GPS & GLONASS Receiver Module

1. Product Information

1.1 Product Name: YIC51009EBGG-33

1.2 Product Description

YIC51009EBGG-33 features high sensitivity, low power and ultra small form factor. The module is powered by MediaTek. It can provide you with superior sensitivity and performance even in urban canyon and dense foliage environment. The miniature size makes the module easy to integrate into portable device like mobile phone, PDAs, camera and vehicle locators.

This module supports hybrid ephemeris prediction to achieve faster cold start. One is self-generated ephemeris prediction that is no need of both network assistance and host CPU's intervention. This is valid for up to 3 days and updates automatically from time to time when GPS module is powered on and satellites are available. The other is server-generated ephemeris prediction that gets from an internet server. This is valid for up to 14 days. Both ephemeris predictions are stored in the on-board flash memory and perform a cold start time less than 15 seconds.

YIC51009EBGG-33 is suitable for the following applications:

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

1.3 Product Features

- MediaTek high sensitivity solution
- Support 99-channel (33 Tracking, 99 Acquisition)
- Ultra 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
- Small form factor 10.1mm * 9.7 mm * 2.5mm
- SMD type with stamp holes
- RoHS compliant

1.4 Product Specifications

GNSS Performance

GNSS Receiver		
Chip	MediaTek MT3333	
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)	< 33s
		< 15s with AGPS
Position Accuracy	Autonomous	3m (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 ver 4.10	9600 bps, 8 data bits, no parity, 1 stop bits (default) 1Hz: GGA, GLL, GSA, GSV, RMC, VTG
Physical Characteristic		
Dimensions	10.1mm * 9.7 mm * 2.5mm ±0.1mm	

1.5 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,w/o active antenna,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 YIC51009EBGG-33.

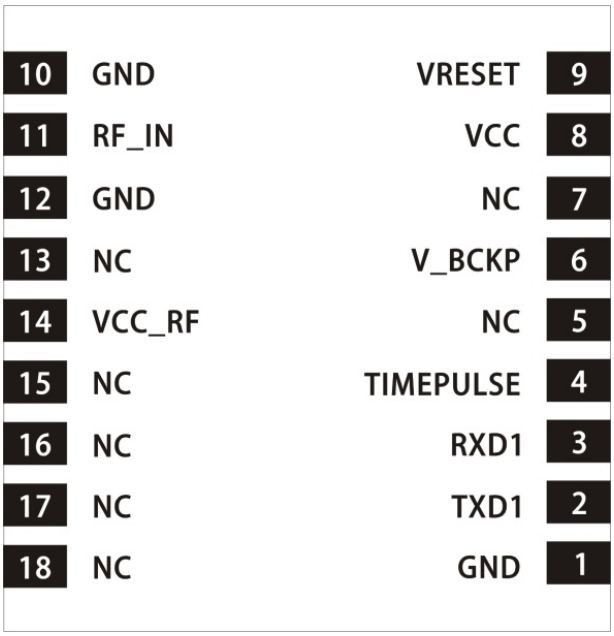
Note 2: Measured when position fix (1Hz) is available, input voltage is 3.3V and the function of self-generated ephemeris prediction is inactive.

Temperature characteristics

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

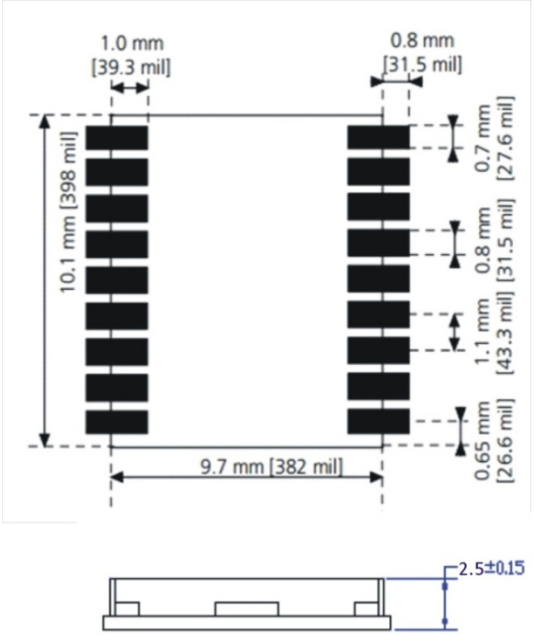
2. Technical Information

2.1 Module Pin Assignment



Pin NO.	Pin Name	I/O	Remark
1.	GND	G	Ground.
2.	TXD1	O	
3.	RXD1	I	
4.	TIMEPULSE	O	1 Pulse per second
5.	NC	N	Not connected
6.	V_BCKP	PWR	Backup battery supply voltage
7.	NC	N	Not connected
8.	VCC	PWR	Main power supply to the engine board.
9.	VRESET	I	Reset
10.	GND	G	Ground.
11.	RF_IN	RF	GPS antenna input
12.	GND	G	Ground.
13.	NC	N	Not connected
14.	VCC_RF		
15.	NC	N	Not connected
16.	NC	N	Not connected
17.	NC	N	Not connected
18.	NC	N	Not connected

2.2 Dimensions



unit: mm
Tolerance: ±0.1

3. NMEA 0183 Protocol

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

YIC51009EBGG-33 modules support the following NMEA-0183 messages: GGA, GLL,GSA, GSV, RMC and VTG.

Table 3.1: NMEA-0183 Output Messages

NMEA Record	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 3.2 contains the values of the following example:

$GPGGA,183015.000,2503.7123,N,12138.7446,E,2,16,0.68,123.2,M,15.3,M,0000,0000*66

Table 3.2: GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Position	183015.000		hhmmss.sss
Latitude	2503.7123		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12138.7446		dddmm.mmmm
E/W Indicator	E		E=east orW=west
Position Fix Indicator	2		See Table 2-1
Satellites Used	16		Range 0 to 33
HDOP	0.68		Horizontal Dilution of Precision
MSL Altitude	123.2	meters	
Units	M	meters	
Geoids Separation	15.3	meters	
Units	M	meters	
Age of Diff. Corr.	0000	second	Null fields when DGPS is not Used
Diff. Ref. Station ID	0000		
Checksum	*66		
<CR> <LF>			End of message termination

Table 3.211: 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

Table 3.3 contains the values of the following example:

$GPGLL , 3723.24755, N,12158.34161,W,161229.487, A,D*2C.

Table 3.3: GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.24755		ddmm.mmmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.34161		dddmm.mmmmm
E/W Indicator	W		E=east orW=west
UTC Position	161229.487		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	*2C		
<CR> <LF>			End of message temination

GSA-GNSS DOP and Active Satellites

Table 4.4 contains the values of the following example:

$GNGSA,A,3,18,193,21,09,12,22,27,15,25,14,,,1.44,0.68,1.27*2F
$GNGSA,A,3,76,72,77,75,66,65,,,,,,,1.44,0.68,1.27*12

Table 4.4: GSA Data Format

Name	Example	Units	Description
Message ID	$GNGSA		GSA protocol header
Mode 1	A		See Table 4-2
Mode 2	3		See Table 4-1
ID of satellite used	18		Sv on Channel 1
ID of satellite used	193		Sv on Channel 2
…	…		…
ID of satellite used			Sv on Channel 12
PDOP	1.44		Position Dilution of Precision
HDOP	0.68		Horizontal Dilution of Precision
VDOP	1.27		Vertical Dilution of Precision
Checksum	*2F		
<CR> <LF>			End of message termination

Table 4.4.1: Mode 1

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

Table 4.4.2: Mode 2

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

GSV-GNSS Satellites in View

Table 4.5 contains the values of the following example:

$GPGSV,3,1,11,18,67,344,48,09,55,031,50,42,54,142,40,193,47,174,45*4D

$GPGSV,3,2,11,21,44,219,46,27,39,035,48,12,34,131,44,15,30,057,46*76

$GPGSV,3,3,11,22,27,319,47,14,22,285,42,25,19,171,40*44

$GLGSV,2,1,07,76,71,201,44,65,57,041,40,75,48,028,39,72,27,108,39*68
$GLGSV,2,2,07,66,25,333,43,77,17,207,37,81,02,280,29*5C

Table 4.5: GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header (GPGSV and GLGSV)
Number of Message(1)	3		Range 1 to 6
Message Number(1)	1		Range 1 to 6
Satellites in View	11		
Satellite ID	18		Channel 1(Range 1 to 196)
Elevation	67	degrees	Channel 1(Range 0 to 90)
Azinmuth	344	degrees	Channel 1(Range 0 to 359)
SNR(C/NO)	48	dBHz	Channel 1(Range 0 to 99,null when not tracking)
…			…
Satellite ID	09		Channel 4(Range 1 to 196)
Elevation	55	degrees	Channel 4(Range 0 to 90)
Azimuth	031	degrees	Channel 4(Range 0 to 359)
SNR(C/NO)	50	dBHz	Channel 4(Range 0 to 99, null when not tracking)
Checksum	*4D		
<CR> <LF>			End of message termination

Note1: Depending on the number of satellites tracked multiple messages of GSV data may be required

RMC-Recommended Minimum Specific GNSS Data

Table 4.6 contains the values of the following example:

$GNRMC,183015.000,A,2503.7123,N,12138.7446,E,0.01,34.92,270812,,,D*43

Table 4.6: RMC Data Format

Name	Example	Units	Description
Message ID	$GNRMC		RMC protocol header (GNRMC or GPRMC)
UTS Position	183015.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2503.7123		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12138.7446		dddmm.mmmm
E/W Indicator	E		E=east orW=west
Speed Over Ground	0.01	Knots	True
Course Over Ground	34.92	Degrees	
Date	270812		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	*43		
<CR> <LF>			End of message termination

VTG-Course Over Ground and Ground Speed

Table 4.7 contains the values of the following example:

$GPVTG,34.92,T,,M,0.01,N,0.02,K,D*07

Table 4.7: VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	34.92	Degrees	Measured heading
Reference	T		True
Course		Degrees	Measured heading
Reference	M		Magnetic
Speed	0.01	Knots	Measured horizontal speed
Units	N		Knots
Speed	0.02	Km/hr	Measured horizontal speed
Units	K		Kilometer per hour
Mode	D		A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse Position, S=Simulator
Checksum	*07		
<CR> <LF>			End of message termination