General Description

The RB5853-GGB-MX1.5 is a receiving module that supports Single-Band&Multi- Mode. It has built-in highly integrated GNSS receiver chip, supports multi band and multi system cm4f (main frequency 350mhz, 22nm Technology) chip of Third-generation BeiDou Navigation Satellite System (BDS-3). Besides,it is capable of tracking all global civil navigation systems (BDS, GPS, GLONASS, Galileo, QZSS and SBAS) in all bands.

RB5853-GGB-MX1.5 is based on the state of art BDS-3 architecture, integrating multi-band and multi-system GNSS RF and base band. This newly designed architecture makes this single chip achieve sub-meter level position accuracy without correction data from ground-based augmentation station and higher sensitivity, greater for improved jam resistance and multipath, provide a highly robust service in complicated environment.

RB5853-GGB-MX1.5 module contains BK1661 positioning engine inside, featuring high sensitivity, low power consumption, and fast TTFF. The superior cold start sensitivity allows it to acquire, track, and get position fix autonomously in difficult weak signal environment. The receiver's superior tracking sensitivity allows continuous position coverage in nearly all outdoor application environments. The high performance signal parameter search engine is capable of testing 16 million time-frequency hypotheses per second, offering superior signal acquisition and TTFF speed.

Applications

- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone

Figure: RB5853-GGB-MX1.5

Features

- Build on high performance, low-power BK1661 chip set
- Ultra high Track sensitivity: -163dBm
- Concurrent reception of Single-Band and multi- system satellite signals
- Supports all civil GNSS signals
- Supports BDS-3 signal
- Extremely fast TTFF at low signal level
- Multipath detection and suppression
- Works with passive and active antenna
- Low power consumption: Max 22mA@3.3V
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage:3.0V to 5.5V
- Patch Antenna Size:35x35x4 mm
- Small form factor: 53.0±0.5x57.6±0.5x20.72±0.5mm
- Communication type: RS232
- Wire interface type: Molex 4Pin , L=150cm
- Waterproofing grade: IP67
- Operating temperature -40 ~ +80ºC
- RoHS compliant (Lead-free)

1. Functional Description

1.1 Firmware Version & NMEA messages

Item	Specification
NMEA messages	• $GNGGA,$GNGSA,$GPGSV,$BDGSV,$GLGSV,$GAGSV,$GNRMC.

Table 1: Key Features

Parameter	Specification
GNSS engine	• 120 tracking channels with fast search engine
GNSS reception	• GPS/QZSS: L1 C/A, L1C, • BDS: B1I, B1C • GLONASS: L1 • Galileo: E1 • SBAS: WAAS, EGNOS, MSAS, GAGAN
Update rate	• GNSS 20Hz , 1Hz by default
Position accuracy	• GNSS 1.5m CEP • SBAS 1.5m CEP
Velocity & Time accuracy	• GNSS 0.01m/s CEP • SBAS 0.05 m/s • 1PPS 20 ns
Time to First Fix(TTFF)	• Hot start 1.0 s • Cold start 28 s • AGPS 1.5s
Sensitivity	• Cold start -148dBm • Hot start -163dBm • Reacquisition -159dBm • Tracking & navigation -163dBm
GNSS Operating limit	• Velocity 515m/s • Altitude 18000m
Datum	• Default WGS-84, User definable
RS232 Port	• RS232 Port: RS232_TX and RS232_ RX • Supports baud rate from 9600bps to 961200bps, 115200 bps by default. • NMEA 0183 Protocol Ver. 4.00/4.10, BK GNSS Receiver Protocol • Supports batch data report mode
Temperature Range	• Normal operation: -40°C ~ +85°C • Storage temperature: -55°C ~ +100°C • Humidity: 5% ~ 95%
Physical Characteristics	• Size: 53.0±0.5x57.6±0.5x20.72±0.5mm • Weight: Approx. 80.0g

1.2. Power Supply

Regulated power for the RB5853-GGB-MX1.5 is required. The VCC Pin Need a stable DC voltage supply. Power supply ripple must be less than 30mV. The input voltage Vcc should be 3.0V~5.5V, Recommended power supply voltage is 3.3V . maximum current is 22mA. Suitable decoupling must be provided by external decoupling circuitry.

1.3 RS232 Ports

The module supports two full duplex serial channels RS232. All serial connections are at 3.0V TTL logic levels, if need different voltage levels, use appropriate level shifters. The baud rate of both serial ports are fully programmable, the data format is however fixed: X, N, 8, 1, i.e. X baud rate, no parity, eight data bits and one stop bit, no other data formats are supported, LSB is sent first. The modules default baud rate is set up 115200bps, however, the user can change the default baud rate to any value from 9600 bps to 961200bps. RS232 is used e.g. for booting and NMEA interface.

2. Application

The module is equipped with a Molex 4Pin connector that connects to your application platform. The RB5853-GGB-MX1.5 module It consists of a BK1661 single chip GNSS IC which includes the RF part and Baseband part, a patch antenna, a RS3220 chip, a LNA, a SAW filter, a TCXO, a crystal oscillator, Also comes with a 0.22F crystal capacitor ,can backup satellite ephemeris about 2 hour.

2.1. Pin Assignment

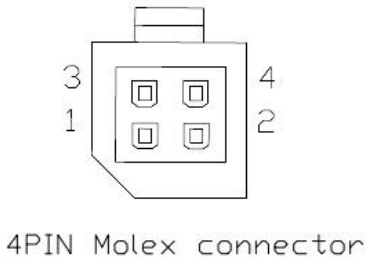

Figure 2: Pin Assignment

Table 2: CON Pin Description

Pin No.	Pin Name	I/O	Description	Remark
1	RS232_RX	I	RS232 Serial Data input	
2	GND	G	Ground	
3	RE232_TX	O	RS232 Serial Data Output	
4	VCC	I	Module Power Supply	Voltage range: 3.0V~5.5V

2.4 Mechanical Dimensions

This chapter describes the mechanical dimensions of the RB5853-GGB-MX1.5 module. Size unit（mm）.

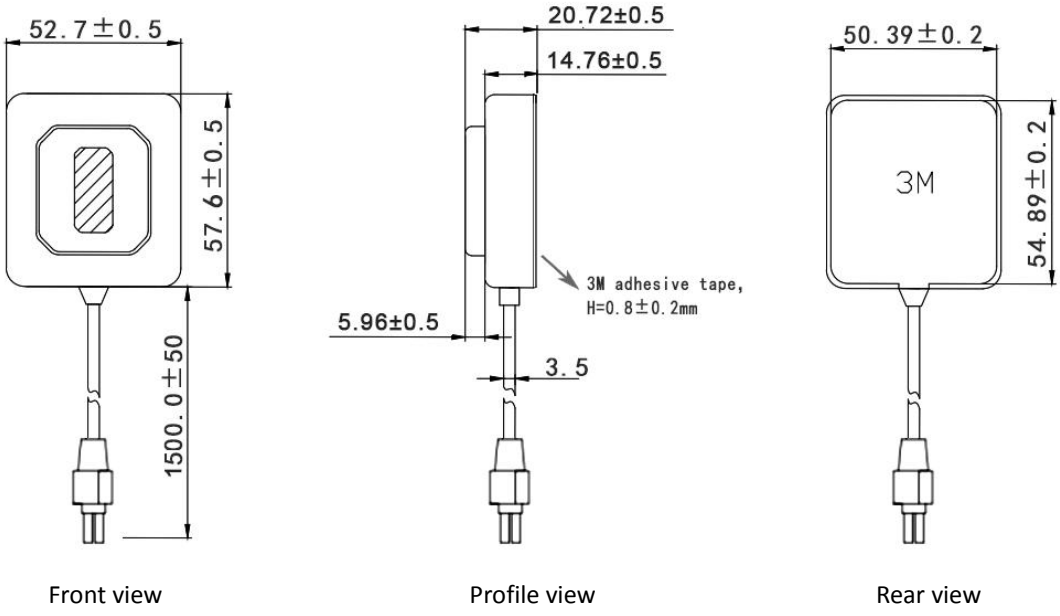

Figure 3: Specification size chart

2.2 Maximum parameter

Parameter	Index	Remark
Power Supply		
Voltage Supply	5.5 V	
Temperature Range		
Operation Temp	-40℃ to + 85℃	
Storage Temp	-40℃ to + 100℃	
Humidity	20~90%RH	

2.3 Electrical feature

Parameter	Index	Remark
Power Supply		
Input voltage	3.0~5.5V	
Current	22mA	
Consumption	300mW	
Time		
The time required for the first valid data	<30S	

3. Packaging information

The follow packing way is for reference only, and the actual packing way can be customized according to customer requirements.

Figure 5: Packaging physical figure

Reel Packaging

Model Name	MOQ for MP	Minimum Package: 1000pcs
RB5853-GGB-MX1.5	100pcs	Size: 365mm × 350mm × 53mm N.W: 11.0kg G.W: 11.6kg

4. NMEA 0183 Protocol

The output protocol supports NMEA-0183 standard. The implemented messages include GGA,GSA,GSV, RMC messages. The NMEA message output has the following sentence structure: $AACCC，c-c*hh.
The Delincomm RB5853-GGB-MX1.5 supports the following NMEA-0183 messages: $GNGGA,$GNGSA, $GPGSV, $BDGSV,$GLGSV,$GAGSV,$GNRMC.

4.1 GGA – Global Positioning System Fix Data

Time, position and fix related data for a GNSS receiver.
Structure:$GNGGA,hhmmss.sss,ddmm.mmmm,a,dddmm.mmmm,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh
For example:$GNGGA,175258.000,2447.0870,N,12100.5221,E,2,15,0.7,95.2,M,19.6,M,,0000*72

Field	Name	Example	Description
1	UTC Time	175258.000	UTC of position in hhmmss.sss format, (000000.000 ~ 235959.999)
2	Latitude	2447.08700	Latitude in ddmm.mmmmm format Leading zeros transmitted
3	N/S Indicator	N	Latitude hemisphere indicator, ‘N’ = North, ‘S’ = South

4	Longitude	12100.52210	Longitude in dddmm.mmmmm format Leading zeros transmitted
5	E/W Indicator	E	Longitude hemisphere indicator, 'E' = East, 'W' = West
6	Quality Indicator	2	Quality Indicator 0: position fix unavailable 1: valid position fix, SPS mode 2: valid position fix, differential GPS mode 3: GPS PPS Mode, fix valid 6: Estimated (dead reckoning) Mode
7	Satellites Used	15	Number of satellites in use, (00 ~ 56)
8	HDOP	0.7	Horizontal dilution of precision, (0.0 ~ 99.9)
9	Altitude	95.2	mean sea level (geoid), (- 9999.9 ~ 17999.9)
10	Geoidal Separation	19.6	Geoidal separation in meters
11	Age pf Differential GPS data		Age of Differential GPS data NULL when DGPS not used
12	DGPS Station ID	0000	Differential reference station ID, 0000 ~ 1023
13	Checksum	72	

4.2 GSA – GNSS DOP and Active Satellites

GNSS receiver operating mode, satellites used in the navigation solution reported by the GGA sentence and DOP values.
Structure:$GPGSA,A,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x,x*hh

For example:$GPGSA,A,3,21, 12,15,18,20,24,10,32,25,13,,,1.2,0.7,1.0,1*18

Field	Name	Example	Description
1	Mode	A	Mode 'M' = Manual, forced to operate in 2D or 3D mode 'A' = Automatic, allowed to automatically switch 2D/3D
2	Mode	3	Fix type 1 = Fix not available 2 = 2D 3 = 3D
3	Satellite used 1~12	21, 12, 15, 18, 20, 24, 10, 32, 25, 13	01 ~ 32 are for GPS; 33 ~ 64 are for WAAS (PRN minus 87); 193 ~ 197 are for QZSS; 65 ~ 88 are for GLONASS (GL PRN) ; 01 ~ 36 are for GALILEO (GA PRN); 01 ~ 37 are for BDS (BD PRN). GPS, GLONASS, GALILEO and BDS satellites are differentiated by the GNSS system ID in table 3. Maximally 12 satellites are included in each GSA sentence
4	PDOP	1.2	Position dilution of precision (0.0 to 99.9)
5	HDOP	0.7	Horizontal dilution of precision (0.0 to 99.9)
6	VDOP	1.0	Vertical dilution of precision (0.0 to 99.9)
7	GNSS System ID	1	1 for GPS, 2 for GLONASS, 3 for GALILEO, 4 for BDS
8	Checksum	18	

4.3 GSV – GNSS Satellites in View

Number of satellites (SV) in view, satellite ID numbers, elevation, azimuth, and SNR value. Four satellites maximum per transmission.
Structure: $GPGSV，x，x，xx，xx，xx，xx，xx，...，xx，xx，xx，xx，xx，x*hh

For example：$GPGSV，4,1，13，02,72，109，43,24，69,035，48,18，52,330，42,21，49,246，43，1*69

Field	Name	Example	Description
1	Number of message	4	Total number of GSV messages to be transmitted (1 - 5)
2	Sequence number	1	Sequence number of current GSV message
3	Satellites in view	13	Total number of satellites in view (00 ~ 20)
4	Satellite ID	02	01 ~ 32 are for GPS; 33 ~ 64 are for WAAS (PRN minus 87); 193 ~ 197 are for QZSS; 65 ~ 88 are for GLONASS (GL PRN) ; 01 ~ 36 are for GALILEO (GA PRN); 01 ~ 37 are for BDS (BD PRN). GPS, GLONASS, GALILEO and BDS satellites are differentiated by the GNSS system ID in table 3. Maximally 12 satellites are included in each GSA sentence
5	Elevation	72	Satellite elevation in degrees, (00 ~ 90)
6	Azimuth	109	Satellite azimuth angle in degrees, (000 ~ 359)
7	SNR	43	C/No in dB (00 ~ 99) Null when not tracking
8	Signal ID	1	1 for L1/CA, 4 for L5/CA
9	Checksum	69	

4.4 RMC – Recommended Minimum Specific GNSS Data

Time, date, position, course and speed data provided by a GNSS navigation receiver.
Structure:$GNRMC,hhmmss.sss,A,dddmm.mmmm,a,dddmm.mmmm,a,x.x,x.x,ddmmyy,,,a*hh

For example:$GNRMC,175258.000,A,2447.0870,N,12100.5220,E,000.0,000.0,220617,,,D*75

Field	Name	Example	Description
1	UTC time	175258.000	UTC time in hhmmss.sss format (000000.00 ~ 235959.999)
2	Status	A	Status 'V' = Navigation receiver warning 'A' = Data Valid
3	Latitude	2447.08700	Latitude in dddmm.mmmmm format Leading zeros transmitted
4	N/S indicator	N	Latitude hemisphere indicator 'N' =North 'S' = South
5	Longitude	12100.52210	Longitude in dddmm.mmmmm format Leading zeros transmitted
6	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
7	Speed over ground	000.0	Speed over ground in knots (000.0 ~ 999.9)
8	Course over ground	000.0	Course over ground in degrees (000.0 ~ 359.9)
9	UTC Date	220617	UTC date of position fix, ddmmyy format
10	Mode indicator	D	Mode indicator 'N' = Data not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode
11	checksum	75	