



DYA421

AIS Class

B Module



DYA421 AIS Class B Module

Hardware Design Manual V1.2

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1. PRODUCT DESCRIPTION

The DYA421 is an AIS Class B terminal module specifically designed for the Automatic Identification System (AIS) for vessels. Users don't need to concern themselves with AIS network details, only the application, using the AIS module for transmission to achieve rapid application development.

The DYA421 device can automatically send and receive AIS information and is configured and used through a serial port. It features ultra-high sensitivity, ultra-compact size, low voltage operation, and is easy to embed in mobile devices.

2. FEATURES

The device can automatically send and receive AIS information and is configured through a serial port. Complies with ITU-R M.1371-5 specification.

- ◆ Complies with NMEA0183 protocol
- ◆ Ultra-compact size for easy integration into mobile devices
- ◆ Low voltage operation mode
- ◆ Ultra-high sensitivity: -116dBm
- ◆ Operating voltage: 3.5-4.2V
- ◆ Interface: Stamped hole soldering method
- ◆ Dimensions: 49.5mm × 32mm

3. INTERNAL BLOCK DIAGRAM

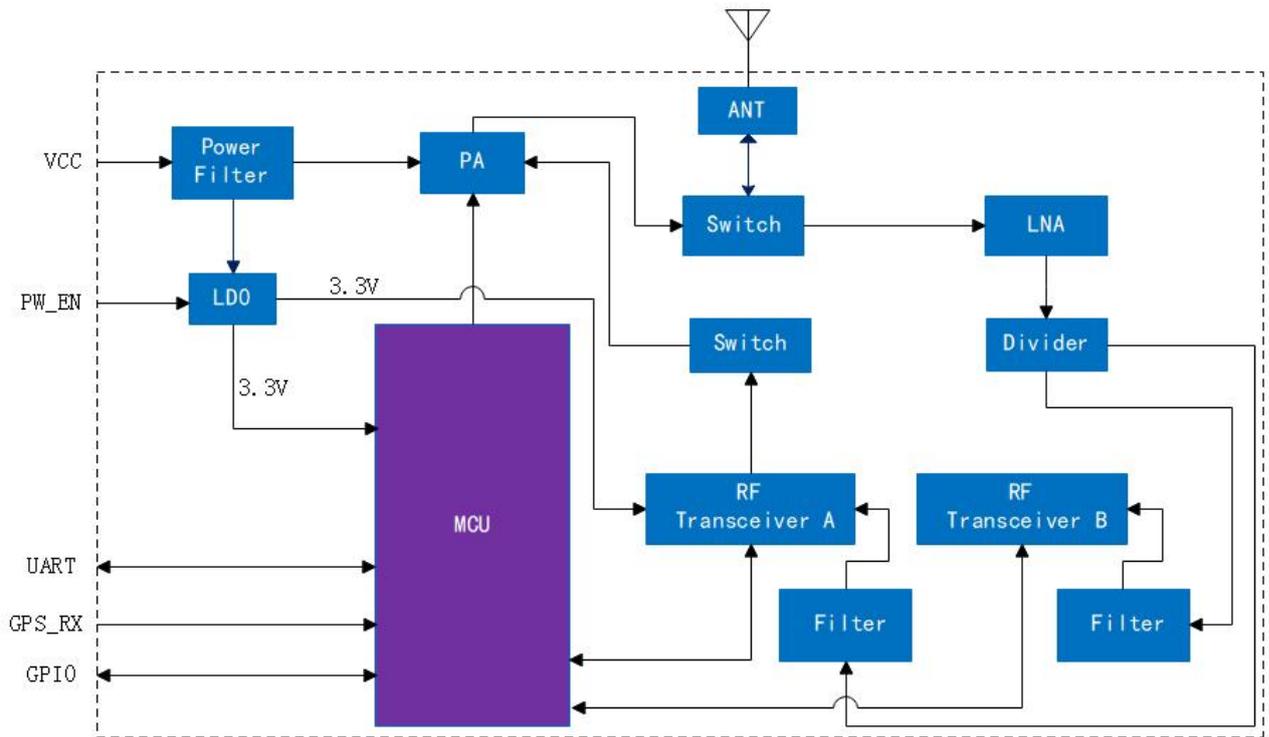


Figure 1: Internal Block Diagram

4. KEY SPECIFICATIONS

Parameter	Description
Transmit Frequency	AIS Channel 1: 161.975MHz AIS Channel 2: 162.025MHz
Modulation	GMSK
Modulation Rate	9.6Kbps
Transmit Power	33dBm \pm 1.5dBm
Receiver Sensitivity	Better than -116dBm
Power Supply	3.5V ~ 4.2V Typical supply voltage: 3.7V
Power Requirements	Maximum pulse current not less than 2A
Power Consumption	Transmit state (transient): 830mA Receive state: 180 \pm 10mA
Debug Serial Port	3.3V TTL level For software debugging, baud rate 38400bps
GPS Serial Port	3.3V TTL level Supports receiving GPS module information, baud rate 9600bps
GPS Interface Level	3.3V TTL level
Antenna Interface	Supports I-PEX connector Stamped hole soldering
Antenna Interface Impedance	50 Ω characteristic impedance
Temperature Range	Operating temperature: -25 $^{\circ}$ C to 70 $^{\circ}$ C Storage temperature: -30 $^{\circ}$ C to 80 $^{\circ}$ C
Logic Level Parameters	VIL (Input Low) Max = 0.66V VIH (Input High) Min = 2.64V VOL (Output Low) Max = 0.4V VOH (Output High) Min = 3V

Table 1 Module Key Features

5. APPLICATION INTERFACE

5.1 Pin Assignment

VCC	1	24	GND
VCC	2	25	GND
GND	3	26	RF_ANT
GND	4	27	GND
PW_EN	5	28	GND
1PPS	6	29	GND
GPS_RX	7	30	GND
RX_LED	8	31	GND
AIS_RX	9	32	GND
AIS_TX	10	33	GND
RK1	11	34	GND
SOS	12	35	GND
LED1	13	36	GND
LED2	14	37	GND
LED3	15	38	GND
LED4	16		
GPS_EN	17		
PGC	18		
PGD	19		
MCLK	20		
GND	21	39	GND
GND	22	40	GND
GND	23	41	GND

Figure 2: Pin Assignment Diagram

5.2 Pin Definitions

Pin Name	Pin No.	I/O	Description
VCC	1-2	POWER	Module power supply, 3.5V~4.2V, typical 3.7V, requires 2A current
GND	3-4, 21-25, 27-41	G	Module power ground
PW_EN	5	I	Module power enable control, active high, range 1.6V~6V
1PPS	6	I	GPS pulse per second input, 3.3V domain
GPS_RX	7	I	GPS serial port input, 3.3V domain
RX_LED	8	O	AIS receive indicator reserved, active high, can be left unconnected, 3.3V domain
AIS_RX	9	I	Module debug data receive port, 3.3V domain
AIS_TX	10	O	Module debug data transmit port, 3.3V domain
PK1	11	I	Silent function reserved, active low, can be left unconnected, 3.3V domain. Keep low for silent mode (module doesn't send AIS data). Keep high for non-silent mode.
SOS	12	I	SOS alarm reserved, active low, can be left unconnected, 3.3V domain. 3 seconds low pulse toggles SOS state (between alarm and non-alarm). Can trigger SOS alarm even in silent mode (PK1 low).
LED1	13	O	Error indicator reserved, active high, can be left unconnected, 3.3V domain
LED2	14	O	AIS transmit indicator reserved, active high, can be left unconnected, 3.3V domain
LED3	15	O	Silent mode indicator reserved, active high, can be left unconnected, 3.3V domain

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LED4	16	O	Operation indicator reserved, active high, can be left unconnected, 3.3V domain
GPS_EN	17	O	GPS enable reserved, default high (active), can be left unconnected, 3.3V domain
PGC	18	I/O	Programming pin
PGD	19	I/O	Programming pin
MCLR	20	I/O	Programming pin
RF_ANT	26	I/O	RF antenna pin

Table 2 Module Pin Definitions

5.3 Typical Circuit

The power input voltage range is 3.5V~4.2V. The power supply must be able to provide 2A current to prevent the voltage from dropping below 3.5V during transmission, which would cause the module to restart abnormally. To ensure better power supply performance, it is recommended to connect a 220 μ F tantalum capacitor, a 10 μ F (0603 package) capacitor, and a 100nF (0402 package) filter capacitor in parallel near the VCC input of the module. The module can operate normally only when PW_EN is high. The typical circuit is shown below:

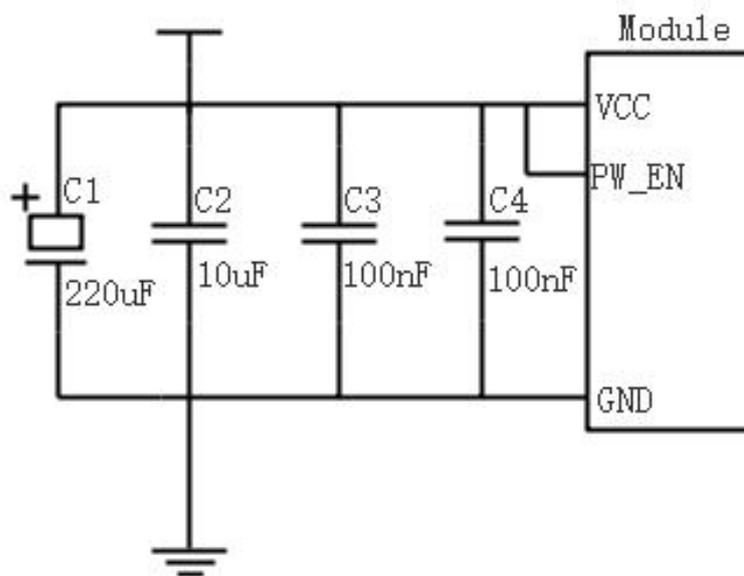


Figure 3: Power Supply Circuit

5.4 Serial Ports

The module has two serial ports: debug serial port and GPS serial port.

5.4.1 Debug Serial Port

- AIS_RX: Receives TXD data from terminal equipment (module protocol commands)
- AIS_TX: Sends data to RXD of terminal equipment (GPS data, AIS data, debug information, module protocol commands)
- Baud rate: 38400bps

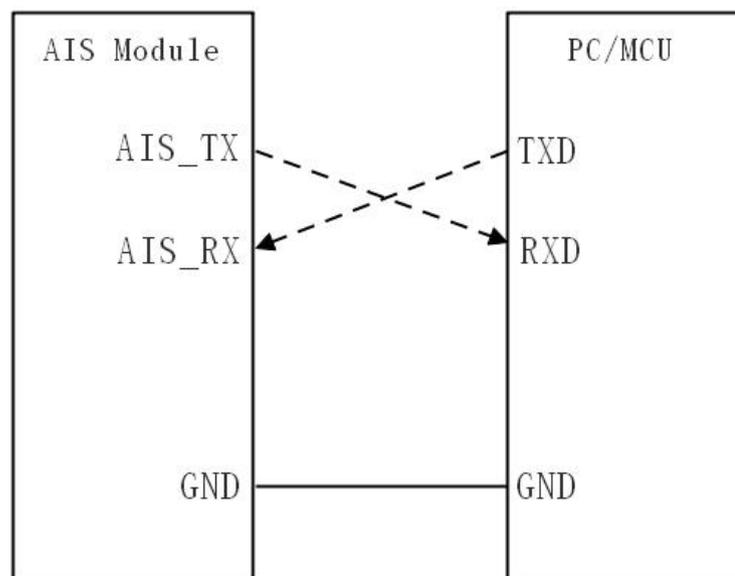
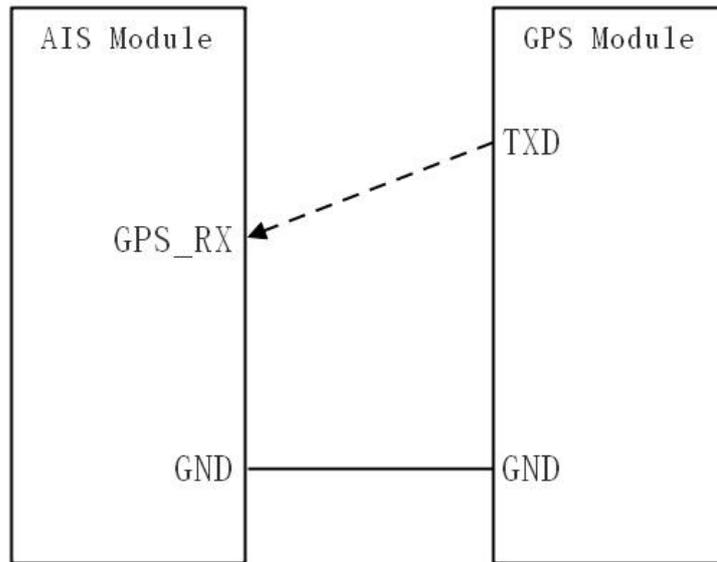


Figure 4: Debug Serial Port Connection Diagram

5.4.2 GPS Serial Port

- GPS_RX: Receives GPS data from GPS module (must comply with NMEA-0183 protocol)
- Baud rate: 9600bps



Parameter	Min	Max	Unit
VIL	0	0.66	V
VIH	2.64	3.3	V
VOL	-	0.4	V
VOH	3	-	V

Figure 5: GPS Serial Port Connection Diagram

Table 3 Serial Port Logic Levels

5.4.3 Antenna Interface

Pin Name	Pin No.	Description
GND	24	Ground
GND	25	Ground
RF_ANT	26	RF antenna interface
GND	27	Ground

Table 4 Pin Definitions

The module has both an IPEX connector and RF antenna pins reserved. If the IPEX connector is not used, the RF antenna pins can be used for custom design. The antenna interface impedance is 50Ω.

RF Antenna Reference Circuit:

For the peripheral circuit design of the antenna interface, a π -type matching circuit is recommended to better adjust RF performance. The π -type matching circuit components should be placed as close as possible to the antenna and selected according to actual conditions. By default, C1 and C2 are not mounted, and only R1 is mounted with a 0Ω resistor.

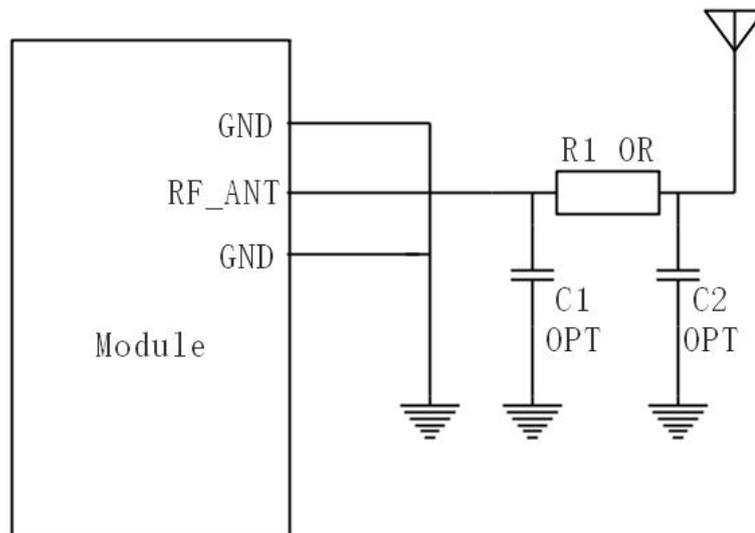


Figure 6: RF Antenna Reference Circuit

6. ELECTRICAL PERFORMANCE AND RELIABILITY

6.1 Absolute Maximum Ratings

The table below shows the maximum withstand voltage and current values for the digital and analog pins of the module power supply.

Parameter	Min	Max	Unit
VCC	-0.3	6	V
PW_EN	-0.3	VCC+0.3	V
Digital Pin Voltage	-0.3	3.3	V

Table 5 Absolute Maximum Ratings

6.2 Operating and Storage Temperature

The table below shows the operating temperature and storage range of the module.

Parameter	Min	Typical	Max	Unit
Operating Temperature	-25	+25	+70	°C
Storage Temperature	-30	-	+80	°C

Table 6 Operating and Storage Temperature Range

6.3 Current Consumption

The current consumption values are shown in the table below.

Parameter	Mode	Description	Typical	Unit
Ivcc	Active	RF Transmit State (33dBm) (Transient)	830	mA
	Active	RF Receive State	180	mA

Table 7 Module Current Consumption

7. MECHANICAL DIMENSIONS

Describes the mechanical dimensions of the module. All dimensions are in millimeters. The tolerance for the following dimensions is $\pm 0.1\text{mm}$.

7.1 Module Mechanical Dimensions

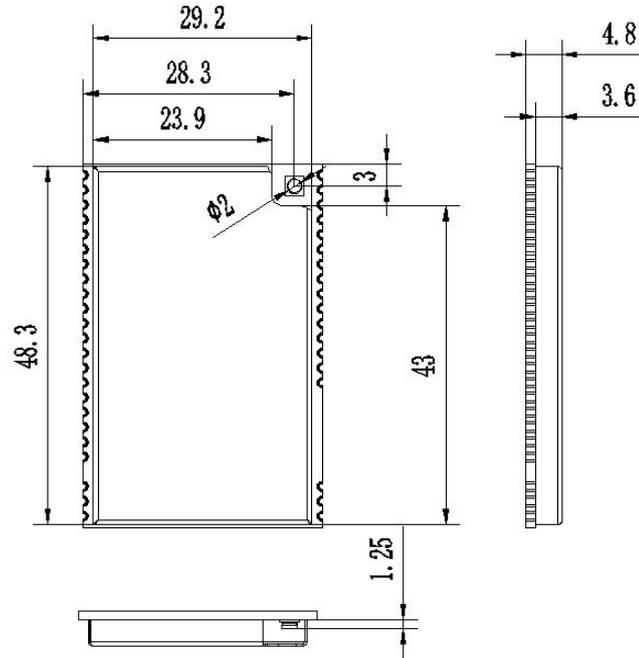


Figure 7: Top and Side View Dimensions

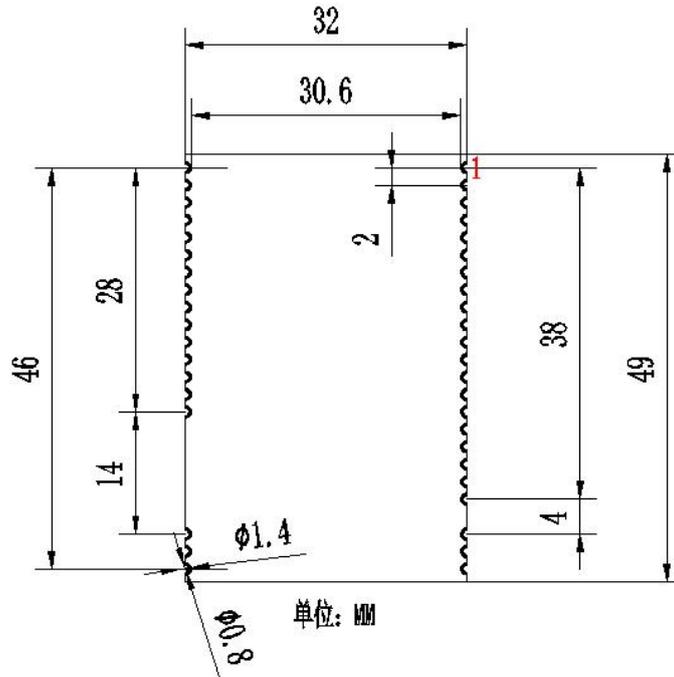


Figure 8: Bottom View Dimensions

8. ORDERING INFORMATION

Information	Description
DYA421	2W Power AIS Transceiver Module

9. FAQ

A. Why can't the module send AIS information?

- ✓ Check if the antenna is installed
- ✓ Check if the power connection is incorrect, preventing the module from operating normally
- ✓ Check if the power enable pin is pulled high
- ✓ Check if the power supply current is insufficient, causing voltage to drop below normal operating level during AIS transmission
- ✓ Check if the module is in normal mode; if not, it won't actively send AIS data
- ✓ If using the silent pin, check if it is at low level
- ✓ Check if the MMSI number is set to 0; if set to 0, the device won't send information

B. Why can't the module receive AIS information?

- ✓ Check if the antenna is installed
- ✓ Check if the antenna is mismatched or installed incorrectly
- ✓ Check if the debug software serial port and baud rate are selected correctly

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