ROHS, TS16949, ISO9001

ST337G-18C43-DZ710

GNSS Receiver Specification

FOR APPROVAL

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Contents

1 Overview

1.1 Description

- ST337G-18C43-DZ710 is a GNSS receiver build-in high sensitivity chip on board. Featuring MediaTek single die high performance and low power consumption positioning engine, ST337G-18C43-DZ710 provides excellent sensitivity and short TTFFwith no host interaction needed. ST337G-18C43-DZ710 is suitable for vehicle or position devices requiring for high sensitivity and need fast TTFF in weak signal environments. ST337G- 18C43-DZ710 provides maximum sensitivity while maintaining low system power.

1.2 GNSS Features

- MediaTek Ultra high sensitivity - 165dBm
- Hybrid GPS/SBAS engine (WAAS ,EGNOS,MSAS ,GAGAN)
- Built-in 12 multi-tone active interference canceller
- Extremely fast TTFF at low signal level
- Advanced Features: AIC;AlwaysLocate; EPO;EASY
- Ultra low power consumption
- Up to 10Hz update rate
- GPS receiver With Patch Antenna
- RoHS Compliant (lead-free)

1.3 ProductApplications

- DVR
- PND (Portable Navigation Device)
- Vehicle navigation system
- Tracker

2 Technical Information

2.1 Supported GNSS Constellations

ST337G-18C43-DZ710 are GNSS receivers and can singly receive and track GPS (including SBAS and QZSS) signals. QZSS and SBAS signals (by default) can be received concurrently with GPS signals.

2.1.1 GPS

ST337G-18C43-DZ710 is designed to receive and track the L1 C/A signals provided at 1575.42 MHz by the Global Positioning System (GPS).

2.13 AGPS Support for Fast TTFF(EPO™)

The AGPS (EPO™) supply the predicated Extended Prediction Orbit data to speed TTFF ,users can download the EPO data to GPS engine from the FTP server by internet or wireless network ,the GPS engine will use the EPO data to assist position calculation when the navigation information of satellites are not enough or weak signal zone .

2.14 AlwaysLocate™

AlwaysLocate™ is an intelligent controller of periodic mode. Depending on the environment and motion conditions, GNSS module can adaptively adjust working/standby time to achieve balance of positioning accuracy and power consumption. In this mode, the host CPU does not need to control GNSS module until the host CPU needs the GPS position data. The following flow chart is an example to make GNSS module go into AlwaysLocate™ mode and then back to normal operation mode.

2.15 EASY™

The EASY™ is embedded assist system for quick positioning, the GPS engine will calculate and predict automatically the single emperies (Max. up to 3 days)when power on ,and save the predict information into the memory , GPS engine will use these information for positioning if no enough information from satellites , so the function will be helpful for positioning and TTFF improvement under indoor or urban condition ,the Backup power (VBACKUP) is necessary .

2.16 Embedded Logger function

The Embedded Logger function don't need host CPU (MCU) and external flash to handle the operation , GPS Engine will use internal flash (embedded in GPS chipset) to log the GPS data (Data format : UTC, Latitude longitude, Valid ,Checksum), the max log days can up to 2 days underAlwaysLocate™ condition .

2.17 AIC_Multi-tone active interference canceller

Because different application (Wi-Fi , GSM/GPRS,3G/4G,Bluetooth) are integrated into navigation system , the harmonic of RF signal will influence the GPS reception , The multi-tone active-interference canceller can reject external RF interference which come from other active components on the main board , to improve the capacity of GPS reception without any needed HW change in the design .ST337G-18C43-DZ710 can cancel up to 12 independent channel interference continuous wave.

2.2 Augmentation Systems

2.2.1 Satellite-BasedAugmentation System (SBAS)

The modules support reception of SBAS broadcast signals. These systems supplement GNSS data with additional regional or wide area GPS augmentation data. The system broadcasts range correction and integrity information via satellite which can be used by GNSS receivers to improve resulting precision. SBAS satellites can be used as additional satellites for ranging (navigation), further enhancing availability. The following SBAS types are supported: GAGAN, WAAS, EGNOS and MSAS.

2.2.2 QZSS

The Quasi-Zenith Satellite System (QZSS) is a navigation satellite overlay system for the Pacific region covering Japan and Australia which transmits additional GPS L1C/A signals. ST337G- 18C43-DZ710 positioning modules are able to receive and to track these signals simultaneously with GPS, resulting in better availability, especially under bad signal conditions e.g. in urban canyons.

2.3 Protocols and interfaces

Protocol	Type
NMEA 0183	Input/output , ASCII , 0183 , 2 .3 (compatible to 3 .0)
RTCM	Input message, 1, 2, 3, 9

Table : Available Protocols

2.4 Clock generation

2.4.1 Oscillators

ST337G-18C43-DZ710 GNSS modules use TCXO versions which allows accelerated weak signal acquisition, enabling faster start and re-acquisition times rather than crystal versions.

Oscillators used on ST337G-18C43-DZ710 modules are carefully selected and screened for stability and against frequency perturbations across the full operating range (–40° to +85°C). The careful selection and qualification of critical parts, such as GNSS oscillators, has resulted in GNSS modules being the most reliable positioning modules in the industry, particularly in challenging conditions.

2.4.2 Real-Time Clock (RTC)

The RTC is driven by a 32 kHz oscillator using an RTC crystal. If the main supply voltage fails, parts of the receiver switch off, but the RTC still runs providing a timing reference for the receiver. This operating mode is called Hardware Backup Mode, which enables all relevant data to be saved in the backup RAM to allow a hot or warm start later.A “battery” is integrated in ST337G-18C43-DZ710 to support the function as backup power supply.

2.5 Power management

ST337G- 18C43-DZ710 offers a power-optimized architecture with built-in autonomous power saving functions to minimize power consumption at any given time. Furthermore, the receiver can be used in two operating modes: Continuous mode for best performance or Power Save Mode for optimized power consumption respectively.

2.5.1 DC/DC converter

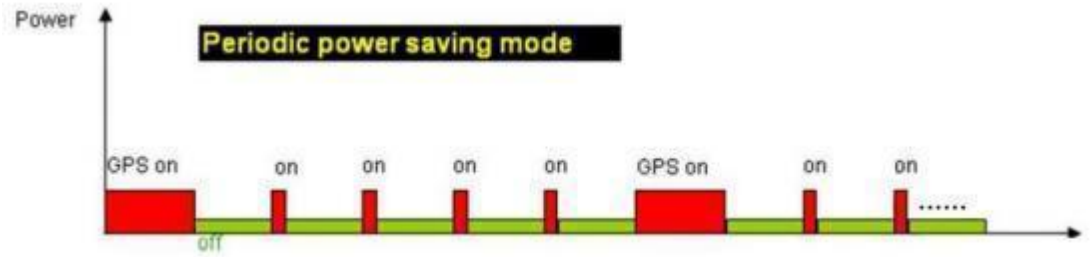
The ST337G-18C43-DZ710 modules integrate a DC/DC converter in the chip, allowing reduced power consumption.

2.52 Standby Mode

User can issue software command to make GNSS module go into standby mode that consumes less than 200uA current. GNSS module will be awaked when receiving any byte. The following flow chart is an example to make GNSS module go into standby mode and then wake up.

2.53 Periodic Mode

When GNSS module is commanded to periodic mode, it will be in operation and standby periodically. Its status of power consumption is as below chart



2.5.4 Continuous Mode

Continuous Mode uses the acquisition engine at full performance resulting in the shortest possible TTFF and the highest sensitivity. It searches for all possible satellites until the Almanac is completely downloaded. The receiver then switches to the tracking engine to lower power consumption.

Thus, a lower tracking current consumption level will be achieved when:

- A valid GNSS position is obtained
- The entire Almanac has been downloaded
- The Ephemeris for each satellite in view is valid

3 GNSS Performance

Parameter	Specification	
Receiver type	GPS L1C/A, SBAS L1C/A, QZSS L1C/A, QZSS L1 SAIF	
Accuracy of time pulse signal	RMS	10 ns
	99%	60 ns
Frequency of time pulse signal		0.25 Hz ... 10 MHz (configurable)
Operational limits [1]	Dynamics	4 g
	Altitude	50,000 m
	Velocity	500 m/s
Velocity accuracy [2]		0.05m/s
Heading accuracy [2]		0.3 degrees
GNSS		**GPS**
Horizontal position Accuracy [3]		2.5 m
Max update rate		10 Hz
Time-To-First-Fix [5]	Cold start	29 s
	Hot start	1 s
	Aided starts [6]	5 s
Sensitivity[7]	Tracking & Navigation	– 165 dBm
	Re-acquisition	– 160dBm
	Cold start	– 148 dBm
	Hot start	– 156dBm

[1] All satellites at - 130 dBm
[2] Dependent on aiding data connection speed and latency
[3] 24 hours static average with good coverage
[4] CEP, 50%, 24 hours static, - 130 dBm, > 6 SVs
[5] 50% @ 30 m/s
[6] Assuming Airborne < 4 g platform

4 Electrical Characteristics

4.1 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Power Supply Voltage	V_{CC}	0	6.0	V
Serial Port Input Voltage	V_{TTL}	-0.5	3.6	V
ESD Contact	V_{ESD}	-	2000	V
Storage Temperature	T_S	-40℃	+85℃	℃

Stressing the device beyond the “Absolute Maximum Ratings” may cause permanent damage. These are stress ratings only. The product is not protected against over-voltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection diodes.

4.2 Electrical characteristics

Characteristics	Symbol	Min	Typ	Max	Units
Power Supply Voltage	V_{CC}	3.0	5.0	5.5	V
Supply Peak Current (Tracking)	I_T	-	25		mA
Supply Peak Current (Acquisition)	I_A	-	30		mA
Operation Temperature	T_O	-30	+25	+80	℃

All specifications are at an ambient temperature of 25°C. Extreme operating temperatures can significantly impact specification values. Applications operating near the temperature limits should be

Values in Table are provided for customer information only as an example of typical power requirements. Values are characterized on samples, actual power requirements can vary depending on FW version used, external circuitry, number of SVs tracked, signal strength, type of start as well as time, duration and conditions of test.

5 Antenna

5.1 Antenna placement

Antennas are a critical part of any GNSS receiver design and their importance cannot be stated highly enough. The position of the antenna mounting is crucial for an optimal performance of the GPS receiver. The GPS signal is right-hand circular polarized (RHCP). When using patch antennas, the antenna plane should be parallel to the geographic horizon. The antenna must have full view of the sky ensuring a direct line-of-sight with as many visible satellites as possible. Place the antenna as far away as possible from radiating orjamming signals.

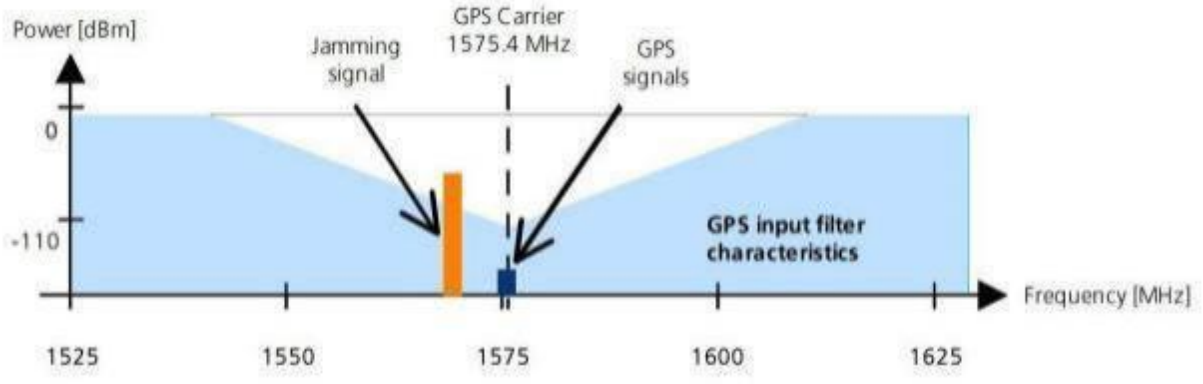
5.2 Antenna Parameters

Characteristics	Min	Typ	Max	Units
Range of Receiving Frequency	-	1575.42	-	MHz
Band With(Return loss ≤- 10dB)	5	-	-	MHz
V.S.W.R(in Center Frequency)	-	-	1.5	-
Gain(Zenith)	-	2	-	dBi
Axial Ratio	-	-	5	dB
Frequency Temperature Coefficient	- 10	0	10	ppm/℃

Jamming signals come from in-band and out-band frequency sources may reduce the performance.

5.3 In-bandjamming

With in-band jamming the signal frequency is very close to the GPS frequency of 1575 MHz. Such jamming signals are typically caused by harmonics from displays, micro-controller, bus systems, etc.

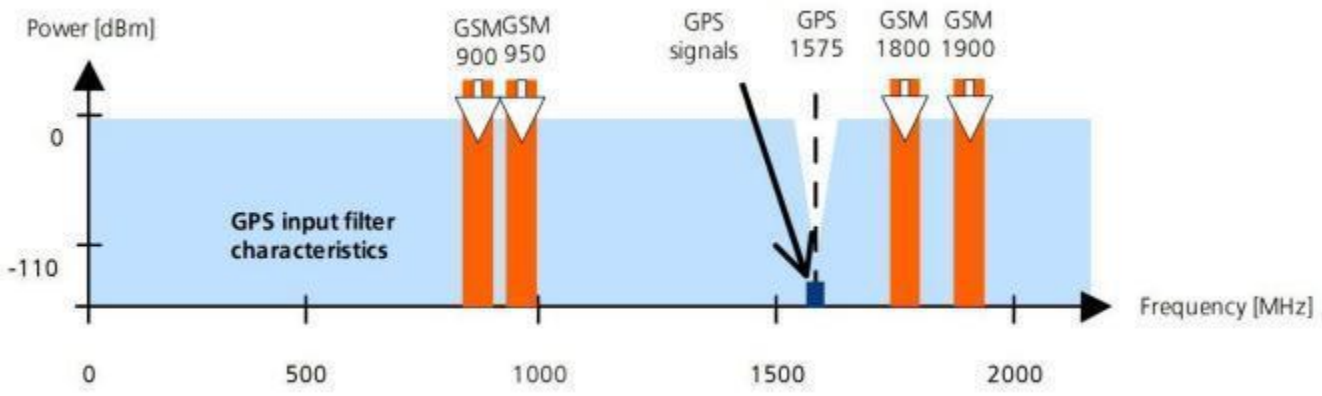


Measures against in-bandjamming include:

- Shielding
- Layout optimization
- Filtering
- Placement of the GPS antenna
- Adding a CDMA, GSM, WCDMA band-pass filter before handset antenna

5.4 Out-bandjamming

Out-band jamming is typically caused by signal frequencies that are different from the GPS carrier. The sources are usually wireless communication systems such as GSM, CDMA, WCDMA, WiFi, BT, etc..



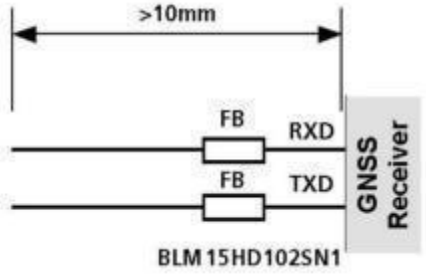
ST337G-18C43-DZ710 configured SAW to reduce the out-bandjamming by adding SAW filter.

5.5 Electromagnetic interference on I/O lines

Any I/O signal line with a length greater than approximately 3 mm can act as an antenna and may pick up arbitrary RF signals transferring them as noise into the GNSS receiver. This specifically applies to unshielded lines, in which the corresponding GND layer is remote or missing entirely, and lines close to the edges of the printed circuit board .

If, for example, a cellular signal radiates into an unshielded high-impedance line, it is possible to generate noise in the order of volts and not only distort receiver operation but also damage it permanently. On the other hand, noise generated at the I/O pins will emit from unshielded I/O lines. Receiver performance may be degraded when this noise is coupled into the GNSS antenna.

To avoid interference by improperly shielded lines, it is recommended to use resistors (e.g. R>20 W), ferrite beads (e.g. BLM15HD102SN1) or inductors (e.g. LQG15HS47NJ02) on the I/O lines in series. These components should be chosen with care because they will affect also the signal rise times. The below shows an example of EMI protection measures on the RXD/TXD line using a ferrite bead.



6 Software Protocol

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 $GNxxx 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. $GPxxx is for GPS.

Table :NMEA-0183 Output Messages

NMEA Record	Description	Default
GNGGA	Global positioning system fixed data	Y
GNGLL	Geographic position—latitude/longitude	N
GPGSA	GNSS DOP and active satellites for GPS	Y
GLGSA	GNSS DOP and active satellites for GLONASS	Y
BDGSA	Beidou DOP and active satellites for BD	N
GPGSV	GNSS satellites in view for GPS	Y
GLGSV	GNSS satellites in view for GLONASS	Y
BDGSV	Beidou satellites in view for BD	N
GNRMC	Recommended minimum specific GNSS data	Y
GNVTG	Course over ground and ground speed	N
GNZDA	Date and Time	N

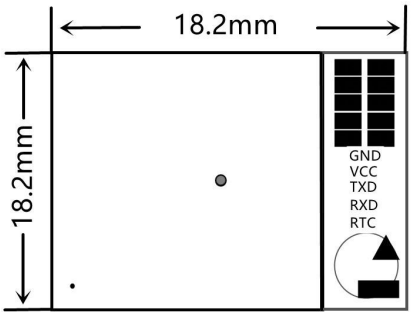
CMD List

Table : CMD List

CMD TYPE	CMD Example:
Hot Restart	$PMTK101*32<CR><LF>
Warm Restart	$PMTK102*31<CR><LF>
Cold Restart	$PMTK103*30<CR><LF>
Full Cold Restart	$PMTK104*37<CR><LF>
Search GLONASS satellites only	$PMTK353 ,0 , 1,0 ,0 ,0*2A<CR><LF>
Search GPS satellites only	$PMTK353 , 1 ,0 ,0 ,0 ,0*2A<CR><LF>
Search GPS and GLONASS satellites	$PMTK353 , 1 , 1,0 ,0 ,0*2B<CR><LF>
Search BEIDOU satellites only	$PMTK353 ,0 ,0 ,0 ,0 , 1*2A<CR><LF>
Search GPS and BEIDOU satellites	$PMTK353 , 1 ,0 ,0 ,0 , 1*2B<CR><LF>
System Sleep Mode	$PMTK161 , 1*29<CR><LF>
System Wake up	$PMTK161,0*28<CR><LF>

7 Hardware

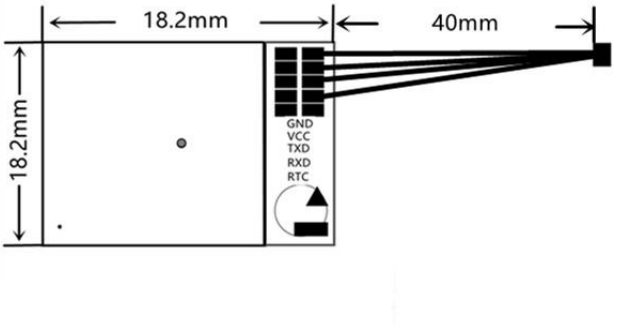
7.1 Dimensions



Characteristics	Symbol	Min	Typ	Max	Units
Length	L	-	18.2	-	mm
Width	W	-	18.2	-	mm
MAX High	H	-	6.8	-	mm

Tolerance: ±0.3mm

7.2 Definition



Pin	Name	Type	Pin Description
1	GND	G	Ground
2	VCC	P	Power Supply Voltage
3	TXD	O	Serial TX Port (GPS to Host)
4	RXD	I	Serial RX Port (Host to GPS)

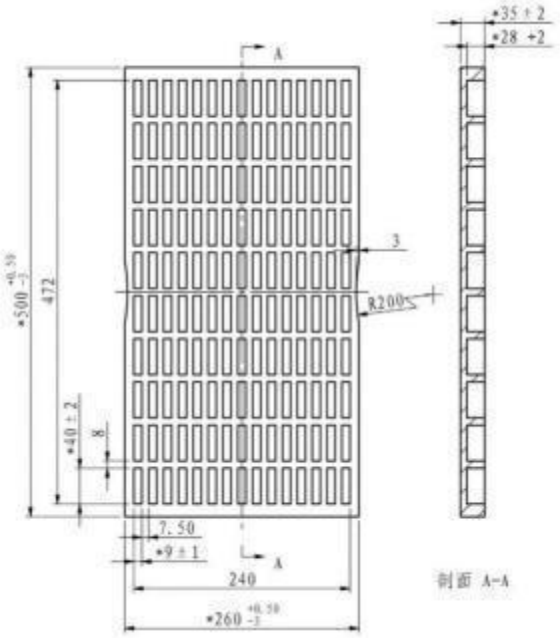
※ **Type : G (Ground), P (Power) ,O (output, I (input)**

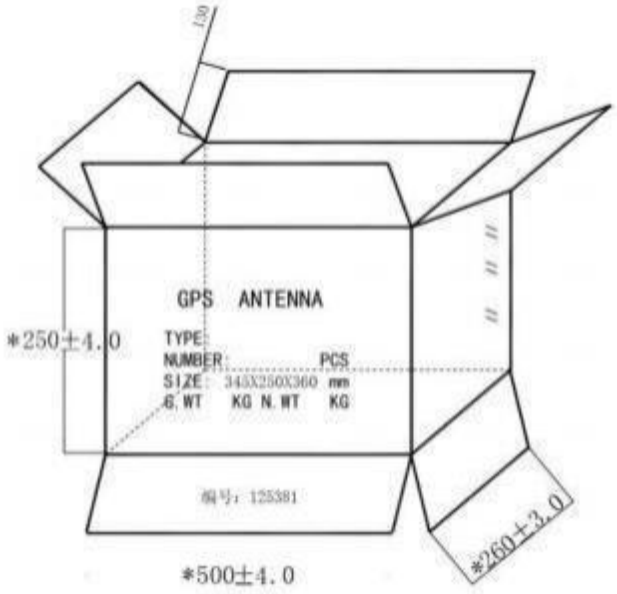
8 Product handling & Delivery

8.1 Packaging

ST337G-18C43-DZ710 are delivered as boxed sealed in order to enable efficient production, production lot set-up and tear-down. MOQ Package number: 150*8=1200 PCS

NO	Part Name	Q,ty / Ctn	Out Size (mm)
1	Box Carton	1/1	500(W)mm×260(D)×250(H)mm
2	Pad Carton	8/1	-
3	Tray	150/1	-





8.2 ESD hand ng precau ons

ST337G-18C43-DZ710 modules are Electrostatic Sensitive Devices (ESD). Observe precautions for handling! Failure to observe these precautions can result in severe damage to the GNSS receiver!

GNSS receivers are Electrostatic Sensitive Devices (ESD) and require special precautions when handling. Particular care must be exercised when handling patch antennas, due to the risk of electrostatic charges. In addition to standard ESD safety practices, the following measures should be taken into account whenever handling the receiver:

Unless there is a galvanic coupling between the local GND (i.e. the work table) and the PCB GND, then the first point of contact when handling the PCB must always be between the local GND and PCB GND.

Before mounting an antenna patch, connect ground of the device

When handling the RF pin, do not come into contact with any charged capacitors and be careful when contacting materials that can develop charges (e.g. patch antenna ~10 pF, coax cable ~50-80 pF/m, soldering iron,)

To prevent electrostatic discharge through the RF input, do not touch any exposed antenna area. If there is any risk that such exposed antenna area is touched in non ESD protected work area, implement proper ESD protection measures in the design.

When soldering RF connectors and patch antennas to the receiver's R F pin, make sure to use an ESD safe soldering iron

9 Ordering Information

9.1 Ordering Information

Ordering No.	Description	Default Frequency	Antenna Size	Interface	MAX Height	Default
ST337G-18C43-DZ710	GNSS Module	GPS	18*18*4 mm	40 ± 1mm 4PIN cable-1.0/4P	6.8mm	9600

深圳市西博泰科电子有限公司

精准时空 万物互联

地址：广东省深圳市南山区前海信利康大厦23楼
网站：http//:www.xbteek.com