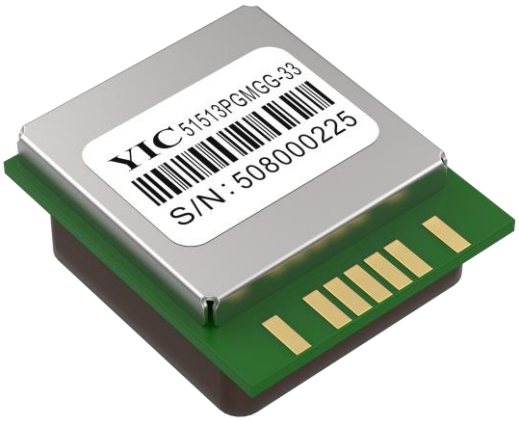
YIC



YIC51513PGMGG-33

Standard Precision Antenna Module

Datasheet

www.yic.com.tw

Directory

1. Product Information

1.1 Product Description

YIC51513PGMGG-33 is a complete standalone GPS/GNSS antenna module. It can simultaneously acquire and track multiple satellite constellations that include GPS, GLONASS, GALILEO, QZSS and SBAS. It features low power and small form factor.

YIC51513PGMGG-33 is suitable for the following applications

- Wearable and portable devices
- Automotive navigation
- Personal positioning
- Fleet management
- Mobile phone navigation
- Marine navigation

1.2 Product Features

- Very small size with antenna module
- MediaTek high sensitivity solution
- Support 99-channel (33 Tracking, 99 Acquisition)
- Very low power consumption
- Fast TTFF at low signal level
- Built-in 12 multi-tone active interference canceller
- Free hybrid ephemeris prediction to achieve faster cold start
- Built-in data logger
- Built-in DC/DC converter to save power
- Up to 10 Hz update rate
- ±11ns high accuracy time pulse (1PPS)
- Capable of SBAS (WAAS, EGNOS, MSAS, GAGAN)
- Support Japan QZSS
- Indoor and outdoor multi-path detection and compensation

1.3 Product Specifications

GNSS Receiver		
Chip	MediaTek	
Frequency	GPS, GALILEO, QZSS: L1 1575.42MHz, C/A code GLONASS: L1 1598.0625MHz ~ 1605.375MHz, C/A code	
Channels	Support 99 channels (33 Tracking, 99 Acquisition)	
Update rate	1Hz default, up to 10Hz	
Sensitivity	Tracking	-161dBm, up to -165dBm (with external LNA)
	Cold start	-142.5dBm, up to -148dBm (with external LNA)
Acquisition Time	Hot start (Open Sky)	< 1s
	Cold Start (Open Sky)	< 38s
		< 18s with AGPS
Position Accuracy	Autonomous	5m (2D RMS).
	SBAS	2.5m (depends on accuracy of correction data).
Max. Altitude	< 18,000 m, up to 50,000m by request	
Max. Velocity	Velocity < 515 m/s	
Protocol Support	NMEA 0183	9600 bps, 8 data bits, no parity, 1 stop bits (default) 1Hz: GGA, GLL, GSA, GSV, RMC, VTG
Physical Characteristic		
Dimensions	15.0.0mm * 13.0 mm * 6.8mm ±0.2mm	

1.4 DC Electrical Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Voltage	VCC		3.0	3.3	4.3	V
Input Backup Battery Voltage	V_BCKP		2.0		4.3	V
Supply Current	Iss	VCC = 3.3V Peak Acquisition Tracking Standby		 31 24(2) 600	150(1)	 mA mA mA uA
Backup Battery Current	Ibat	VCC = 0V		7		uA
High Level Input Voltage	VIH		2.0		3.6	V
Low Level Input Voltage	VIL		-0.3		0.8	V
High Level Input Current	IIH	no pull-up or down	-1		1	uA
Low Level Input Current	IIL	no pull-up or down	-1		1	uA
High Level Output Voltage	VOH		2.4		3.3	V
Low Level Output Voltage	VOL				0.4	V
High Level Output Current	IOH			2		mA
Low Level Output Current	IOL			2		mA

Note 1: This happens when downloading AGPS data to module.

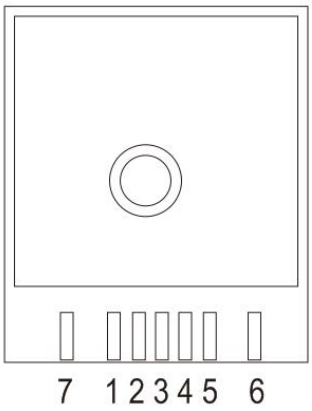
Note 2: Measured when position fix (1Hz) is available, input voltage is 3.3V and the function of self-generated ephemeris prediction is inactive.

Temperature characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Temperature	Topr	-40	25	85	℃
Storage Temperature	Tstg	-40	25	85	℃

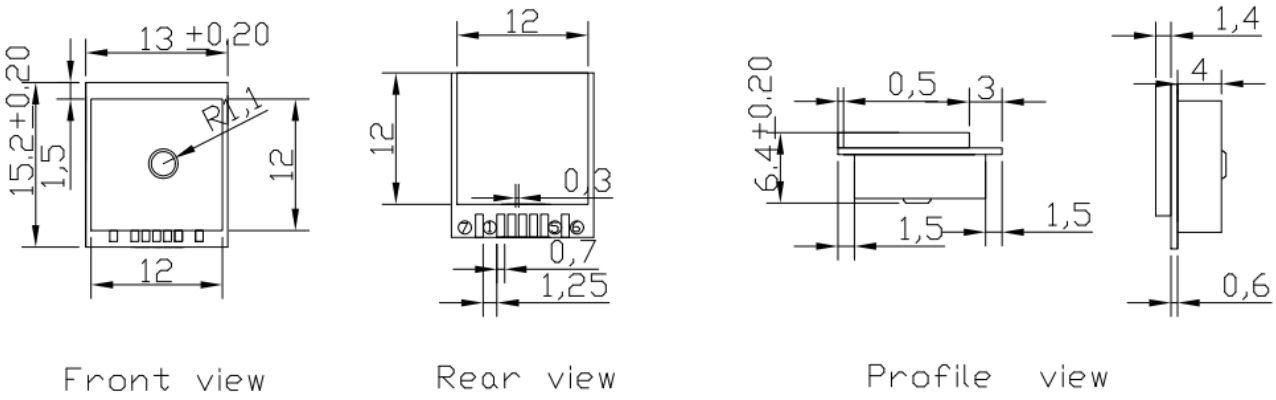
2. Technical Information

2.1 Module Pin Assignment



Pin NO.	Pin Name	I/O	Remark
1.	VBAT	I	RTC Battery Input
2.	TXD	O	UART/TTL Serial Data Output ,Pull up (75KΩ) if not used
3.	RXD	I	UART/TTL Serial Data Input, Pull up (75KΩ) if not used.
4.	VCC	I	Module Power Supply
5	GND	G	Ground
6	PPS	O	Time Pulse(1PPS)
7	GPIO1	I/O	General purpose I/O

2.2 Dimensions



3. Installation Guidelines

Introduction

Proper placement and installation of a GNSS antenna module significantly affects signal reception performance. This application note outlines key recommendations for integrating GNSS modules (especially those with built-in antennas) into a final product enclosure to ensure optimal positioning, minimum interference, and stable operation.

3-1 Prioritize Top or Upper Surface Placement

The GNSS antenna should face the sky directly, typically meaning the top side of the device enclosure. Avoid or minimize any obstruction above the antenna to ensure a clear line of sight to satellites.

3-2 Keep Away from Metal Parts

Avoid placing the GNSS antenna near internal metal components such as brackets, shielding covers, metal frames, battery packs, large metal housings, or bundled cables. Maintain a minimum distance of 1–2 cm from such structures; the farther, the better.

3-3 Avoid any High-Frequency Noise

Do not place the antenna close to noise-generating components, especially:

- Wi-Fi/Bluetooth modules
- Cellular transceivers (especially during transmission)
- High-speed digital circuits (e.g., CPUs, GPUs, data buses)
- Switching power supplies
- Motor drivers
- Display backlight drivers

These components emit electromagnetic interference that can overwhelm the weak GNSS signals.

3-4 Avoid Metal-Coated Plastic Enclosures

Some enclosures use metal spraying or electroplating for aesthetics or EMC reasons. These coatings may block satellite signals. Ensure the area directly above and around the antenna (at a certain radiation angle) is made of non-metallic materials such as pure plastic or glass.

3-5 Minimize Obstructions Around the Antenna

Avoid placing tall or dense components (e.g., battery packs, camera modules, speakers, or large connectors) directly above or around the antenna within a vertical angle of 5°–10°. These parts can block signal reception at low elevation angles.

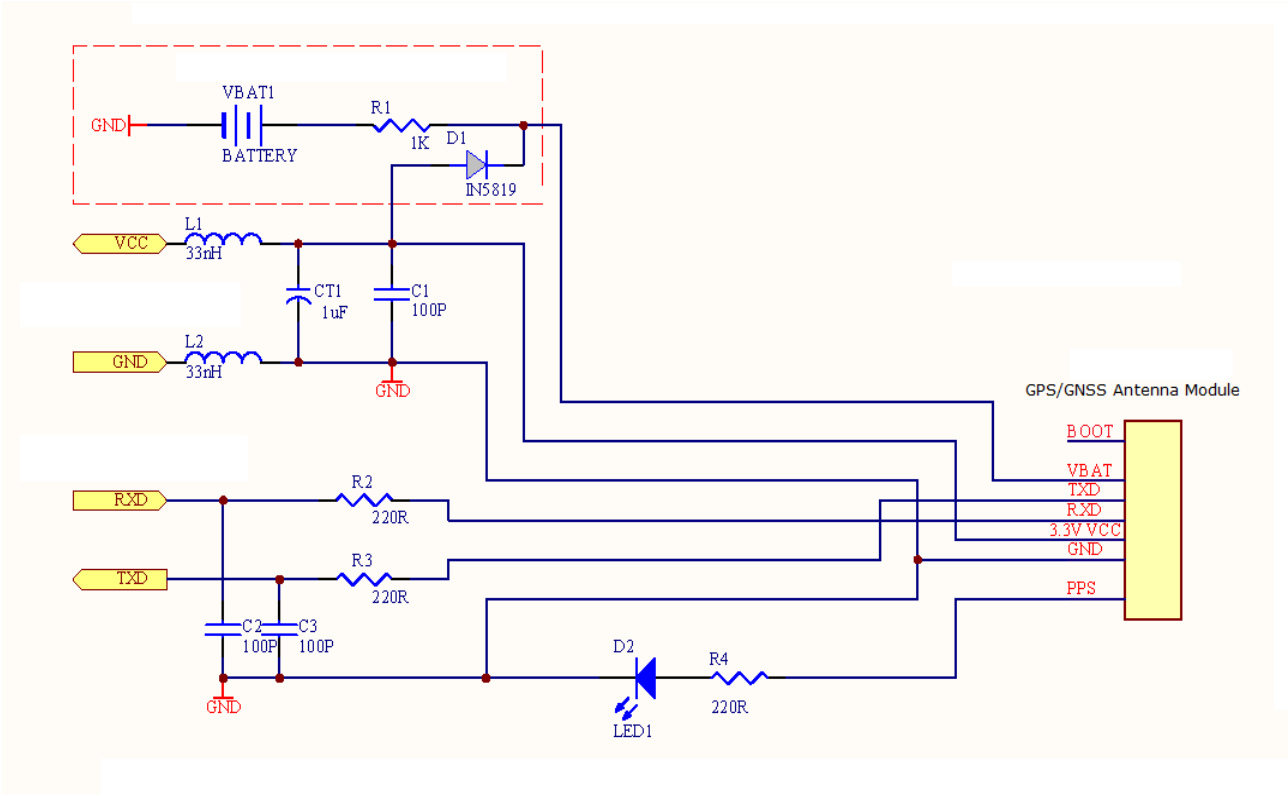
3-6 Ensure Clean and Stable Power Supply

Provide the module with a power source that has low ripple and stable voltage. It is recommended to use an LDO or a low-noise DC-DC converter, and place sufficient decoupling capacitors close to the module's power pins (as specified in the module datasheet).

3-7 Product Placement Recommendations

During the mechanical design of a product, the GNSS antenna module's placement should be pre-defined. Typically, a plastic cavity or grid structure is reserved in the enclosure to securely fit the module. The structure should be dimensioned to tightly hold the module in place. If additional fixation is needed, apply a small amount of adhesive to the backside of the module to ensure it stays firmly in position.

4. Application Circuit ：(Example)



5. Software Protocol

NMEA output message

Table 4.1 NMEA output message

NMEA	Description
GGA	Global positioning system fixed data
GLL	Geographic position - latitude/longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed

GGA--- Global Positioning System Fixed Data

Table 4.2 contains the values for the following example:

$GPGGA,060406.000,2503.7148,N,12138.7451,E,2,17,0.71,116.7,M,15.3,M,0000,0000*6D

Table4. 2 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	060406.000		hhmmss.sss
Latitude	2503.7148		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12138.7451		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	2		See Table 4.3
Satellites Used	17		Range 0 to 33
HDOP	0.71		Horizontal Dilution of Precision
MSL Altitude	116.7	mters	
Units	M	mters	
Geoid Separation	15.3	mters	
Units	M	mters	
Age of Diff. Corr.	0000	second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*6D		
<CR> <LF>			End of message termination

Table4.3 Position Fix Indicators

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3-5	Not supported
6	Dead Reckoning Mode, fix valid

GLL--- Geographic Position – Latitude/Longitude

Table4.4 contains the values for the following example:

$GNGLL,2503.7148,N,12138.7451,E,060406.000,A,D*46

Table3.4 GLL Data Format

Name	Example	Units	Description
Message ID	$GNGLL		GLL protocol header (GPGLL or GNGLL; GP indicates the device receives GPS satellites signal only and GN indicates the position is calculated with BEIDOU satellite signal)
Latitude	2503.7148		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12138.7451		dddmm.mmmm
E/W indicator	E		E=east or W=west
UTC Time	060406.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	D		A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse Position, S=Simulator
Checksum	*46		
<CR> <LF>			End of message termination

GSA---GNSS DOP and Active Satellites

Table 4.5 contains the values for the following example:

$GNGSA,A,3,22,21,18,12,24,25,14,15,193,,,,1.18,0.71,0.95*2C

$GNGSA,A,3,205,207,210,202,201,203,209,208,,,,,1.18,0.71,0.95*1C

Table3. 5 GSA Data Format

Name	Example	Units	Description
Message ID	$GNGSA		GSA protocol header (GNGSA or GPGSA; GP indicates the device receives GPS satellites signal only and GN indicates the position is calculated with BEIDOU satellite signal).First row of GSA message contains GPS & QZSS satellites and second row of GSA message contains BEIDOU satellites.
Mode 1	A		See Table 4.6
Mode 2	3		See Table 4.7
ID of satellite used	22		Sv on Channel 1
ID of satellite used	21		Sv on Channel 2
….			….
ID of satellite used			Sv on Channel 12
PDOP	1.18		Position Dilution of Precision
HDOP	0.71		Horizontal Dilution of Precision
VDOP	0.95		Vertical Dilution of Precision
Checksum	*2C		
<CR> <LF>			End of message termination

Table 4.6 Mode 1

Value	Description
M	Manual- forced to operate in 2D or 3D mode
A	Automatic-allowed to automatically switch 2D/3D

Table 4.7 Mode 2

Value	Description
1	Fix not available
2	2D
3	3D

GSV---GNSS Satellites in View

Table 4.8 contains the values for the following example:

$GPGSV,6,1,21,18,78,169,36,209,72,273,36,22,63,309,38,207,63,328,38*7B

$GPGSV,6,2,21,203,58,205,39,25,56,138,39,201,55,141,34,206,50,168,*45

$GPGSV,6,3,21,210,49,282,34,12,48,076,39,204,39,118,,14,38,322,37*77

$GPGSV,6,4,21,193,37,180,34,202,36,246,29,24,23,041,34,31,21,244,*71

$GPGSV,6,5,21,21,17,198,33,205,16,258,28,15,12,092,33,208,09,169,30*7B

$GPGSV,6,6,21,51,,,*7E

Table 4.8 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Total number of messages1	6		Range 1 to 6
Message number1	1		Range 1 to 6
Satellites in view	21		
Satellite ID	18		Channel 1 (Range 01 to 237), GPS Satellites ID : 01~32,SBAS Satellites ID : 33~64, QZSS Satellites ID:193~196, &BEIDOU Satellites ID : 201~214
Elevation	78	degrees	Channel 1 (Range 00 to 90)
Azimuth	169	degrees	Channel 1 (Range 000 to 359)
SNR (C/No)	36	dB-Hz	Channel 1 (Range 00 to 99, null when not tracking)
Satellite ID	207		Channel 4 (Range 01 to 237) , GPS Satellites ID : 01~32,SBAS Satellites ID : 33~64, QZSS Satellites ID:193~196, &BEIDOU Satellites ID : 201~214
Elevation	63	degrees	Channel 4 (Range 00 to 90)
Azimuth	328	degrees	Channel 4 (Range 000 to 359)
SNR (C/No)	38	dB-Hz	Channel 4 (Range 00 to 99, null when not tracking)
Checksum	*7B		
<CR> <LF>			End of message termination

Depending on the number of satellites tracked multiple messages of GSV data may be required.

RMC---Recommended Minimum Specific GNSS Data

Table 4.9 contains the values for the following example:

$GNRMC,060406.000,A,2503.7148,N,12138.7451,E,0.01,0.00,180313,,,D*78

Table 4.9 RMC Data Format

Name	Example	Units	Description
Message ID	$GNRMC		RMC protocol header (GNRMC or GPRMC; GP indicates the device receives GPS satellites signal only and GN indicates the position is calculated with BEIDOU satellite signal)
UTC Time	060406.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2503.7148		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12138.7451		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed over ground	0.01	knots	True
Course over ground	0.00	degrees	
Date	180313		ddmmyy
Magnetic variation		degrees	
Variation sense			E=east or W=west (Not shown)
Mode	D		A=autonomous, D=DGPS, E=DR, N=Data not valid,R=Coarse Position, S=Simulator
Checksum	*78		
<CR> <LF>			End of message termination

VTG---Course Over Ground and Ground Speed

Table 4.10 contains the values for the following example:

$GPVTG,0.00,T,,M,0.01,N,0.02,K,D*3B

Table 4.10 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course over ground	0.00	degrees	Measured heading
Reference	T		True
Course over ground		degrees	Measured heading
Reference	M		Magnetic
Speed over ground	0.01	knots	Measured speed
Units	N		Knots
Speed over ground	0.02	km/hr	Measured speed
Units	K		Kilometer per hour
Mode	D		A=autonomous, D=DGPS, E=DR, N=Data not valid,R=Coarse Position, S=Simulator
Checksum	*3B		
<CR> <LF>			End of message termination