

1 INTRODUCTION

The GNS1301 module utilizes the new generation MediaTek MT3333 GNSS chip that supports GPS and GLONASS and GALILEO simultaneously.

Due to its capability to use GLONASS and GPS and GALILEO at the same time, GNS1301 benefits from the higher availability of satellites in critical environments. The navigation performance and accuracy is further improved by using the correction data from SBAS (WAAS, EGNOS, GAGAN, MSAS), QZSS or DGPS(RTCM).

First Fixes after just a few seconds are achieved with the help of A-GPS using EPO™ (Extended Prediction Orbit) and the EASY™ "self generated orbit prediction" algorithm. EASY™ (Embedded Assist System) does not require any resources or assist data from the host.

The excellent low power design makes it easy to implement this module in power sensitive, battery supplied applications. The new AlwaysLocate™ power management feature will improve this behaviour additionally. It adaptively adjusts power consumption depending on the environment and motion conditions, in order to achieve a balance between fix rate, power consumption and position accuracy.

Very low power requirements (typ 66mW@ 3.3V) and internal voltage regulator makes it easy to run the module with various power supplies and allows direct connection to LiIon batteries.

GNS1301 offers the industry's highest level of navigation sensitivity up to -165dBm. It has superior dynamic performance at high velocity and provides effective protection against interference signals using MTAIC™ (Multi-tone active interference canceller). Up to 12 independent channel interference continuous wave jammers <-80dBm can be eliminated or reduced.

The embedded logger function LOCUS with a 16-hrs on chip memory makes this GNSS module a complete track logger for many applications. With AlwaysLocate™ data logging can be achieved up to 32-hrs under standard conditions.

In professional timing applications the outstanding high accuracy PPS (pulse per second) hardware pin is used for synchronization to GPS second. Typical accuracy is 10ns.

Features

- GLONASS and GPS and GALILEO simultaneously
- 99 acquisition-/ 33 tracking channels
- Ultra high tracking/navigation sensitivity: -165dBm
- Extremely fast TTFF at low signal level
- QZSS, SBAS (WAAS, EGNOS, MSAS, GAGAN) or DGPS (RTCM) correction support
- A-GPS by EPO "Extended Prediction Orbit"™ enables 7/14 days prediction
- 12 Multitone Active Interference Canceller (MTAIC) for GPS-in-band jammer rejection
- EASY™ : Self generated orbit prediction support
- AlwaysLocate™ : Intelligent Algorithm for power saving
- Embedded logger function
- High accuracy 1PPS output
- NMEA-0183 or binary protocol
- High update rate (up to 10/s)
- GPS+GLONASS Consumption current(@3.3V):
Acquisition: 35mA Typical
Tracking: 22mA Typical
- Low backup current consumption 15uA, typical
- SMD type with stamp holes
- Small form factor: 11.5x13x2.1 mm
- CE, FCC and RohS certified

Applications

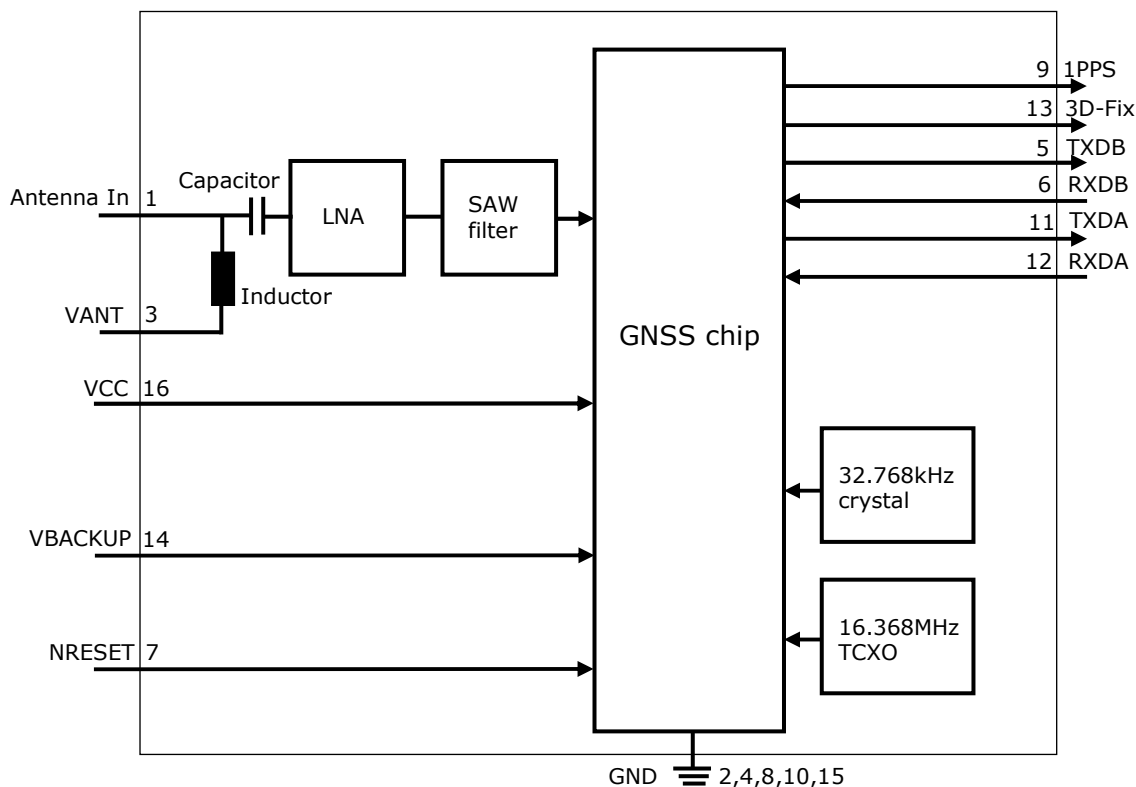
- Navigation
 - In-vehicle Navigation equipment
 - Dynamic Navigation
 - Portable ("nomadic") devices
 - Netbooks, tablet PCs and mobile phones
- Timing
 - Precision timing via GPS
- Location based applications
 - GPS Logger
 - GPS Tracker
 - Security devices
 - Camera equipment
 - Geofencing

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3 FUNCTIONAL DESCRIPTION

3.1 Block diagram



3.2 System description

The GNS1301 core is a high performance, low power GPS and GLONASS and GALILEO receiver that includes an integrated RF frontend. The receiver can process all three GNSS systems simultaneously, which improves the availability of usable satellites in critical reception scenarios. Due to high input sensitivity and integrated low noise amplifier (LNA), it can work directly with a passive antenna.

GNS1301 is a complete GNSS engine, including:

- Full GPS and GLONASS and GALILEO processing without any host processing requirements
- Standard NMEA message output
- A powerful command and control interface
- All clock sources integrated on module
- RF frontend for direct connection of passive or active antennas
- Rich additional features like complete logger, geofencing, single sentence output, last position retention and magnetic variation
- Interfaces for DGPS, PPS, Fix Status Indicator

3.3 GPS and GLONASS simultaneous operation

GNS1301 supports tracking of the GPS and the GLONASS and GALILEO satellite system at one time. This feature enhances the overall performance significant.

- Increased availability of number of satellites
- Increased spatial distribution allows better geometrical conditions
- Reduced Horizontal (HDOP) and Vertical Dilution of Precision (VDOP) factors

In GPS-only operation, a minimum of 3 SVs is needed to determine a 2D position fix solution. When using both systems, 5 SVs are needed to determine the four unknowns and one more SV to calculate the GPS/GLONASS time offset.

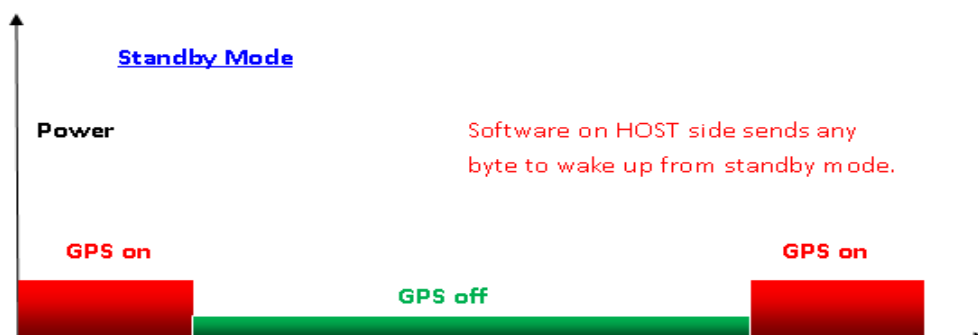
Using a combined receiver, users have an access to potentially 48 or more satellites. This high number of satellites can overcome the typical problems of restricted visibility of the sky, such as in urban canyons or indoor scenarios.

3.4 Power Management Features

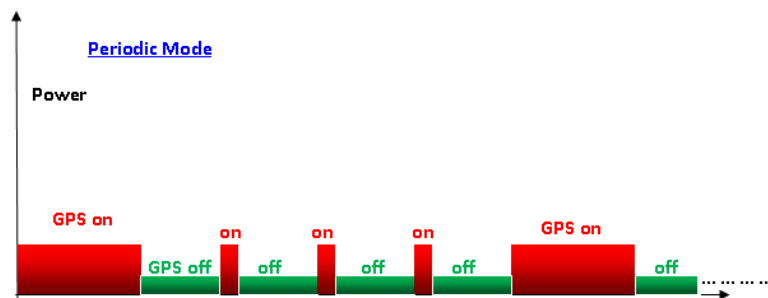
Power management schemes implemented for any GPS system requires an optimally tuned performance for both accuracy of the position fixes and the average power consumed for best user experience. GNS1301 architecture achieves these both aspects by providing flexibility and design choices for the system integration, based on wide range of use cases and by leveraging on the proven silicon methodologies. Also GNS1301 provides position, velocity and time measurements without any host loading. This, coupled with the optional built-in power management options, reduces the overall system power budget.

Selectable Power management features:

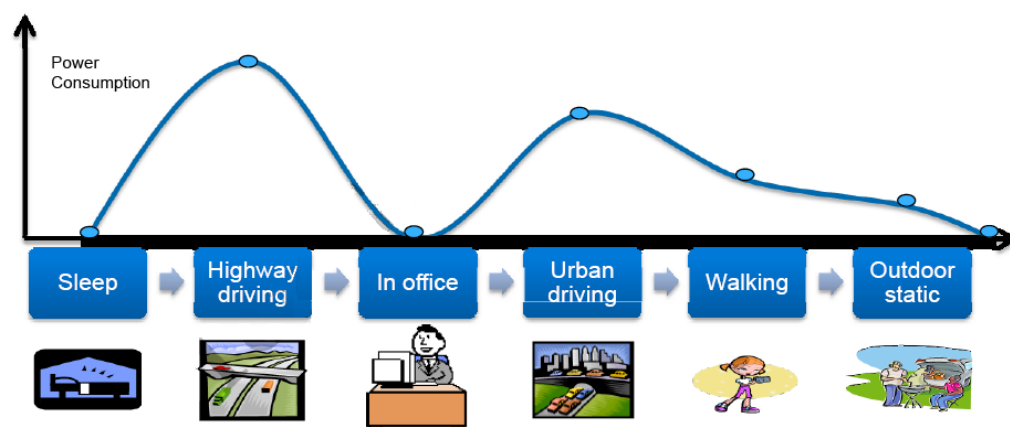
- In **Standby mode** RF frontend and internal MPU are switched to deep sleep state. Power consumption is reduced to 0.6 mW (200µA). This state can be entered by sending the NMEA command: \$PMTK161,0*28<CR><LF>. Leaving standby mode and resuming to normal operation will be managed by sending any byte to the module.



- **Backup mode** can be entered by sending NMEA command: \$PMTK225,4*2F<CR><LF>. The GPS core will shut down autonomously to backup state, Vcc supply can now be switched off by an external power supply switch.
- **Periodic mode** describes a power mode, which will autonomously power on/off the module in programmable time slots with reduced fix rate. Periodic mode is useful during stationary operation or if position fixes are just needed from time to time. Since power consumption in **GPS off** times is nearly zero, the power consumption in periodic mode can be estimated by $P_{\text{tracking}} * (t_{\text{on}} / (t_{\text{on}} + t_{\text{off}}))$. Periodic mode is controlled with NMEA command \$PTMK225. See document *GNS1301NMEACommandInterface manual* for programming details.



- **AlwaysLocate™** feature provides an optimized overall GPS system power consumption in tracking mode under open sky conditions. Always Locate is an intelligent control of periodic mode. Depending on the environment and motion conditions, GNS1301 can adjust the on/off time to achieve balance of positioning accuracy and power consumption. The best power saving will be made under good reception in stationary mode. Critical reception conditions and dynamic movements will need full activity of the GNSS engine which causes nominal power requirements (29mA typ in tracking mode).



3.5 Logger function

GNS1301 provides an autonomous logger function that automatically stores position information in an internal 128kB flash memory. A complete tracking unit can be realized without any external CPU or memory.

The parameters for logging are programmable via the NMEA command interface. The following parameter can be set to optimize logging time:

- logger rate

The commands for logger include:

- start logging
- stop logging
- erase memory
- readout memory

please refer to the *GNS1301NMEACOMMANDInterface manual* for details.

Internal Logger Function					
Logger data rate	1/15		1	1/s	
Logger data memory		128		kBytes	Flash memory
Logger trigger		programmable			Logger can be triggered on various events

3.6 Active interference cancellation (MTAIC)

Because different wireless technologies like Wi-Fi, GSM/GPRS, 3G/4G, Bluetooth are integrated into portable systems, the harmonic of RF signals may 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, thus improving the performance of GPS reception. GNS1301 can cancel up to 12 independent continuous wave (CW) channels having signal levels of up to -80dBm. The functionality is enabled by default and increases power consumption by about 1mA.

3.7 AGPS with EPO™ data

AGPS (assisted GPS) allows to shorten TTFF (TimeToFirstFix) by injecting ephemeris data from an external source into the module's memory. With the help of these data, the module does not need to acquire satellite positions by receiving the data from the satellites.

Depending on time and position information that is still available in the module memory, the TTFF can be reduced to just a few seconds.

The GNS AGPS service is based on a short term predicted data service. The predicted data will be fully processed by the GPS engine, the host must load the data from the web and transfer them over the UART to the module:

1. Check GNS1301 module EPO data for validity by comparing the time. (time parameters for existing 1301 data can be retrieved through a NMEA command)
2. Connect to web server through network connection (GPRS, WLAN, LAN,...)
3. Download file. There are just two files, covering all GPS satellites. The first file (MTK7d.EPO) is for 7 days (53kB), the other is 106Kbytes for 14 days (MTK14d.EPO)
4. "Parse" file, using software example. This is quite easy, there must be added some header bytes and a checksum and a control counter. GNS offers software support on this.
5. Download to 1301 module. please refer to the *GNS1301NMEACommandInterface manual* for details

If the host has low memory available, there's no need to save the whole file. The steps 3..5 can be done frame by frame needing less than 2kBytes of buffer memory.

Code samples and support for several platforms are available from GNS (in preparation)

Thanks to the predicted system, download data stay valid for up to 14 days. Therefore, users can initiate the download everytime and benefit from using (W)LAN instead of using expensive GSM. File size will be ~50kBytes for a one week prediction data set.

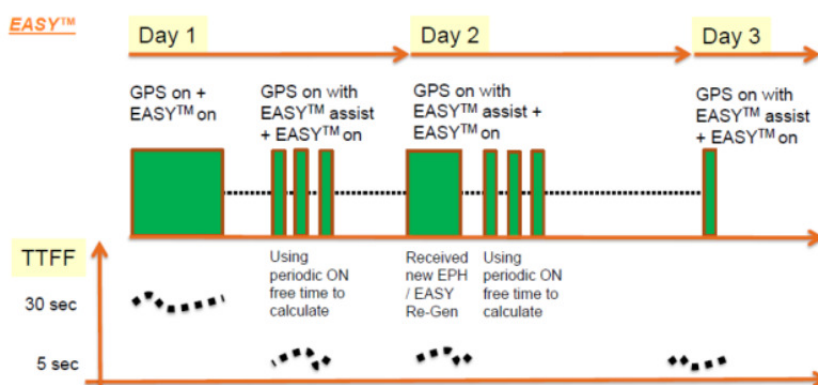
AGPS characteristics					
System					6hrs predicted data
File size for data download		53		kB	1 week prediction data
Maximum prediction time	7	14		days	
TTFF		1		sec	Time and last position available
TTFF		15		sec	Last position available

3.8 EASY™ self generated prediction data feature

GNS1301 includes an internal prediction system, that allows to sample satellite orbit data during operation and use that data to speed up TTFF on later starts. The prediction time frame is up to three days forward.

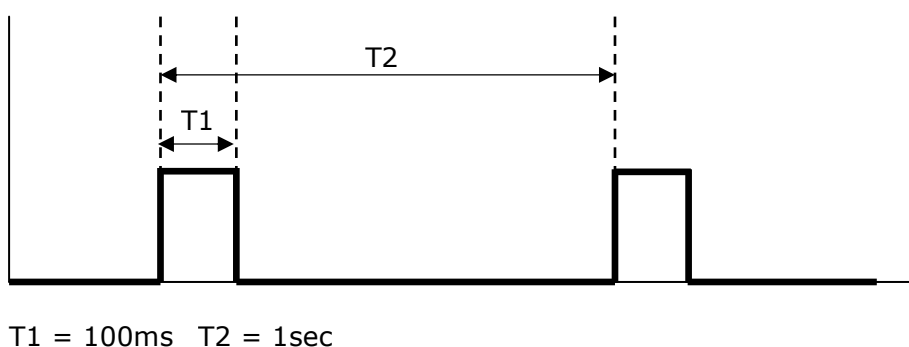
Although this prediction feature does not provide the very short TTFF that is achieved using AGPS, it can help to find a fix solution faster and in weak signal condition scenario. Prediction data will be kept in memory as long as VBACKUP is present. This option is activated by default.

Note: The EASY functionality is only supported, if "VBACKUP" pin is connected and the NMEA update rate is 1Hz.



3.9 Pulse Per Second (PPS)

GNS1301 provides a Pulse Per Second (PPS) hardware output pin for timing purposes. After calculation of a 3D position fix (default setting), the PPS signal is accurately aligned to the GPS second boundaries. The pulse generated is approximately 100 milliseconds in duration and the repetition rate is 1 second. On request PPS output can be activated on a 2D-fix or after power-up of the module, providing a time accuracy decreased PPS signal.



GNS1301 module provides an exceptionally low RMS jitter of typical 10 nanoseconds.

PPS characteristics based upon a 3D-fix					
1PPS pulse duration	-	100	-	msec	
1PPS time jitter	-	10		nsec RMS	Pulse rising edge deviation from expected pulse time, measured with full 3D fix
1PPS rise and fall time		5		nsec	10%..90%, load is 10k 5pF

3.10 SBAS (Satellite Based Augmentation) support

GNS1301 supports Satellite Based Augmentation for improvement of the navigation precision. Correction data is sent from geostationary satellites to the GPS receiver. GNS1301 supports European, US, and Asian augmentation systems (EGNOS, WAAS, QZSS, GAGAN, MSAS) to enable precision improvements in nearly every region of the world.

SBAS is active by default and will automatically track the available SBAS satellites. It can be disabled by NMEA command. See document *GNS1301NMEACOMMANDInterface* for details.

Note : In SBAS mode, the maximum fix rate is limited to 5 per second.

3.11 DGPS (Differential GPS) support

GNS1301 accepts DGPS input in RTCM format. DGPS provides precision position fixes down to centimetres and is used in professional applications like agriculture. The second UART (UART_B) of the module is used to feed the data in. DGPS is deactivated by default. For configuration of the UART port, some NMEA commands must be implemented. See *GNS1301NMEACOMMANDInterface* document for details.

Note : Since SBAS and DGPS both do (different) corrections on the fix position solution, they cannot be used at the same time! SBAS / DGPS usage is programmed through the NMEA Interface.

3.12 Single sentence output

GNS1301 allows to reduce data transfer to host to a minimum. Reduced data transfer can save host processor activity times and thus reduce system power consumption. All relevant information will be provided in a single sentence output. To save further channel load, the sentence can be formatted as binary.

3.13 Last position retention

Depending on the application, it might be useful to retain the last position or to clear the position when having no fix solution. When enabled, the last known position is outputted in the NMEA sentences.

3.14 Geofencing function

GNS1301 has an internal algorithm to determine whether the actual position is within a circular area around a predefined location point. A proprietary sentence indicates the "inside" or "outside" status.

3.15 Distance calculation feature

This feature allows to request the real "line of sight" distance in relation to a predefined position. This feature can remove some load from the host processor.

3.16 Magnetic variation feature

As the magnetic variation feature is enabled, data output provides informations about the degree of magnetic variation and the measured magnetic heading.

3.17 GPS almanac and ephemeris data

For quick re-acquisition of the GPS after off-times, the GPS engine should have access to almanac and ephemeris data. This data is permanently stored inside GNS1301 module, even if all power supplies have been removed. When the GPS is powered-up again, the data will be used to allow a quick re-acquisition, as soon as a coarse time information is available. Time will be available immediately, when RTC is kept running.

3.18 Real time clock (RTC)

GNS1301 has a real time clock with 32,768Hz crystal onboard. As long as VBACKUP is connected to a power source, the real time clock and the module memory can be kept alive at very low power consumption of just 7uA. The RTC will track the current time and enable the module to start from sleep states with very fast time to first Fix (TTFF).

3.19 UART interface

GNS1301 core and I/O sections work at 3.3V nominal. Absolute Maximum Ratings should not be exceeded. Should the GNS1301 be interfaced to a host with I/O at higher/lower levels, level shifters should be used. UART baud rate is 9600baud by default. The baud rate can be modified to higher rates by a NMEA software command. See document *GNS1301NMEAcCommandInterface manual* for details.

GPS UART Default Settings	
Parameter	Value
Baud rate	9600
Data length	8 bits
Stop bit	1
Parity	None

3.20 Module default settings

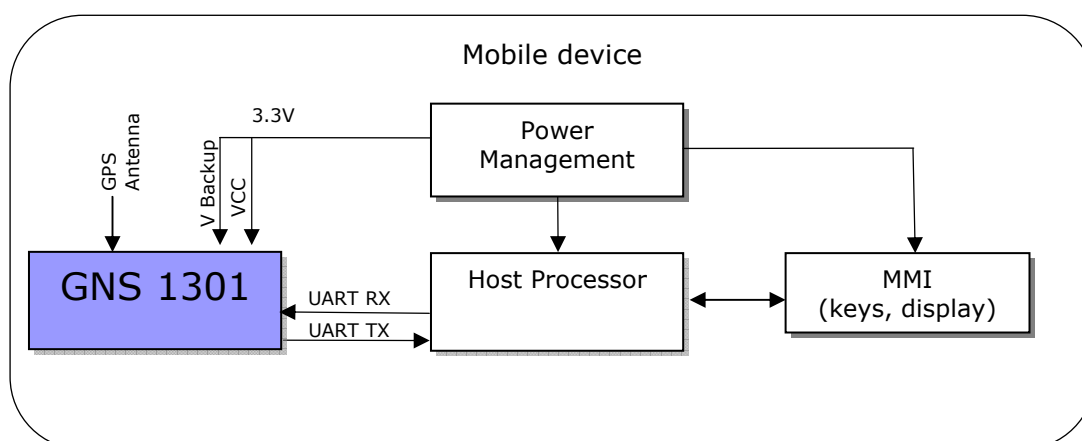
The 1301 module comes with default settings, which are persistently programmed. Whenever power is removed from the module (both Vcc and VBACKUP), the settings will be reset to the values shown in the following table.

Default settings	
Setting	Default value
UART setting	9600,8,N,1
Fix frequency (update rate)	1/sec
NMEA sentences	\$GPRMC,\$GNGSA,\$GPGSV,\$GLGSV,\$GPVTG,\$GPGGA
NMEA rate	Once a second: RMC,GSA,VTG every 5 sec :GSV sentences
Self survey prediction mode: EASY™	enabled
Active interference cancellation:MTAIC	enabled
DGPS option	SBAS enabled
Datum	WGS 84
PPS pulse output length	100ms
Logging parameters	Full&Stop / Content Basic / Interval 15 sec
Single sentence output	Customized firmware needed
Last position retention	Customized firmware needed
Magnetic variation	Customized firmware needed
Geofencing function	Customized firmware needed
Distance calculation feature	Customized firmware needed

On request, other options can be selected as preprogrammed (persistent default) options.
Please contact the GNS support for your project requirements.
Note : Customized options are solely available for fixed order lots.

4 TYPICAL APPLICATION BLOCK DIAGRAM

4.1 Typical System overview



5 GNSS characteristics

5.1 GNSS characteristics					
Parameter	Min	Typ	Max	Unit	Note
general					
Frequency		1575.42		MHz	GPS L1
		1598.0625~ 1609.3125		MHz	GLONASS L1
		1559 - 1591		MHz	GALILEO L1
SV Numbers					GPS #1~32 GLONASS #65~96 GALILEO #201~253*
DGPS					SBAS[QZSS,WAAS,EGNOS, MSAS,GAGAN], RTCM
AGPS					Internal processing of predicted orbit data. Service available via ftp. 6hrs prediction interval
Output data frequency	1/10	1	10	1/sec	Configurable
Navigation&tracking sensitivity		-165	-167	dBm	
Acquisition sensitivity		-148		dBm	autonomous
TTFF hotstart		<1		sec	All SVs @-130dBm
TTFF autonomous cold start		34		sec	All SVs @-130dBm
Number of channels tracking		33			
Number of acquisition channels		99			
Dimension		11.5x13x2.1		mm ³	Tolerance is 0.2 mm
Weight		1		g	
Power consumption					
GPS/GLONASS ACTIVE (acquisition)		35*		mA	NMEA frequency = 1/sec*,SBAS enabled, MTAIC enabled
GPS/GLONASS ACTIVE (tracking)		22*		mA	NMEA frequency = 1/sec*, SBAS enabled, MTAIC enabled
Backup current @ 3V		15		μA	

*note: further power savings are possible using AlwaysLocate or periodical modes. Actual possible savings depend on use cases.

Accuracy					
Position error CEP50	-	3	-	m	Without aid
Position error CEP50	-	2.5	-	m	Using (SBAS)
Velocity error	-	0.1	-	m/s	Without aid
velocity error	-	0.05	-	m/s	Using (SBAS)

ITAR limits					
Operation altitude		-	18,000	m	
Operation velocity	-	-	515	m/s	
Operation acceleration	-	-	4	G	

6 DESIGN GUIDELINES

6.1 General

Although GNS1301 GPS&GLONASS&GALILEO module provides best performance at low power consumption, special care should be taken to provide clean signal and clean power supplies. A multi layer carrier board with solid power- and ground planes is recommended. Power lines should be blocked near to the module with low ESR capacitors.

Radiated noise from neighbour components may also reduce the performance of the module. Special care must be taken when designing the RF input tracks and antenna connection.

6.2 GNSS antenna

GNS1301 contains all input circuitry needed to connect a passive antenna directly. A special GNSS antenna that covers all three frequencies must be chosen.

If there is a long wire between GNS1301 RF input and antenna, there should be an LNA (on the antenna side) to compensate for cable losses ("active" antenna).

The module is already prepared for connecting an active antenna. DC injection and DC decoupling from RF input is already onboard. Please connect a suitable power supply to pin3 (VANT). The power supply voltage should match the active antenna specified voltage. The current flowing from pin 3 to the antenna should be maximum 30mA. In many cases, pin3 can be directly connected to Vcc (pin16).

More information about connecting and implementing a GNSS antenna to an application PCB, please refer to *GPS Antenna Design Guide.pdf*.

7 ELECTRICAL SPECIFICATION

7.1 Absolute Maximum Ratings

Parameter	Value	Unit
Supply voltage range: V _{cc}	-0.5 to 4.3	V
Backup voltage: V _{BACKUP}	-0.5 to 4.3	V
Input voltage to analog pins	-0.5 to 3.3	V
Input voltage to all other pins	-0.5 to V _{cc}	V
I/O ESD voltage	-1000 to 1000	V
Operating ambient temperature range	-40 to +85	°C
Storage temperature range	-40 to +85	°C

7.2 Recommended Operating Conditions

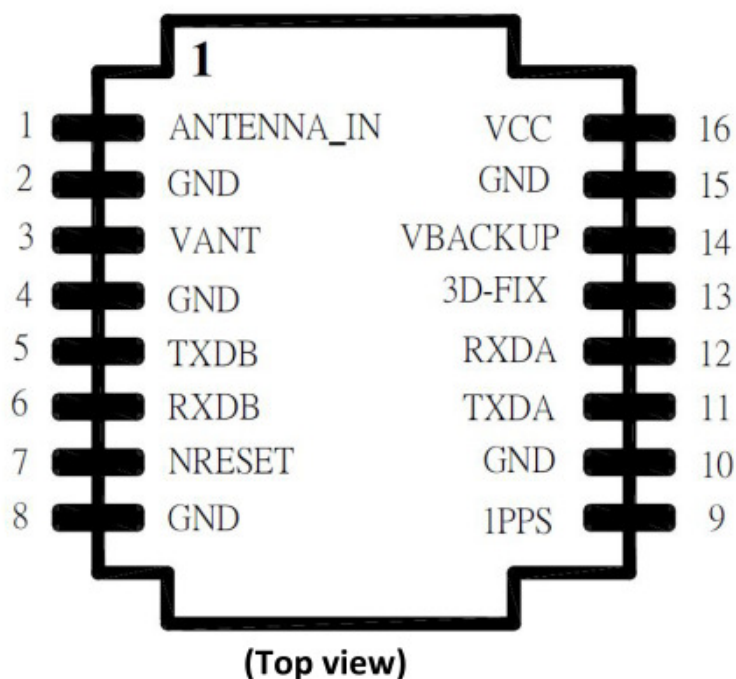
Parameter	Min	Typ	Max	Unit	Note
V _{cc}	3.0	3.3	4.3	V	supply voltage
V _{BACKUP}	2.0	3.0	4.3	V	Backup voltage for RTC and memory retention, must be available during normal operation
High level output voltage V _{OH}	0.8 * V _{cc}		V _{cc}	V	
Low level output voltage V _{OL}	0		0.2 * V _{DD}	V	
High-level input voltage V _{IH}	0.80 * V _{cc}		V _{cc}	V	
Low-level input voltage V _{IL}	0		0.35 * V _{cc}	V	
Operating temperature	-40		85	°C	Full specified sensitivity

7.3 GPS/GLONASS input characteristics

Parameter	Min	Typ	Max	Unit	Note
Maximum input level	0			dBm	
Input return loss		-6.5		dB	

8 DEVICE PINOUT DIAGRAM

8.1 Pin configuration



8.2 Pin assignment

Pin	Name	I/O	Description & Note
1	Antenna_IN	I	Antenna Signal Input This is the GNSS RF signal input pin, which can be connected to a passive antenna or an active antenna.
2	GND	p	Ground
3	VANT	P	External Antenna power input The power supply input for external active antenna. The input voltage should be kept from 2.5V to 5V. DC current <=30mA.
4	GND	P	Ground
5	TXDB	O	Serial Data Output This is the UART-B transmitter of the module. It is used for customization by firmware. If not used, keep floating
6	RXDB	I	Serial Data Input for DGPS RTCM data streaming This pin receives DGPS data of RTCM protocol (TTL level), if not used keep floating.
7	NRESET	I	Reset Input, Low Active Low active, it causes the module to reset. If not used, keep floating.
8	GND	P	Ground
9	1PPS	O	1PPS Time Mark Output 2.8V CMOS Level This pin provides one pulse-per-second output from the module and synchronizes to GPS time. Keep floating if not used.
10	GND	P	Ground
11	TXDA	O	Serial Data Output A for NMEA output (TTL) This is the UART-A transmitter of the module. It outputs GPS information for application.
12	RXDA	I	Serial Data Input A for Firmware update (TTL) This is the UART-A receiver of the module. It is used to receive commands from system
13	3D_FIX	O	3D-Fix Indicator The 3D_FIX is assigned as a fix flag output. If not used, keep floating. Before 2D Fix The pin will continuously toggle with 0.5 Hz. output one second high-level and one-second low-level signal After 2D or 3D Fix The pin will continuously output low-level signal This pin may not connected to high-level at power-on sequence.
14	VBACKUP	P	Backup power input for RTC & navigation data keep This connects to the backup power of the GPS module. Power source (such as battery) connected to this pin will help the GPS chipset in keeping its internal RTC running when the main power source is turned off. The voltage should be kept between 2.0V~4.3V, Typical 3.0V. If VBACKUP power was not reserved, the GNSS module will perform a lengthy cold start every time it is powered-on because previous satellite information is not retained and needs to be re-transmitted.
15	GND	P	Ground
16	VCC	P	Main DC power input The main DC power supply for the module. The voltage should be kept between from 3.0V to 4.3V. The ripple must be limited under 50mVpp (Typical: 3.3V).

(1) I = INPUT; O = OUTPUT; I/O = BIDIRECTIONAL; P = POWER PIN; ANA = ANALOG PIN.

9 NMEA DATA interface

GNS1301 provides NMEA (National Marine Electronics Association) 0183 compatible data. A set of proprietary NMEA commands are available to send control messages to the module. These commands are described in a separate document: *GNS1301NMEACommandInterface manual*. For standard operation, no commands are needed; the module will start outputting NMEA sentences after power supply has been attached. GNS1301 will always start communication output with 9600 bit per second.

If non standard options are needed (f.e. other baud rate , other NMEA sequence) they can be programmed from host controller during runtime.

Important note : options set by using NMEA command interface are not persistent! They will be lost when power is removed. A backup supply at VBACKUP will be sufficient to keep them.

9.1 NMEA output sentences for GPS and GLONASS

NMEA output sentences	
Type	content
Common sentences	
RMC	Recommended Minimum Navigation Information
GGA	Fix Data, Time, Position and fix related data for a GPS receiver
GLL	Geographic Position - Latitude/Longitude
GSA	GLONASS DOP and active satellites
VTG	Course and Speed Information relative to the Ground
GSV	Satellites in view

NMEA output sentences identifier, related to its GNSS system:

NMEA output identifier					
System	GGA	GSA	GSV	RMC	VTG
GPS	GPGGA	GPGSA	GPGSV	GPRMC	GPVTG
GPS+GLONASS	GNGGA	GPGSA GLGSA	GPGSV GLGSV	GPRMC ¹ or GNRMC	GNVTG
GPS+GLONASS +GALILEO	GNGGA	GPGSA GLGSA GAGSA	GPGSV GLGSV GAGSV	GNRMC	GNVTG

Note1: Before 3D fix RMC output is GPRMC, after 3D fix it changes to GNRMC.

For more informations, please refer to the **NMEA protocol** document, available at the GNS forum:
www.forum.gns-gmbh.com .

9.2 NMEA command interface

GNS1301 NMEA command interface allows to control settings and the extended functions. The command interface specification is available in an extra document:

GNS1301NMEACOMMANDInterface manual.

Two groups of commands are available:

Setting commands do modify the behavior of the module.

Note : modified settings will be valid as long as the module is powered through Vcc or VBACKUP. (f.e. : setting of a new baud rate). After removing Vcc and VBACKUP, all settings are reset to their default values.

Action commands will perform the specified action one time after the command has been received. (f.e. : request for cold start)

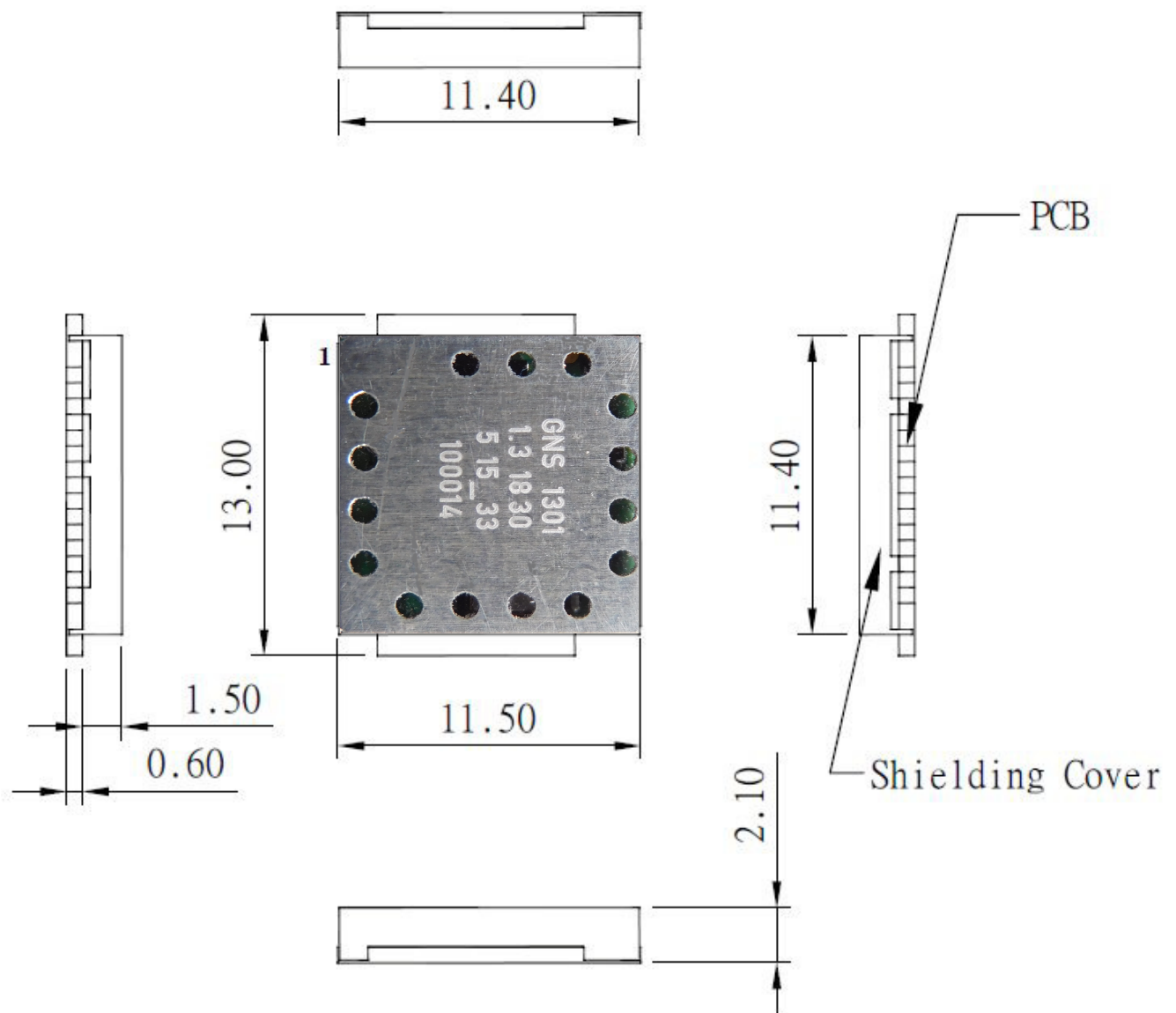
Commands are always started with \$PTMK, directly followed by the command number 000..999. Each command must be terminated by *<chksum> and a <CR><LF>.

The checksum calculation is simple, just XOR all the bytes between the \$ and the * (not including the delimiters themselves). Then use the hexadecimal ASCII format.

10 PHYSICAL DIMENSIONS

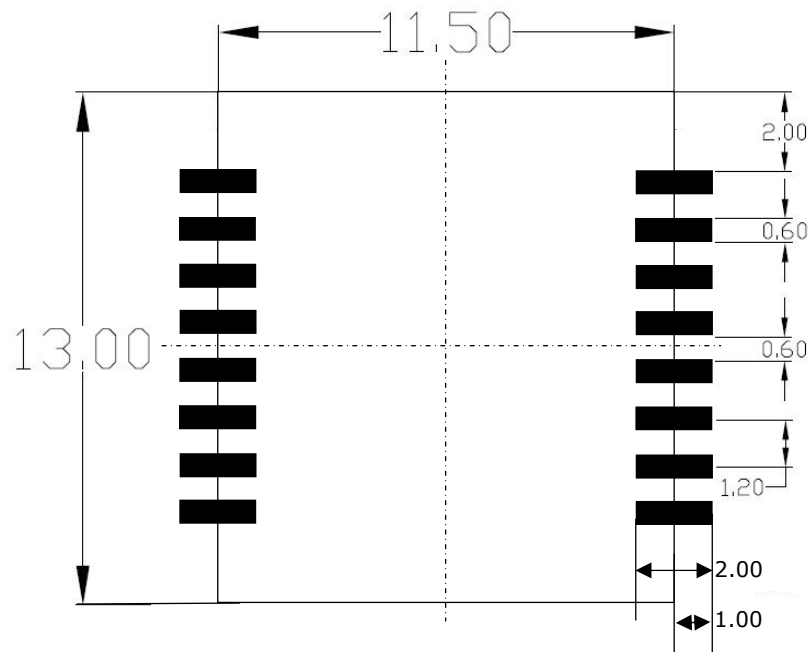
TOP VIEW

all units in mm, tolerance is $\pm 0.2\text{mm}$



11 RECOMMENDED PAD LAYOUT

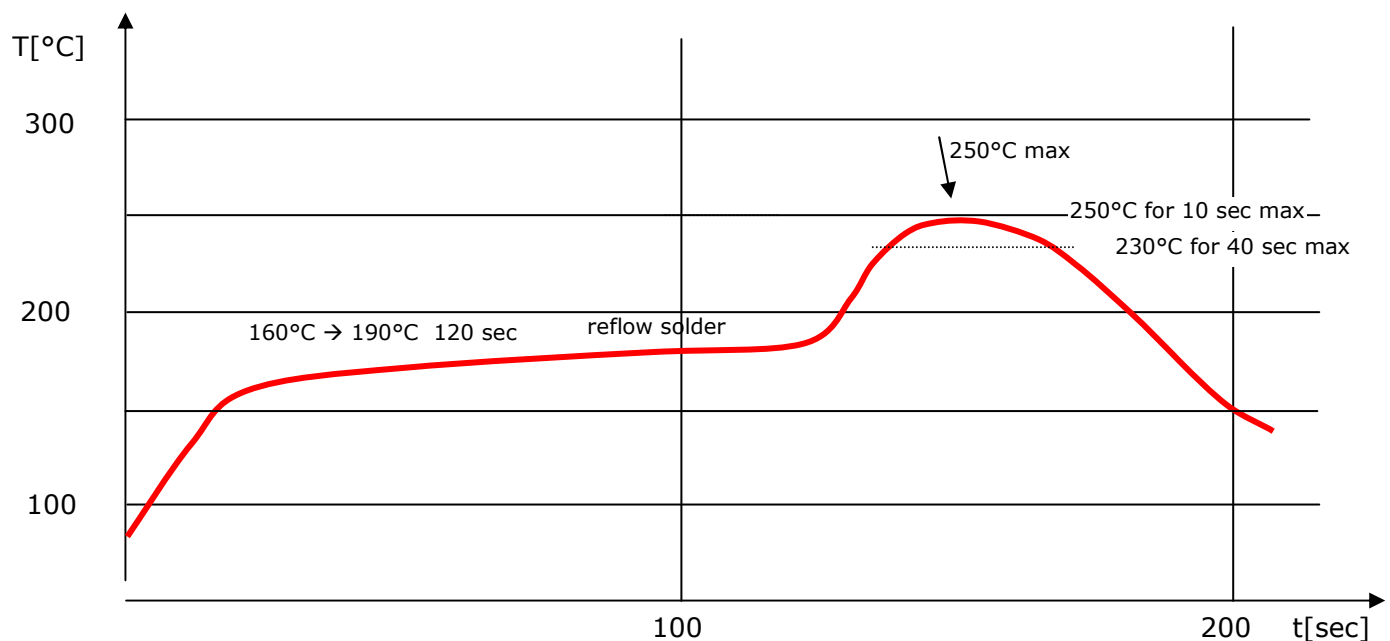
TOP VIEW
all units in mm



12 MATERIAL INFORMATION

Complies to ROHS standard
ROHS documentations are available on request
Contact surface: gold over nickel

13 RECOMMENDED SOLDERING REFLOW PROFILE



Notes:

1. GNS1301 should be soldered in upright soldering position. In case of head-over soldering, please prevent shielding / GNS1301 Module from falling down.
2. Do never exceed maximum peak temperature
3. Reflow cycles allowed : 1 time
4. Do not solder with Pb-Sn or other solder containing lead (Pb)
5. This device is not applicable for flow solder processing
6. This device is not applicable for solder iron process

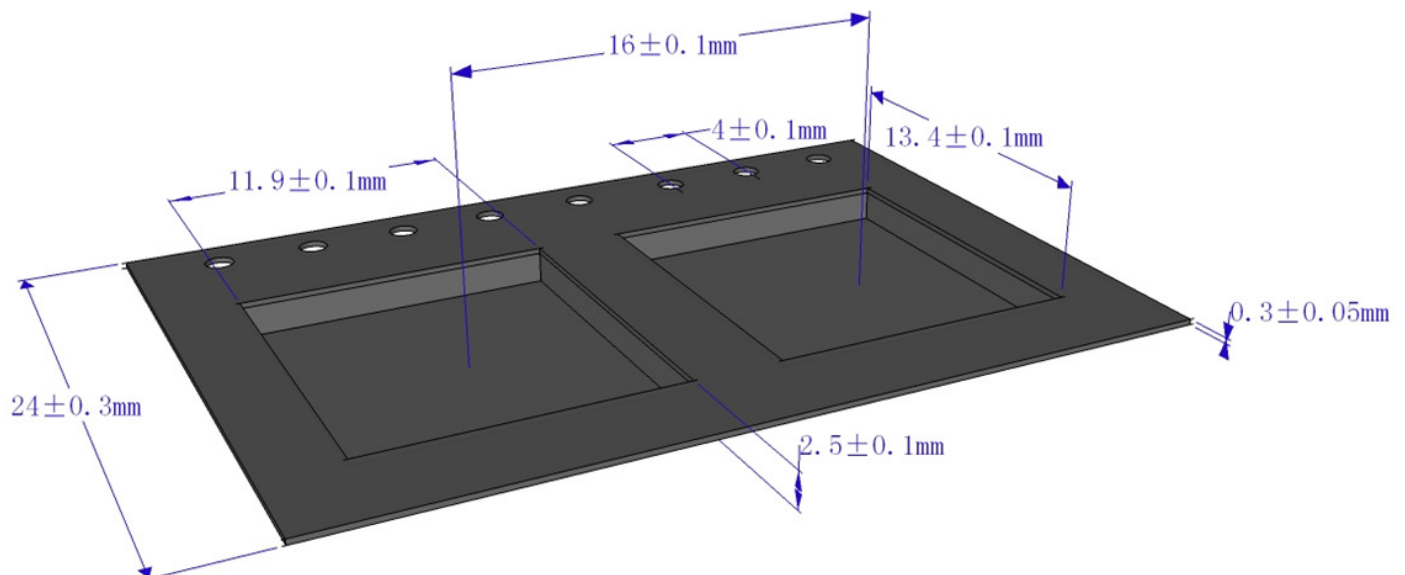
14 TRAY PACKAGE INFORMATION

The GNS1301 are placed on a tray for quantities below 100 pieces. The trays will be stacked and packed together. The trays are placed inside an antistatic bag.

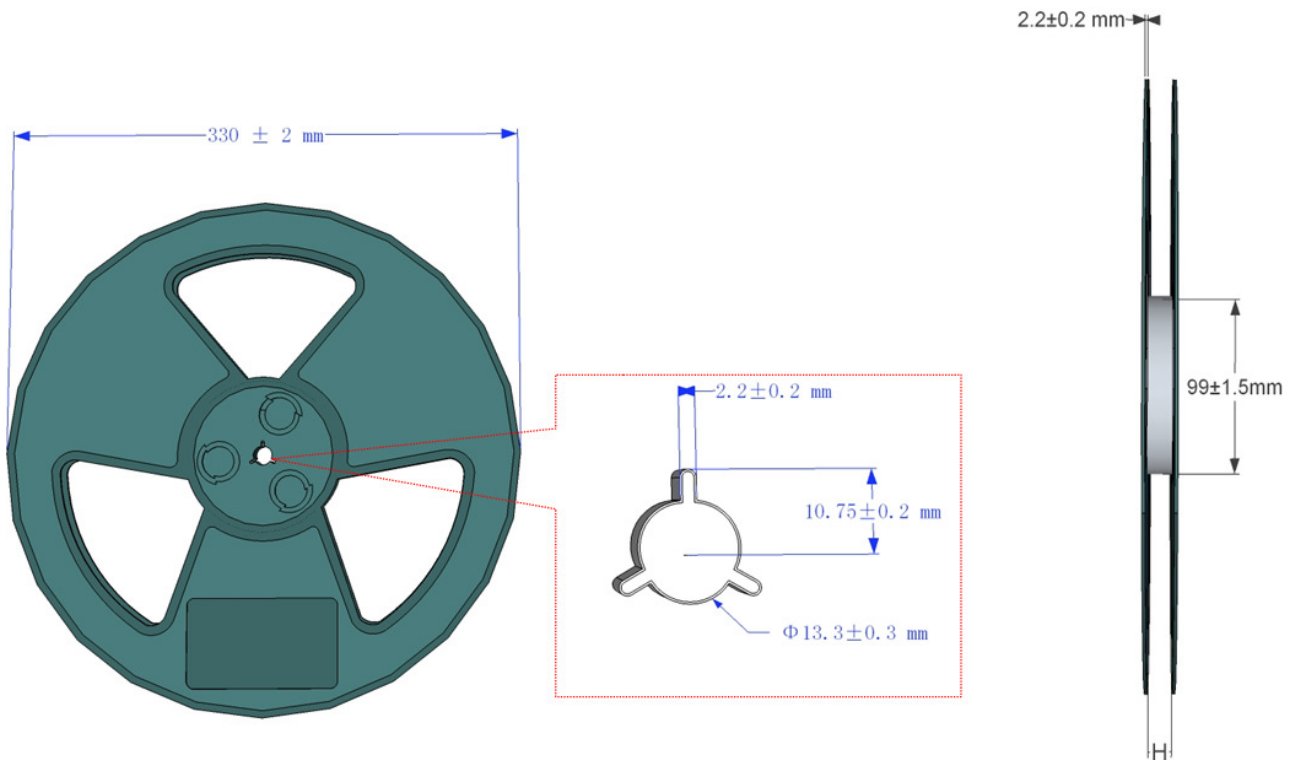


15 TAPE&REEL INFORMATION

Tape information:



Reel information:



H= 24.5mm

Number of devices: 1000pcs/reel

16 ORDERING INFORMATION

Ordering information			
Type	Part#	label marking	Description
GNS1301	4037735104761	<div style="border: 1px solid black; padding: 2px; display: inline-block;"> GNS1301 1.3 18 27 5.15_33 100001 </div> <div style="margin-left: 10px;"> <p>← Type</p> <p>← HW version</p> <p>← datecode</p> <p>← FW version</p> <p>← serial#</p> </div>	datecode : YY WW FW version: MEDIATEK f/w release

17 QUALITY AND ENVIRONMENTAL SPECIFICATIONS

Test	Standard	Parameters
PCB Inspection	IPC-6012B, Class 2. Qualification and Performance Specification for Rigid Printed Boards - Jan 2007	
Assembly Inspection	IPC-A-610-D, Class 2 "Acceptability of electronic assemblies"	
Temperature Range	ETSI EN 300 019-2-7 specification T 7.3	-30 °C, +25 °C, +85 °C, operating
Damp Heat	ETSI EN 300 019-2-7 specification T 7.3	+70 °C, 80% RH, 96 hrs, non-operating
Thermal Shock	ETSI EN 300 019-2-7 specification T 7.3 E	-40 °C ... +85 °C, 200 cycles
Vibration	ISO16750-3	Random vibration, 10~1000Hz, 27.8m/s ² , 8hrs/axis, X, Y, Z 8hrs for each 3 axis non-operating
Shock	ISO16750-3	Half-sinusoidal 50g, 6ms, 10time/face, ±X, ±Y and ±Z non-operating
Moisture/Reflow Sensitivity	IPC/JEDEC J-STD-020D.1	MSL3
Storage (Dry Pack)	IPC/JEDEC J-STD-033C	MSL3
Solderability	EN/IEC 60068-2-58 Test Td	More than 90% of the electrode should be covered by solder. Solder temperature 245 °C ± 5 °C

Moisture Sensitivity

GNS ships all devices dry packed in tape on reel with desiccant and moisture level indicator sealed in an airtight package. If on receiving the goods the moisture indicator is pink in color or a puncture of the airtight seal packaging is observed, then follow J-STD-033 "Handling and Use of Moisture/Reflow Sensitive Surface Mount Devices".

Storage (Out of Bag)

The GNS 1301 modules meet MSL Level 3 of the JEDEC specification J-STD-020D - 168 hours Floor Life (out of bag) ≤30 °C/60% RH. If the stated floor life expires prior to reflow process then follow J-STD-033 "Handling and Use of Moisture/Reflow Sensitive Surface Mount Devices".

18 DOCUMENT REVISION HISTORY

V0.01	Jul 12 2012	P.Skaliks	initial , internal , not published
V1.0	Oct 29 2012	P.Skaliks	Initial preliminary release
V1.1	Nov 29 2012	M.Reiff	Standard baudrate modified, System block diagram added, Tray package information added
V1.2	Mar 01 2013	M.Reiff	Tracking power consumption corrected; NMEA output identifier table added; External GPS/GLONASS active antenna maximum DC current corrected; Tape&Reel information added.
V1.3	Mar 13 2013	M.Reiff	PPS direction at blockdiagram corrected;Tape&Reel information changed;
V1.4	Apr 2 2013	M.Reiff	Backup current corrected; Related documents updated;
V1.5	Jul 2 2018	M.Heinzel	Quality and Environmental Specifications Updated label marking New author -> GNS Electronics GmbH
V1.6	Apr 1 2019	M.Heinzel	Extension to GALILEO

19 RELATED DOCUMENTS

Title	Description / File	Available from
<i>GPS Antenna Connection Design Guide</i>	Design Guide to implement an GPS antenna to an application PCB	www.forum.gns-gmbh.com
<i>GNS1301NMEAcCommandInterface</i>	Detailed description of NMEA commands	www.forum.gns-gmbh.com
<i>GNS1301 StarterKit user manual</i>	User manual for the GNS1301 receiver based evaluation kit	www.forum.gns-gmbh.com
<i>NMEA protocol</i>	Detailed description of NMEA protocol	www.forum.gns-gmbh.com