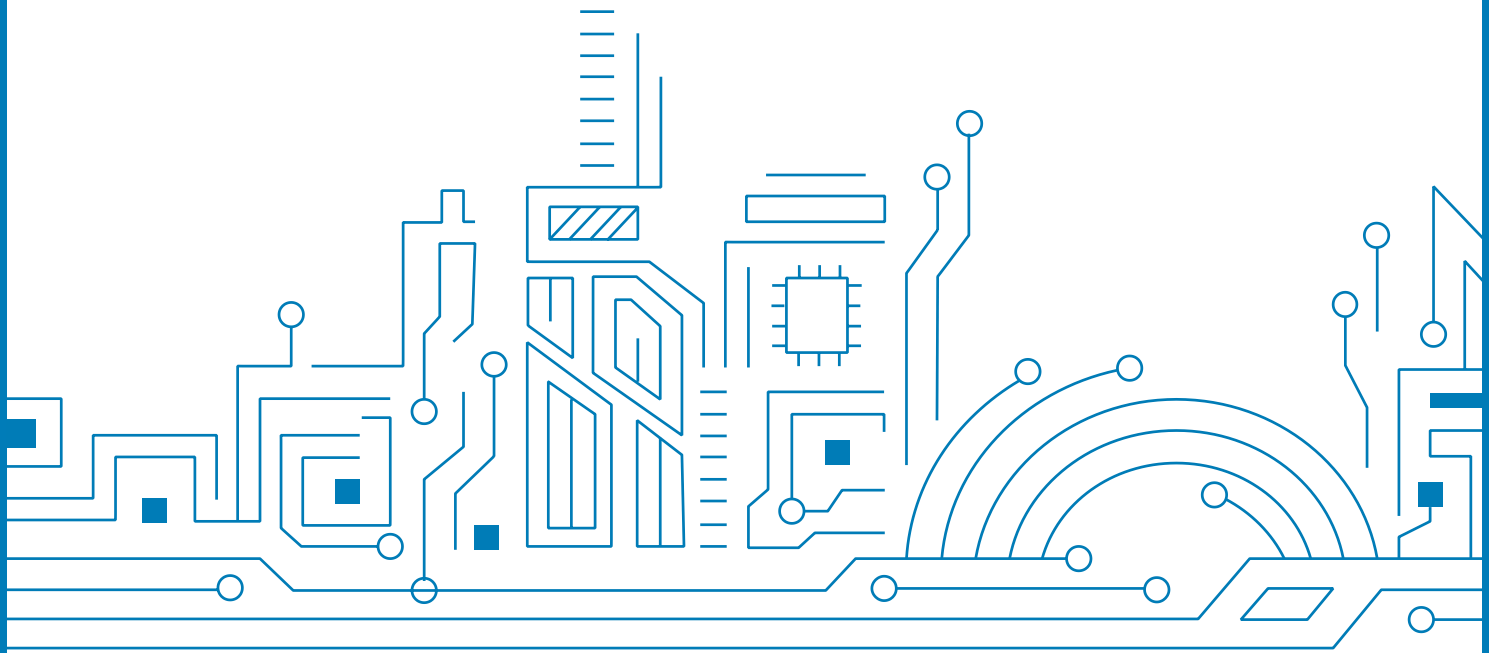
GNSS Positioning Module

TAU1113-1010A00E

Datasheet V1.8



www.allystar.com

Notice, Statement and Copyright

ALLYSTAR Technology offers this document as a service to its customers, to support application and engineering efforts that use the products designed by ALLYSTAR Technology. Products and specifications discussed herein are for reference purposes only. Performance characteristics listed in this document do not constitute a warranty or guarantee of product performance.

ALLYSTAR Technology assumes no liability or responsibility for any claims or damages arising out of the use of this document, or from the use of integrated circuits based on this document, including, but not limited to claims or damages based on infringement of patents, copyrights or other intellectual property rights.

This document contains proprietary technical information which is the property of ALLYSTAR Technology, copying of this document and giving it to others and using or communication of the contents thereof, are forbidden without express authority. Offenders are liable to the payment of damages. ALLYSTAR Technology reserves the right to make changes in its products, specifications and other information at any time without notice.

For more recent documents, please visit www.allystar.com.
Copyright © Allystar Technology (Shenzhen) Co., Ltd. 2025. All rights reserved.

About the Document

■ Basic info

Document applies to	TAU1113-1010A00E
Document type	Datasheet
Revision and date	V1.8/2025-05
Product status	Preliminary

■ Product status description

In development	Objective specification. Revision may be released in later status.
Engineering sample	Product specifications tested on early. Revision may be released in later status.
Preliminary	Product specifications come from small production. Revision may be released in later status.
Mass production	Final product specification to mass market.

Copyright © ALLYSTAR

TABLE OF CONTENT

1 SYSTEM OVERVIEW 7

1.1 General Description 7

1.2 Features 7

1.3 Module Photo 8

1.4 Block Diagram 8

1.5 Specifications 8

2 PIN DESCRIPTION 10

2.1 Pin Assignment 10

2.2 Detailed Pin Descriptions 11

3 ELECTRICAL CHARACTERISTICS 12

3.1 Absolute Maximum Rating 12

3.2 IO Characteristics 12

3.2.1 PRRSTX and PRTRG 12

3.2.2 Others 12

3.3 DC Characteristics 13

3.3.1 Operating Conditions 13

3.3.2 Power Consumption 13

4 HARDWARE DESCRIPTION 14

4.1 Connecting Power 14

4.2 Power on/off sequence 14

4.2.1 Initial system power on 14

4.2.2 Power off in application 14

4.3 Antenna Design 15

4.4 Reset and Mode Control 15

5 DEFAULT MESSAGE 17

6 MECHANICAL SPECIFICATION 18

Copyright © ALLYSTAR

7 REFERENCE DESIGN 19
7.1 Minimal Design 19
7.2 PCB Footprint Reference 20
7.3 Layout Notes 20
8 PRODUCT PACKAGING AND HANDLING 21
8.1 Packaging 21
8.1.1 Packaging Notes 21
8.1.2 Tape and Reel 21
8.1.3 Shipment Packaging 22
8.2 Storage 22
8.3 Handling 23
8.3.1 ESD Handling Precautions 23
8.3.2 ESD Protection Measures 23
8.3.3 Moisture Sensitivity Level 23
9 LABELING AND ORDERING INFORMATION 24
9.1 Labeling 24
9.2 Ordering info 24
10 RELATED DOCUMENTS 25
11 REVISION HISTORY 25

Copyright © ALLYSTAR

List of Tables

Table 1 TAU1113 7
Table 2 Specifications 8
Table 3 Detailed pin descriptions 11
Table 4 Absolute rating 12
Table 5 PRRSTX and PRTRG 12
Table 6 Others 12
Table 7 Operating conditions 13
Table 8 Power consumption 13
Table 9 Default messages 17
Table 10 Dimensions 18
Table 11 Packing hierarchy 21
Table 12 Ordering codes 24

List of Figures

Figure 1 TAU1113 module 8
Figure 2 Block diagram 8
Figure 3 Pin assignment (top view) 10
Figure 4 Initial system power on sequence 14
Figure 5 System power off sequence 15
Figure 6 Timing of mode entry with host controller 16
Figure 7 Dimensions 18
Figure 8 Minimal application diagram 19
Figure 9 PCB Footprint Reference 20
Figure 10 Tape dimensions 21
Figure 11 Reel dimensions 22
Figure 12 Packaging 22

Copyright © ALLYSTAR

1 SYSTEM OVERVIEW

1.1 General Description

TAU1113 is a cost-effective low power GNSS positioning module based on CYNOSURE III Lite GNSS SoC chip. It supports GPS/QZSS, BDS, Galileo, GLONASS and SBAS. The module features SAW, LNA, flash memory as well as an antenna supervisor in a compact form factor.

TAU1113 is a versatile receiver that can be used with active and passive antennas, making it an excellent choice for a wide range of applications such as tracking, telematics and navigation. The fast start-up in combined with the lower power consumption and the very low backup current make the TAU1113 particularly suitable for use in battery-powered devices, e.g., for asset tracking.

1.2 Features

- Versatile GNSS module supporting GPS/QZSS, BDS, Galileo, GLONASS and SBAS
- Low current consumption of only 16 mA for GPS/QZSS
- Backup current of only 15 µA
- Active and passive antennas supported thanks to built-in SAW and LNA
- Support Allystar's free-of-charge A-GNSS service for minimal startup times
- Pin-compatible with previous generation TAU1103, TAU1105 and many mainstream GNSS modules

Table 1 TAU1113

Product	GNSS								Feature					Interface				Accuracy			Grade	
	GNSS system mode	Band (S/D/T)	GPS/QZSS	BDS	GLONASS	Galileo	NavIC	SBAS	Built-in LNA	Programmable (flash)	Data logging	D-GNSS	Oscillator	UART	I2C	USB	SPI	Meter	Sub-meter	Centimeter	Industrial	Automotive
TAU1113-1010A00E	01	S	●		●			●	●	●	●	●	T	●				●			●	
	02	S	●		●	●		●	●	●	●	●	T	●				●			●	
	03	S	●	●		●		●	●	●	●	●	T	●				●			●	

T = TCXO

Copyright © ALLYSTAR

1.3 Module Photo

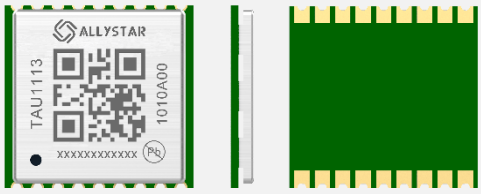


Figure 1 TAU1113 module

1.4 Block Diagram

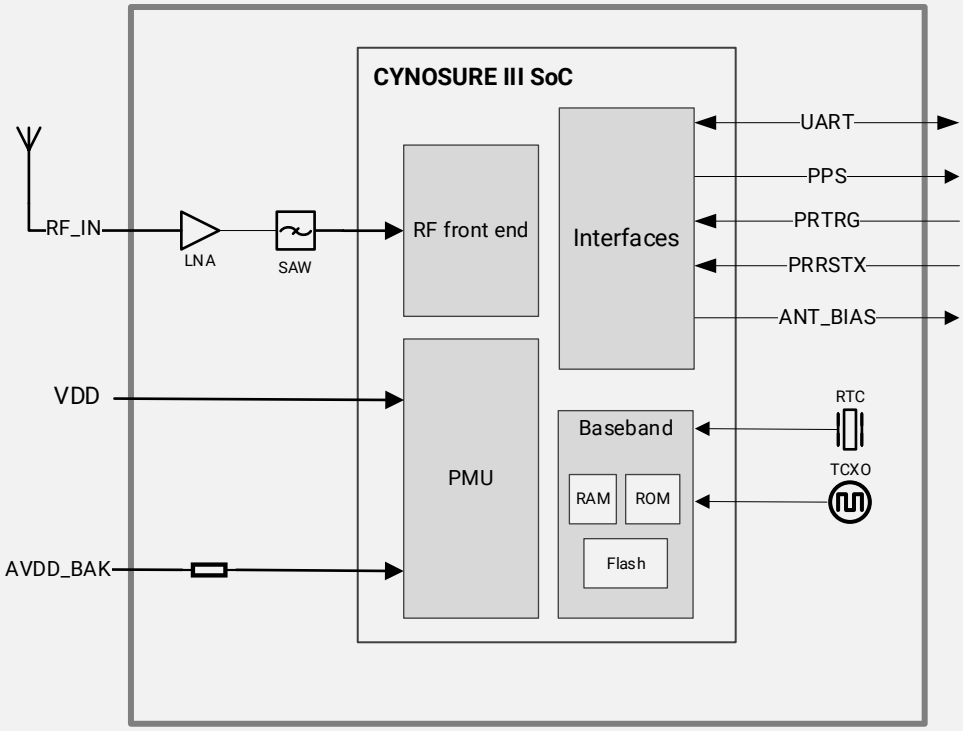


Figure 2 Block diagram

1.5 Specifications

Table 2 Specifications

Parameter	Specification
GNSS channels	88 in total
GNSS reception	GPS/QZSS: L1C/A
	GLONASS: G1
	Galileo: E1
	BDS: B1I

Copyright © ALLYSTAR

	SBAS: L1 (SDCM, WAAS, EGNOS, GAGAN and MSAS)		
Updating rate	5 Hz maximum		
Position accuracy[1]	GNSS	1.5m CEP	
	GNSS (with SBAS)	< 1.0m CEP	
Velocity & Time accuracy	GNSS	0.1 m/s CEP	
	1PPS	20 ns	
Time To First Fix (TTFF)	Hot start	2s	
	Cold start	28s	
Sensitivity[2]	Cold start	-148 dBm	
	Hot start	-154 dBm	
	Reacquisition	-154 dBm	
	Tracking	-160 dBm	
Operating condition	Main voltage	2.0V-3.63V	
	Digital I/O voltage	2.0V-3.63V	
	Backup voltage	1.8V-3.63V	
Power consumption	Tracking	GNSS[3]	22 mA @ 3.3V
	Acquisition	GNSS[3]	23 mA @ 3.3V
	Standby mode	15 uA @ 3.3V	
Serial interface	UART	1	
Protocol	NMEA 0183 Protocol Ver.3.01/4.00/4.10 (Default) Cynosure GNSS Receiver Protocol		
Operating limit	Velocity	515 m/s	
	Altitude	18,000m	
Antenna supervision	Antenna short circuit protection and open circuit detection		
Operating temperature	-40°C to +85°C		
Storage temperature	-40°C to +85°C		
Package	10.1x9.7x2.5 mm 18-pin LCC		
Certification	RoHS, REACH, FCC, CE-RED		

* *[1] Open sky condition.*
* *[2] Demonstrated with a good external LNA.*
* *[3] Configured as GPS/QZSS by default. The power consumption varies as the GNSS modes are different.*

Copyright © ALLYSTAR

2 PIN DESCRIPTION

2.1 Pin Assignment

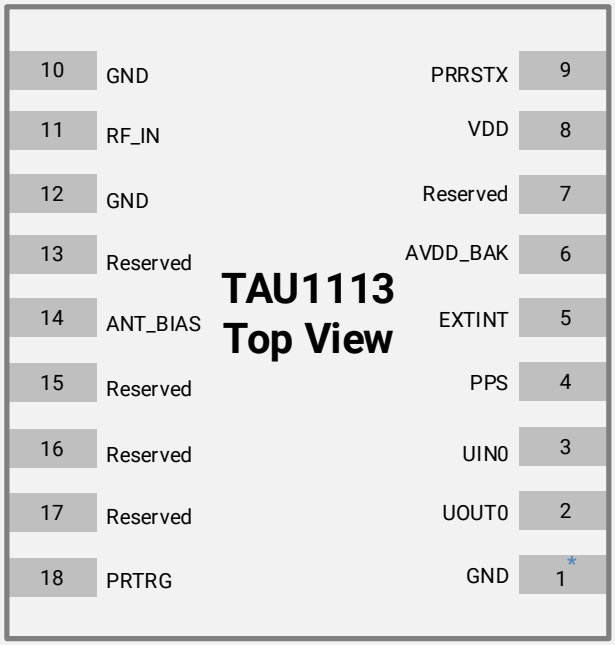


Figure 3 Pin assignment (top view)

* *Pin 1 aligns to the circular hole on module cover.*

Copyright © ALLYSTAR

2.2 Detailed Pin Descriptions

Table 3 Detailed pin descriptions

Function	Symbol	No.	I/O	Description
Power	VDD	8	Power	Main power supply voltage input.
	GND	1, 10, 12	VSS	Assure a good GND connection to all GND pins of the module, preferably with a large ground plane.
	AVDD_BAK	6	Power	Backup power supply voltage input. Backup power is needed in order to enable warm and hot start features. Backup power is a must for system working. If no backup power is available, connect AVDD_BAK to the main power supply.
Antenna	RF_IN	11	I	RF signal input. Use a controlled impedance of 50Ω for the routing from RF_IN pin to the antenna or the antenna connector.
	ANT_BIAS	14	O	Antenna bias voltage output. The ANT_BIAS pin can be used to power an external active antenna, and the current should be no more than 25 mA.
UART	UOUT0	2	O	UART0 serial data output.
	UIN0	3	I	UART0 serial data input.
Other	PRTRG	18	I	Mode selection, or the trigger input in deep sleep mode to wake up the system.
	PRRSTX	9	I	External reset, low active
	PPS	4	O	Setting for time pulse output (PPS). Leave it floating if not used.
	EXTINT	5	I	A trigger pin to external interrupt. Leave it floating if not used.
	Reserved	7, 13, 15, 16, 17	--	Reserved. Leave it floating if not used.

Copyright © ALLYSTAR

3 ELECTRICAL CHARACTERISTICS

3.1 Absolute Maximum Rating

Table 4 Absolute rating

Symbol	Parameter	Min.	Max.	Unit
VDD	Power input for the main power domain	-0.5	3.63	V
AVDD_BAK	Power input for the backup power domain	-0.5	3.63	V
VI_{max}	Digital I/O pin input voltage	-0.5	3.6	V
$T_{storage}$	Storage temperature	-40	85	°C
T_{solder}	Solder reflow temperature	--	260	°C
VESD (HBM)	Maximum tolerable ESD level	--	2000	V

3.2 IO Characteristics

3.2.1 PRRSTX and PRTRG

Table 5 PRRSTX and PRTRG

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
I_{IZ}	Input leakage current	--	--	--	+/-1	uA
V_{IH}	Input high voltage	--	AVDD_BAK×0.67	--	AVDD_BAK	V
V_{IL}	Input low voltage	--	0	--	AVDD_BAK×0.27	V
V_{OH}	Output high voltage	I_{OH} = 5.3 mA, AVDD_BAK = 3.3V	2.64	--	--	V
		I_{OH} =1.2 mA, AVDD_BAK = 1.8V	1.53	--	--	V
V_{OL}	Output low voltage	I_{OL} = 3.9 mA, AVDD_BAK = 3.3V	--	--	0.4	V
		I_{OL} = 1.9 mA, AVDD_BAK = 1.8V	--	--	0.45	V

3.2.2 Others

Table 6 Others

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
I_{IZ}	Input leakage current	--	--	--	+/-1	uA
V_{IH}	Input high voltage	--	VDD×0.67	--	VDD	V
V_{IL}	Input low voltage	--	0	--	VDD×0.27	V
V_{OH}	Output high voltage	I_{OH} = 5.3 mA, VDD = 3.3V	2.64	--	--	V

Copyright © ALLYSTAR

V_{OL}	Output low voltage	I_{OL} = 3.9 mA, VDD = 3.3V	--	--	0.4	V

3.3 DC Characteristics

3.3.1 Operating Conditions

Table 7 Operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD	Power supply voltage	2.0	3.3	3.63	V
AVDD_BAK	Backup battery voltage	1.8	3.3	3.63	V
ICC_{max}	Maximum operating current @ VDD	--	--	200	mA
T_{env}	Operating temperature	-40	--	85	℃
V_{ANT_BIAS}	Antenna bias voltage	--	VDD-0.15[1]	--	V

* *[1] Condition: tested at high, low, and room temperature, with 0.1V deviation.*

3.3.2 Power Consumption

Table 8 Power consumption

Parameter		Measure Pin	Typ.	Unit
Tracking	GNSS (GPS/QZSS) [1]	VDD[2]	22	mA
Acquisition	GNSS (GPS/QZSS) [1]		23	
Standby mode		AVDD_BAK[3]	15	uA

* *[1] Configured as GPS/QZSS by default. The power consumption varies as the GNSS modes are different.*
* *[2] Condition: VDD = 3.3V @ Room Temperature. All Pins Open.*
* *[3] Condition: AVDD_BAK = 3.3V @ Room Temperature. All Pins Open.*

Copyright © ALLYSTAR

4 HARDWARE DESCRIPTION

4.1 Connecting Power

In order to ensure the positioning performance, please control the ripple of the module power supply. It is recommended to use the LDO with max output current above 100 mA.

If the power for VDD pin is off, the real-time clock (RTC) and battery backed RAM (BBR) are supplied through the AVDD_BAK pin. Thus, orbit information and time can be maintained and will allow a Hot or Warm start. If the AVDD_BAK needs to be supplied separately, please make sure the voltage is greater than or equal to the main voltage.

Note: If no backup supply is available, keep the AVDD_BAK pin to the main power supply. Floating state is not recommended.

4.2 Power on/off sequence

4.2.1 Initial system power on

To meet the requirement of controlling the power on/off sequence of the module, please connect the external reset pin (PRRSTX) to the Host.

When both backup and main supply power on from their off state, external reset (PRRSTX) must be active and hold more than 10 ms after both backup supply and main supply reach the minimum operating voltage. Initial system power on sequence is illustrated in Figure 4.

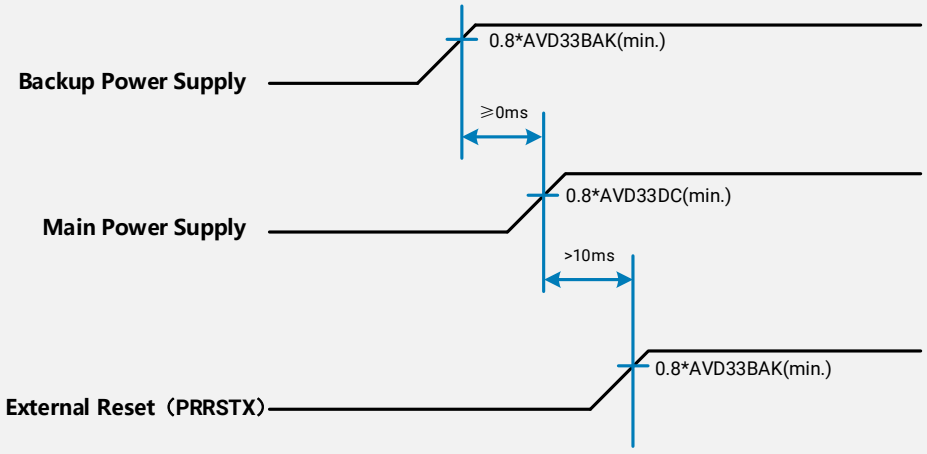


Figure 4 Initial system power on sequence

4.2.2 Power off in application

Power off sequence is as follows:

1. Run the power down command: F1 D9 06 41 05 00 00 00 00 00 03 4F 64
2. Power off the module after 500 ms interval. Please ensure that the main power supply (VDD), backup power supply (AVDD_BAK) (if powered off) and IO power are all below 0.3V, to avoid the residual voltage from affecting the next power-on.

Copyright © ALLYSTAR

Note: The electrical characteristics of each EVK board vary, so does the capacitance and load, which leads to differences in power-off time. Please confirm the power-off time of each EVK with Allystar technical support.

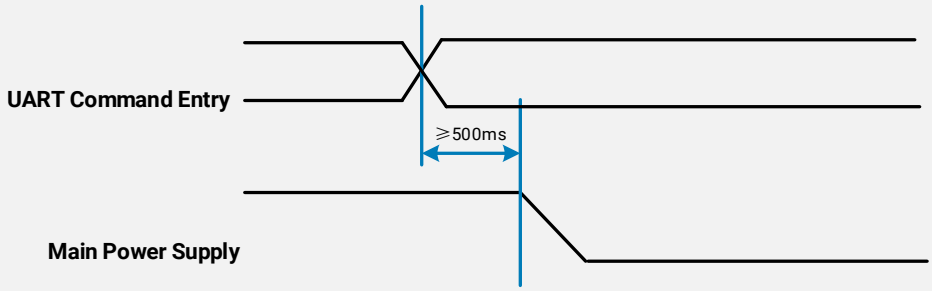


Figure 5 System power off sequence

4.3 Antenna Design

There is a built-in LNA and SAW in the GNSS module. It is recommended to use either a passive or an active antenna with gain less than 25 dB.

The module has built-in short circuit protection and open circuit detection functions, which can detect the antenna status of normal connection, open circuit, and short circuit, and send out the status prompt message in NMEA data.

- **Short circuit protection**
  - The module includes internal short circuit antenna detection. Once an overcurrent is detected at the ANT_BIAS port, the module will cut off this power supply automatically to prevent permanent damages.
- **Open circuit detection**
  - The module can detect an open circuit in the antenna. Users can judge it from antenna status messages.

4.4 Reset and Mode Control

The operation mode of GNSS module is controlled by PRRSTX (nRESET) and PRTRG (BOOT) pin. PRTRG pin cannot work alone when the module operates normally. PRRSTX pin can reset the system. Users **MUST** retain PRTRG and PRRSTX pins in the design to ensure that the Boot mode is accessible in case that there is no firmware written in the embedded chip.

- Keep PRTRG pin floating during system power-up or the external reset (PRRSTX from low to high), and the module will enter **User Normal Mode**.
- When the module powers up or PRRSTX from low to high, the module will execute an **external reset**. (If the power for AVDD_BAK is always on, the external reset will not affect the ephemeris data in the backup domain)
- Drive PRTRG pin to low or connect PRTRG to GND directly (not by pull-down resistance) during system power-up or the external reset (PRRSTX from low to high), and the system enters **BootROM Command Mode** at PRTRG pin being released from low to floating state, and ready for firmware upgrading command.

Copyright © ALLYSTAR

When connecting PRRSTX and PRTRG to any host IO, DO NOT use the pull-up or pull-down resistance.

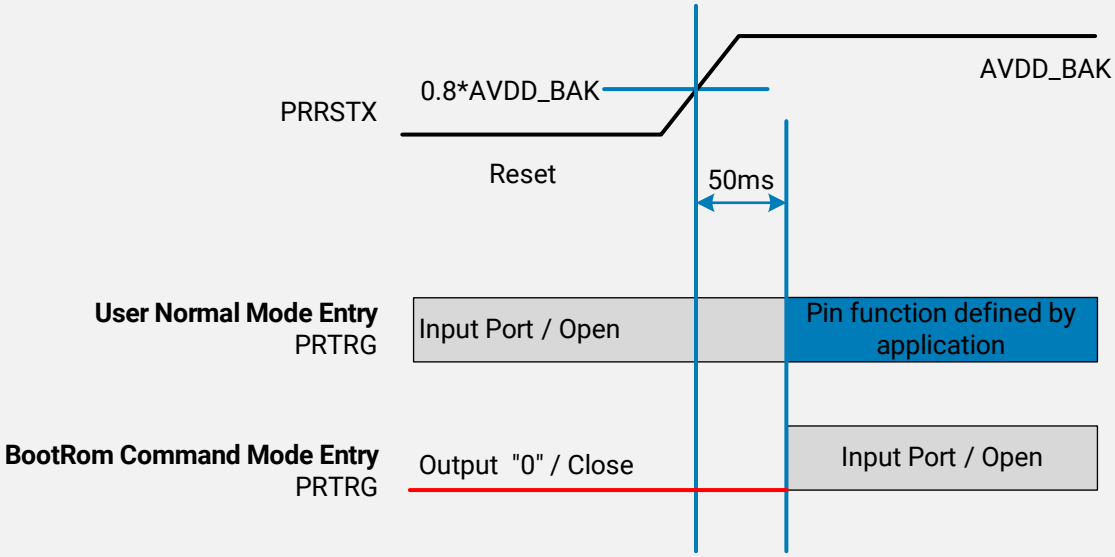


Figure 6 Timing of mode entry with host controller

Copyright © ALLYSTAR

5 DEFAULT MESSAGE

Table 9 Default messages

Interface	Settings
UART output	9600 baud, 8 data bits, no parity bit, 1 stop bit. Configured to transmit both NMEA and HD Binary protocols, but only the following NMEA (and no HD Binary sentence) messages have been activated at start-up: GGA, GSA, GSV, RMC, ZDA, TXT-ANT
UART input	9600 baud, 8 data bits, no parity bit, 1 stop bit, autobauding disabled. Automatically accepts the following protocols without need of explicit configuration: HD binary sentence, NMEA The GNSS receiver supports interleaved HD Binary and NMEA messages.
Timepulse (1 Hz Nav)	1 pulse per second, synchronized at rising edge, pulse length 100 ms.

* *Refer to GNSS_Protocol_Specification for information about other settings.*

When the module is applied to the specific application, users can shut off the main power in order to further reduce the power consumption. To avoid the high level in serial interface influencing the normal operation, it is highly suggested to cut off the serial port when shut off the main power. Otherwise, please set the serial port to input mode or high impedance state with pull-down resistor.

Copyright © ALLYSTAR

6 MECHANICAL SPECIFICATION

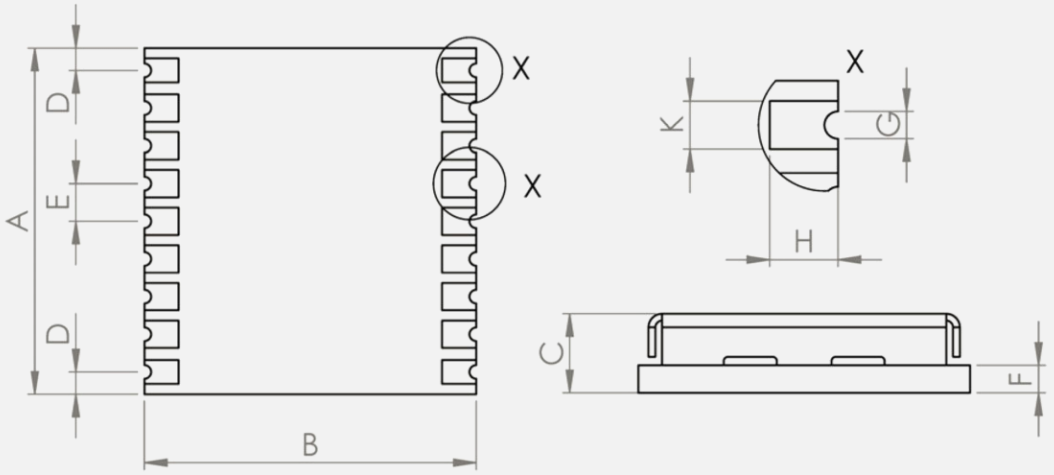


Figure 7 Dimensions

Table 10 Dimensions

Symbol	Min. (mm)	Typ.(mm)	Max. (mm)
A	9.9	10.1	10.3
B	9.5	9.7	9.9
C	2.3	2.5	2.7
D	0.55	0.65	0.95
E	1.0	1.1	1.2
F	0.6	0.8	--
G	0.4	0.5	0.6
H	0.8	0.9	1.0
K	0.7	0.8	0.9

Copyright © ALLYSTAR

7 REFERENCE DESIGN

7.1 Minimal Design

The minimal design of TAU1113 shows as below. The 39 nH inductor is used only when an active antenna is connected, and no need with a passive antenna. The characteristic impedance from RF_IN pin to the antenna connector should be 50Ω.

Note: Do not keep the AVDD_BAK pin open. There is no diode between AVDD_BAK and VDD inside the module. The AVDD_BAK can be powered by VDD through an external diode, or an external independent power supply.

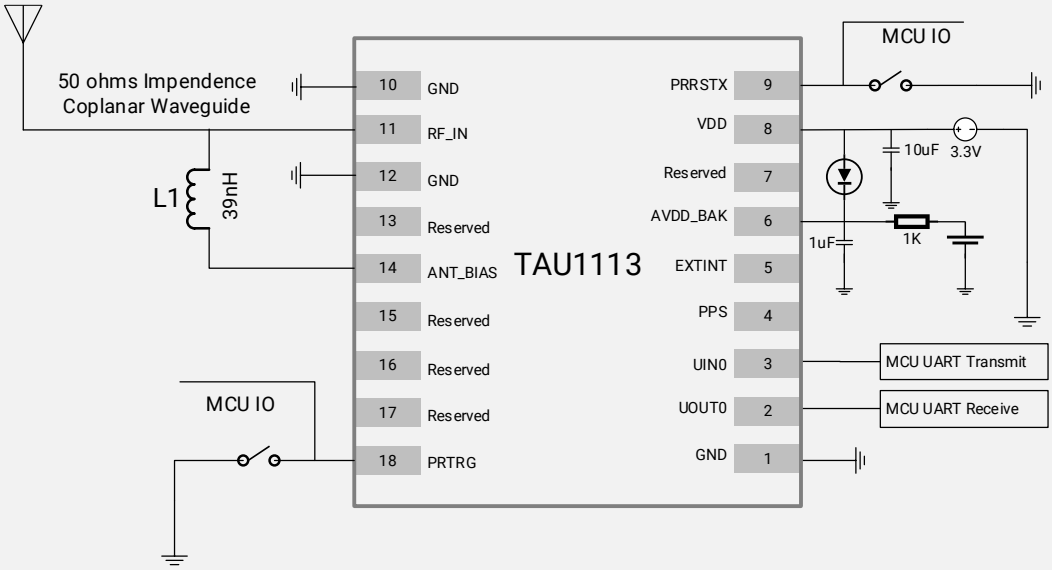


Figure 8 Minimal application diagram

Copyright © ALLYSTAR

7.2 PCB Footprint Reference

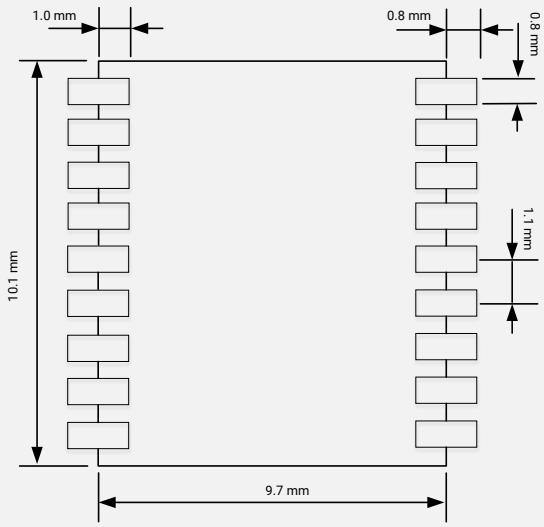


Figure 9 PCB Footprint Reference

7.3 Layout Notes

(1) A decoupling capacitor should be placed close to VDD pin of the module, and the width of power routing should be more than 0.5 mm.

(2) The width of RF routing between RF port to antenna interface should be wider than 0.2 mm. The characteristic impedance of RF routing between RF port to antenna interface should be controlled to 50Ω.

(3) It is recommended that the routing from RF port to antenna interface refers to the second layer, and no routing are recommended on the layer.

(4) Do not place the module close to any EMI source, like antenna, RF routing, DC/DC or power conductor, clock signal or other high-frequency switching signal, etc. It is optimal to fill all the bottom of the module with ground plane.

Copyright © ALLYSTAR

8 PRODUCT PACKAGING AND HANDLING

8.1 Packaging

8.1.1 Packaging Notes

TAU1113 GNSS module is a Moisture Sensitive Device (MSD) and Electrostatic Sensitive Device (ESD). During the packing and shipping, it is strictly required to take appropriate MSD handling instructions and precautions. The table below shows the general packing hierarchy for the standard shipment.

Table 11 Packing hierarchy

Module	Reel	Sealed bag	Packing box	Shipping carton
				

8.1.2 Tape and Reel

TAU1113 modules are delivered as hermetically sealed, reeled tapes in order to enable efficient production, production lot set-up and tear-down. The figure below shows the tape dimensions.

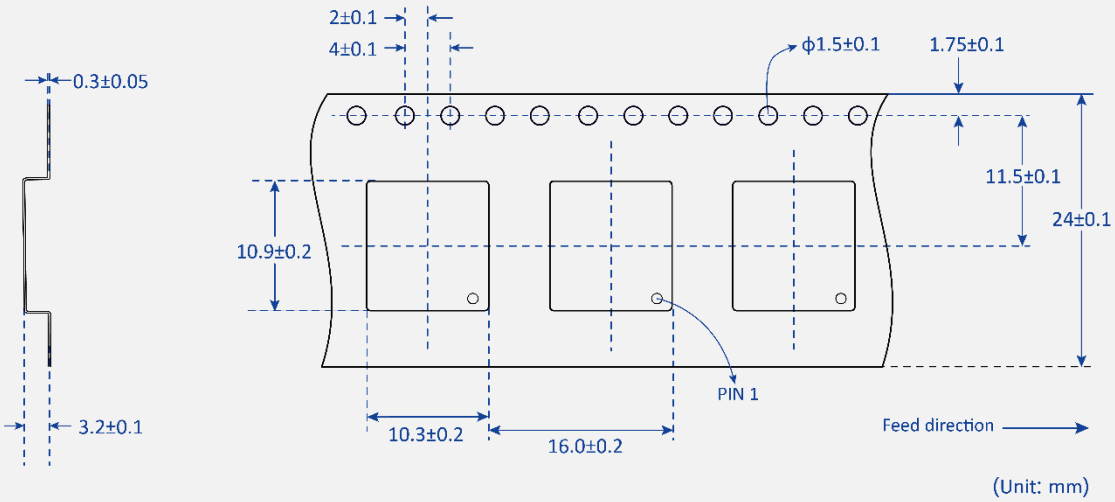


Figure 10 Tape dimensions

Copyright © ALLYSTAR

The TAU1113 modules are deliverable in quantities of 1000 pcs on a reel. The figure below shows the dimensions of reel for TAU1113.

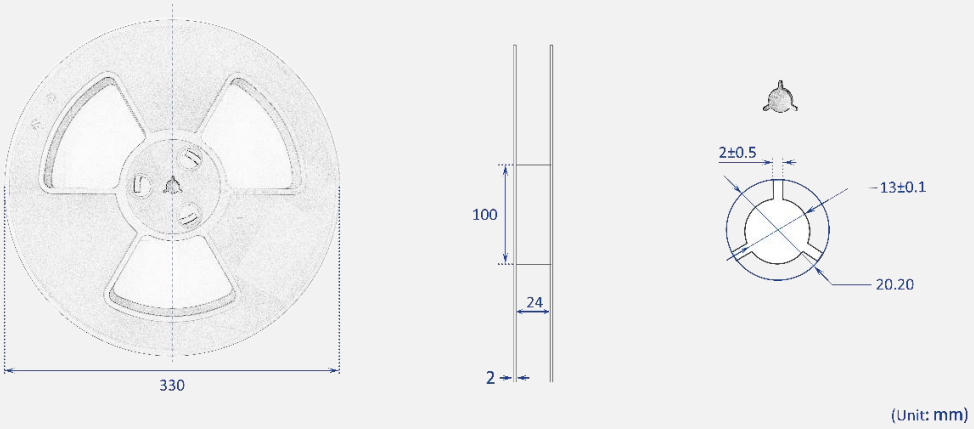


Figure 11 Reel dimensions

8.1.3 Shipment Packaging

The reels of TAU1113 are packed in the sealed bags in packing boxes and shipped by shipping cartons. Up to five boxes (5000 pcs in total) can be packed in one shipping carton.

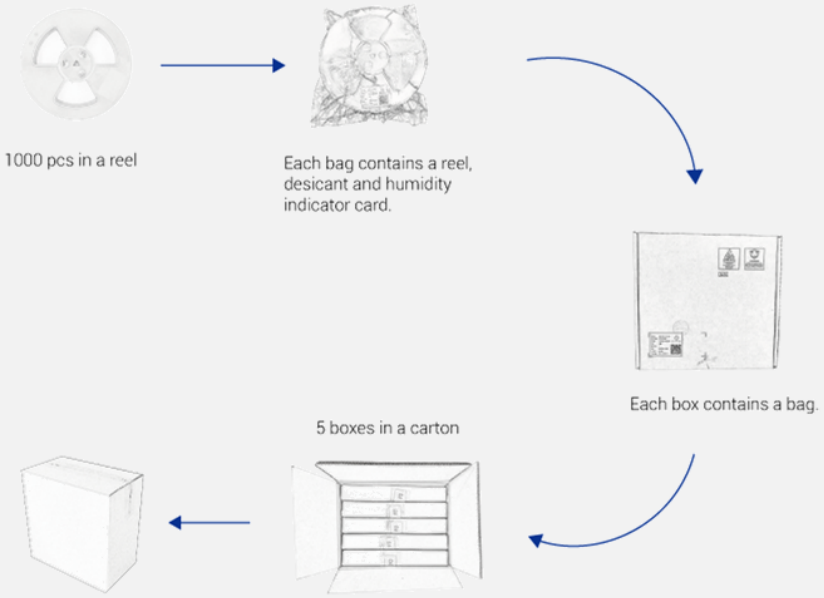


Figure 12 Packaging

8.2 Storage

In order to prevent moisture intake and protect against electrostatic discharge, TAU1113 is packaged together with a humidity indicator card and desiccant to absorb humidity.

Copyright © ALLYSTAR

8.3 Handling

8.3.1 ESD Handling Precautions

The TAU1113 module that contains highly sensitive electronic circuitry is Electrostatic Sensitive Device (ESD). Observe precautions for handling! Failure to observe these precautions may result in severe damage to the GNSS module!

- Unless there is a galvanic coupling between the local GND (i.e. the workbench) and the PCB GND, then the first point of contact when handling the PCB must 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 ~10 pF, coax cable ~50 - 80 pF/m, soldering iron …)
- To prevent electrostatic discharge through the RF input, do not touch any exposed antenna area. If there is any risk that such exposed antenna area is touched in non ESD protected work area, implement proper ESD protection measures in the design.
- When soldering RF connectors and patch antennas to the receiver's RF pin, make sure to use an ESD safe soldering iron (tip).



8.3.2 ESD Protection Measures

This series of GNSS positioning modules is sensitive to static electricity. Whenever handling the module, particular care must be exercised to reduce the risk of electrostatic charges. In addition to standard ESD safety practices, the following measures should be taken into account.

- Adds ESD protective device to the RF input part to prevent electrostatics discharge.
- Do not touch any exposed antenna area.
- Adds ESD protective device to the UART interface.

8.3.3 Moisture Sensitivity Level

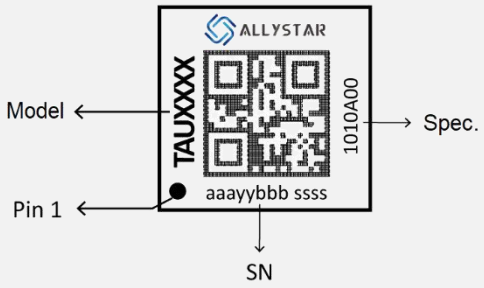
The Moisture Sensitivity Level (MSL) of the GNSS modules is MSL3.

Copyright © ALLYSTAR

9 LABELING AND ORDERING INFORMATION

Labeling and ordering information help customers get more about Allystar products.

9.1 Labeling



Symbol	Explanation	Instance
TAUXXXX	Product model	TAU1113
1010A00	Product specification	1010A00, 1010A00E
aaayybbbssss	Serial number	351190010001

9.2 Ordering info

Table 12 Ordering codes

Ordering No.	Product Information
TAU1113-1010A00E[1]	Concurrent GNSS LCC Module, TCXO, Flash, 10.1*9.7 mm, 1000 pieces/reel.

* *[1] See Table 1 for the GNSS systems supported.*

Copyright © ALLYSTAR

10 RELATED DOCUMENTS

[1] Recommended Reflow Profile

[2] Satrack User Manual

[3] Allystar Common Commands

[4] GNSS Protocol Specification

11 REVISION HISTORY

Revision	Date	Reviser	Status/Comments
V1.0	2021-12	Cao Min	Initial release.
V1.1	2021-12	Cao Min	Updates parameters in operating mode
V1.2	2022-07	Cao Min	Deletes I^2C support Updates PRTRG and PRRSTX pins configuration for Boot mode Updates maximum power input for VDD and AVDD_BAK. Modifies the Grade classification Updates the product general description in Section 1.1 and features in Section 1.2 Updates the updating rate, position accuracy, power consumption, and sensitivity, adds FCC and CE-RED certification in Table 2 Adds Table 3 Time to First Fix and updates TTFF Adds maximum tolerable ESD level in Table 4 Updates MSL to MSL3
V1.3	2022-08	Cao Min	Updates the total GNSS channels in Table 2
V1.4	2022-08	Cao Min	Adds the antenna bias voltage in Table 7
V1.5	2022-10	Cao Min	Updates the chip description in section 1.1 Modifies the minimum backup supply voltage Optimizes the backup battery supply instruction in section 4.1
V1.6	2024-11	Cao Min	Removes the software interface chapter Updates the package specification
V1.7	2024-12	Cao Min	Replaces the block diagram in 1.4 and module photo Adds section 4.2 Power on/off sequence
V1.8	2025-05	Cao Min	Revises the product label Modifies the sensitivity and power consumption in Table 2 Removes Time to First Fix table

Copyright © ALLYSTAR

www.allystar.com

info.gnss@allystar.com

Headquarters

Allystar Technology (Shenzhen) Co., Ltd.
Address: 1301-2A(10), Tower F, Xinghe World, No.1, Yabao Road, LongGang District, Shenzhen City, Guangdong Province, China.

