A16-1612 Series Module Data Sheet

A16-1612 GNSS Module

Version: 1.3

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CONTENT

1 Introduction

The **A16-1612** module is a high sensitivity, low power consumption and very compact Surface Mount Device (SMD), and it support Various location and navigation applications, including autonomous GPS/Galileo/GLONASS/BD2/QZSS/SBAS (including WAAS, EGNOS, and MSAS),DGPS and A-GPS. **A16-1612** is designed to allow quick and easy integration into GNSS-related applications, especially for compact size devices, such as:

- PDA, Pocket PC and other computing devices
- Fleet Management / Asset Tracking
- AVL and Location-Based Services
- Hand-held Device for Personal Positioning and Navigation

2 A16-1612 Overview

Key Features

- Small footprint: 16.0x12.2x2.5mm, 24-pin LCC Package
- 12 multi-tone active interference cancellers and jamming elimination
- Indoor and outdoor multi-path detection and compensation
- Advanced software features
  1. EASY™ self-generated orbit prediction for instant positioning fix
  2. AGPS support Fast TTFF(EPO orbit prediction)
  3. Alwayslocate™ advanced location awareness technology for power saving
  4. Support logger function
  5. Support active interference cancellation (AIC)
- Pulse-per-second(PPS) GNSS time reference

  Adjustable duty cycle

  Typical accuracy: ±20ns
- Interface

  UART0(default)/UART1(Special version configurable)
- Operation temperature: -40 ~ +85℃

- Accuracy <2.5m CEP
- RoHS compliant

The module provides complete signal processing from antenna input to host port in either NMEA messages. The module requires 3.0V~4.3V power supply. The host port is configurable to UART. Host data and I/O signal Levels are 2.85V CMOS compatible.

2.1 Functional Diagram

The following figure shows a functional diagram of the A16-1612 and illustrates the mainly functional parts:

- The GNSS chip
- SAW filter
- LNA
- The antenna interface
- The communication interface
- The control signals

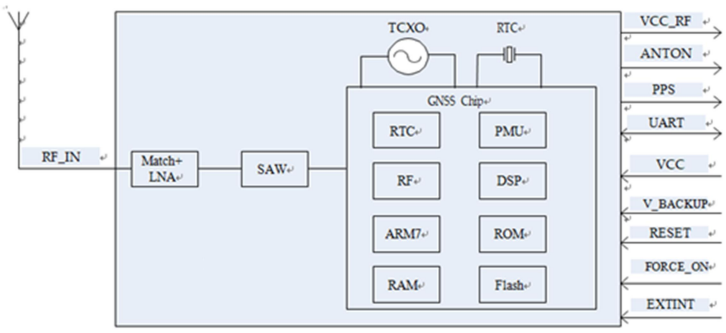


Figure 2-1 A16-1612 functional diagram

2.2 GNSS performance

Table 2-1 GNSS Performance

Item	Parameter	Description	Performance			
			Min	Type	Max	Unit
A16-1612 Series	Horizontal Position Accuracy(1)	Autonomous		<2.5		m
	Velocity Accuracy(2)	Without Aid		0.1		m/s
	Acceleration Accuracy	Without Aid		0.1		m/s^2
	Timing Accuracy			20		ns
	Dynamic Performance	Maximum Altitude			18000	m
		Maximum Velocity			515	m/s
		Maximum Acceleration			4	G
	GPS Time To First Fix(3)	Hot start		<1		s
		Warm start		30		s
		Cold start		35		s
	BD2 Time To First Fix(3)	Hot start		<1		s
		Warm start		29		s
		Cold start		36		s
	GPS+Glonass Time To First Fix(3)	Hot start		<1		s
		Warm start		23		s
		Cold start		25		s
	A-GPS TTFF With EASY™	Hot start		<1		s
		Warm start		1.5		s
		Cold start		15		s
	A-GPS TTFF (EPO mode)	Hot start		<1		s
		Warm start		2		s
		Cold start		14		s
	GPS Sensitivity(3)	Autonomous acquisition (cold start)		-148		dBm
		Re-acquisition		-160		dBm
		Tracking		-165		dBm
	BD2 Sensitivity(3)	Autonomous acquisition (cold start)		-142		dBm
		Re-acquisition		-155		dBm
		Tracking		-160		dBm
	GPS+BD2 Sensitivity(3)	Autonomous acquisition (cold start)		-148		dBm
		Re-acquisition		-160		dBm
		Tracking		-165		dBm

	GPS+GLONASS Sensitivity(3)	Autonomous acquisition (cold start)		-148		dBm
		Re-acquisition		-160		dBm
		Tracking		-165		dBm
	Receiver	Channels		132		
		Update rate		1	10	Hz
		Tracking L1, CA Code Protocol support NMEA,PMTK				
	GPS Power consumption(4)	Acquisition		20		mA
		Continuous tracking		19		mA
		Sleep current		340		uA
		Backup current		14		uA
	BD2 Power consumption(4)	Acquisition		23		mA
		Continuous tracking		21		mA
		Sleep current		340		uA
		Backup current		14		uA
	GPS+BD2 Power consumption(4)	Acquisition		30		mA
		Continuous tracking		26		mA
		Sleep current		340		uA
		Backup current		14		uA
	GPS+GLONASS Power consumption(4)	Acquisition		27		mA
		Continuous tracking		22		mA
		Sleep current		340		uA
		Backup current		14		uA

(1) 50% 24hr static, -130dBm

(2) 50% at 30m/s

(3) –130dBm, GPS&Glonass&BD2 mode

(4) Single Power supply 3.3V under GPS/BD2/ GPS+GLONASS/GPS+BD2 signal@-130dBm

(5) Single Power supply 3.3V under GPS/BD2/ GPS+GLONASS/GPS+BD2 signal

3 Package Information

3.1 Pin out diagram

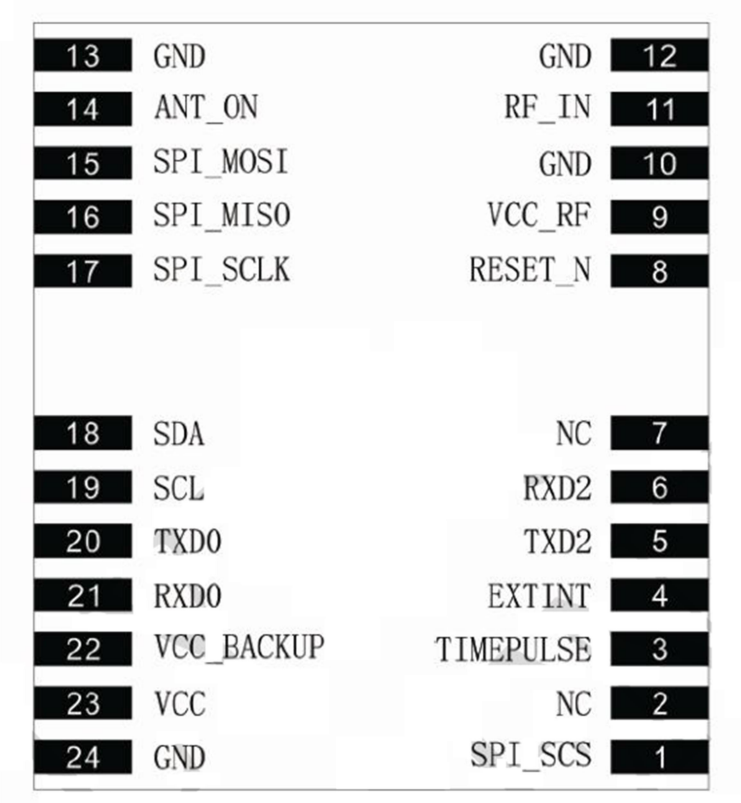


Figure3-1 Pin out diagram (TOP View)

3.2 Pin Description

Table 3-1 Pin description

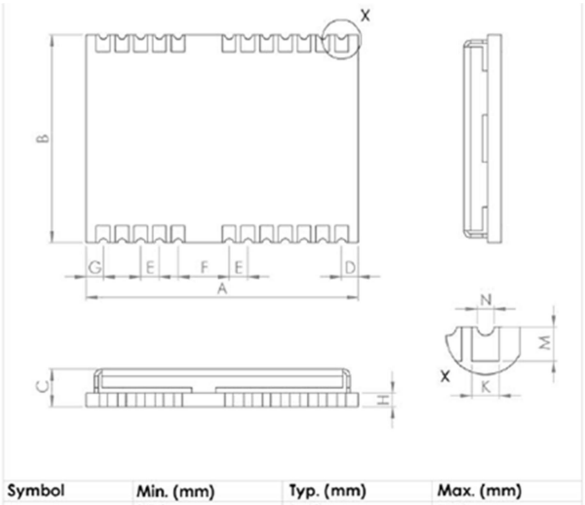
Pin Name	Pin Numbers	I/O	Description	Comment
Power Supply				
VCC	23	I	Main Power input, Typical:3.3V Recommend LDO as VCC, ripple rejection:>60dB@1kHz	Add 4.7uF Capacitor to this pin for decoupling
ANTON	14	O	2.8V power output supply for active	If unused, Keep open

			Antenna or external LNA control pin for power save	
VCC_RF	9	O	Power supply for active antenna or external LNA	If unused, Keep open
VCC_BACK	22	I	The backup battery input power Supply for RTC 2.-~4.3V, Typical 3.0V	If unused, Keep open
GND	10 12 13 24		Ground	
Host port interface				
TXD0	20	O	Serial data output of NMEA	
RXD0	21	I	Serial data input for firmware update	
TXD2	5	I/O	Serial output as RTCM	
RXD2	6	I	Serial input as RTCM	
SDA	18	I/O	Serial data output of NAME	Requires a special version, please contact Just Right
SCL	19	I	Serial data input of NAME	
SPI_SCS	1	I	Chip select	Requires a special version, please contact Just Right
SPI_MOSI	15	I	Master out line, Slave in line	
SPI_MISO	16	O	Master in line, Slave out line	
SPI_SCLK	17	I	Chip clock	
GPIOS				
TIMEPLUS	3	O	1PPS Time Mark output 2.85V CMOS level, timing pulse related to receiver time	If unused, Keep open
RESET_N	8	I	Reset input, active low, default pull-up	If unused, Keep open

EXIIN	4	I	This interrupt source could act as wake up event during power saving mode.	If unused, Keep open
RF interface				
RF_IN	11	I	GNSS antenna port	Impendence must be Controlled to 50ohm
Other interface				
NC	2 7		Not Connected	

3.3 Package Dimensions

Following figure shows the mechanical dimensions of A16-1612 series (top view, side view and bottom view).



Symbol	Min. (mm)	Typ. (mm)	Max. (mm)
A	15.9	16.0	16.6
B	12.1	12.2	12.3
C	2.2	2.4	2.6
D	0.9	1.0	1.3
E	1.0	1.1	1.2
F	2.9	3.0	3.1
G	0.9	1.0	1.3
H		0.82	
K	0.7	0.8	0.9
M	0.8	0.9	1.0
N	0.4	0.5	0.6

Figure 3-2 Mechanical dimensions (Unit:mm)

3.4 Recommended PCB Decal

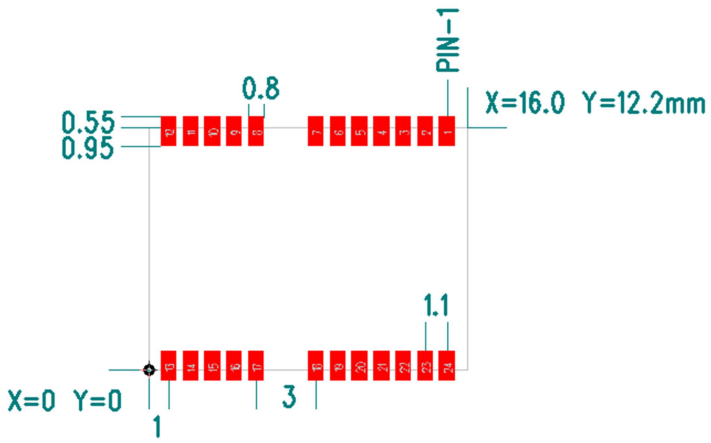


Figure 3-3 Recommended PCB decal (TOP VIEW) (Unit: mm)

4 Application Interface

4.1 Power Management

4.1.1 Power Input

The power supply range of A16-1612 series is from 3.0V to 4.3V. The power supply should be able to provide sufficient current up to 100mA.

The power supply range of VCC_BACKUP is from 2.0V to 4.3V, typical 3.0V, suggesting customer keep the VCC_BACKUP supply active all the time, module will perform a quick start every time it is power-on.

Note: IF VCC_BACKUP power was not reserved, the GNSS module will perform a lengthy cold start every time it is powered-on because previous satellite information is not retained and needs to be re-transmitted

4.1.2 Starting A16-1612 Series

When power is first applied, A16-1612 series goes into operation mode.

4.1.3 Verification of A16-1612 Series Start

System activity indication depends upon the chosen serial interface: When it is activated, A16-1612 series will output messages at the selected UART speed and message types.

4.1.4 Power Saving Modes

A16-1612 series supports operating modes for reduced average power consumption like standby mode, backup mode, periodic mode, and AlwaysLocateTM mode.

- **Sleep mode:** In this mode the receiver stays at full on power state. When this mode that can be wake up by the host sends the command through the communication interface. It also describe

called Standby mode.

Note:

using the PMTK161 command "$PMTK161,0*28" Stop mode;

"$PMTK161,1*29" into Sleep mode; but also to stop the NMEA output; Send any character, which can wake up A16-1612 series module after the longer dormancy.

'0' = Stop mode, stop NMEA output, the receiver stays at ultra low power state '1' = Sleep mode, stop NMEA output, the receiver stays at full on power state

● **AlwaysLocate™ mode**: AlwaysLocateTM is an intelligent controller of A16-1612 series periodic mode. Depending on the environment and motion conditions, A16-1612 series can adaptive adjust the on/off time to achieve balance of positioning accuracy and power consumption.

Note:

AlwaysLocateTM Standby

"$PMTK225,0 " "$PMTK225,8 "

AlwaysLocateTM Backup"

"$PMTK225,0 " "$PMTK225,9"

“8”: AlwaysLocateTM standby mode

“9”: AlwaysLocateTM backup mode

Note: the modes mentioned above are operated by PMTK commands, users can refer to document [1] for more information.

4.1.5 Operating Mode

Table 4-1 Power supply and clock state according to operation mode

Mode	VCC	VCC_BACKUP	Internal LDO	Main clock	RTC clock
Full on	on	on	on	on	on
Sleep	on	on	on	off	on
Backup	off	on	off	off	on

4.1.5.1 Full on Mode

The module will enter full on mode after first power up with factory configuration settings. Power consumption will vary depending on the amount of satellite acquisitions and number of satellites in track.

4.1.5.2 Sleep Mode

Sleep mode means a low quiescent (340uA type.) power state, non-volatile RTC, and backup RAM block is powered on. Other internal blocks like digital baseband and RF are internally powered off. The power supply input VCC shall be kept active all the time, even during sleep mode.

Entering into sleep mode is sent PMTK command through the communication interface by host side.

Waking up from sleep mode is sent any byte through the communication interface by host side.

4.1.5.3 Backup Mode

This connects to the backup power of the module. Power source (such as battery or cap) connected to VCC_BACKUP pin will help the chipset in keeping its internal RTC running when the VCC power source is turned off. The voltage should be kept between 2.0~4.3V, Typical 3.0V. It is recommended to power VCC_BACKUP through a battery, which can ensure the module EASYTM and improves TTFF after next restart.

The VCC_BACKUP power should be kept active all the time, the module will perform a quick start every time it is power-on.

You can send PMTK command to enter into backup mode through the communication interface. The only way to wake up the module from backup mode is pulling the FORCE_ON high.

4.1.5.4 Periodic Mode

In this mode the A16-1612 series enters tracking and sleep or Backup mode according to the interval configured by users in the commands.

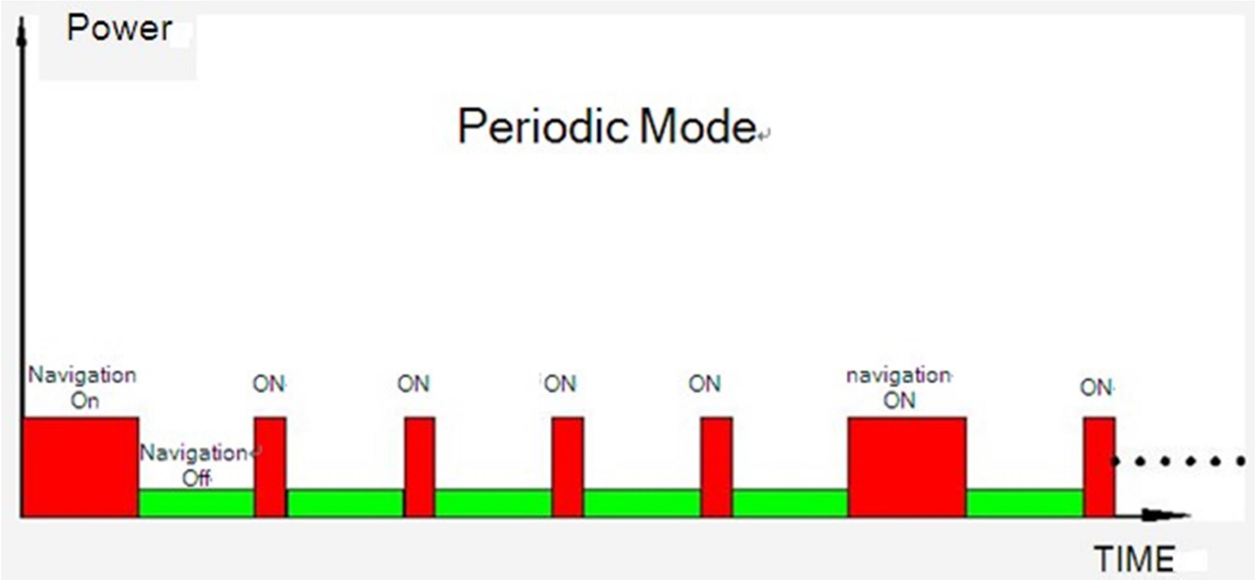


Figure 4-1 Periodic mode

4.1.6 VCC_RF

Power supply for active antenna or external LNA, the power domain is VCC.

4.1.7 ANTON

2.8V power output for active antenna or external LNA control pin for power save. See the following table for details.

Table 4-2 ANTON status

Mode	ANTON
Full on	2.8V power output
Sleep	no power output
Backup	no power output

4.2 UART Interface

A16-1612 series includes two UART (UART0 and UART1) interface for serial communication. The UART0 is as NMEA output and PMTK command input. The receiver (RXD0) and transmitter (TXD0) side of every port contains a 16-byte FIFO and has 256 bytes URAM. UART can provide the developers signal or message outputs. The baud rates are selectable and ranging from 9.6 to 115.2kbps through PMTK commands. UART1 is as RTCM input.

4.3 RESET Input

The RESET pin (active low) is used to reset the system, normally external control of RESET is not necessary. The signal can be left floating, if not used.

When RESET signal is used, it will force volatile RAM data loss. Note that Non-Volatile backup RAM content is not cleared and thus fast TTFF is possible. The input has internal pull up.

4.4 PPS Output

The PPS pin outputs one pulse-per-second (1PPS) pulse signal for precise timing purposes. The PPS signal can be provided through designated output pin for many external applications. This pulse is not only limited to be active every second but also allowed to set the required duration, frequency, and active high/low by programming user-defined settings.

The following figure is the typical application of the PPS function.

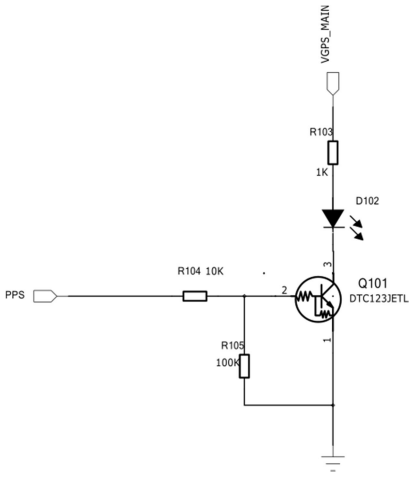


Figure 4-2 PPS application circuit

4.5 AGPS and DGPS

A-GPS is the meaning of Assisted GPS, which is a system that can improve the startup performance and time-to-first-fix (TTFF) of a GPS satellite-based positioning under certain conditions. A16-1612 series module supports EPO file, EASYTM mode.

4.5.1 EPO

The A16-1612 series supports the EPO (Extended Prediction Orbit) data service. The EPO data service is supporting 7/14/30-day orbit predictions to customers. It needs occasional download from EPO server. Supply of aiding information like ephemeris, almanac, rough last position and time and satellite status and an optional time synchronization signal will reduce time to first fix significantly and improve the acquisition sensitivity.

The user should update the EPO files from the EPO server daily through the internet. Then the EPO data should send to the A16-1612 series by the HOST side. A16-1612 series has the short cold TTFF and warm TTFF, when the A-GPS is used.

Note: For more information about EPO, please contact MOBILETEK sales. Users can refer to document [2] for more information

4.5.2 EASYTM MODE

EASYTM is the abbreviation of Embedded Assist System, it works as embedded firmware which accelerates TTFF by predicting satellite navigation messages from received ephemeris.

No additional computing interval for EASYTM task. EASYTM is efficiently scheduled and computed in free time of every second after GNSS navigation solution.

EASYTM function is conceptually designed to automatically engage for predicting after first receiving the broadcast ephemeris. After a while (generally tens of seconds), 3-day extensions will be completely generated then all EASYTM functions will be maintained at a sleep condition. EASYTM assistance is going to be engaged when the GNSS requests in new TTFF condition or re-generates again with another new received ephemeris. Meanwhile, TTFF will be benefited by EASYTM assistance.

Note: EASYTM function is default open and can be closed by PMTK command.

4.5.3 DGPS

SBAS is the abbreviation of Satellite Based Augmentation System. The SBAS concept is based on the transmission of differential corrections and integrity messages for navigation satellites that are within sight of a network of reference stations deployed across an entire continent. SBAS messages are broadcast via geostationary satellites able to cover vast areas.

Several countries have implemented their own satellite-based augmentation system. Europe has the European Geostationary Navigation Overlay Service (EGNOS) which covers Western Europe and beyond. The USA has its Wide Area Augmentation System (WAAS). Japan is covered by its

Multi-functional Satellite Augmentation System (MSAS). India has launched its own SBAS program named GPS and GEO Augmented Navigation (GAGAN) to cover the Indian subcontinent.

A16-1612 series module supports SBAS and RTCM, but only one mode can be applied at one time, and SBAS is the default feature, customers who want to apply RTCM in the design can contact JUSTRIGHT sales for supporting

4.6 GNSS Antenna

The antenna is a critical item for successful GNSS reception in a weak signal environment. Proper choice of the antenna will ensure that satellites at all elevations can be seen, and therefore, accurate fix measurements are obtained.

User can choose an appropriate antenna for better performance, like active antenna or passive antenna.

4.6.1 Antenna Interface

The A16-1612 series receives L1 band signals from GPS and L1 band signals from Glonass or B1 band signals from BD2 satellites at a nominal frequency of 1558～1607MHz .The RF signal is connected to the GNSS_ANT pin. And the trace from the GNSS_ANT pin to antenna should be 50Ω controlled.

To suit the physical design of individual applications the RF interface pad can lead to two alternatives: Recommended approach: solderable RF coaxial cable assembly antenna connector, such as

- HRS' U.FL-R-SMT connector or I-PEX's 20279-001E-01 RF connector.
- SMA connector.

4.6.2 Antenna Choice and RF Design Consideration

To obtain excellent GNSS reception performance, a good antenna will always be required. Proper choice and placement of the antenna will ensure that satellites at all elevations can be seen, and therefore, accurate fix measurements are obtained.

Compare the active antenna and passive antenna as follow:

Table 4-3 Antenna Specifications

Parameter	**Specification**	
Passive Antenna Recommendations	Frequency range	1558-1607MHz
	Polarization	RHCP & Linear
	Gain	>0dBi
Active Antenna Recommendations	Frequency range	1558-1607MHz
	Polarization	RHCP & Linear
	Noise Figure	<1.5dB
	Gain	>10dBi

Passive Antenna

Passive antenna contains only the radiating element, e.g. the ceramic patch, the helix structure, and chip antenna. Sometimes it also contains a passive matching network to match the electrical connection to 50Ω impedance.

The most common antenna type for GNSS applications is the patch antenna. Patch antennas are flat, generally have a ceramic and metal body and are mounted on a metal base plate.

Figure 4-3 shows a minimal setup for a GNSS receiver with A16-1612 series module.

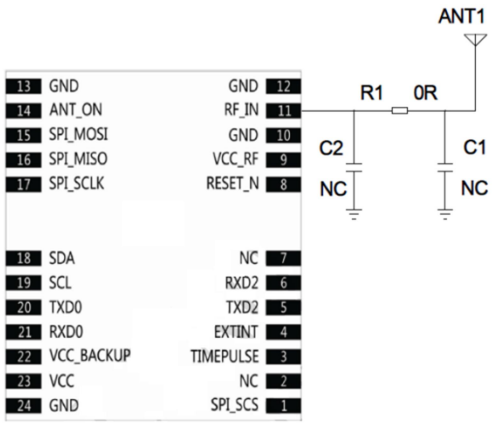


Figure 4-3 A16-1612 series passive antenna design

If the electromagnetic environment of module is very complicated, e.g. coexisted with GSM, UMTS, WLAN and Bluetooth user can use a saw (IL<1.4dB) to increase the sensitivity. Please see Figure 4-4.

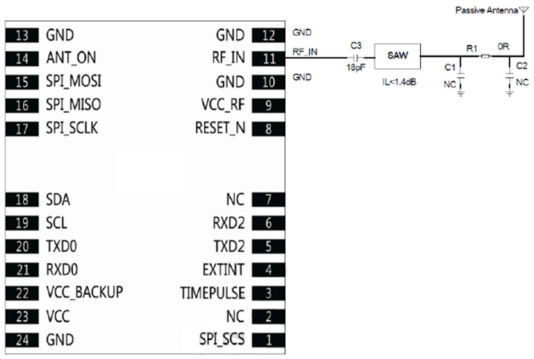


Figure 4-4 A16-1612 series passive antenna design (with external SAW)

Active Antenna

Active antennas have an integrated Low-Noise Amplifier (LNA). Active antennas need a power supply that will contribute to GNSS system power consumption.

Usually, the supply voltage is fed to the antenna through the coaxial RF cable shown as Figure 10. The output voltage domain of PIN 9 is VCC. If the supply voltage domain of active antenna is VCC, PIN 7 VCC_RF can be connected to RF_IN as figure 4-5 shows. If the supply voltage domain of active antenna is not VCC, other power should be connected to RF_IN.

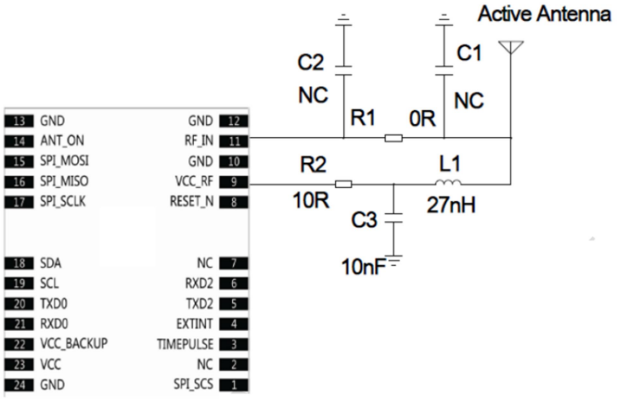


Figure 4-5 A16-1612 series active antenna design

GNSS antenna choice should base on the designing product and other conditions. For detailed Antenna designing consideration, please refer to related antenna vendor's design recommendation. The antenna vendor will offer further technical support and tune their antenna characteristic to achieve successful GNSS reception performance depending on the customer's design.

5 Electrical Reliability and Radio Characteristics

5.1 Absolute Maximum Ratings

The absolute maximum ratings stated in Table 5-1 are stress ratings under non-operating conditions. Stresses beyond any of these limits will cause permanent damage to A16-1612 series.

Table 5-1 Absolute maximum rating

Parameter	Min	Max	Unit
VCC		4.3	V
VCC_RF		VCC	V
ANTON		2.9	V
Input Power at GNSS_ANT		-12	dBm
VCC_BACKUP		4.3	V
I/O pin voltage		3.6	V
Storage temperature	-40	85	℃
Operating Temperature	-40	85	℃

5.2 Recommended Operating Conditions

Table 5-2 A16-1612 series operating conditions

Parameter	Symbol	Min	Type	Max	Unit
Operating temperature range		-40	25	85	℃
Main supply voltage	VCC	3	3.3	4.3	V
Backup battery voltage	VCC_BACKUP	2	3	4.3	V

Table 5-3 A16-1612 series standard IO feature

Parameter	Symbol	Min	Type	Max	Unit
Low level output voltage Test conditions IOL = 2mA and 4.0mA	VOL		0	0.4	V
High level output voltage Test conditions IOL = 2mA and 4.0mA	VOH	2.4	2.8		V
Low level input voltage	VIL	-0.3		0.8	V
High level input voltage	VIH	2		3.6	V
Input Pull-up resistance	RPU	40		190	KΩ
Input Pull-down resistance	RPD	40		190	KΩ
Input capacitance	CIN		5		pF
Load capacitance	CL			8	pF
Tri-state leakage current	IOZ	-10		10	uA

5.3 Electro-Static Discharge

The GNSS engine is not protected against Electrostatic Discharge (ESD) in general. Therefore, it is subject to ESD handing precautions that typically apply to ESD sensitive components. Proper ESD handing and packaging procedures must be applied throughout the processing, handing and operation of any application using a A16-1612 series module. The ESD test results are shown in the following table.

Table 5-4 The ESD characteristics(Temperature:25℃,Humidity:45%)

Pin	Contact discharge	Air discharge
VCC_BACKUP	±5kV	±10kV
ANTON	±5kV	±10kV
VCC_RF	±5kV	±10kV
GND	±5kV	±10kV
RXD0,TXD0	±4kV	±8kV
RESET	±4kV	±8kV
PPS	±4kV	±8kV

6 Manufacturing

6.1 Top and Bottom View of A16-1612 Series

Figure 6-1 Top and Bottom View of A16-1612 series

6.2 Assembly and Soldering

The A16-1612 series module is intended for SMT assembly and soldering in a Pb-free reflow process on the top side of the PCB. Suggested solder paste stencil height is 150um minimum to ensure sufficient solder volume. If required paste mask pad openings can be increased to ensure proper soldering and solder wetting over pads.

The following figure is the Ramp-Soak-Spike Reflow Profile of A16-1612 series:

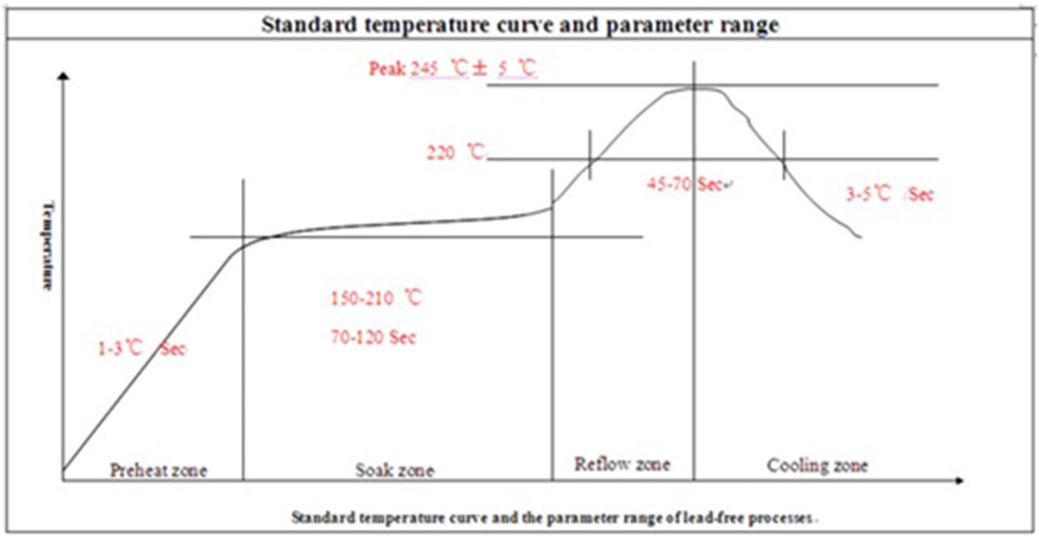


Figure 6-3 The Ramp-Soak-Spike reflow profile of A16-1612 series

A16-1612 series is moisture sensitive devices (MSD), appropriate MSD handling instruction and precautions are summarized in Chapter 6.3

A16-1612 series modules are also Electrostatic Sensitive Devices (ESD), handling A16-1612 series modules without proper ESD protection may destroy or damage them permanently.

Avoid ultrasonic exposure due to internal crystal and SAW components.

6.3 Moisture Sensitivity

A16-1612 series module is moisture sensitive at MSL 3, dry packed according to IPC/JEDEC specification J-STD-020C. The calculated shelf life for dry packed SMD packages is a minimum of 6 months from the bag seal date, when stored in a noncondensing atmospheric environment of <40°C/90% RH.

Table 12 lists floor life for different MSL levels in the IPC/JDEC specification:

Table 6-2 Moisture classification level and floor life

Level	Floor Life(out of bag)at factory ambient≦+30℃/60%RH or as stated
1	Unlimited at≦+30℃/85% RH
2	1 year
2a	4 weeks
3	168 hours
4	72 hours
5	48 hours
5a	24 hours
6	"Mandatory bake before use. After bake, module must be reflowed within

Factory floor life is 1 week for MSL 3, A16-1612 series must be processed and soldered within the time. If this time is exceeded, the devices need to be pre-baked before the reflow solder process. Both encapsulate and substrate materials absorb moisture. IPC/JEDEC specification J-STD-020 must be observed to prevent cracking and delamination associated with the "popcorn" effect during reflow soldering. The popcorn effect can be described as miniature explosions of evaporating moisture. Baking before processing is required in the following case:

- Floor life or environmental requirements after opening the seal have been exceeded, e.g. exposure to excessive seasonal humidity.

Refer to Section 4 of IPC/JEDEC J-STD-033 for recommended baking procedures.

Notes: Oxidation Risk: Baking SMD packages may cause oxidation and/or inter metallic growth of the terminations, which if excessive can result in solder ability problems during board assembly. The temperature and time for baking SMD packages are therefore limited by solder ability considerations. The cumulative bake time at a temperature greater than 90°C and up to 125°C shall not exceed 96 hours.

6.4 ESD Handling Precautions

A16-1612 series modules are Electrostatic Sensitive Devices (ESD). Observe precautions for handling! Failure to observe these precautions can result in severe damage to the GNSS receiver!

GNSS receivers are Electrostatic Sensitive Devices (ESD) and require special precautions when handling. Particular care must be exercised when handling patch antennas, due to the risk of electrostatic charges. In addition to standard ESD safety practices, the following measures should be taken into account whenever handling the receiver:
Unless there is a galvanic coupling between the local GND (i.e. the work Table) and the PCB GND, then the first point of contact when handling the PCB shall always be between the local GND and PCB GND.

Before mounting an antenna patch, connect ground of the device

When handling the RF pin, do not come into contact with any charged capacitors and be careful when contacting materials that can develop charges (e.g. patch antenna ~10pF, coax cable ~50-80pF/m, soldering iron)

To prevent electrostatic discharge through the RF input, do not touch the mounted patch antenna.

When soldering RF connectors and patch antennas to the receiver's RF pin, the user must make sure to use an ESD safe soldering iron (tip).

6.5 Shipment

A16-1612 series is designed and packaged to be processed in an automatic assembly line, and it is now packaged tray and reel.

7 Reference Design

Configuration settings can be modified with configuration messages. The modified settings remain effective until power-down or reset. If these settings have been stored in battery-backup RAM, then the modified configuration will be retained, as long as the backup battery supply is not interrupted.

Note that: If any new configuration needs to be done, please refer to module Receiver Description Including Protocol Specification.

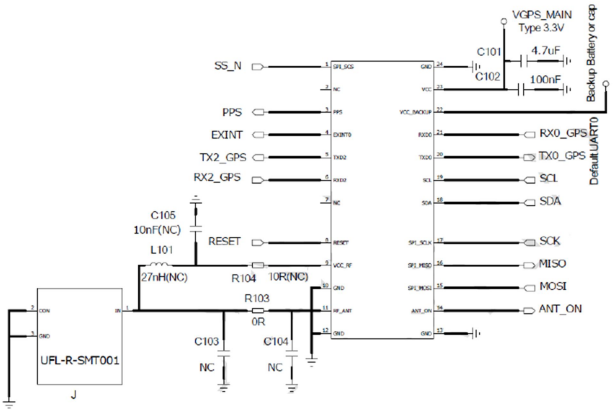


Figure 7-1 Application schematics

8 Safety Information

For the reasonable usage of the module, please comply with all these safety notices of this page. The product manufacturers should send followed safety information to user, operator or product's spec.

The devices using the module may disturb some electronic equipment. Put the module away from the phone, TV, radio and automation equipment to avoid the module and the equipment to interfere with each other.

Shut down the mobile device or change to flying mode before boarding. The Using of wireless appliances in an aircraft is forbidden to avoid the interference, or else cause to unsafe flying, even violate the law.

In hospital or health care center, switch off the mobile devices. RF interference may damage the medical devices, like hearing-aid, cochlear implant and heart pacemakser etc.

Mobile devices can't guarantee to connect in all conditions, like no fee or with an invalid SIM card. When you need emergent help, please remember using emergency calls and make sure your device power on in an area with well signal.

Put the module away from inflammable gases. Switch off the mobile device when close to gas station, oil depot, chemical plant etc.

The module is not water proof. Please don't use the module in the area with high humidity like bathroom, which will decelerate the physical performance, insulation resistance and mechanical strength.

Non-professionals can't teardown the module which will damage it. Refer to the specification or communicate the related staffs to repair and maintain it.

Please switch on the module before cleaning. The staffs should be equipped with anti-ESD clothing and gloves.

The users and product manufacturers should abide by the national law of wireless modules and devices. If not, JUSTRIGHT will not respond the related damages.

Terms and Abbreviations

Abbreviation	Description
A-GPS	Assisted Global Positioning System
CMOS	Complementary Metal Oxide Semiconductor
CEP	Circular Error Probable
DGPS	Difference Global Positioning System
EEPROM	Electrically Erasable Programmable Read Only Memory
EPO	Extended Prediction Orbit
ESD	Electrostatic Sensitive Devices
EASY	Embedded Assist System
EGNOS	European Geostationary Navigation Overlay Service
GPS	Global Positioning System
GAGAN	The GPS Aided Geo Augmented Navigation
I/O	Input / Output
IC	Integrated Circuit
Inorm	Normal Current
Imax	Maximum Load Current
kbps	Kilo bit per second
MSL	moisture sensitive level
MSAS	Multi-Functional Satellite Augmentation System
NMEA	National Marine Electronics Association
PRN	Pseudo Random Noise Code
QZSS	Quasi-Zenith Satellites System
SBAS	Satellite Based Augmentation Systems
WAAS	Wide Area Augmentation System

9 Revision History

Date	Revision	Modify records	Author
2018-05-07	R1.0	Origin	Laude Liu
2018-08-10	R1.1	Modify mechanical dimensions	Laude Liu
2019-07-08	R1.2	Add description of BD2 performance Modify the Power domain of VCC_RF	Laude Liu
2019-09-28	R1.3	Modify Pin 23 description	Laude Liu