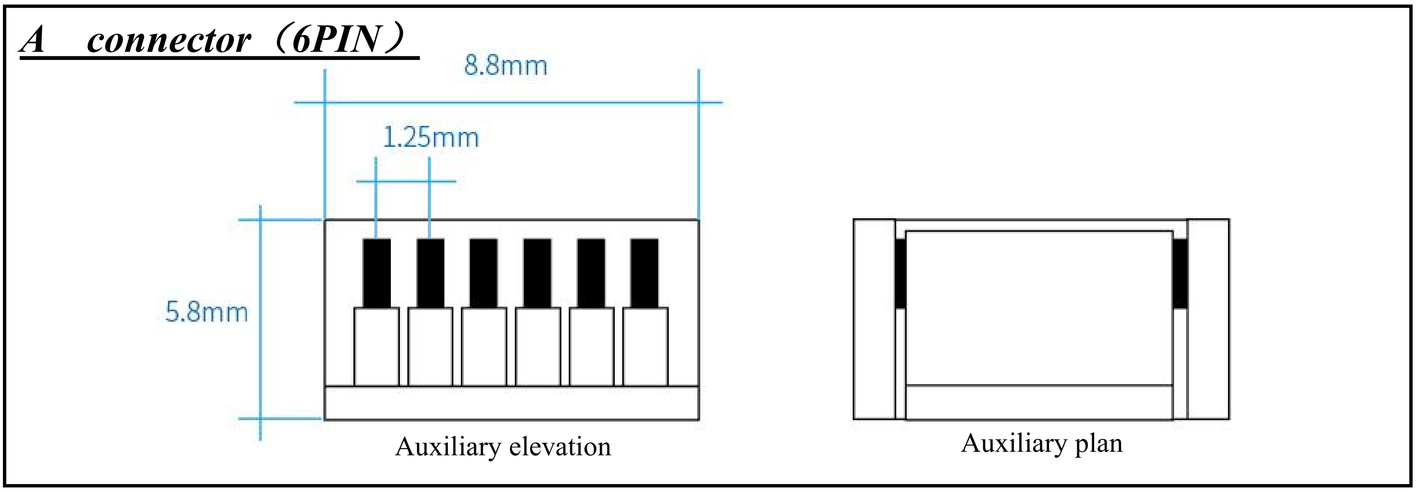
2.2 LED Indicator Status



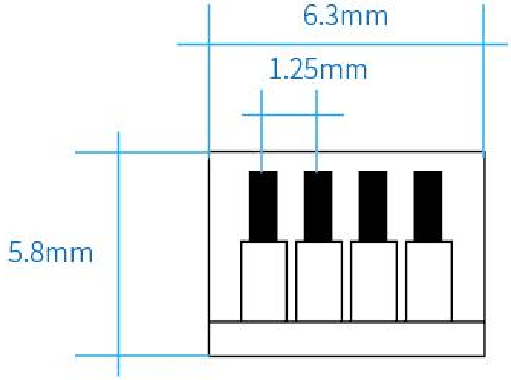
LED Indicator	JS-A56U9D is in working condition
Long bright	Fixed state
Twinkle	Receive RTCM data
Extinguish	No RTCM data

2.3 Connector Instructions

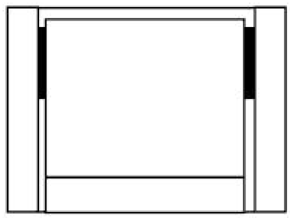




B connector (4PIN)



Auxiliary elevation



Auxiliary plan

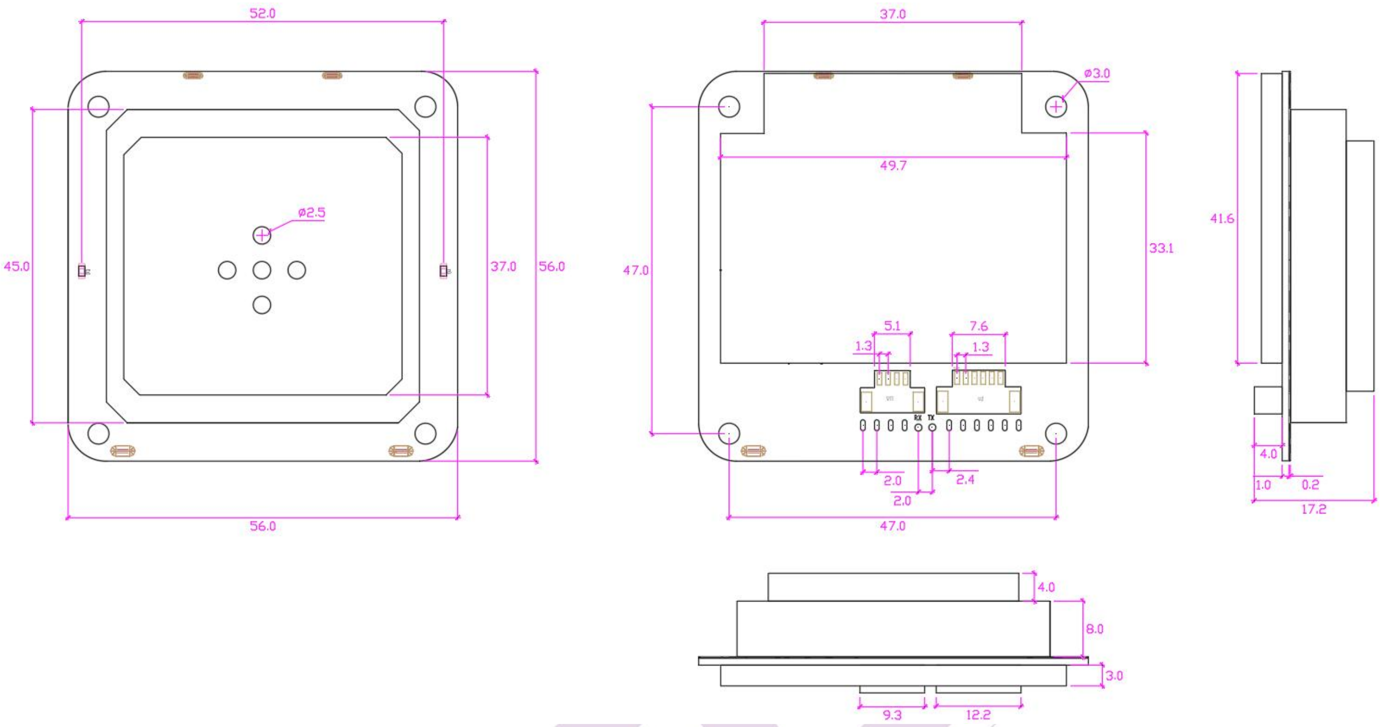
3 Electrical specifications

	Symbol	Min	Type	Max	Units
Power supply voltage	VCC	5.0	5.0	12.0	V
Average supply current	Acquisition	89@5.0V	91@5.0V	100@5.0V	mA
	Tracking	87@5.0V	90@5.0V	95@5.0V	mA
Backup battery			0.07		F
Digital IO voltage	Div	3.3		3.3	V
Storage temperature	Tstg	-40		85	℃
Operating temperature[1]	Topr	-40		85	℃
Farah capacitance[2]	Tstg	-25		60	℃
Humidity				95	%

1 The temperature range is the operating temperature range without the Farad capacitor

2 Hot start cannot be carried out when the temperature is below -20℃ or above 60℃

4 Mechanical specifica



Units: mm　　Error: ±0.5mm

5 Interface configuration selections

5.1 Interfaces description

The JS-A56U9D module include one UART (Defined by default) RS232,USB interface, which can be used for communication to a host. You can choose any one of the output interface output data, It supports configurable baud rates.

5.2 Interface configuration selection

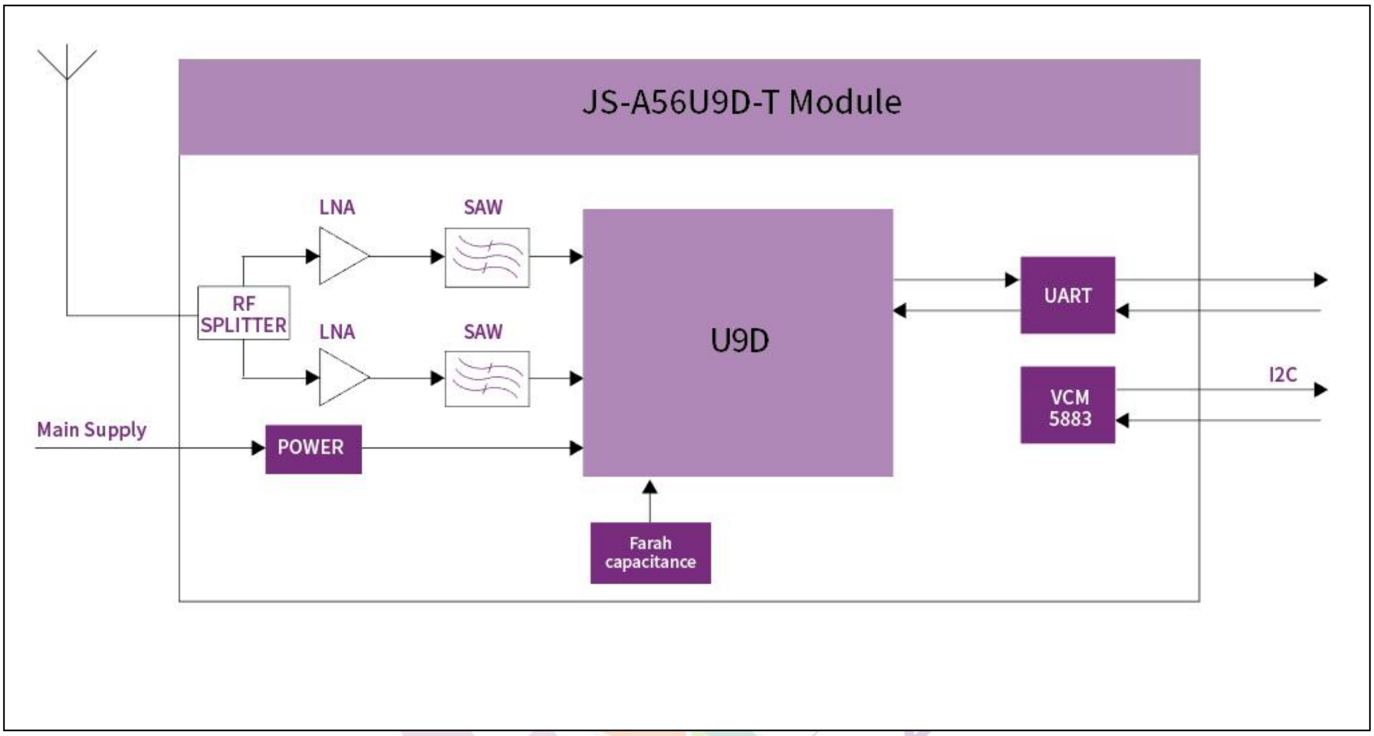
The JS-A56U9D series GNSS module can be selected based on the corresponding interface output. There are mainly the following options. The relevant sensor is an optional part that can be selected according to actual needs.

NAME	TTL	RS232	USB	QMC5883L	IST8310
JS-A56U9D-T	√	--	--	optional	optional
JS-A56U9D-R	--	√	--	optional	optional
JS-A56U9D-U	--	--	√	optional	optional

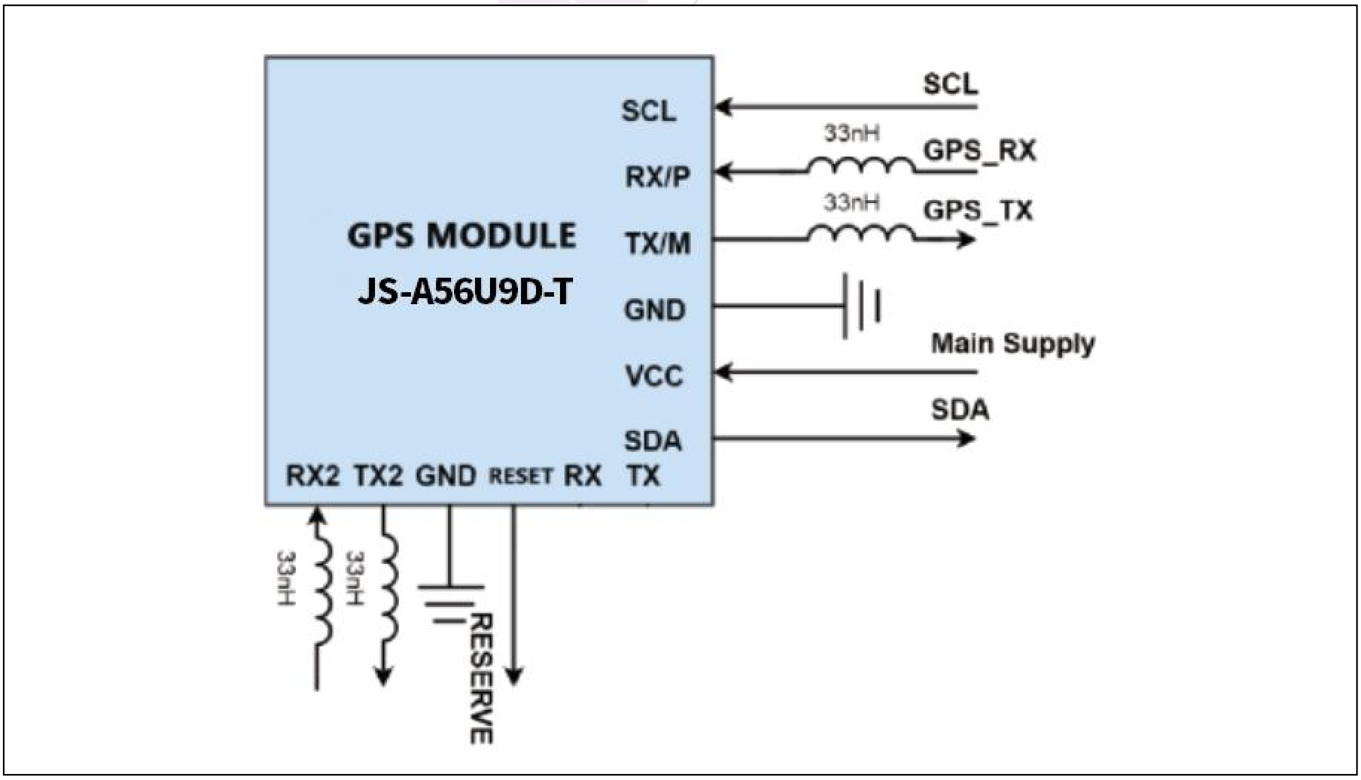
5.2.1 JS-A56U9D-T

The series uses the UART as a statement output method, which includes a geomagnetic sensor . The specific block diagram is as follows:

Block Diagram



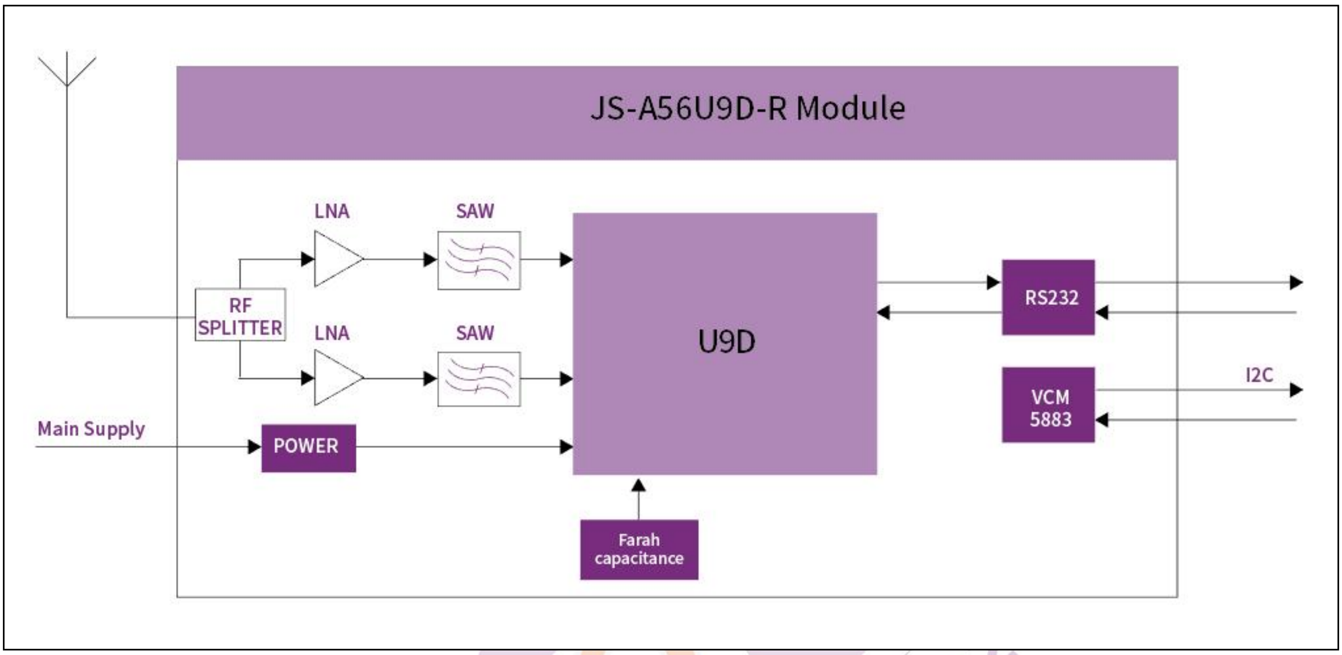
Application Circuit



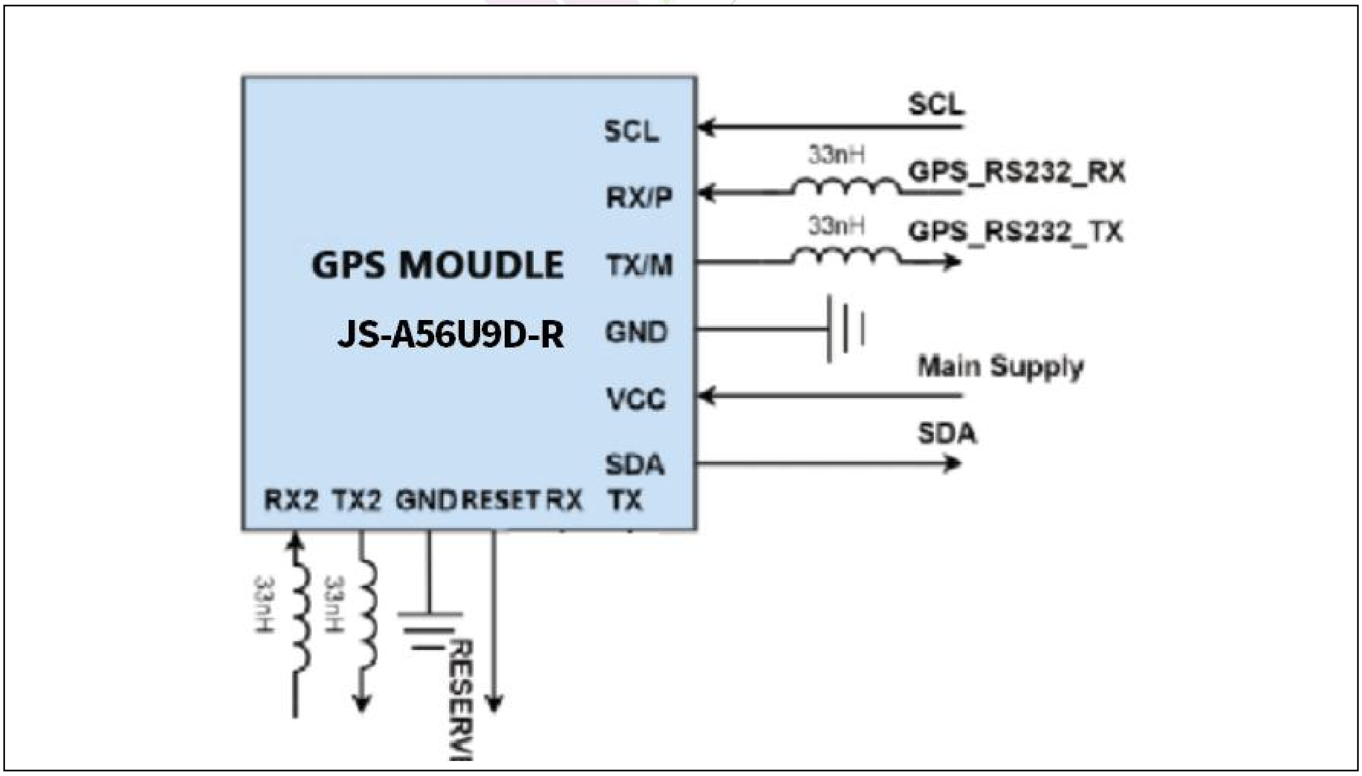
5.2.2 JS-A56U9D-R

The series uses RS232 as a statement output method, which includes a geomagnetic sensor .The specific block diagram is as follows:

Block Diagram



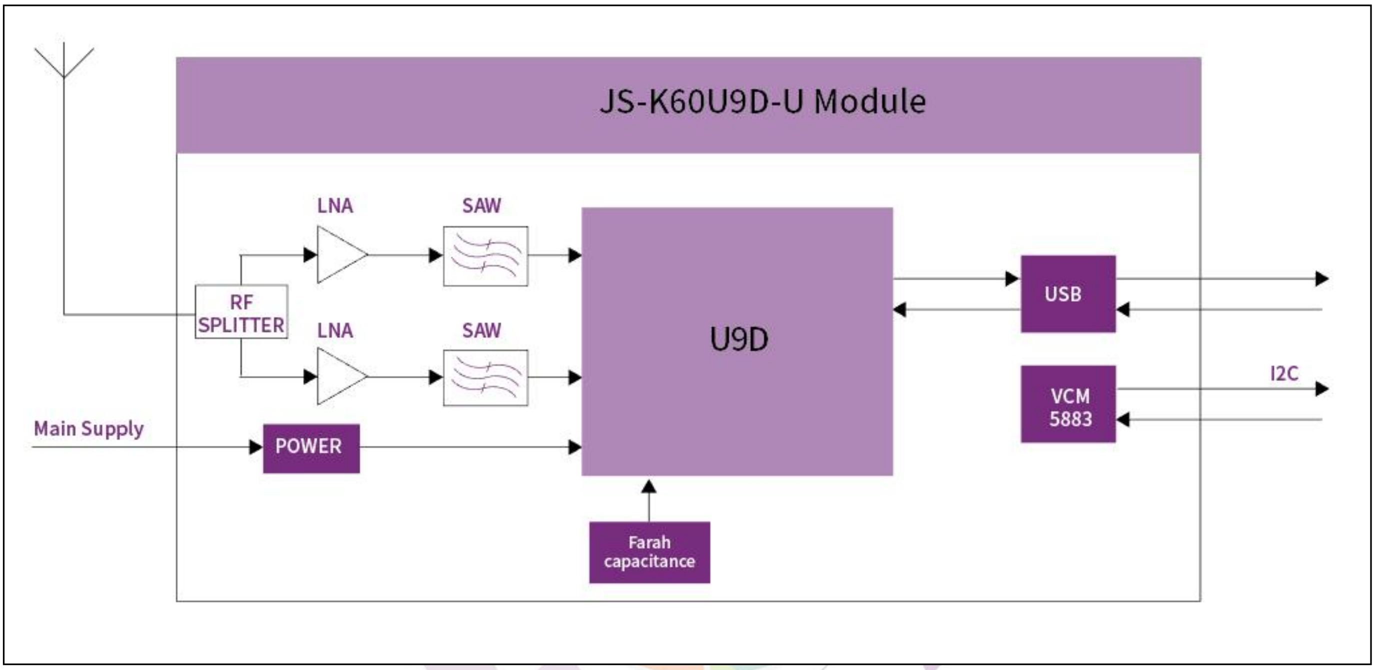
Application Circuit



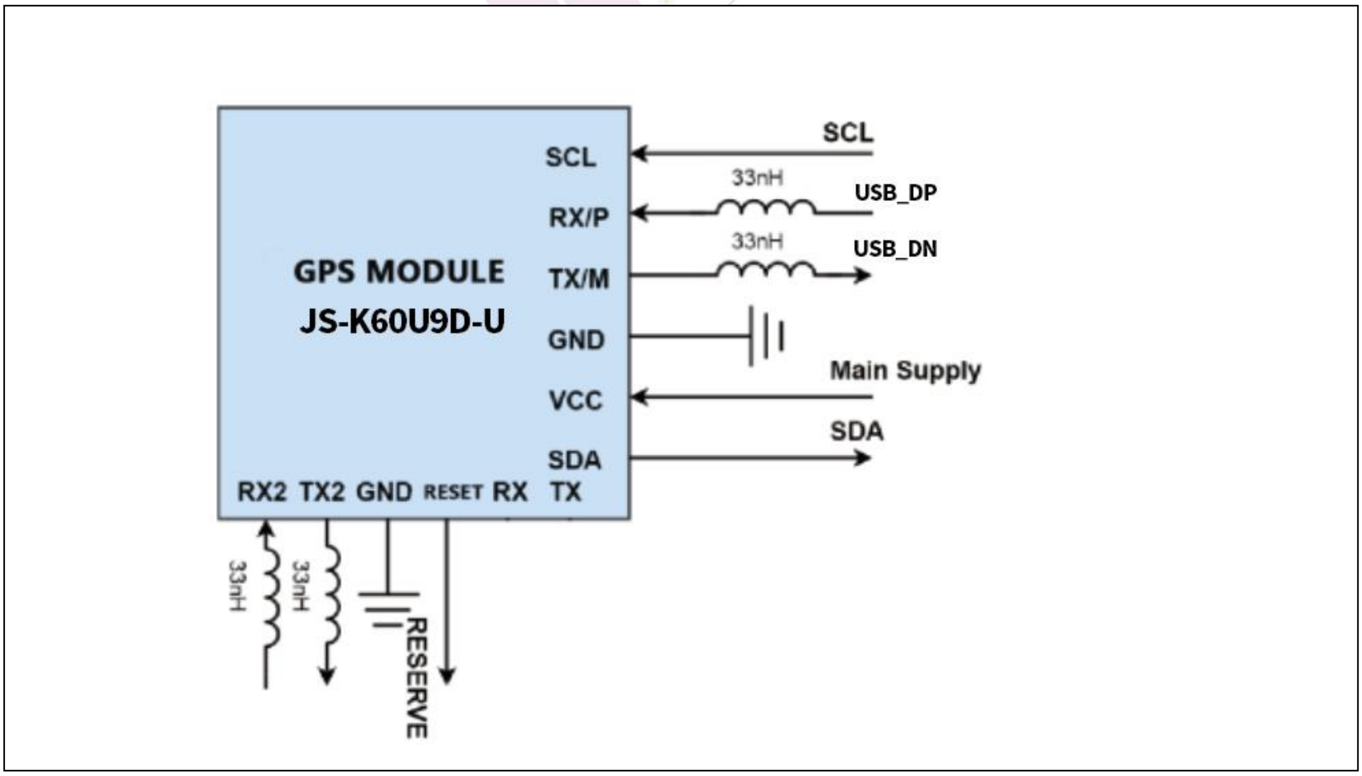
5.2.3 JS-A56U9D-U

The series uses USB as a statement output method, which includes a geomagnetic sensor .The specific block diagram is as follows:

Block Diagram



Application Circuit



6 UART interface

There are two UART interfaces: UART1 and UART2. UART1 is the primary host communications interface while UART2 is dedicated for RTCM3 corrections and NMEA. No UBX protocol is supported. UART1 and UART2 operate up to and including a speed of 921600 baud. No hardware flow control on UART1 and UART2 is supported.

UART1 is enabled by default if D_SEL = 1 or open.

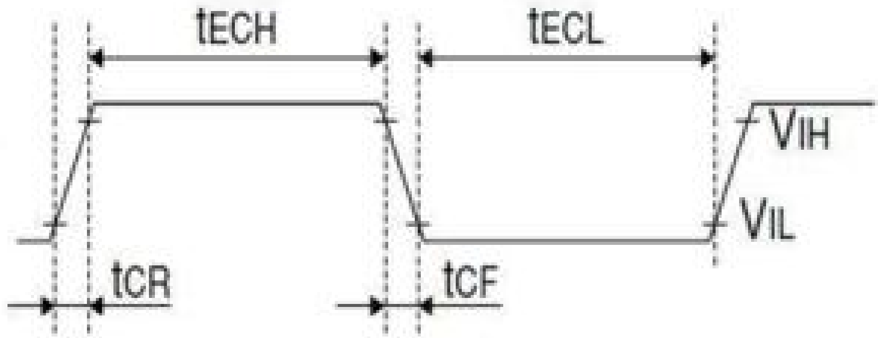


Figure: JS-A56U9D high precision receiver UART timing specifications

Symbol	Symbol	Min	Max	Units
VIL	LOW-level input voltage	0	0.2VCC	V
VIH	HIGH-level input voltage	0.7VCC	VCC+0.3	mA
tECH	HIGH period of External data input	0	0.4	µs
tECL	Low period of External data input			µs
Ru	Baudrate	9600	921600	bps
tCR	Rise time of Data	-40	5	ns
tCF	Fall time of Data	-40	5	ns

Table:JS-A56U9D UART timings and specifications

7 ROHS

7.1 RoHS Compliance

This product is RoHS compliance