GPS & BDS Antenna Module

1. Product Information

1.1Product Name: YIC82525GMGB

1.2Product Description:

YIC82525GMGB is a compact, high performance, and low power consumption GNSS engine board.It uses the chipset which can track up to 32 channels at a time and perform fast TTFF in weaksignal nvironments.

YIC82525GMGB is suitable for the following applications:

- Automotive navigation
- Personal positioning
- Fleet management
- Mobile phone navigation
- Marine navigation

1.3Product Features:

- High performance and low power consumption GPS Chipset
- Very high sensitivity
- Extremely fast TTFF (Time To First Fix) at low signal level
- Two serial ports
- Built-in LNA
- Compact size suitable for space-sensitive application
- One size component, easy to mount on another PCB board
- Support NMEA 0183 and Realtek binary protocol

1.4Product Specifications

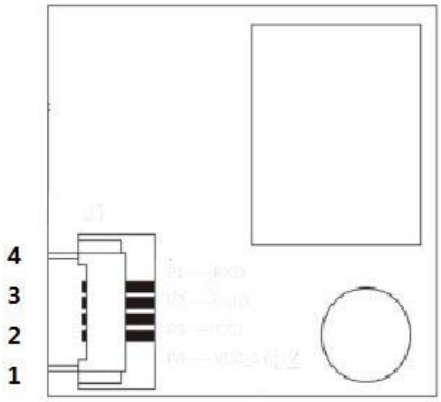
GPS Performance

GNSS Receiver	
Chip	REALTEK RTL8771AW
Frequency	GPS, QZSS: L1 1575.42MHz, C/A code, BD：1561.098MHz
Code	C/A Code
Available Baud Rate	9,600 bps
Channels	Support 32
Sensitivity	Tracking:-161dBm Reacquisition:-160dBm ColdStart:-148dBm
Cold Start	31 seconds, average
Warm Start	28 seconds, average
Hot Start	8 seconds, average
Accuracy	3m (2D RMS).
Maximum Altitude	50,000 meter
Maximum Velocity	280 m/s(1000 knots)
Dynamics	≦4G
Update Rate	4 Hz
A-GPS	AssistNow on-line and off-line
Interface	
I/O Pins	1 serial ports
Physical Characteristic	
Dimensions	25.1mm * 25.1 mm * 8.8mm
DC Characteristics	
Power Supply	3.3~5.5VDC ± 5%

GPS Mode Power Consumption		
Power Consumption	Max Performance: Acquisition:75mA Tracking: 55mA	
GPS/BeiduoMode Power Consumption		
Power Consumption	Max Performance: Acquisition:80mA Tracking: 65mA	
GPS/GlonassMode Power Consumption		
Power Consumption	Max Performance: Acquisition:76mA Tracking: 60mA	
Environmental Range		
Humidity Range	5% to 95% non-condensing	
Operation Temperature	-30℃ to 75℃	
Storage Temperature	-40℃ to 85℃	
Protocol Support	NMEA 0183	9600 bps, 8 data bits, no parity, 1 stop bits (default) 1Hz: GGA, GLL, GSA, GSV, RMC, VTG,ZDA

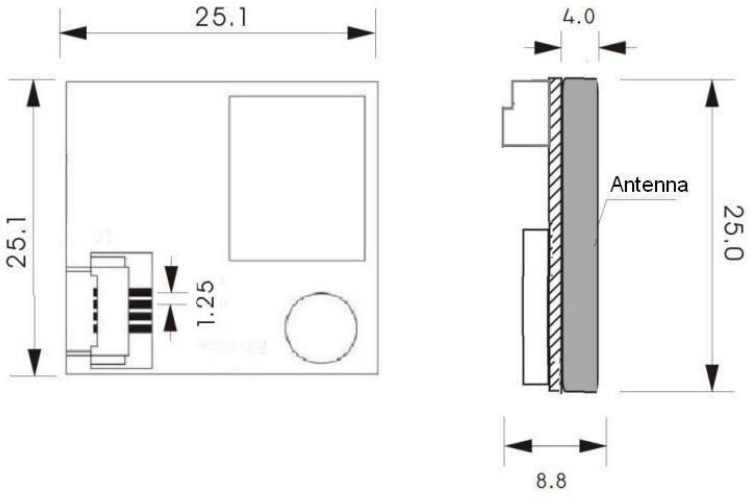
2. Technical Information

Module Pin Assignment



Pin NO.	Pin Name	I/O	Remark
1.	VCC		+3.3~5.5V
2.	TXD	O	
3.	GND	G	Ground.
4.	RXD	I	

Dimensions



Unit : mm

3. Application guideline

Layout Rules

Do not routing the other signal or power trace under the engine board .

Design Notes

GND

Ground pin for the baseband circuit.

RXD

This is the main channel for receiving software commands.

TXD

This is the main transmits channel for outputting navigation and measurement data to user’snavigation software or user written software.

4. NEMA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a $ and with carriagereturn/line feed. GPS specific messages all start with $GPxxx where xxx is a three-letter identifierof the message data that follows. NMEA messages have a checksum, which allows detection ofcorrupted data transfers.

YIC82525GMGB modules support the following NMEA-0183 messages:
GGA,VTG,RMC,GLL,GSA, GSV and ZDA.

Table 1: NMEA-0183 Output Messages

Item	Name	Data	Length(approximation), unit bytes(note 1)
0	GGA	UTC, latitude/longitude, position fixed, number of satellites in positioning, HDOP, height, DGPS	71
1	VTG	Forward direction, magnetic trace degree, speed	37
2	RMC	UTC, data status, latitude/longitude, speed, forward direction, UTC days, magnetic trace degree, position mode	61
3	GLL	latitude/longitude, UTC time, status	44
4	GSA	Position mode, position calculation mode, PRN, PDOP, HDOP, VDOP	66
5	GSV	Total of GSV message , Serial number of GSV message, Number of visible satellites, PRN No. of 1st satellite, Elevation angle of 1st satellite (00～90 degree), Direction angle of 1st satellite (000～359 degree), SNR signal strength C/No of 1st satellite (00～99 dB)	70
6	ZDA(note 2)	Date and time	36

Note 1：The actual length will be due to the time, latitude and longitude of the display of the number of decimal places, satellite number definition, statement format and a slight adjustment.

Note 2：This statement should be generated by the original factory customized.

4.1 GGA

Excerpts from the NMEA0183 agreement are as follows:

$GPGGA, hhmmss, xxxx.xxx, a, yyyyy.yyy, a, x, x, xx, uxxxx, M, uxxx, M, xx, xxxx *hh<CR><LF>

1 23 45 67 8 9 10 11 12 13 14

1: UTC (Hour, Minute, Second)
2,3: Latitude (Degree, Minute), N/S (the datum specified by user)
4,5: Longitude (Degree, Minute), E/W (the datum specified by user)
6: GPS position fixed information
0: No positioning or invalid data,
1: GPS positioning,
2: Differential GPS positioning
7: Number of satellites for positioning
8: HDOP
9,10: Antenna height above mean sea level (m) (the datum specified by user)
11,12:Geoidal height (m)
13: DGPS data correction lapsed time (second), 00 when non DGPS positioning.
14: DGPS Reference Station No., 0000 when non DGPS positioning.

Example:

$GPGGA,044103.00,2446.78905,N,12059.72063,E,1,12,0.8,160.8,M,19.5,M,,*6F

Table 4.1: GGA Table

Name	Example	Units	Description
Message ID	$%sGGA		GGA protocol header, %s please reference to Table 2.1
UTC Time	044103.00		hhmmss.ss
Latitude	2446.78905		ddmm.mmmmm
N/S indicator	N		N=north or S=south
Longitude	12059.72063		dddmm.mmmmm
E/W indicator	E		E=east or W=west
Position Fix Indicator	1		See table
Satellites Used	12		Range 00 to 12
HDOP	0.8		Horizontal Dilution of Precision
MSL Altitude	160.8	meters	Altitude above mean sea level
Units	M	meters	
Geoids Separation	19.5	meters	Separation from Geoids, can be blank
Units	M	meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref.Station ID			Null fields when DGPS is not used
Checksum	*6F		
<CR><LF>			End of message terminal(ASCII 13 ASCII 10)

4.2 VTG

Excerpts from the NMEA0183 agreement are as follows:

$GPVTG, xxx.x,T,,M,xxx.x,N,xxx.x,K,A*hh<CR><LF>

123 4 5 6 7 8 9

1,2: Track Degrees (degree), T = True

3,4: Track Degrees(degree), M = Magnetic

5,6: Speed (knot)

7,8: Speed (km/h)

9: Mode indication (NMEA0183 only version 3.01 A= output, self localization, D= difference, E= estimates, N= data is invalid)

Example:

$GPVTG,000.00,T,,M,000.02,N,000.03,K,A*51

Table 4.2: VTG Table

Name	Example	Units	Description
Message ID	$%sVTG		VTG protocol header, %s please reference to Table 2.1
Track Degrees	000.00	degree	ddd.dd
	T		
Track Degrees		drgree	Null if no E-compass or magnetic sensor
	M		
Speed	000.02		ddd.dd, speed represents in knot
	N	Knots	
Speed			ddd.dd, speed represents in km/hr
	K	Km/hr	
mode	A		Mode indication (NMEA0183 only version3.01 A= output, self localization, D= difference, E= estimates, N= data is invalid)
Checksum	*51		
<CR><LF>			End of message terminal(ASCII 13 ASCII 10)

4.3 RMC

Excerpts from the NMEA0183 agreement are as follows:

$GPRMC,hhmmss.ss,f,ddmm,mm,a,dddmm.mm,a,xxx.x,xxx.,xxxxxx, x.x, b, c*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10 11 12

1: UTC (Hour, Minute, Second)

2: Data status A: Valid, V: Invalid

3,4: Latitude (degree, minute), N/S (the datum specified by user)

5,6: Longitude(degree, minute), E/W (the datum specified by user)

7: Speed (knots)

8: Forward Direction (degree)

9: UTC day, month, year

10: Declination(000.0~180.0 degrees, in front of 0 will also be transmitted)

11: Declination direction，E（east）or W（west）

12: Mode indication (NMEA0183 only version3.01 A= output, self localization, D= difference, E= estimates, N= data is invalid)

Example:

$GPRMC,044103.00,A,2446.78905,N,12059.72063,E,000.02,000.00,160715,,,A*52

Table 4.3: RMC Table

Name	Example	Units	Description
Message ID	$%sRMC		RMC protocol header, %s please reference to Table 2.1
UTC Time	044103.00		hhmmss.ss
Data status	A		A: valid, V: invalid
Latitude	2446.78905		ddmm.mmmmm
N/S indicator	N		N=north or S=south
Longitude	12059.72063		Dddmm.mmmmm
E/W indicator	E		E=east or W=west
Speed	000.02	knots	Speed in knots
Forward direction	000.00	degree	ddd.dd
UTC day	160715		ddmmyy
Declination(magnetic variation)		degree	Null if no e-compass or magnetic sensor exists

Declination direction(E/W indicator)			E=east or W=west, null if no e-compass or magnetic sensor exists
mode	A		Mode indication (NMEA0183 only version3.01 A= output, self localization, D= difference, E= estimates, N= data is invalid)
Checksum	*52		
<CR><LF>			End of message terminal(ASCII 13 ASCII 10)

4.4 GLL

Excerpts from the NMEA0183 agreement are as follows:

$GPGLL,ddmm.mm, a, dddmm.mm, a, hhmmss.ss, A ,B*hh<CR><LF>

1 2 3 4 5 6 7

1,2: Latitude (degree, minute), N/S

3,4: Longitude(degree, minute), E/W

5: UTC (hour, minute, second)

6: Status A=Valid V=Invalid

7: Mode indication (NMEA0183 only version3.01 A= output, self localization, D= difference, E= estimates, N= data is invalid)）

Example:

$GPGSA,A,3,01,04,23,07,09,11,193,27,16,19,22,28,1.1,0.8,0.8*03

Table 4.4: GLL Table

Name	Example	Units	Description
Message ID	$%sGLL		GLL protocol header, %s please reference to Table 2.1
Latitude	2446.78905		ddmm.mmmmm
N/S indicator	N		N=north or S=south
Longitude	12059.72063		Dddmm.mmmmm
E/W indicator	E		E=east or W=west
UTC Time	044103.00		hhmmss.ss
Data status	A		A: valid, V: invalid
mode	A		Mode indication (NMEA0183 only version3.01 A= output, self localization, D= difference, E= estimates, N= data is invalid)
Checksum	*52		
<CR><LF>			End of message terminal(ASCII 13 ASCII 10)

4.5 GSA

Excerpts from the NMEA0183 agreement are as follows:

$GPGSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx.x,xx.x,

1 2 3 45 6 7 8 910 11 12 13 1415 16

xx.x*hh<CR><LF>

17

1: Positioning mode M = Manual (2 or 3 dimension). A = AUTO

2: Positioning Calculation Mode

1 = not positioning, 2 = 2 dimension, 3 = 3 dimension

3～14: Satellite PRN No. ("00" for no satellite in case of less than 12 satellites)

15: PDOP

16: HDOP

17: VDOP

Example:

$GPGSA,A,3,01,04,23,07,09,11,193,27,16,19,22,28,1.1,0.8,0.8*03

Table 4.5: GSA Table

Name	Example	Units	Description
Message ID	$%sGSA		GSA protocol header, %s please reference to Table 2.1
Positioning mode	A		M = Manual (2 or 3 dimension). A = AUTO
Positioning calculation mode	3		1 = not positioning, 2 = 2 dimension, 3 = 3 dimension
Satellite PRN number	01,04,23,07,09,11,193,27,16,19,22,28		"00" for no satellite in case of less than 12 satellites
PDOP	1.1		
HDOP	0.8		
VDOP	0.8		
Checksum	*03		
<CR><LF>			End of message terminal(ASCII 13 ASCII 10)

4.6 GSV

Excerpts from the NMEA0183 agreement are as follows:

$GPGSV,x,x,xx,xx,xx,xxx,xx,xx,xx,xxx,xx,xx,xx,xxx,xx,xx,

1 2 345 6 7 8 9 10 11 12 13 14 15 16

xx,xxx,xx*hh<CR><LF>

1718 19

1: Total of GSV message

2: Serial number of GSV message

3: Number of visible satellites

4: PRN No. of 1st satellite

5: Elevation angle of 1st satellite (00～90 degree)

6: Direction angle of 1st satellite (000～359 degree)

7: SNR signal strength C/No of 1st satellite (00～99 dB)

8～11: Data of 2nd satellite (same order as 4～7)

12～15: Data of 3rd satellite (same order as 4～7)

16～19: Data of 4th satellite (same order as 4～7) * "00" and "000" for no satellite in case of less than 4 satellites. In case of more than 5 satellites, 2 sentences are employed and in case of more than 9 satellites, 3 sentences are employed.

Example:

$GPGSV,4,1,14,01,49,181,49,04,68,136,51,07,57,304,49,09,16,232,42*7E

$GPGSV,4,2,14,11,70,208,49,16,22,089,43,19,51,016,50,22,01,068,35*7C

$GPGSV,4,3,14,23,09,197,43,27,25,041,45,28,03,300,42,193,35,138,45*47

$GPGSV,4,4,14,03,00,000,26,30,00,000,47*7B

Table 4.6: GSV Table

Name	Example	Units	Description
Message ID	$%sGSV		GSV protocol header, %s please reference to Table 2.1
Total of GSV messages	4		Total GSV message number, here is 4 lines
Serial number of GSV message	1~4		The serial number of current GSV message
Number of visible satellites	14		Number of all visible satellites
PRN	01,04,07,09 in		Prn of all visible satellites

	line1 11,16,19,22 in line 2 23,27,28,193 in line 3 03,30 in line 4		
Elevation angle	49,68,57,16 in line 1 70,22,51,01 in line 2 09,25,03,35 in line 3 00,00 in line 4	degree	Elevation angle of all visible satellites
Azimuth angle	181,136,304,232 in line 1 208,089,016,068 in line 2 197,041,300,138 in line 3 000,000 in line 4	Degree	Azimuth angle of all visible satellites
SNR	49,51,49,42 in line 1 49,43,50,35 in line 2 43,45,42,45 in line 3 26,47 in line 4	dB	SNR signal strength C/No
Checksum	*7E in line 1 *7C in line 2 *47 in line 3 *7B in line 4		
<CR><LF>			End of message terminal(ASCII 13 ASCII 10)

4.7 ZDA

Excerpts from the NMEA0183 agreement are as follows:

$GPZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh

1 2 3 4 5 6

1: Time (UTC)
2: Day, 01 to 31
3: Month, 01 to 12
4: Year
5: Local zone hour description, 00 to +/- 13 hours
6: Local zone minutes description, same sign as local hours, 00~59

Example:

$GPZDA,201530.00,04,07,2002,00,00*60

Table 4.7: ZDA Table

Name	Example	Units	Description
Message ID	$%sZDA		GSV protocol header, %s please reference to Table 2.1
Time (UTC)	201530.00		hhmmss.ss
Day	04		dd
Month	07		mm
Year	2002		yyyy
Local zone hour description	00		hh
Local zone minute description	00		mm
Checksum	*60		
<CR><LF>			End of message terminal(ASCII 13 ASCII 10)

5. Example

5.1 Format

1. Support GGA/GLL/GSA/GSV/RMC/VTG;
2. Single and double mode at the beginning of the unified format for GP,GSA/GSV different mode satellite merger display;
3. BD prn 141~178，GLONASS prn 53~76;
4. Single mode statement sequence: GPGGA -> GPGLL -> GPGSA -> GPGSV -> GPRMC -> GPVTG
5. Two mode statement sequence: GPGGA -> GPGLL -> GPGSA -> GPGSV -> GPRMC -> GPVTG

5.2 GPS Single mode positioning

GPS:02,05,06,07,12,13,15,20,29,30,50,193

NMEA Capture examples:

$GPGGA,103124.00,2446.78971,N,12059.71961,E,1,12,0.89,168.6,M,19.5,M,,*5C
$GPGLL,2446.78971,N,12059.71961,E,103124.00,A,A*6F
$GPGSA,A,3,02,193,05,06,07,30,20,15,29,13,12,50,1.25,0.89,0.86*3C
$GPGSV,3,1,12,02,65,079,50,05,53,359,51,06,31,111,47,07,08,054,40*76
$GPGSV,3,2,12,12,03,225,39,13,71,186,51,15,37,219,49,20,30,289,48*72
$GPGSV,3,3,12,29,29,308,48,30,19,083,43,50,50,133,50,193,65,044,49*4B
$GPRMC,103124.00,A,2446.78971,N,12059.71961,E,0.042,0.000,040915,,,A*57
$GPVTG,0.000,T,,M,0.042,N,0.079,K,A*05

5.3 GPS/BeidouDual mode positioning

GPS:04,08,09,16,19,22,23,27,28,30,32,193,50,26
Beidou:146,147,148,150,151,152,141,173

NMEA Capture examples:

$GPGGA,013008.00,2446.79039,N,12059.71897,E,1,17,0.68,160.8,M,19.5,M,,*53
$GPGLL,2446.79039,N,12059.71897,E,013008.00,A,A*6C
$GPGSA,A,3,09,28,32,19,08,04,27,193,23,16,22,147,0.98,0.68,0.71*07
$GPGSV,6,1,22,04,72,117,50,08,51,012,49,09,13,228,39,16,18,096,42*71
$GPGSV,6,2,22,19,57,358,49,22,02,062,37,23,05,191,40,27,21,045,43*7F
$GPGSV,6,3,22,28,06,304,42,30,60,294,00,32,09,137,42,193,37,139,45*45
$GPGSV,6,4,22,50,00,000,47,26,00,000,28,146,04,174,37,147,72,162,49*7D

$GPGSV,6,5,22,148,67,309,49,150,76,295,49,151,03,242,37,152,48,271,49*72
$GPGSV,6,6,22,141,00,000,52,173,00,000,51*7B
$GPRMC,013008.00,A,2446.79039,N,12059.71897,E,0.020,0.000,040915,,,A*50
$GPVTG,0.000,T,,M,0.020,N,0.036,K,A*0A

5.4 GPS/GLONASS Dual mode positioning

GPS:01,03,04,07,08,11,17,19,27,28,30,32,193
GLONASS:62,74,61,57,72,71,73,56

NMEA Capture examples
$GPGGA,025616.00,2446.79076,N,12059.72056,E,1,19,0.85,163.8,M,19.5,M,,*5C
$GPGLL,2446.79076,N,12059.72056,E,025616.00,A,A*6D
$GPGSA,A,3,01,193,03,04,07,08,11,19,28,32,30,17,1.21,0.85,0.86*37
$GPGSV,6,1,21,01,76,030,51,03,29,144,45,04,46,038,49,07,47,215,48*7C
$GPGSV,6,2,21,08,29,052,45,11,60,021,50,17,16,279,40,19,33,042,47*7F
$GPGSV,6,3,21,27,00,073,00,28,32,326,47,30,50,269,49,32,27,099,45*72
$GPGSV,6,4,21,193,52,129,48,62,72,282,51,74,00,248,00,61,41,172,39*4E
$GPGSV,6,5,21,57,14,104,35,72,43,355,44,71,09,041,43,73,36,285,49*72
$GPGSV,6,6,21,56,07,055,40*4A
$GPRMC,025616.00,A,2446.79076,N,12059.72056,E,0.022,0.000,040915,,,A*53
$GPVTG,0.000,T,,M,0.022,N,0.040,K,A*09