1 INTRODUCTION

GNS302uLP is a complete GPS receiver that is optimized for very low power consumption. Thanks to an advanced dynamic power management technology, the current is reduced to a minimum of ~7 mA (<25mW). Average power savings in comparison with common low power GPS modules are 60%.

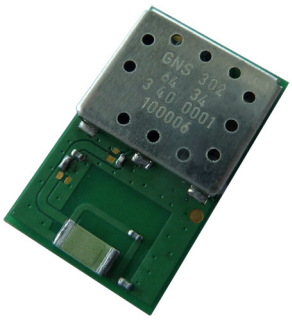
Unlike other concepts that use trickle operation modes with reduced update rates of the position, GNS302uLP works at full 1-per-second position update rate.

Best power savings can be achieved in typical outdoor scenarios with wide view angles to the sky.
GNS 302uLP allows long term tracking in small applications like fitness wearables, pet tracking and camera applications.
Very low power requirements and internal voltage regulator makes it easy to run the receiver with various power supplies and allows direct connection to LiIon batteries.

For high accuracy and additional SBAS operation, the GNS302uLP can be switched to continous high activity power mode by software command.

GNS 302uLP utilizes a tiny chip antenna to realize high sensitivity with very small space requirements.
If radiation pattern and best antenna performance is a main requirement, GNS also offers a patch antenna version (GNS601uLP).

Its attractive price and ready-to run configuration with integrated antenna solution reduces time-to-market to a minimum.



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 from the host and no data from the network.

AlwaysLocate™ power management feature can be activated to further lower the power requirements at lower update rates. It adaptively adjusts power consumption depending on the environment and motion conditions, in order to achive a balance between fix rate, power consumption and position accuracy.

GNS302uLP offers the industry's highest level of navigation sensitivity up to -165dBm[1]. 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 continious wave jammers <-80dBm can be eliminated or reduced.

The embedded logger function LOCUS with a 16-hrs (8000 samples) on chip memory makes this GPS module a complete track logger for many applications.

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 RMS.

Features

- Ultra low power technology at full tracking output rate
- 66 acquisition-/ 22 tracking channels
- Ultra high tracking/navigation sensitivity: -165dBm[1]
- tuned ceramic chip antenna
- SBAS (WAAS,EGNOS,MSAS,GAGAN, QZSS) correction support in high activity mode
- A-GPS by EPO "Extended Prediction Orbit" ™ enables 7/14days prediction
- 12 Multitone Active Interference Canceller (MTAIC) for GPS-in-band jammer rejection
- EASY ™ : 3 day self generated orbit prediction support
- High accuracy 1PPS output
- NMEA-0183 protocol, configurable
- High update rate (up to 10/s) in high activity mode
- Embedded logger function with 16hrs internal memory
- GPS current consumption (@3.3V):
  Acquisition: 22mA typical
  Tracking: 7mA typical
- Low backup current consumption 7uA, typical
- SMD type LGA
- Small form factor: 15.7x10x2.0mm

[1] Note: Measured navigation sensitivity at RF input of chipset

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3 FUNCTIONAL DESCRIPTION

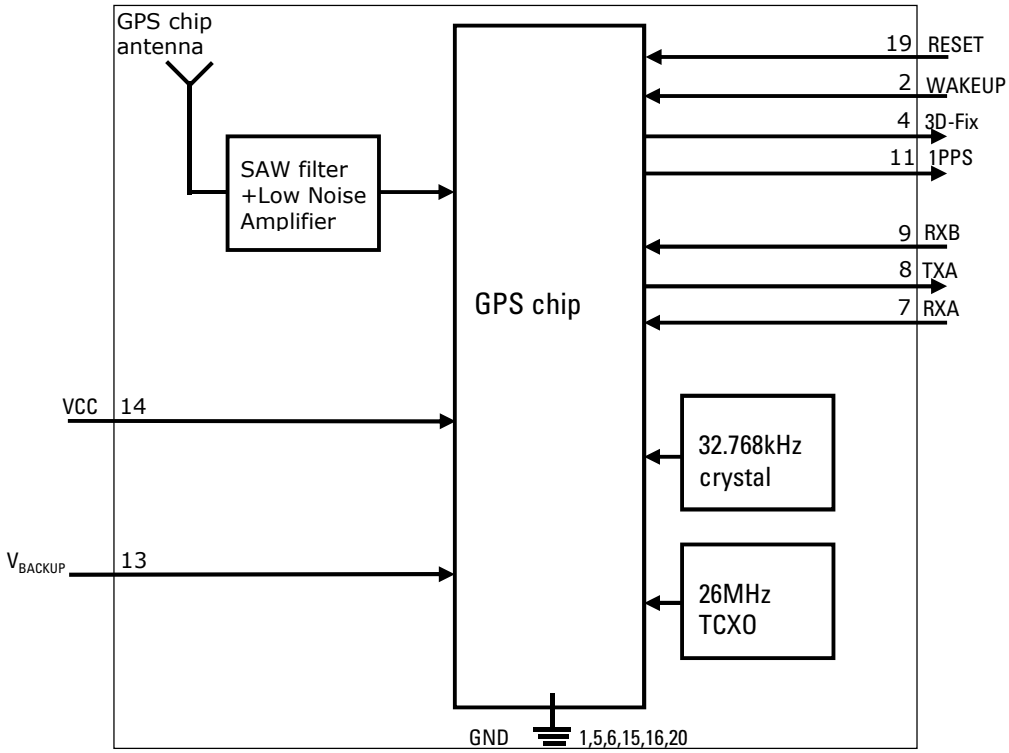
3.1 System description

The GNS302uLP is a high performance, ultra low power GPS receiver that includes an integrated RF frontend (SAW Filter + LNA) and a ceramic chip antenna.
Due to high input sensitivity and low noise amplifier (LNA), it can work at weak GPS signals.

GNS302uLP is a complete autonomous GPS receiver, including:

- Full GPS processing, without any host processing requirements
- Standard NMEA message output
- A powerful NMEA command and control interface
- All clock sources integrated
- RF frontend integrates a two stage low noise amplifier (LNA) a SAW filter and a high performance chip antenna
- Interface for UART, PPS output pin, Fix Status Indicator pin

3.2 Block diagram



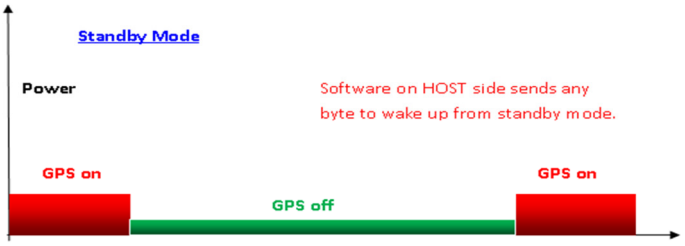
3.3 Power Management Features

GNS302uLP uses an advanced hardware / firmware architecture to minimize power consumption at full navigation update rate of 1position per second.
Best savings are possible with 6 SVs in track and good fieldstrength.

- ***uLP feature*** is a dynamic power management that allows to reduce the power consumption to ~40% in average. Thanks to advanced hardware and firmware architecture and unlike other power management features, uLP feature will calculate and output position data every second. uLP feature has been developed for fitness- and other wearable applications. The average accuracy will be slightly reduced (4m instead of 3m). For static or slow moving scenarios , the savings can be better than 70%. uLP feature is activated by default and can be deactivated through $PMTK262,0 command.

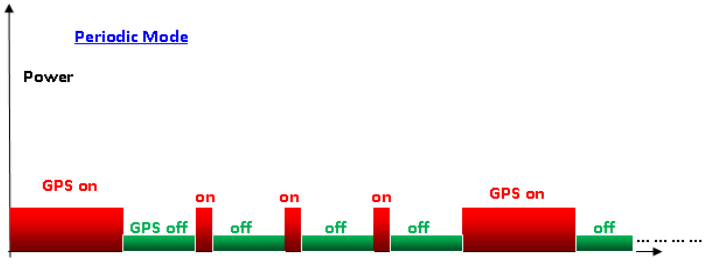
Besides of the uLP power mode, the well known power savings modes with reduced output rate and performance are available when uLP is disabled.
Power management schemes implemented for any GPS system requires an optimally tuned performance for both accuracy of the position fixes and the average power consumed for best user experience. GNS302uLP architecture achieves these both aspects by providing flexibility and design choices for the system integration, based on wide range of use cases and by lever-aging on the proven silicon methodologies. Also GNS302uLP 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.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.

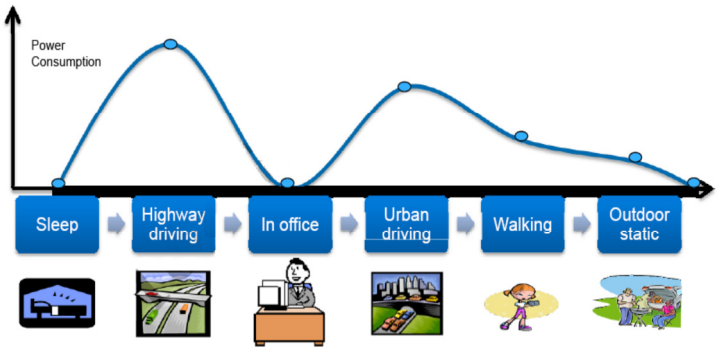


Backup mode can be entered by sending NMEA command: $PMTK225,4*2F<CR><LF>. The GPS core will shut down autonomously to backup state, Vcc supply can now be switched off by an external power supply switch.

- ***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
  $P_{tracking} * (t_{on}/(t_{on}+t_{off}))$.
  Periodic mode is controlled with NMEA command $PTMK225. See document *NMEAcommandInterface manual* for programming details.

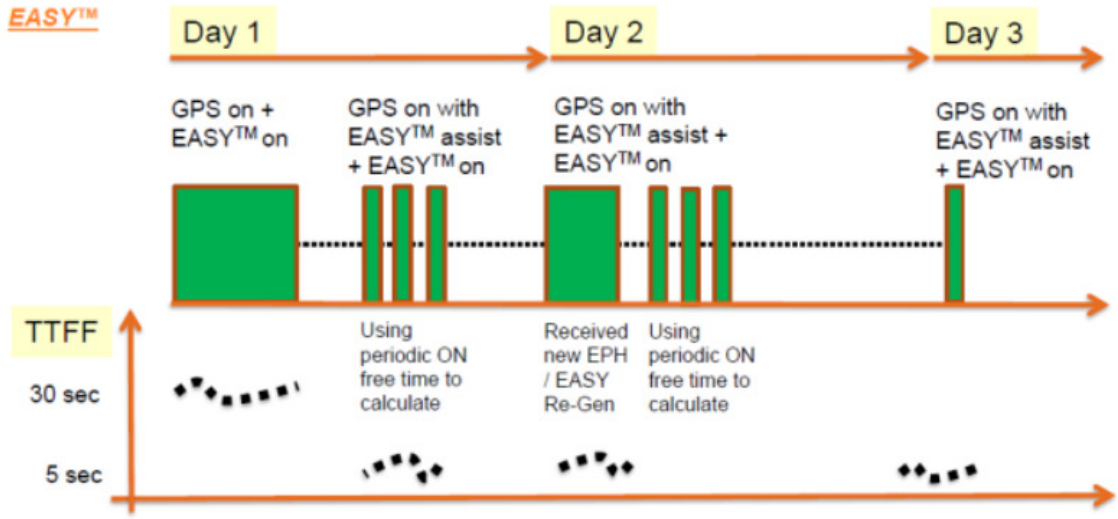


- ***AlwaysLocate***™ feature provides an optimized overall GPS system power consumption in tracking mode under open sky conditions. Always Locate is an intelligent control of periodic mode. Depending on the environment and motion conditions, GNS302uLP can adjust the on/off time to achieve balance of 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 GPS engine which causes nominal power requirements (20mA typ in tracking mode).



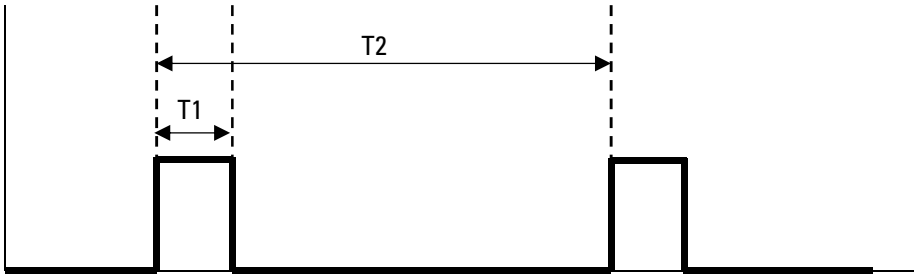
3.4 EASY™ self generated prediction data feature

GNS302uLP 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 "V_{BACKUP}" pin is conntected and the NMEA update rate is 1Hz.



3.5 Pulse Per Second (PPS)

GNS302uLP 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 activated on a 2D- fix or after power-up of the module, providing a time accuracy decreased PPS signal.



T1 = 100ms T2 = 1sec

GNS302uLP 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

3.6 Logger function

GNS302uLP 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 *NMEA command Interface 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

3.7 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.
GNS302uLP 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.

3.8 SBAS (Satellite Based Augmentation) support

GNS302uLP supports Satellite Based Augmentation for improvement of the navigation precision. Correction data is sent from geostationary satellites to the GPS receiver. GNS302uLP supports European, US, and Asian augmentation systems (EGNOS, WAAS, GAGAN, MSAS, QZSS) 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 NMEAcommandInterface manual for details.
Note: SBAS is deactivated in uLP mode. For SBAS activation, uLP mode must be disabled

3.9 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 GNS302uLP 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.

3.10 Real time clock (RTC)

GNS302uLP has a real time clock with 32,768Hz crystal onboard. As long as V_{BACKUP} 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).

3.11 UART interface

GNS302uLP core and I/O sections work at 3.3V nominal. Absolute Maximum Ratings should not be exceeded. Should the GNS302uLP be interfaced to a host with I/O at higher/lower levels, level shifters should be used. UART baud rate is 9600 baud by default. The baud rate can be modified to higher rates by a NMEA software command. See document *NMEAcommandInterface manual* for details.

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

3.12 Module default settings

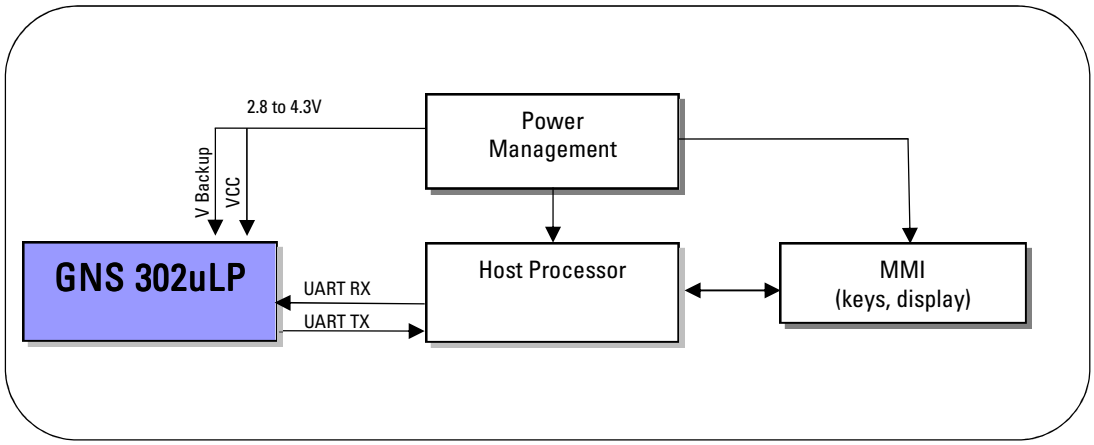
The GNS302uLP receiver comes with default settings, which are persistently programmed. Whenever power is removed from the module (both VCC and VBACKUP), the settings will be reset to the values shown in the following table.

NMEA output sentences	
Setting	**Default value**
UART setting	9600,8,N,1
Fix frequency (update rate)	1/sec
NMEA sentences	$GPRMC,$GPGSA,$GPGSV,$GPGGA
NMEA rate	Once a second
Self survey prediction mode: EASY™	enabled
Active interference cancellation:MTAIC	enabled
Datum	WGS 84
Logging parameters	Wrap when full / Content Basic / Interval 15 sec
uLPower Feature	Activated (disabled on request)
Elevation mask	5°

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 GPS characteristics

5.1 GPS characteristics

Parameter	Min	Typ	Max	Unit	Note
general					
Frequency		1575.42		MHz	GPS L1 C/A code
SBAS					WAAS,EGNOS,MSAS,GAGAN,QZSS[1]
Datum					WGS84
AGPS	7		14	days	Configurable
Output data frequency	1/10	1	10	1/sec	1/s in uLP mode
Navigation&tracking sensitivity[1]		-165		dBm	autonomous
Acquisition sensitivity[1]		-148		dBm	Cold start
Reacquisition sensitivity[1]		-163		dBm	Hot start
TTFF hotstart		1		sec	6 SVs @-130dBm
TTFF autonomous warm start		34		sec	6 SVs @-130dBm
TTFF autonomous warm start		5..10		sec	6 SVs @-130dBm / with EASY on
TTFF autonomous cold start		35		sec	6 SVs @-130dBm
Reacquisition time		<1		sec	6 SVs @-130dBm
Number of channels tracking		22			
Number of acquisition channels		66			
Dimension		15.7x10x2		mm	Tolerance is 0.2 mm
Weight		0.64		g	

Note:
1) Only available when uLP mode is disabled

Accuracy					
Position error (50%CEP)	-	4	-	m	2D-RMS
Position error (50%CEP)	-	2.5	-	m	Using (SBAS) , uLP mode disabled
Velocity error	-	0.1	-	m/s	
velocity error	-	0.05	-	m/s	Using (SBAS) , uLP mode disabled

Antenna specifications					
Frequency	-	1575.42	-	MHz	
VSWR	-	-	2	-	f = 1575.4 MHz
gain	-	3.2	-	dB	peak@zenith , f = 1575.4 MHz
impedance	-	50	-	Ohm	f = 1575.4 MHz
Polarization		Linear		-	

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

[1] note: based on chip specifications

6 ELECTRICAL SPECIFICATION

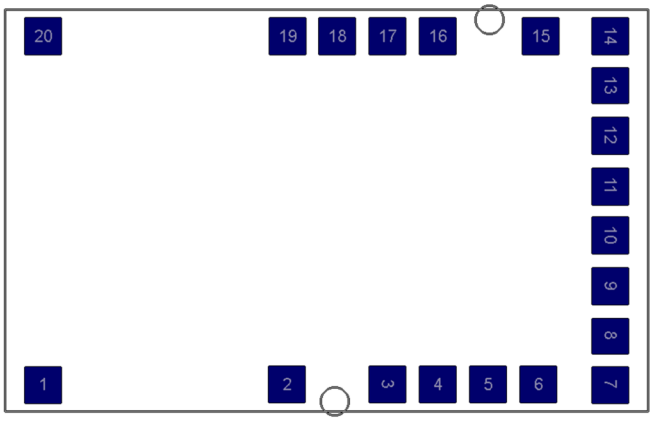
6.1 Absolute Maximum Ratings

Parameter	Value	Unit
Supply voltage: Vcc	–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 Vcc	V
Operating ambient temperature range	–40 to +85	°C
Storage temperature range	–50 to +125	°C

6.2 Electrical characteristics

Parameter	Min	Typ	Max	Unit	Note
V_{cc}	2.8	3.3	4.3	V	supply voltage
V_{cc} ripple voltage			50		mVpp
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}	2.38		2.9	V	
Low level output voltage V_{OL}	0		0.42	V	
High-level input voltage VIH	2.1		3.5	V	
Low-level input voltage VIL	-0.3		0.7	V	
Operating temperature	-40		85	°C	Full specified sensitivity

7 PIN CONFIGURATION



Top View

Pin	Name	I/O	Description & Note
1	GND		Ground
2	WAKEUP	I	Wakeup input (TBD) leave open
3	NC		Not connected
4	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 1 Hz. output 100ms high-level and 0.9s low-level signal After 2D or 3D Fix The pin will continuously output low-level signal **This pin must not be connected to high-level at power-on sequence.**
5	GND		Ground
6	GND		Ground
7	RXA	I	Serial Data Input A for NMEA commands (TTL) This is the UART-A receiver of the module. It is used to receive commands from system
8	TXA	O	Serial Data Output A for NMEA output (TTL) This is the UART-A transmitter of the module. It outputs GPS information for application.
9	RXB	I	Serial Data Input B This is the UART-B receiver of the module. It is used to receive RTCM data from system
10	NC		Not connected
11	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.
12	NC		Not conected
13	V_{BACKUP}	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 2.8V~4.3V, Typical 3.3V. If V_{BACKUP} power was not reserved, the GPS receiver 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. **This pin must be connected for normal operation.**
14	VCC	P	Main DC power input The main DC power supply for the module. The voltage should be kept between from 2.8V to 4.3V. The ripple must be limited under 50mVpp (Typical: 3.3V).
15	GND		Ground
16	GND		Ground
17	NC		Not conected
18	NC		Not conected
19	RESET	I	System reset pin An external reset applied to this pin overrides all other internal controls. RESET# is an active low signal. Pulling this pin low for at least 20 µs causes a system reset.
20	GND		Ground

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

8 NMEA DATA interface

GNS302uLP 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: *NMEA_Interface_manual_MTK_Vx* manual.
For standard operation, no commands are needed; the module will start outputting NMEA sentences after power supply has been attached. GNS302uLP 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 V_{BACKUP} will be sufficient to keep them.

8.1 NMEA output sentences

NMEA output sentences	
Type	**content**
Common GPS sentences	
$GPRMC	Recommended Minimum Navigation Information
$GPGGA	Fix Data, Time, Position and fix related data for a GPS receiver
$GPGSA	DOP and active satellites
$GPGLL	Geographic Position - Latitude/Longitude
$GPGSV	GPS Satellites in view

8.2 NMEA command interface

GNS302uLP NMEA command interface allows to control settings and the extended functions. The command interface specification is available in an extra document: *NMEA_Interface_manual_MTK_Vx* 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 V_{BACKUP}. (f.e. : setting of a new baud rate). After removing V_{BACKUP}, all settings are reset to their default values.

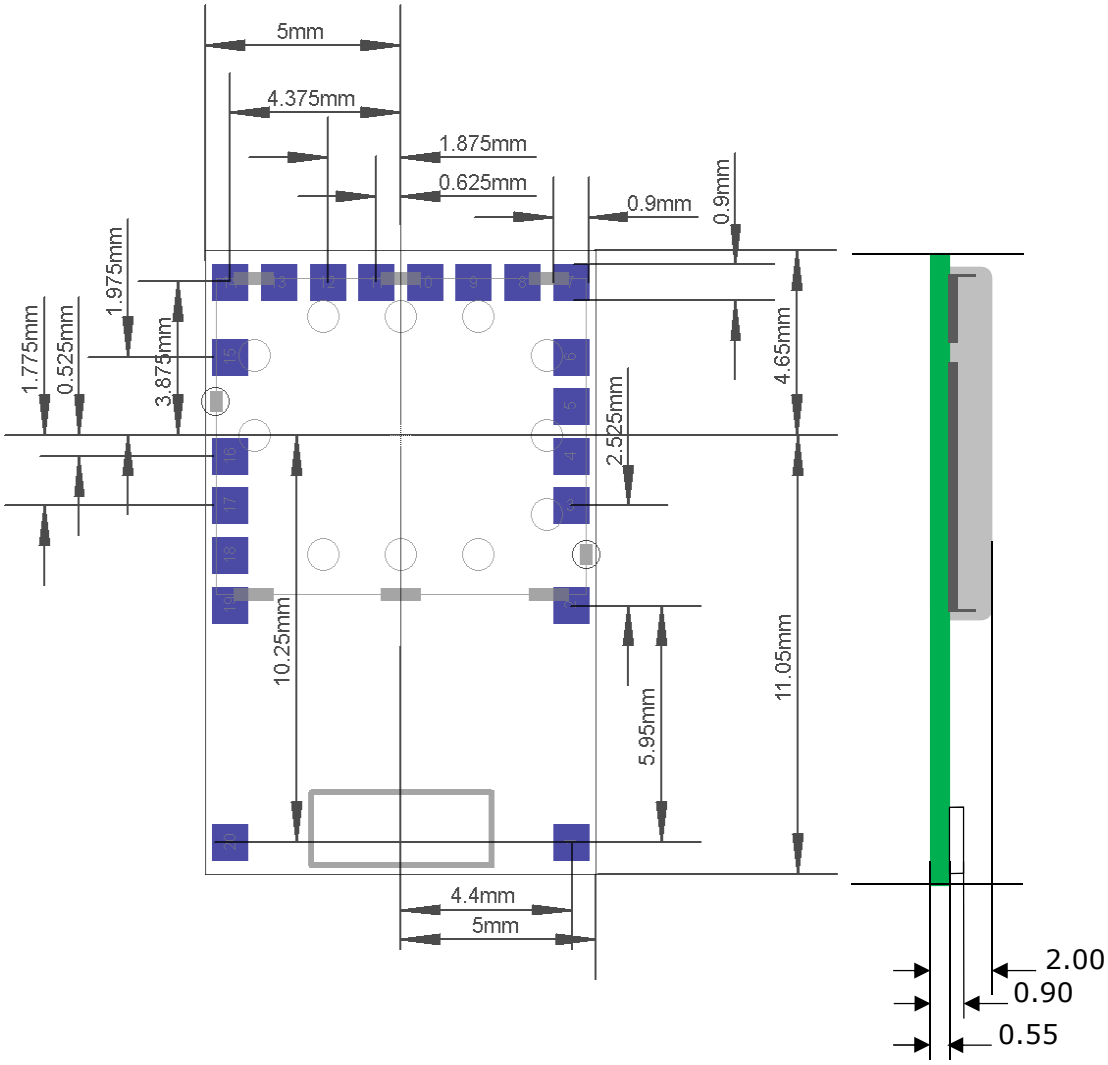
Action commands will perform the specified action one time after the command has been received. (f.e. : request for cold start)

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.

9 PHYSICAL DIMENSIONS

TOP VIEW

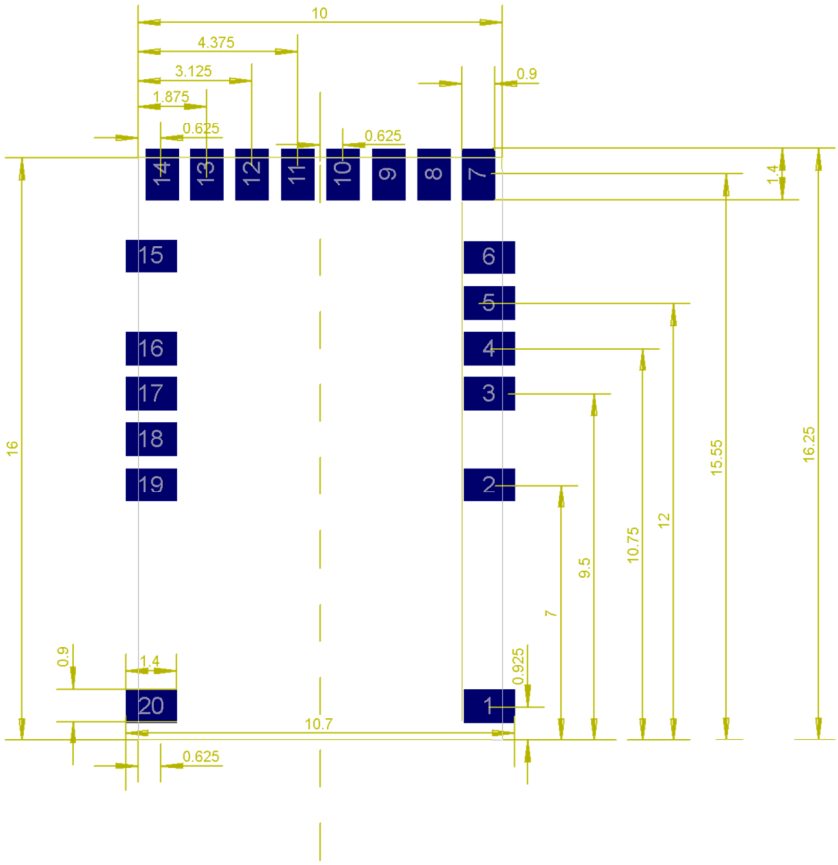
all units in mm, tolerance is ±0.2mm



10 RECOMMENDED PAD LAYOUT

all units in mm

Footprint Top View

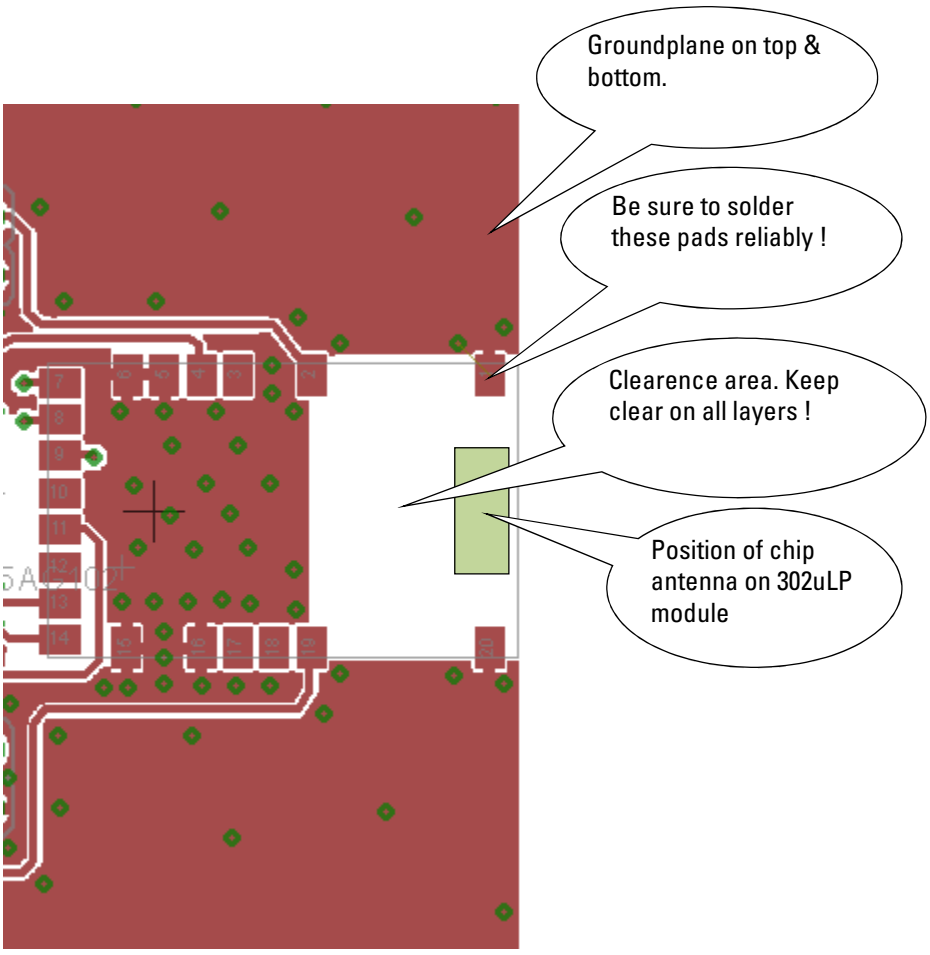


11 DESIGN GUIDELINES

Although GNS302uLP GPS receiver provides best performance at low power consumption, special care should be taken to provide clean signal and clean power supplies. Power lines should be blocked near to the receiver with low ESR capacitors. Radiated noise from neighbour components may also reduce the performance of the receiver.

11.1 PCB LAYOUT GUIDELINES

GNS302uLP uses a high performance chip antenna design.
For optimum performance, a ground plane area is needed on the main board. This area should be at least 20 x 30mm, a larger ground like 30 x 60mm is recommended.
The groundplane can be part of the main ground layer of the mainboard, some (small) components in the neighbourhood of the antenna are acceptable. Do not place any bulky or metallic components near to the antenna (in a distance below 30mm) to avoid unwanted electromagnetic shielding effects.
It's recommended to place GNS302uLP at the rim of the main PCB, so that the antenna has a wide unobstructed working angle.



The marked clearance area below the antenna must be kept clear in any case ! Do not design any copper tracks or planes in the clearance area !
The two ground solder pads near the chip antenna must be reliably soldered to mainboard groundplanes to make the antenna work at high performance.
Please do not place any shielding or lids in the area 5mm below your PCB under the Clearance area.
Plastic enclosures can also have impact on the antenna. Avoid that the antenna is in touch with any enclosure parts. Product testing should be performed with the PCB already mounted in the final enclosure.
Generally the rules for good and low noise design should be followed:

- ➔ Use a solid ground plane, best on layer 2 of the mainboard
- ➔ Keep noisy components (µC, switch mode supplies) as far as possible away from sensitive antenna inputs
- ➔ Place decoupling capacitors near to the source of noise and provide a short and low induction connection to ground (use multi-vias if needed)
- ➔ EMC filters or noise filtering coils or beads can help to reduce the noise level further.
- ➔ Select system clocks in a way, that no harmonics will match the GPS frequency of 1575.42 MHz

12 NMEA DATA interface

GNS302uLP provides NMEA (National Marine Electronics Association) 0183 compatible data.
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These commands are described in a separate document: *NMEA_Interface_manual_MTK_Vx*.
For standard operation, no commands are needed; the module will start outputting NMEA sentences after power supply has been attached. GNS302uLP 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 V_{BACKUP} will be sufficient to keep them.

12.1 NMEA output sentences

NMEA output sentences	
Type	**content**
Common GPS sentences	
$GPRMC	Recommended Minimum Navigation Information
$GPGGA	Fix Data, Time, Position and fix related data for a GPS receiver
$GPGSA	DOP and active satellites
$GPGLL	Geographic Position - Latitude/Longitude
$GPGSV	GPS Satellites in view

Refer to *NMEA_Interface_manual_MTK_Vx* document for more information.

12.2 NMEA command interface

GNS302uLP NMEA command interface allows to control settings and the extended functions. The command interface specification is available in an extra document: *NMEA_Interface_manual_MTK_Vx.*

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 V_{BACKUP}. (f.e. : setting of a new baud rate). After removing V_{BACKUP}, all settings are reset to their default values.

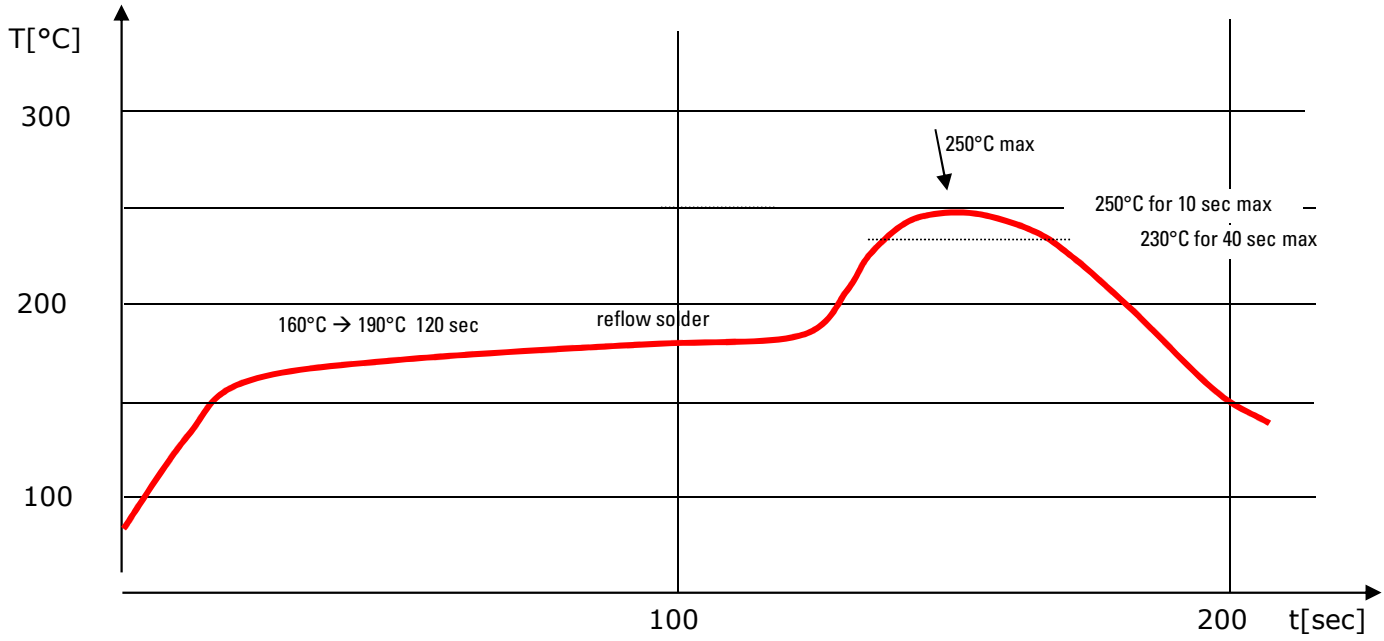
Action commands will perform the specified action one time after the command has been received. (f.e. : request for cold start)

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.

13 MATERIAL INFORMATION

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

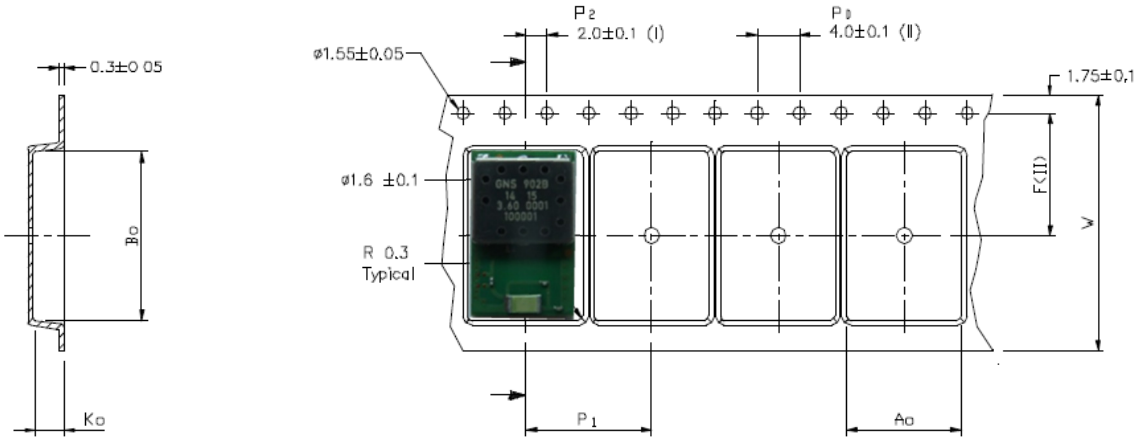
14 RECOMMENDED SOLDERING REFLOW PROFILE



Notes:
1. GNS302uLP should be soldered in upright soldering position. In case of head-over soldering, please prevent shielding / GNS302uLP receiver from falling down.
2. Do never exceed maximum peak temperature
3. Reflow cycles allowed : 1 time
4. RohS compliance status will be lost if soldered with solder containing lead (Pb).
5. This device is not applicable for flow solder processing
6. This device is not applicable for solder iron process

15 PACKAGE INFORMATION

15.1 TAPE

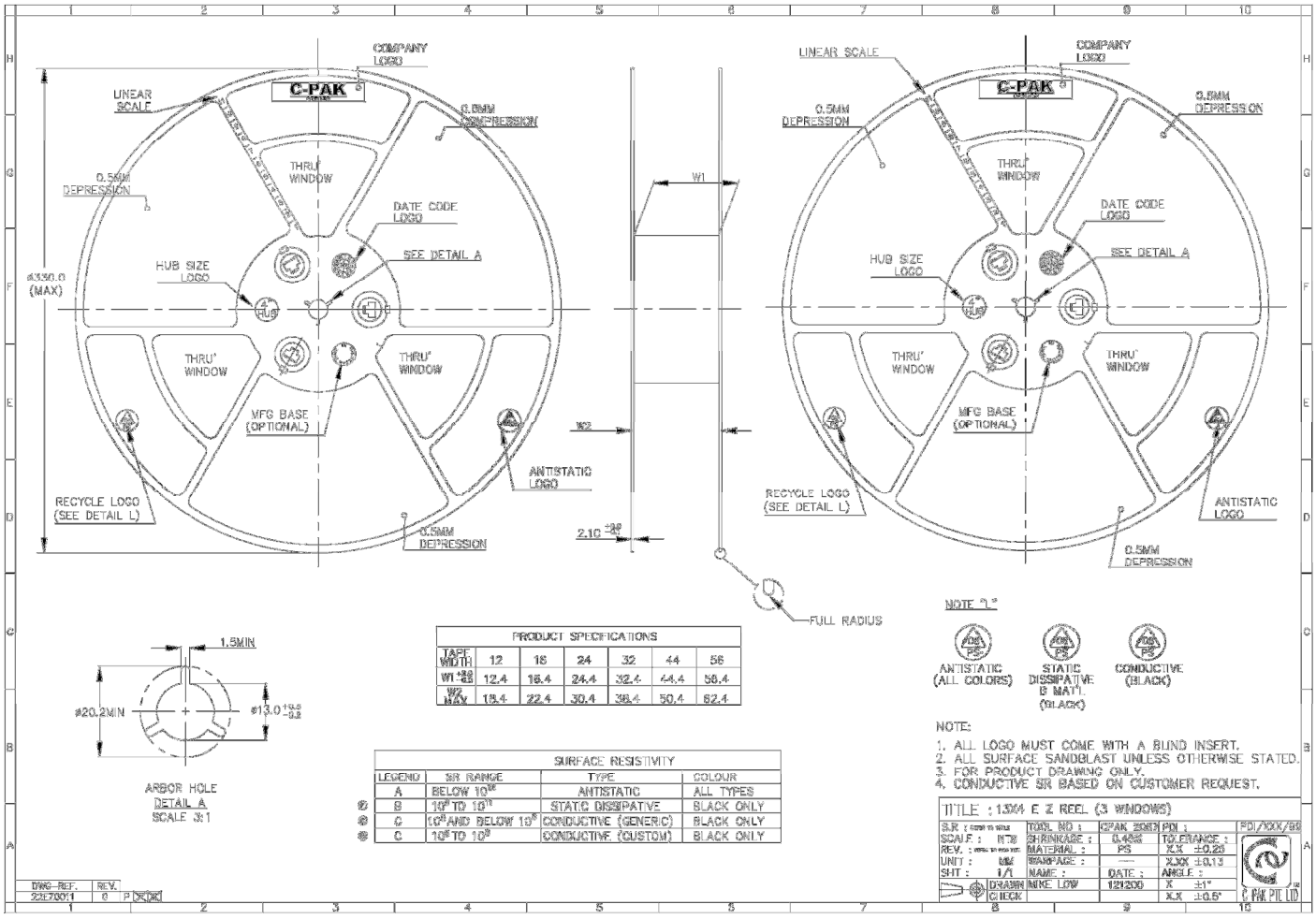


Ao	10.90 +/− 0.1
Bo	15.82 +/− 0.1
Ko	3.00 +/− 0.1
F	11.50 +/− 0.1
P_1	12.00 +/− 0.1
W	24.00 +/− 0.3

(I) Measured from centreline of sprocket hole to centreline of pocket
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

15.2 REEL



PRODUCT SPECIFICATIONS						
TAPE WIDTH	12	16	24	32	44	56
W1 +2.0 -0.5	12.4	16.4	24.4	32.4	44.4	56.4
W2 MAX	15.4	22.4	30.4	38.4	50.4	62.4

SURFACE RESISTIVITY			
LEGEND	SR RANGE	TYPE	COLOUR
A	BELOW $10^{6}\Omega$	ANTISTATIC	ALL TYPES
B	10^{6} TO $10^{11}\Omega$	STATIC DISSIPATIVE	BLACK ONLY
C	(10^{5} AND BELOW $10^{6}\Omega$	CONDUCTIVE (GENERIC)	BLACK ONLY
C	10^{5} TO $10^{9}\Omega$	CONDUCTIVE (CUSTOM)	BLACK ONLY

Number of devices: 1500 pcs/reel

16 ORDERING INFORMATION

Ordering information			
Type	**Part#**	**label marking**	**Description**
GNS302uLP	4037735105393	GNS302uLP YYWW 2.5_39 SN	GNS302uLP GPS receiver YYWW → date code FW Version SN → serial number

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 cove-red 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 302uLP 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".

This product is free of environmental hazardous substances and complies with 2002/95/EC. (RoHS directive).

18 DOCUMENT REVISION HISTORY

V0.1	Sep 23 2015	P.Skaliks	initial document, preliminary
V0.2	Jan 26 2016	P.Skaliks	Laser marking def
V0.3	Dec 21 2016	O.Diegel	Package Information / General review
V0.4	Oct 04 2018	M.Heinzel	New company CI

19 RELATED DOCUMENTS

Title	Description / file		Available from
NMEA_Interface_manual_MTK_Vx	Detailed description of NMEA commands and protocol		www.forum.gns-gmbh.com www.gns-gmbh.com