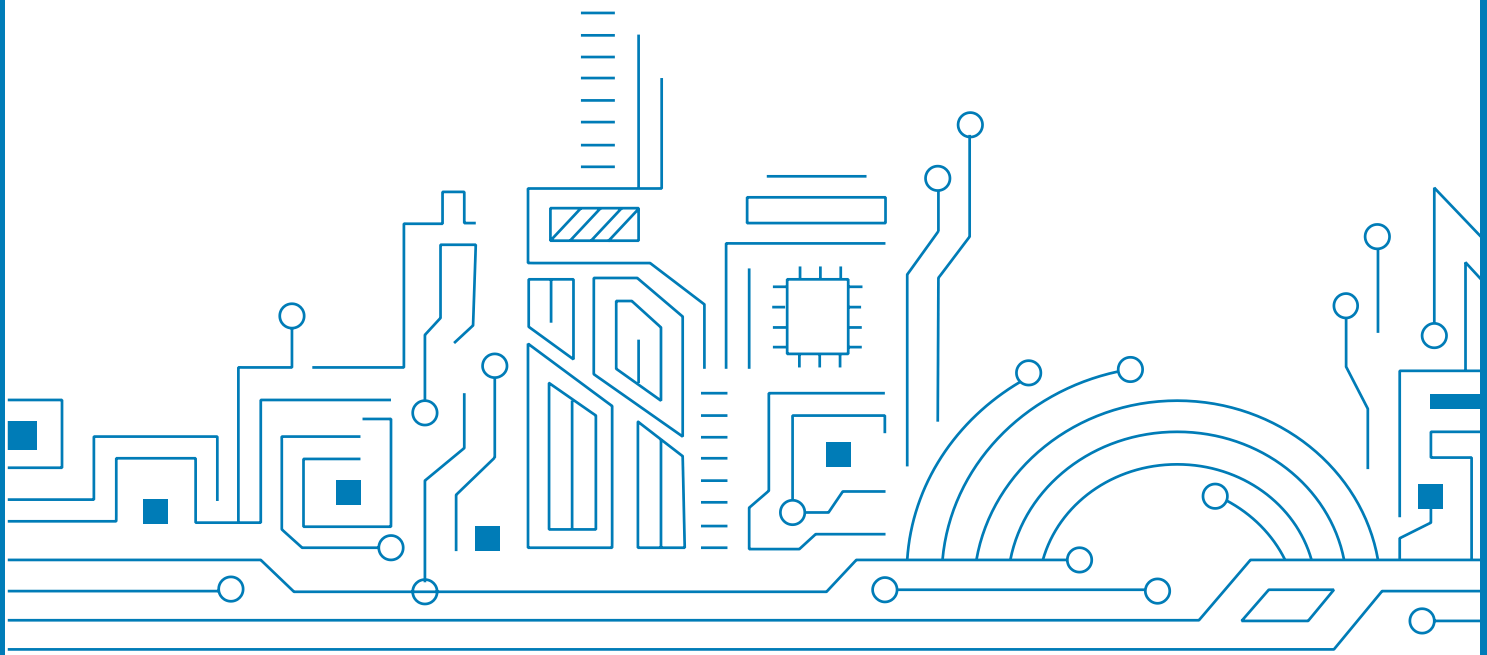
ALLYSTAR

Multi-Band Multi-System GNSS Positioning Module

TAU1202 TAU1205

Datasheet V1.2



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.

TABLE OF CONTENT

List of tables

List of figures

1 SYSTEM OVERVIEW

1.1 Overview

TAU1202/TAU1205 is a high-performance dual-band GNSS positioning module, which is based on the state of the art CYNOSURE III architecture. It supports BDS-3 (BeiDou Navigation Satellite System 3). Besides, it is capable of tracking all global civil navigation systems (BDS, GPS, GLONASS, Galileo, IRNSS, QZSS and SBAS). TAU1202/TAU1205 integrates efficient power management architecture, while providing high precision, high sensitivity and low power GNSS solutions which make it suitable for navigation applications on automotive and consumer electronics, as well as fleet management.

1.2 Features

- Supports all civil GNSS systems
- Supports BDS-3 signal: B1C and B2a
- Concurrent reception of L1 and L5 band signals
- Sub-meter position accuracy, superior in multipath mitigation and lower noise in city valley
- Smart jammer detection and suppression
- Highly integrated module, the best cost-effective high precision solution
- Supports single IRNSS mode

1.3 Module photo

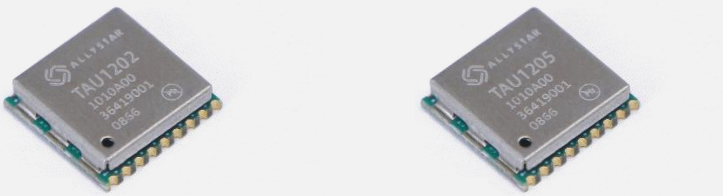


Figure 1 TAU1202/TAU1205 module photo

1.4 Block diagram

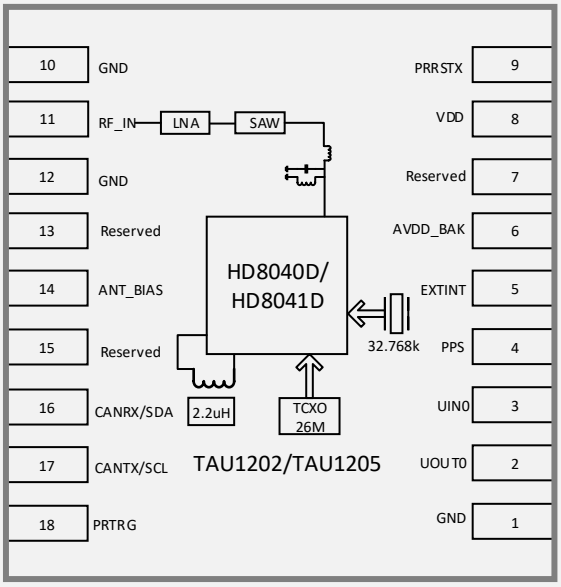


Figure 2 Block diagram

1.5 Specifications

Table 1 Specifications

Parameter	Specification	
GNSS Tacking channel	40 channels	
GNSS reception	TAU1202	GPS/QZSS: L1C/A, L5C
		BDS: B1I, B2a
		GLONASS: L1OF
		Galileo: E1, E5a
		SBAS
	TAU1205	GPS/QZSS: L1C/A, L5C
		BDS: B1I, B2a
		Galileo: E1, E5a
		IRNSS
		SBAS
Update rate	Maximum 10Hz	
Position accuracy [1]	GNSS	<1m CEP
Velocity & Time accuracy	GNSS	0.1m/s CEP
	1PPS	20ns
Time to First Fix(TTFF)	Hot start	1 sec
	Cold start	24 secs
Sensitivity	Cold start	-148dBm
	Hot start	-155dBm
	Reacquisition	-158dBm

Parameter	Specification	
	Tracking & navigation	-161dBm
Operating limit	Velocity	515 m/s
	Altitude	18,000 m
Safety supervision	Antenna short circuit and open circuit detection, and short circuit protection	
	System clock stop detection	
	Low voltage detection	
Serial interface	UART	1
	I2C	1
	CAN [2]	1
Protocol	NMEA 0183 Protocol Ver. 4.00/4.10, Cynosure GNSS Receiver Protocol	
Operating condition	Main voltage	1.8 ~ 3.6V
	Digital I/O voltage	1.8 ~ 3.6V
	Backup voltage	1.8 ~ 3.6V
Power consumption	GPS+QZSS, L1 band	22mA@3.3V
	GNSS, L1+L5 band	41mA@3.3V
	Standby	12uA
Operating temperature	-40 °C ~ +85 °C	
Storage temperature	-40 °C ~ +85 °C	
Package	10.1mm x 9.7mm x 2.5mm 18-pin stamp hole	
Certification	RoHS & REACH	

* *[1] Open sky, dual band, demonstrated with a good external LNA*
* *[2] Only customized firmware supported*

2 PIN DESCRIPTION

2.1 Pin assignment

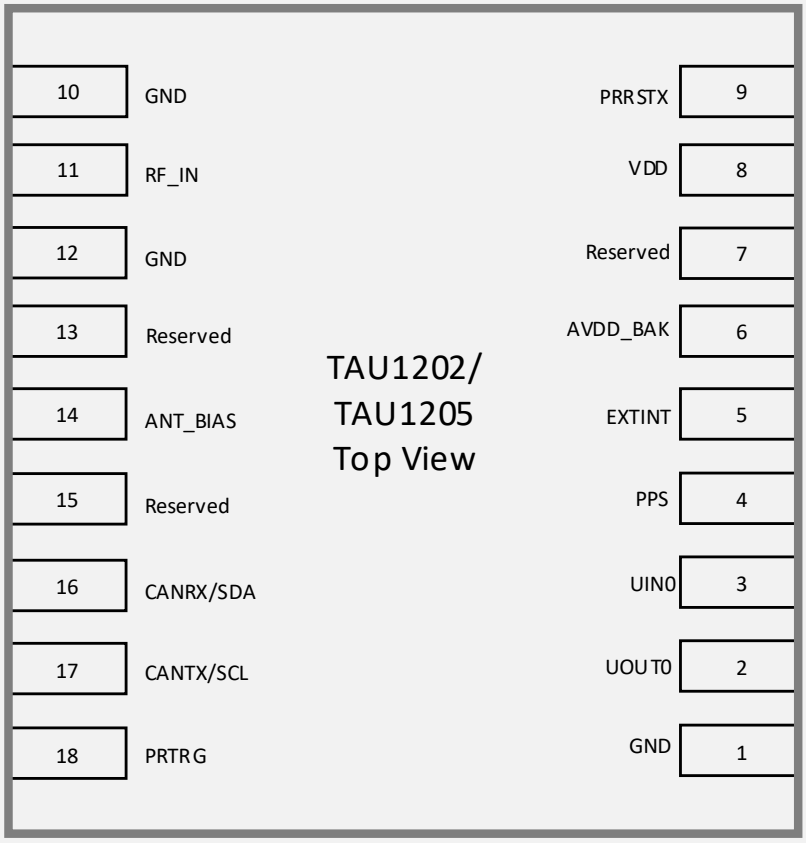


Figure 3 Pin assignment (top view)

2.2 Detailed pin descriptions

Table 2 Detailed pin descriptions

Function	Symbol	No.	I/O	Description
Power	VDD	8	Power	Main power supply voltage input. Provide clean and stable supply.
	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. If no backup power is available, connect AVDD_BAK to the main power supply or leave it floating.
Antenna	RF_IN	11	I	The connection to the antenna must be routed on the PCB. Use a controlled impedance of 50Ω from connect RF_IN to the antenna or the antenna connector.
	ANT_BIAS	14	O	RF section output voltage. The ANT_BIAS pin can be used to supply powers to an external active antenna.
UART	UOUT0	2	O	UART0 serial data output.
	UIN0	3	I	UART0 serial data input.
I2C/CAN	CANRX/SDA	16	I/O	I^2C or CAN data input, leave it floating if not used
	CANTX/SCL	17	O	I^2C or CAN data output, leave it floating if not used
System	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)
	EXTINT	5	I	GPIO, Default(EXTINT): a trigger pin to external interrupt, leave it floating if not used.
Reserved	Reserved	7,13,15,	--	Reserved, leave it floating if not used

3 ELECTRICAL CHARACTERISTICS

3.1 Absolute Maximum Rating

Table 3 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
$T_{storage}$	Storage temperature	-40	85	°C
T_{solder}	Solder reflow temperature	--	260	°C
T_a	Ambient temperature	-40	85	°C

3.2 IO Characteristics

3.2.1 PRRSTX and PRTRG

Table 4 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. 7	--	AVDD_BAK	V
V_{IL}	Input low voltage	--	0	--	AVDD_BAK*0.3	V
C_i	Input capacitance	--	--	--	10	pF
R_{PU}	Pull-up resistance	--	18	--	84	kOhm

3.2.2 Others

Table 5 Others

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
I_{IZ}	Input leakage current	--	--	--	+/-1	uA
V_{IH}	Input high voltage	--	VDD*0.7	--	VDD	V
V_{IL}	Input low voltage	--	0	--	VDD*0.3	V
V_{OH}	Output high voltage	I_{OH}=11.9 mA, VDD=3.3V	2.64	--	--	V
		I_{OH}=2.8 mA, VDD=1.8V	1.53	--	--	V
V_{OL}	Output low voltage	I_{OL}=7.9 mA, VDD=3.3V	--	--	0.4	V
		I_{OL}=3.9 mA, VDD=1.8V	--	--	0.45	V
C_i	Input capacitance	--	--	--	11	pF
R_{PU}	Pull-up resistance	-	35	--	84	kOhm

3.3 DC Characteristics

3.3.1 Operating Conditions

Table 6 Operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD	Power input for the main power domain	1.8	3.3	3.6	V
AVDD_BAK	Power input for the backup power domain	1.8	3.3	3.6	V
ICC_{max}	Maximum operating current @ VDD	--	--	200	mA
T_{env}	Operating temperature	-40	--	85	°C
$T_{storage}$	Storage temperature	-40	--	85	°C

3.3.2 Power Consumption

Table 7 Power consumption

Symbol	Parameter	Measure Pin	Typ.	Unit
I_{CCRX1}[1]	Run Mode (GPS+QZSS, L1 only)	VDD[3]	22	mA
I_{CCRX2}[2]	Run Mode (All GNSS, L1+L5)	VDD[3]	41	mA
I_{CCDBM}	Data backup Mode	AVDD_BAK[4]	12	uA

* *[1] GPS+QZSS, L1 band only, 16 tracking channels, position fixed*
* *[2] All GNSS, L1 + L5 band, 32 tracking channels, position fixed*
* *[3] Condition: VDD=3.3V@Room Temperature; All Pins Open.*
* *[4] Condition: AVDD_BAK=3.3V@Room Temperature; All Pins Open.*

4 HARDWARE DESCRIPTION

4.1 Connecting power

TAU1202/TAU1205 positioning module has two power supply pins: VDD and AVDD_BAK. The main power is supplied through the VDD pin, and the backup power is supplied through the AVDD_BAK pin. 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 100mA.

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 no backup battery is connected, the module performs a cold start at every power up if no aiding data are sent to the receiver.

Note: *If no backup supply is available, connect the AVDD_BAK pin to the main power supply or leave it floating.*

4.2 Antenna design

There is built-in LNA and SAW in the GNSS module. It is recommended to use an active antenna with gain less than 36dB and noise figure less than 1.5dB. The module has built-in short circuit detection and open circuit detection function, which can detect the status of normal connection, and send out antenna 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.

4.3 Reset and mode control

The operation mode of GNSS module is controlled by PRRSTX (nRESET) and PRTRG(BOOT) pin.

- When system powers up or PRRSTX pin is pulled from "low" to “high”, the module will execute an external reset (If the power for AVDD_BAK is always on, this 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”), system will enter BootROM Command Mode and wait for firmware upgrading after internal system reset finish.
- Keep PRTRG pin floating during system power-up or the external reset (PRRSTX from "low" to “high”), and system will enter User Normal Mode after internal system reset finish.
- When connecting PRRSTX and PRTRG to any host IO, DO NOT use the pull-up or pull-down resistance.

Leave PRRSTX and PRTRG pin floating while the module is in normal operation.

4.4 Serial interfaces

The module provides a TTL Universal Asynchronous Receiver / Transmitter (UART) interface. The data format is: 1 start bit, 8 data bits, 1 stop bit, no checksum, and the default baud rate is 115200 bps. NMEA data outputs while the module is powered on.

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.

5 MECHANICAL SPECIFICATION

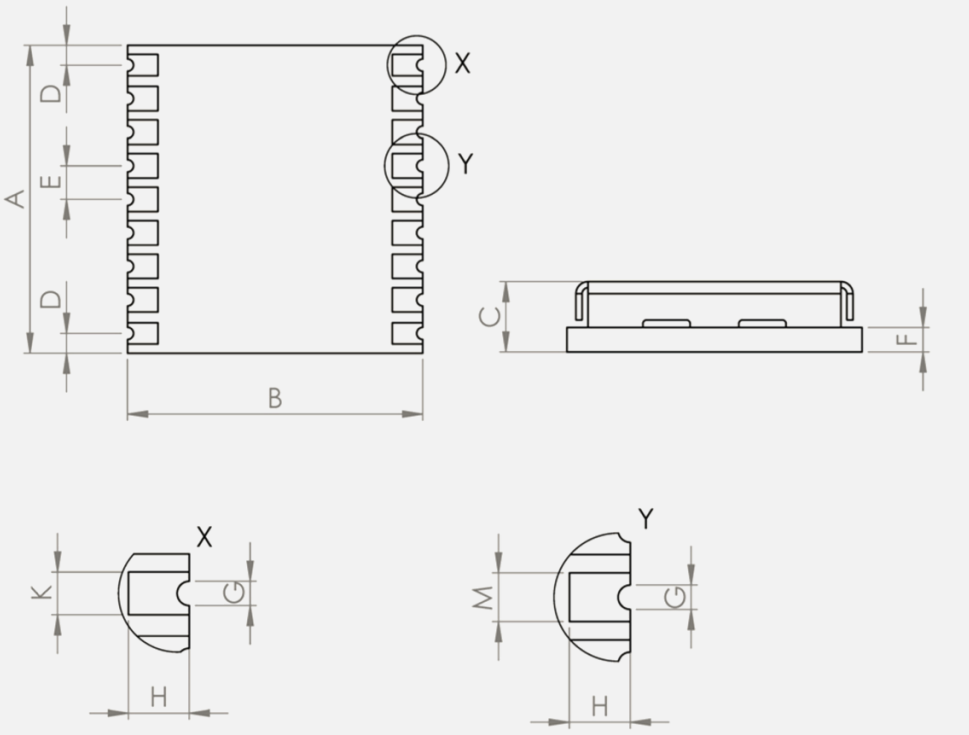


Figure 4 Dimensions

Table 8 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	0.8	0.95
E	1.0	1.1	1.2
F	0.6	0.8	--
G	0.4	0.5	0.6
H	0.7	0.8	0.9
K	0.7	0.8	0.9
M	0.8	0.9	1.0

6 REFERENCE DESIGN

6.1 Minimal Design

This is a minimal design for TAU1202/TAU1205 GNSS module as below. The 39nH 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.

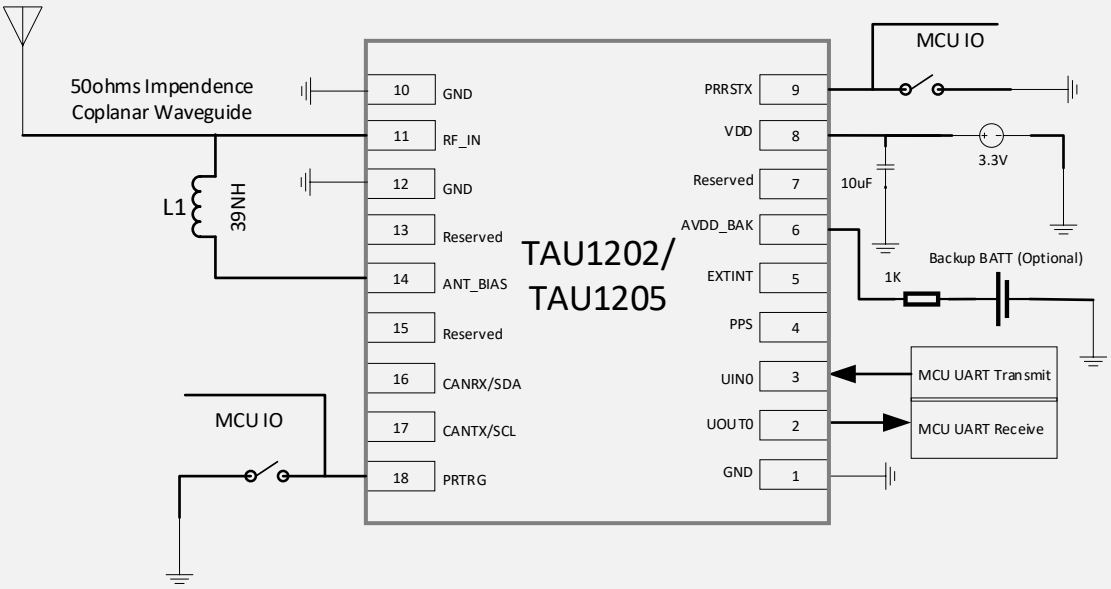


Figure 5 Minimal application diagram

6.2 PCB Footprint Reference

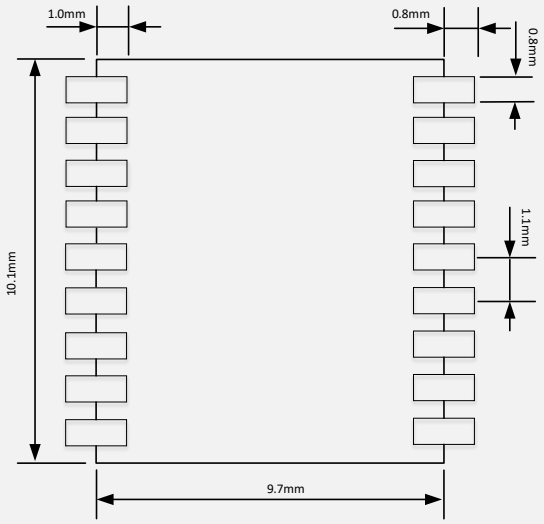


Figure 6 PCB Footprint Reference

Note: The recommended land dimensions are shown for reference only, as actual pads layouts may vary depending on applications.

6.3 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 0.5mm;

(2) Routing under the module is not recommended.

(3) The characteristic impedance of RF routing between RF port to antenna interface should be controlled to 50Ω.

(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.

7 PRODUCT PACKAGING AND HANDLING

7.1 Packaging

7.1.1 Packaging Notes

TAU1202/TAU1205 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 9 Packing hierarchy

Module	Reel	Sealed bag	Shipping carton
			

Note: *Packaging of non-standard quantities is not explained here. Take the reality as a reference.*

7.1.2 Tape and Reel

The TAU1202/TAU1205 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 dimension.

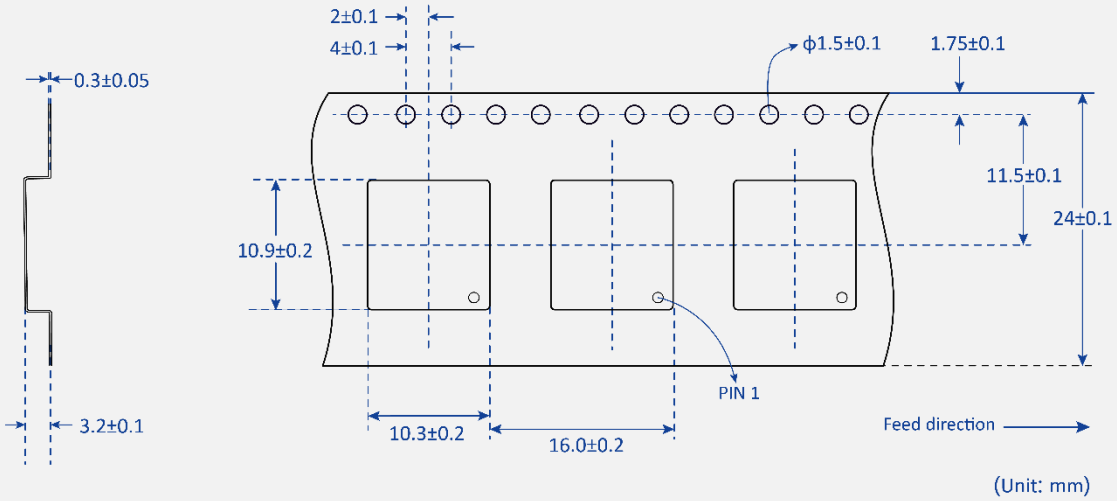


Figure 7 Tape dimensions

The TAU1202/TAU1205 modules are deliverable in quantities of 1000pcs on a reel. The figure below shows the dimensions of reel for TAU1202/TAU1205.

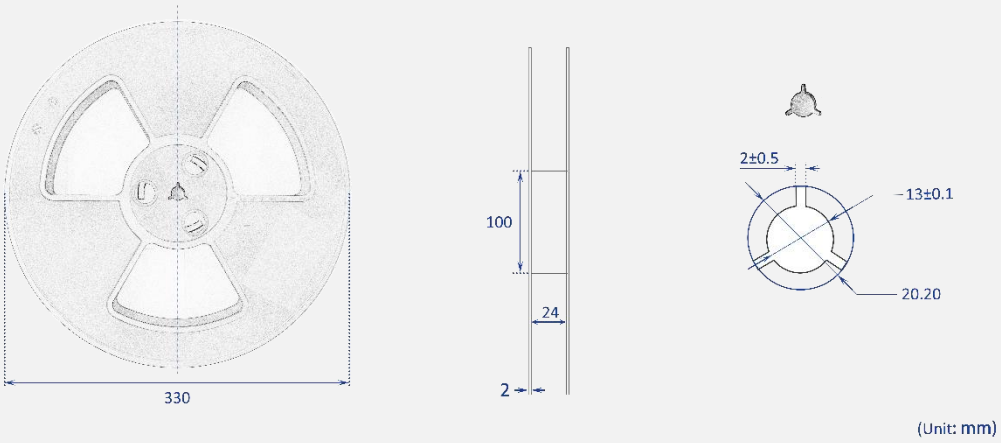


Figure 8 Reel dimensions

7.1.3 Shipment Packaging

The reels of TAU1202/TAU1205 modules are packed in the sealed bags and shipped by shipping cartons. Up to five sealed bags (5000pcs in total) can be packed in one shipping carton.

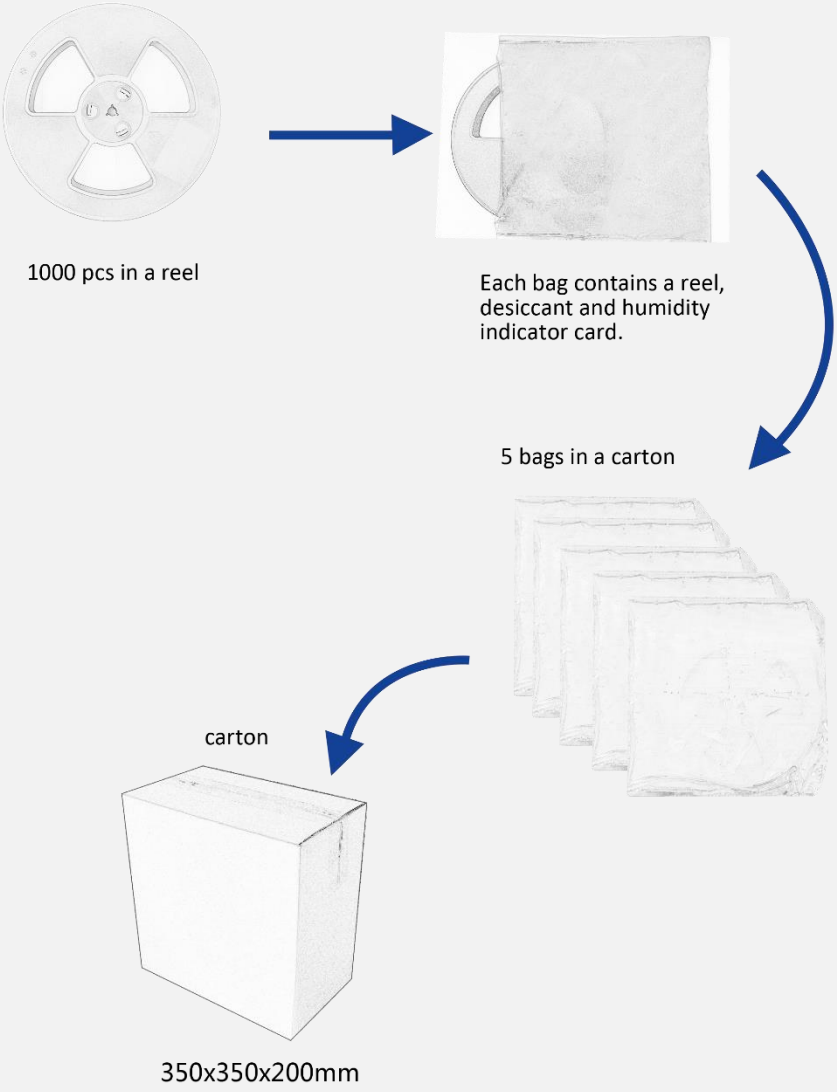


Figure 9 Packaging

7.2 Storage

In order to prevent moisture intake and protect against electrostatic discharge, TAU1202/TAU1205 is packaged together with a humidity indicator card and desiccant to absorb humidity.

7.3 Handling

7.3.1 ESD Handling Precautions

TAU1202/TAU1205 module which 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).

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

7.3.3 Moisture sensitivity level

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

8 REVISION HISTORY

Revision	Date	Author	Status / Comments
V1.0	2019-05-31	Daisy	Start version, first released
V1.1	2019-09-09	Vita Wu	Logo, product photos and wording update
V1.2	2019-12-06	Vita Wu	Adds packaging info in Section 7; Updates mechanical specification; Updates sensitivity and power consumption in Table 1 and Table 7; Updates antenna gain in Section 4.2; Adds PCB package reference and layout notes in Section 6; Updates Section 6.1;

ALLYSTAR

www.allystar.com

info.gnss@allystar.com

5F, Building No.4, Winlead Intelligent Park, No.3, FaDa road (middle), Bantian Subdistrict, LongGang District, Shenzhen City, Guangdong Province, China.