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Accurate Positioning
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G129C

Data-sheet

Shenzhen Huasim Technology Co,.Ltd
www.huasim.cn

Huasim

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Huasim Technology Co., Ltd.

http://www.huasim.cn

Customer Service Email: support@huasim.cn

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Content

1 General Description

1.1 General Description

The G129C is a complete GPS module that features high sensitivity, low power and small form factor. The GPS signal is applied to the antenna input of module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol.

It is based on the high performance features of the MediaTek MT3337 single-chip architecture, Its – 165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible working before. The small form factor and low power consumption make the module easy to integrate into portable device like PNDs, dash cameras, trackers and vehicle navigation systems.

1.2 Key Performance

Parameter	Specification	
Receiver Type	GPS, QZSS L1 frequency band, C/A code, 22 Tracking / 66 Acquisition-Channels	
Sensitivity	Tracking Acquisition	-165dBm Typical -148dBm Typical
Accuracy	Position Velocity Timing (PPS)	3.0m CEP50% without SA(Typical Open Sky) 0.1m/s without SA 10ns RMS
Acquisition Time	Cold Start Hot Start Re-Acquisition	28s(Typical Open Sky) 1s <1s
Power Consumption	Tracking Acquisition	18mA @3.3V Typical 21mA @3.3V

Data Update Rate	Max 10Hz	Default 1Hz
Operational Limits	Altitude Velocity Acceleration	Max 18,000m Max 515m/s Less than 4g

2 Technical Information

2.1 Supported constellations

Huasim G129C supports GPS and QZSS satellite constellation, and the receiving frequency is: 1575.42 MHz.

2.2 AGPS

Huasim G129C supports 3 AGPS acceleration positioning solutions such as EPO™, AlwaysLocate™, and EASY™.

2.2.1 EPO™

EPO™ provides predicted orbit data to speed up TTFF, user can download EPO data from FTP server via Internet or wireless network to GPS engine, GPS engine will use EPO data to assist position calculation. Insufficient satellite navigation information or weak signal area.

2.2.2 AlwaysLocate™

AlwaysLocate™ is an intelligent controller in periodic mode. According to environmental and motion conditions, the GNSS module can adaptively adjust the work/standby time to achieve a balance between positioning accuracy and power consumption. In this mode, the host CPU does not need to control the GNSS module until the host CPU needs GPS position data.

2.2.3 EASY™

EASY™ is an embedded assistance system for fast positioning, the GPS engine will automatically calculate and predict ephemeris data (up to 3 days) when powered on, and save the predicted information to memory, which the GPS engine will use if there is not enough satellite positioning

information, the function will help with positioning and TTFF improvement in indoor or urban conditions with backup power supplied (V_BACKUP).

2.3 Quasi-Zenith Satellites

The Quasi-Zenith Satellite System (QZSS) is a navigation satellite coverage system used to cover the Pacific region of Japan and Australia, which transmits other GPS L1C/A signals. The module is able to receive and track these signals simultaneously with GPS, improving usability, especially in maintaining positioning in harsh signal conditions such as urban canyons.

2.4 Crystal oscillator

G129C uses the TCXO version, which allows for accelerated weak signal acquisition, resulting in faster start-up and re-acquisition times than the crystal version. The TCXO enables the product to be stable and immune to frequency interference over the entire operating range (–40° to +85°C), making it the most reliable positioning module in the industry.

2.5 Real-time clock

The RTC is driven by a 32 kHz oscillator using an RTC crystal. If the mains voltage fails, parts of the receiver will shut down, but the RTC will still run, providing a timing reference for the receiver. This mode of operation is called "Hardware Backup Mode", which enables all relevant data to be kept in backup RAM for later warm booting. The G129C incorporates a "battery" to support the function as a backup power source.

2.6 Power System

G129C offers a power-optimized architecture with built-in automatic power saving to minimize power consumption at a given time. In addition, the receiver can be used in two modes of operation: continuous mode for best performance and power saving mode to optimize power consumption, respectively.

2.6.1 Standby mode

The user can issue a software command to put the GNSS module into standby mode, which consumes less than 200uA. The GNSS module will wake up when any byte is received.

2.6.2 Periodic mode

When the GNSS module is commanded to periodic mode, it will be in running and standby state periodically. Its power consumption is as follows.

2.6.3 Continuous mode

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

Therefore, lower tracking current consumption levels will be achieved under the following conditions:

- ✓ Obtain a valid GNSS position
- ✓ The entire yearbook has been downloaded
- ✓ Ephemeris valid for each satellite in view

2.6.4 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 .SKG09BL can cancel up to 12 independent channel interference continuous wave.

3 Electrical Characteristics

3.1 Absolute Maximum Rating

Parameter	Symbol	Min	Max	Units
Power Supply				
Power Supply Volt.	VCC	-0.3	4.3	V
Input Pins				
Input voltage on any input connection	VIO	-0.3	3.6	V
Backup Battery	V_BCKP	-0.3	4.3	V
RF input power	RF_IN		-40	dBm
Human Body Model ESD capability	RF_IN		2000	V
Machine Model ESD capability	RF_IN		100	V
Environment				
Storage Temperature	Tstg	-40	125	°C
Peak Reflow Soldering Temperature <10s	Tpeak		260	°C
Humidity			95	%

Stressing the device beyond the Absolute Maximum Ratings may cause permanent damage.

The above data is only the pressure level. The product has no over-voltage or reverse-voltage protection. If necessary, voltage spikes that exceed the supply voltage specifications listed in the table above must be limited to the specified range using appropriate protection diodes.

3.2 Operating Conditions

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power supply voltage	VCC		3	3.3	4.2	V
Backup Battery	V_BCKP		2	3.3	4.2	V

Power supply voltage ripple	VCC_PP	VCC=3.3V			30	mV
Supply current - Acquisition	Icc	VCC=3.3V		21		mA
Supply current - Tracking	Icc	VCC=3.3V		18		mA
Supply current- backup mode	Ibckp	VCC=3.3V		7		uA
VCC_RF Antenna bias supply	VCC_RF			VCC		V
Input high voltage	VIH		2		3.6	V
Input low voltage	VIL		-0.3		0.8	V
Output high voltage	VOH		2.4		3.1	V
Output low voltage	VOL		-0.3		0.4	V
Operating temperature	Topr		-40		85	°C

All specifications are performed at an ambient temperature of 25°C. Extreme operating temperatures can severely affect specification values. Applications operating near temperature extremes. The values in the table are for customer reference only and are only examples of typical power requirements. Values are sampled, actual power requirements will vary depending on firmware version used, external circuitry, number of satellites tracked, signal strength, type of start-up as well as time, duration and test conditions.

4 Package Definition

4.1 Pin assignment

G129C adopts 10.1*9.7mm, LGA-18pin package, defined as follows:

Pin No.	Pin name	I/O	Description	Remark
1	GND	G	Ground	GND
2	TXD	O	UART serial data output.	Leave open if not used
3	RXD	I	UART serial data input.	Leave open if not used
4	PPS	O	Time pulse signal.	Leave open if not used
5	EXTINT	I	External Interrupt pin.	Leave open if not used
6	V_Backup	I	RTC and backup SRAM power	Operating range: 2.0V to 4.2V
7	NC			Leave open
8	VCC	P	Module power supply.	Operating range: 3.0V to 4.2V
9	RESET	I	Module reset (Active Low).	Leave open if not used
10	GND	G	Ground	GND
11	RF_IN	I	GPS signal input.	50Ω@1.57542GHz, DC block inside
12	GND	G	Ground	GND
13	NC	O	.	Leave open if not used
14	VCC_RF	O	VCC output for Active antenna	Leave open if not used

15	NC			Leave open
16	NC			Leave open
17	NC			Leave open
18	NC			Leave open

5 Integration Guide

5.1 Power supply

Regulated power for the G129C is required. The input voltage VCC should be 3.0V to 4.2V range, current is no less than 100mA. Suitable decoupling must be provided by external decoupling circuitry. It can reduce the Noise from power supply and increase power stability.

Main power supply VCC current varies according to the processor load and satellite acquisition. Maximum VCC peak current is about 25mA during acquisition.

5.2 Antenna

G129C built-in low noise figure LNA and SAW. It is designed for supporting the active antenna or passive antenna connected with pin RF_IN. The gain of active antenna should be no more than 25dB (18~20dB Typical). The maximum noise figure should be no more than 1.5dB and output impedance is at 50 Ohm. In order to maintain the integrity of the ground wire, it is recommended that no traces or minimal traces be traced under the module.

NOTE: With passive antenna keep the cable loss at minimum(<1dB).

5.3 Serial Communication

Provide a TTL level universal asynchronous transceiver (UART), the data format is: 1 start bit, 8 data bits, 1 stop bit, no parity bit, the default baud rate is 9600 bps. After the module is powered on normally, the serial port will automatically send NMEA data. The host computer can set the module working mode, baud rate, etc. through the serial port. When this module is used in some specific application scenarios, the main power of the module may be turned off due to a power saving strategy, thereby further reducing power consumption.

At this time, in order to prevent the high level of the serial port from affecting the normal operation of the module, it is strongly recommended to disconnect the serial port connection at the same time when the main power supply is disconnected, or set the serial port to the state of input state + pull-down resistor or high-impedance state + pull-down resistor status.

5.4 Backup Battery Power

In case of a power failure on pin VCC, real-time clock and backup RAM are supplied through pin V_BCKP. This enables the G129C GPS module to recover from power failure with either a hot start or a warm start (depending on the duration of VCC outage). If no Backup Battery is connected, the receiver performs a cold start upon powered up.

Backup Battery Power V_BCKP draws typically 7uA current in backup state.

5.5 Reset

G129C modules include a RESET pin. Driving RESET low activates a hardware reset of the system. RESET is only an input and will not reset external circuitry. At power down the reset is forced when the VCC drops below 2.7V.

NOTE: If not used, leave RESET not connected (floating).

5.6 PPS Signal

A pulse per second (1 PPS) is an electrical signal that very precisely indicates the start of a second. Depending on the source, properly operating PPS signals have an accuracy ranging 10ns. The PPS signals are used for precise timekeeping and time measurement.

6 Software protocol

6.1 NEMA0183 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. G129C supports the following NMEA-0183 messages:

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

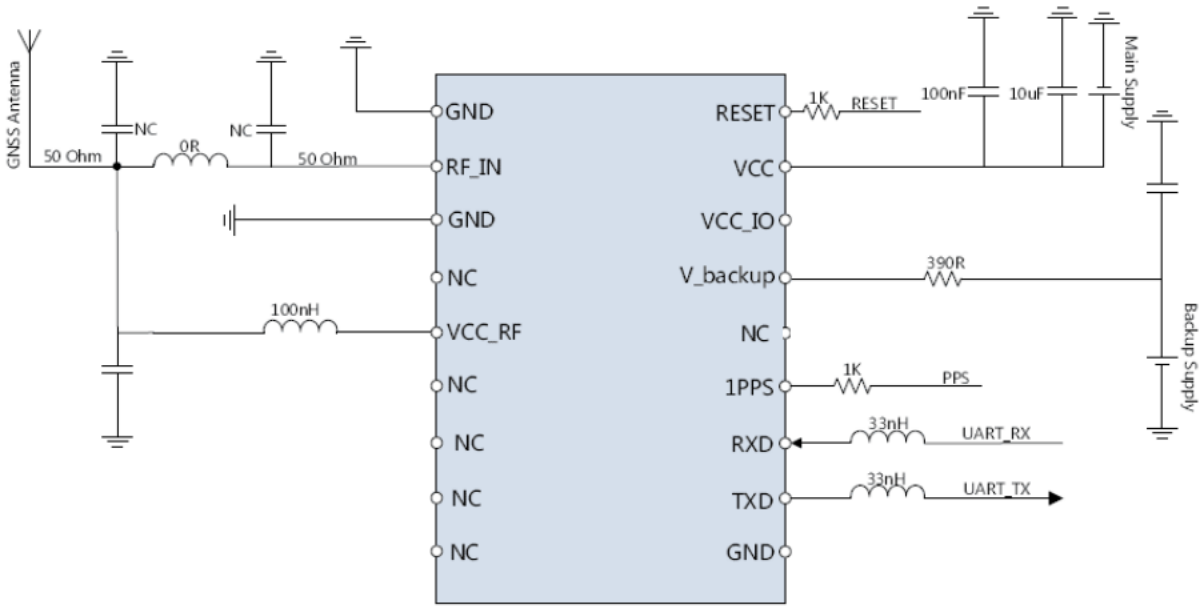
6.2 Common commands

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>
System Sleep Mode	$PMTK161,1*29<CR><LF>
System Wake up	$PMTK161,0*28<CR><LF>
Set baud rate	$PMTK251,baudrate*CRC<CR><LF>

7 Reference design

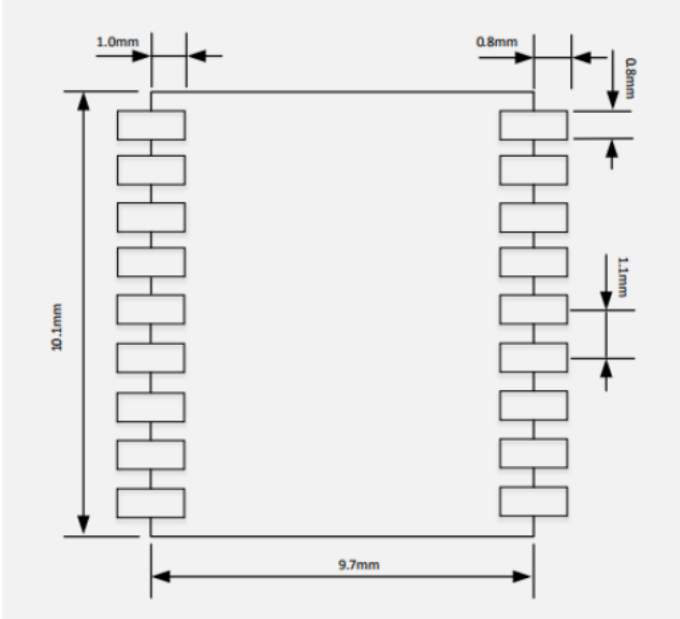
7.1 Schematic Design

The reference design of the G129C is shown in the figure below. When connecting an active antenna, please ensure that the 100nH inductor is in the patch state to supply power to the active antenna; when connecting a passive antenna, you do not need to use a 100nH inductor. The characteristic impedance from the RF_IN pin to the antenna interface is 50Ω. Since G129C is powered on and resets itself, RESET can be left floating.



7.2 PCB Package Reference

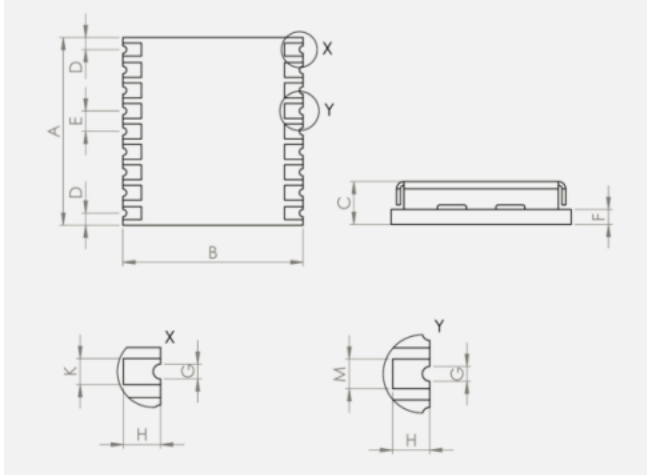
The package reference recommendations for G129C are as follows:



7.3 LAYOUT Notice

- ✓ Place the decoupling capacitors close to the power pins of the module, and ensure that the width of the power traces is more than 0.5mm;
- ✓ No wiring is allowed at the bottom of the module patch;
- ✓ The RF trace from the module RF port to the antenna interface must be at least 0.2mm~0.3mm, and the co-planar wave guide impedance model is used, and the spacing between the trace and the ground copper is controlled at about 1 times the spacing , and the guaranteed impedance is 50Ω;
- ✓ The wiring from the module RF port to the antenna interface refers to the second layer ground, and ensure that the second layer ground plane is relatively complete;
- ✓ Do not place the module near interference sources, such as communication module antennas, RF traces, crystal oscillators, large inductor, and high-frequency digital signal lines.

7.4 Mechanical Dimensions



No.	Min (mm)	Typical (mm)	Max (mm)
A	9.9	10.1	10.3
B	9.5	9.7	9.9
C	2.0	2.2	2.4
D	0.55	0.8	0.95
E	1.0	1.1	1.2
F	0.5	0.6	0.7
G	0.4	0.5	0.6
H	0.7	0.8	0.9
K	0.7	0.8	0.9
M	0.8	0.9	1.0

8 Packaging and Protection

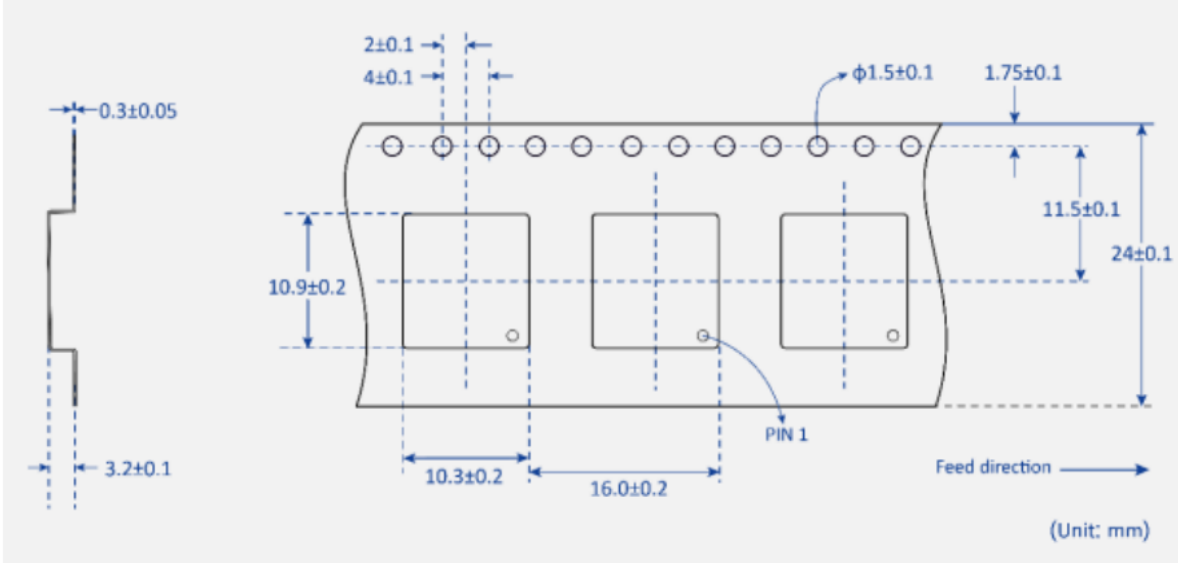
8.1 Package

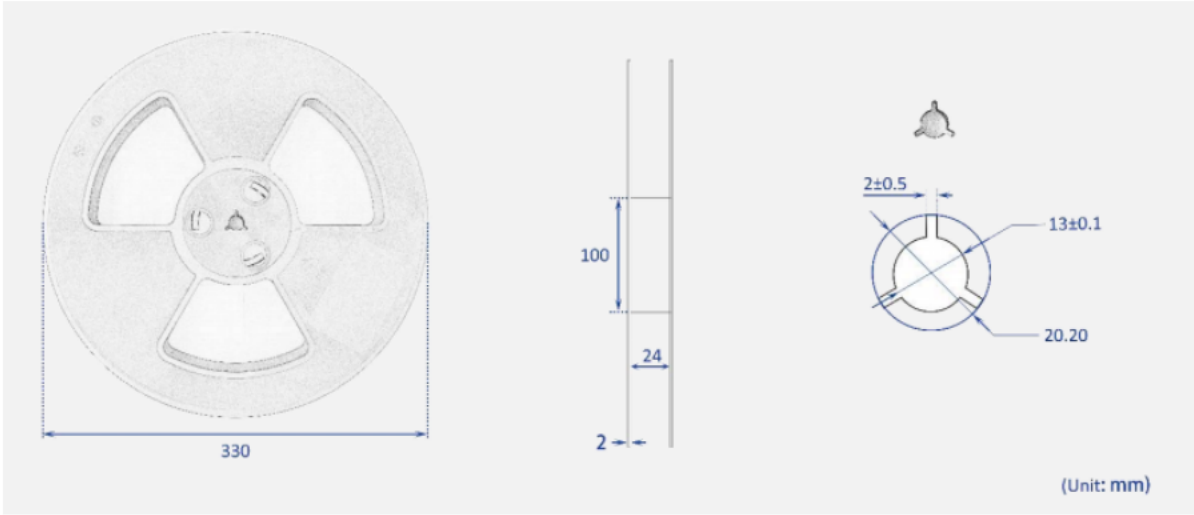
G129C is a device sensitive to humidity and static electricity. During product packaging and shipping, be sure to follow the relevant handling requirements and take appropriate precautions to reduce product damage. The table below shows the standard packaging structure for product shipping.

Product	Reels	Sealed Bags	Shipping Cartons
			
Module	1500 pcs/roll	1 roll/bag	1 bag/box, 3 boxes/carton

8.2 Tapes and reels

G129C adopts the method of reel (consisting of tape and reel), and is packed in sealed bag with anti-static effect to meet the needs of customers for efficient production, batch installation and disassembly. The picture below shows the size details of the tape.





8.3 Storage

In order to prevent the product from being damp and electrostatic discharge, a desiccant and a humidity indicator card are attached in the sealed packaging bag of the product. The user can know the humidity condition of the environment where the product is located through the humidity indicator card.

The moisture sensitivity level of the product is MSL3.

8.4 ESD protection

GNSS positioning modules contain highly sensitive electronics and are classified as electrostatic sensitive devices (ESD). Please pay attention to the following operation matters.

If the following precautions are not followed, it may cause serious damage to the module!

- ✓ Do not touch any live capacitors and other devices when pulling out the RF pins (e.g. antenna patch ~10 pF; coaxial cable ~50 –80 pF/m; soldering iron);
- ✓ To prevent electrostatic discharge, do not expose the antenna area; if it is exposed due to design reasons, please take appropriate ESD protection measures and do not touch any exposed antenna area;
- ✓ When soldering RF connectors and antenna patches, please make sure to use an ESD safe soldering iron.
- ✓ Add an ESD diode to the RF input section and UART interface to prevent electrostatic discharge;

9 Ordering Information

9.1 Ordering model

Welcome to order Huasim products, we promise to give you the best quality products and services.

Model	Product Name	Default Baud Rate	Default Update Rate	Default Frequency	Physical Interface
G129C	GNSS Module	9600	1Hz	GPS/QZSS L1 C/A	10.1*9.7mm，LGA18