GNSS Module GNS410sLP/ GNSS Module GNS413sLP
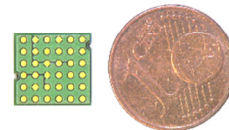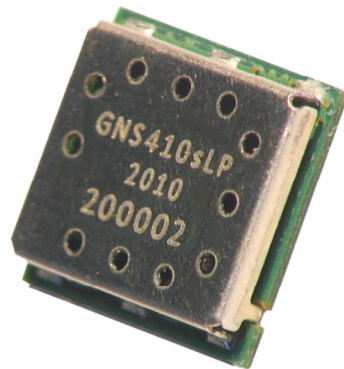
Datasheet V1.6

1 INTRODUCTION

GNS410sLP / GNS413sLP module provide a high performance and super low power multi-GNSS solution in a small form factor.

GNS410sLP / **GNS413sLP** integrate a complete GNSS receiver enabling RF to NMEA solutions that minimize the load on the host processor.

Original size

Features
- High performance small GNSS module for power critical applications
- GNSS tracking&navigation sensitivity: -161dBm
- Low load on host CPU
- Standard NMEA0183 interface
- Precision PPS Output
- Low power consumption (22.5mW at GPS 8-ch tracking)
- I/O voltages 1.8V (GNS410sLP) or 3.3V (GNS413sLP)
- Core voltage 1.8V
- Miniature 36 pin module (10x9.3x2.0) mm
- Evaluation Boards:
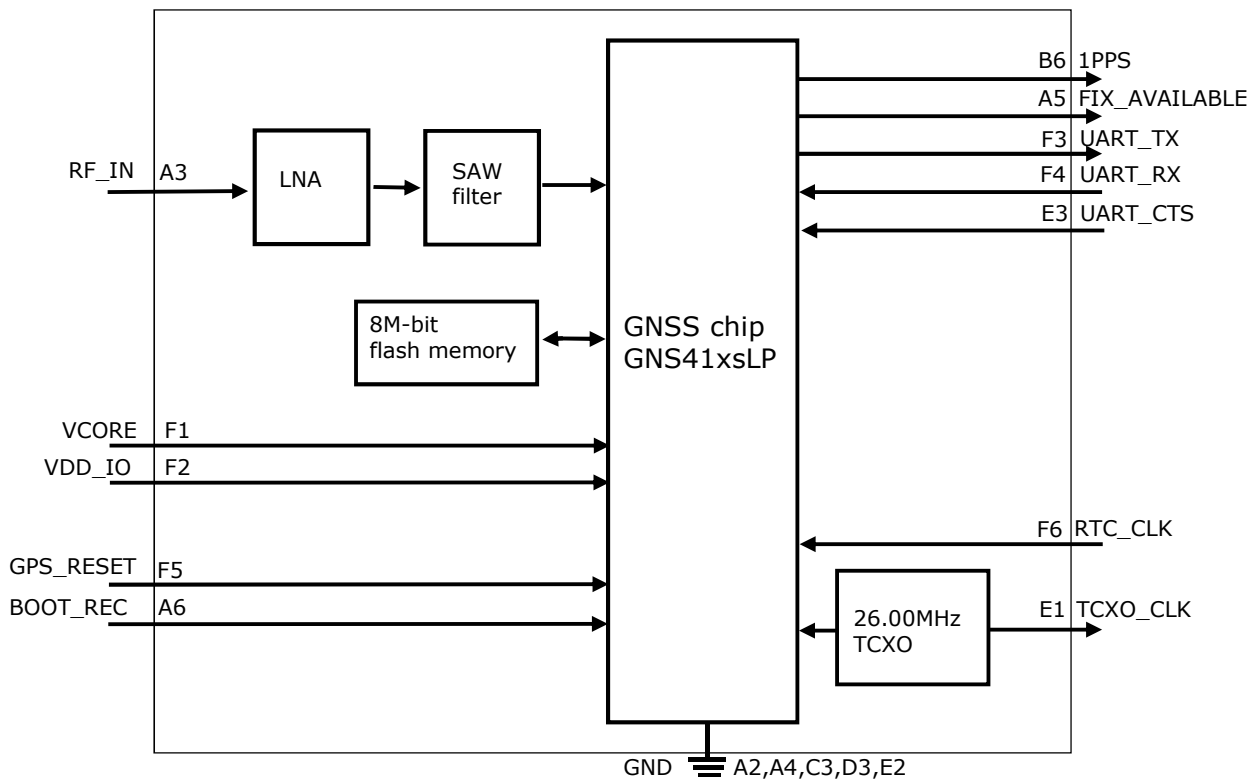 - GNS41x Starter Kit for testing on a PC

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

2 INDEX

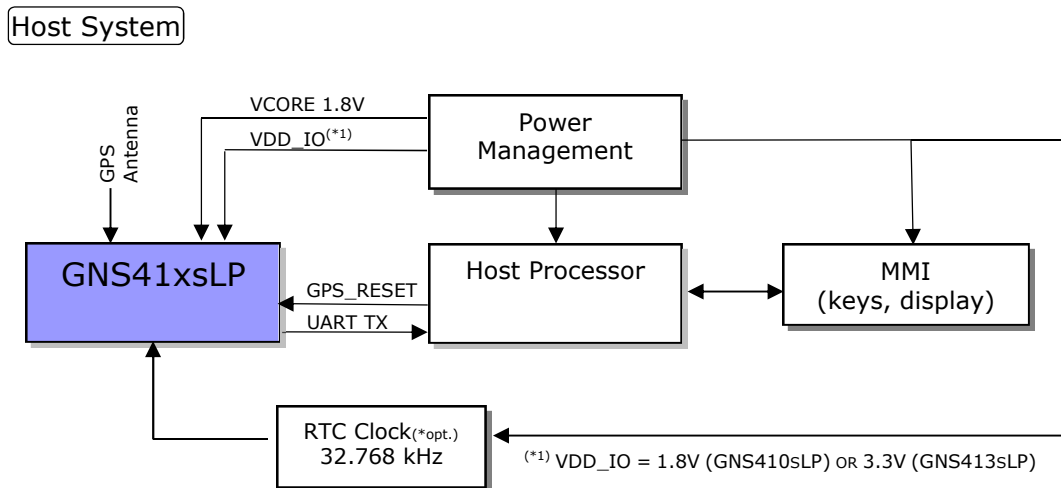*confidential information*   *preliminary specification*

3 DETAILED FEATURES

3.1 Block diagram

3.2 GNSS Features

- A multi-GNSS receiver for GPS, GLONASS, SBAS, QZSS, BeiDou and Galileo
- Ultra-low power consumption
- Embedded NVM (8 Mbit MRAM), no backup battery needed
- Standard NMEA output
- Precision 1PPS output
- GNSS Fix indication output pin

GNSS Module GNS410sLP/
GNSS Module GNS413sLP

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4 TYPICAL APPLICATION BLOCK DIAGRAM

Host System

```
                 VCORE 1.8V        ┌──────────────┐
    GPS          ───────────────→  │    Power     │
    Antenna      VDD_IO(*1)         │  Management  │───────┐
    │            ───────────        └──────┬───────┘       │
    ↓            │   │                     │               │
  ┌────────────┐ │   │              ┌──────┴───────┐  ┌──────────────┐
  │            │←┘   │              │              │  │     MMI      │
  │ GNS41xsLP  │     │   GPS_RESET  │Host Processor│←→│ (keys,       │
  │            │─────────────────→  │              │  │  display)    │
  └────────────┘     │   UART TX    └──────────────┘  └──────────────┘
    │                │←─────────
    │           ┌────┴─────────────┐
    │           │ RTC Clock(*opt.) │←──────
    └───────────│   32.768 kHz     │
                └──────────────────┘  (*1) VDD_IO = 1.8V (GNS410sLP) OR 3.3V (GNS413sLP)
```

5 SYSTEM REQUIREMENTS

GNS41xsLP includes a complete GNSS engine.
- GNSS is fully processed without any host processing requirements
- Standard NMEA message output from the solution to the host
- RTC crystal clock (32.768kHz) should be applied externally.

5.1 Real time clock (RTC)

RTC counter maintains GNSS time and is used for the system wakeup/sleep timer function. Its clock sources are the internal RC oscillator **or** the RTC_CLKI pin with 32.768 kHz.
See chapter 7.7 *RTC Clock characteristics* for more details.

5.2 I/O levels

GNS41xsLP **core** works at 1.8V nominal. **I/O section** works on either 1.8V (GNS410sLP) or 3.3V (GNS413sLP). Absolute Maximum Ratings should not be exceeded.

Digital pins are in **failsafe mode** when the interface (VDD_IO and VCORE) power is not supplied (VBAT power must be less than 50 mV. Hi-Z is NOT acceptable). If the pins are in **failsafe mode** and connected to 1.95 V, protection circuits prevent any unwanted leak current from the pins.

6 <u>DESCRIPTION OF FUNCTIONS</u>

6.1 Supported Satellite Systems

• GPS (L1 C/A)	• GLONASS (L1-OF)	• QZSS (L1-CA)	• QZSS (L1-S)
• SBAS	• BEIDOU (B1)1	• GALILEO (E1 CBOC)1	

It is not possible to receive all satellite systems at the same time. Therefore only a selection from one of the following 3 groups can be made at a time:

Group 1 : GPS + GALILEO + GLONASS + SBAS + QZSS(L1-CA/L1-S)
Group 2 : GPS + GALILEO + BEIDOU + SBAS + QZSS(L1-CA/L1-S)
Group 3 : GPS + GALILEO + GLONASS + BEIDOU + QZSS(L1-CA)

Furthermore, only one system from GLONASS, BEIDOU and GALILEO can be selected within a group besides GPS.

In the default version, the GNS41xsLP is delivered with the combination
GPS & GLONASS & SBAS.

| **6.2 GNSS characteristics**					
Position Accuracy					
Item	GPS	GPS & GLONASS		Unit	Remarks
2DRMS	1.0	1.0		m	Signal strength is -130 dBm
Time-To-First-Fix (TTFF)					
Item	GPS	GPS & GLONASS		Unit	Remarks
Cold Start	35	35		s	Signal strength is -130 dBm
Hot Start	2	2		s	
Sensitivity					
Item	GPS	GPS & GLONASS		Unit	Remarks
Cold Start	-147	-147		dBm	
Hot Start	-160	-160		dBm	
Tracking	-161	-161		dBm	

Noise Filter
An embedded noise filter for GNSS signals. It is automatically enabled at the optimum settings for the input noise.

RF Performance					
Item	Min.	Typ.	Max	Unit	Remarks
Total NF		3		dB	

6.3 Power-on reset

An internal power-on reset circuit enables autonomous startup without external reset control by the system. To avoid malfunction in boot-up, power-off state must be more than 100 ms.
The internal reset is generated from the power-on reset & the externa reset (the NRESET pin).
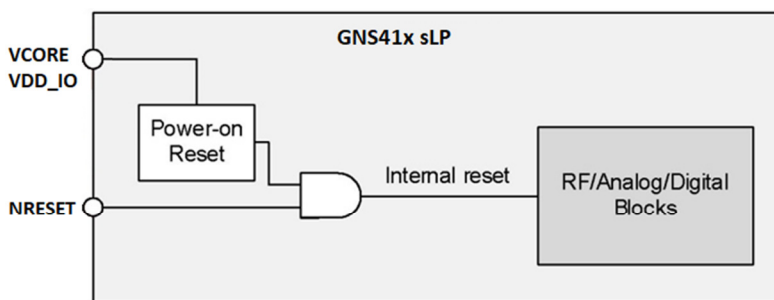
6.4   RTC clock

RTC counter maintains GNSS time and is used for the system wakeup/sleep timer function. Its clock sources are the internal RC oscillator **or** the RTC_CLK pin with 32.768 kHz.
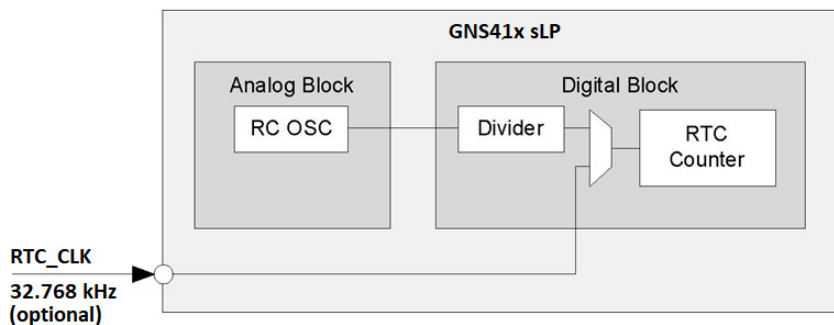
Because the clock from the RC oscillator is calibrated for the RTC counter but it may have frequency drift by temperature during sleep states, the sleep time also may be drifted. Below figure shows the frequency drifts by temperature around 25 °C at stabled input voltage.

It is recommended to use the external crystal RTC_CLK to reduce the temperature dependence of the RTC counter.

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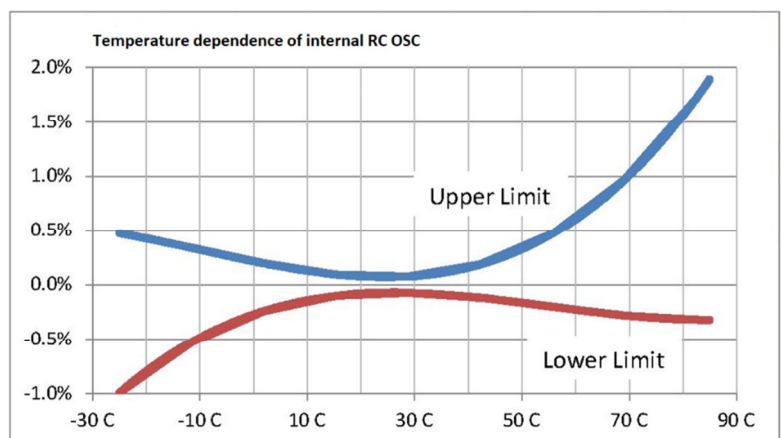
6.5   Interface

The UART interface consists of the connections UART_TX, UART_RX and UART_CTS. The UART interface is used to output NMEA data and to exchange commands and system settings. The interface voltage of the UART interface is VDD_IO (GNS410sLP: 1.8V / GNS413sLP: 3.3V).

6.6 Pulse Per Second (1PPS)

GNS41xsLP provides a so called Pulse Per Second (PPS) for timing purposes. After calculation of a 3D position fix, the PPS signal is accurately aligned to the GPS seconds boundaries. The pulse generated is approximately 1 millisecond in duration and the repetition rate is 1 second.

T1 = 1ms   T2 = 1sec
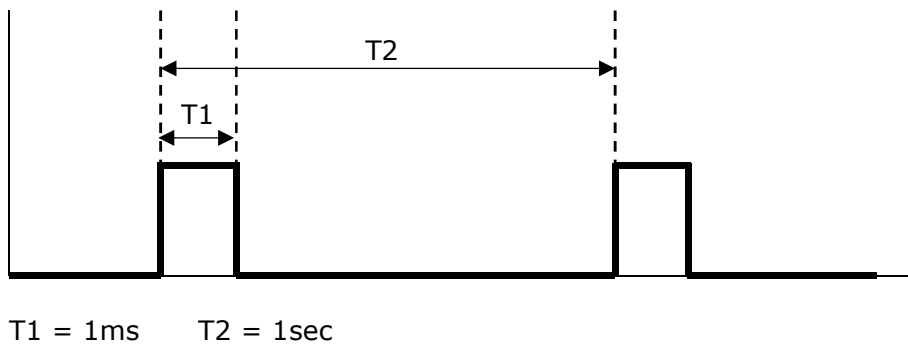
6.7 Fix Available

The *FIX_AVAILABLE* signal is used to indicate the availability of GPS position information. This is typically used to drive an LED buffer so that the state of the device can be easily indicated. The table below lists the various states.

Fix Available Signal	
State	**Indication**
Initial boot up	low
acquisition	low
position fix	continuously high

6.8 GPS Power Management

6.8.1 State Transition

There are some states in the GNS41xsLP operations as shown in the following diagram

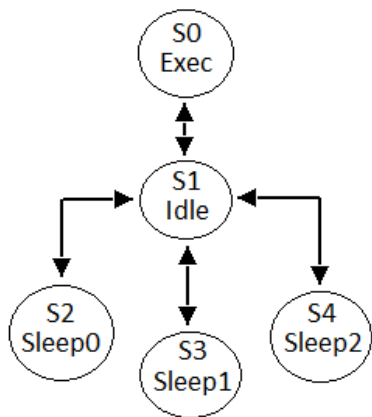| State	GNS41xsLP				
	GNSS	CPU	Always-on block	Backup RAM	Main RAM
S0: Exec	Operation	Operation	Operation	Hold	Hold
S1: Idle	Standby	Operation	Operation	Hold	Hold
S2: Sleep0	Power-off	Power-off	Operation	Hold	Hold
S3: Sleep1	Power-off	Power-off	Operation	Hold	Power-off
S4: Sleep2	Power-off	Power-off	Operation	Power-off	Power-off

6.8.2 State Description

S0: Exec
GNSS positioning can be performed.

S1: Idle
This is a command waiting state. The system can accept commands but power consumption is managed to be low.

S2: Sleep0
The GNS41xsLP holds program code, data and satellite date but other logic circuit is powered off. The GNS41xsLP can wake up from this state without loading the data from an embedded NVRAM or an external FLASH memory or the system MCU.

S3: Sleep1
Because the GNS41xsLP holds satellite data only in this state, it must load program data from an embedded NVRAM or an external FLASH memory or the system MCU for wake-up but it can get a position with hot start.

S4: Sleep2
In this state, the GNS41xsLP is powered off except an internal PMU and always-on block.

6.9 GPS Antenna

GNS41xsLP contains all input circuitry needed to connect a passive GPS antenna directly. Depending on the application patch- or chip antennas or combo antennas (combination of GPS and Bluetooth) can be used. However, if there is a long wire between RF_IN RF input and antenna, there should be an LNA (on the antenna side) to compensate for cable losses ("active" antenna). For active antenna configuration, the antenna supply DC must be blocked from the antenna signal line with a inductor **L** of 100nH and a 100pF capacitor **C** as shown in the diagram below.
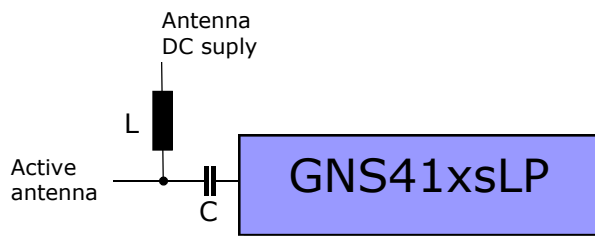
More information about connecting and implementing a GPS antenna to an application PCB, please refer to **GPS Antenna Connection Design Guide.**

7 ELECTRICAL CHARACTERISTICS

7.1 Absolute Maximum Ratings

Item		Min.	Typ.	Max.	Unit	Remarks
VCORE voltage	GNS410sLP	-0.30		2.20	V	
	GNS413sLP	-0.30		2.20	V	
VDD_IO voltage	GNS410sLP	-0.30		2.50	V	
	GNS413sLP	-0.30		3.80	V	
RF_IN input power				0	dBm	
Digital input voltage		-0.30		VDD_IO + 0.30	V	
Analog input voltage		-0.30		VCORE + 0.30	V	
Storage temperature		-65		150	°C	
Magnetic field strength				1400	mT	

7.2 Recommended Operating Conditions

Item		Min.	Typ.	Max.	Unit	Remarks
VCORE voltage	GNS410sLP	1.71	1.80	1.89	V	
	GNS413sLP					
VDD_IO voltage	GNS410sLP	1.65	1.80	1.95	V	
	GNS413sLP	3.00	3.30	3.60	V	
Drivability (VCORE)	GNS410sLP	1.65	1.80	1.95	V	
	GNS413sLP					
Drivability (VDD_IO)	GNS410sLP	1.65	1.80	1.95	V	
	GNS413sLP	3.00	3.30	3.60	V	
Operating temperature		-40	25	85	°C	
Magnetic field strength				45	mT	@ 25°C
				20	mT	@ 105°C

7.3 DC Characteristics Digital IO

Item		Symbol	Min.	Typ.	Max.	Unit	Remarks
Input voltage	H level	V_{IH}	0.7 x VDD_IO		VDD_IO + 0.3	V	
	L level	V_{IL}	-0.3		0.3 x VDD_IO	V	
Output voltage	H level	V_{OH}	0.8 x VDD_IO			V	
	L level	V_{OL}			0.2 x VDD_IO	V	
Drivability (VDD_IO)	H level @V_{OH} (min)	I_{OH}	2			mA	
	L level @V_{OL} (max)	I_{OL}	2			mA	
Drivability (VCORE)	H level @V_{OH} (min)	I_{OH}	2			mA	
	L level @V_{OL} (max)	I_{OL}	2			mA	

7.4 DC Characteristics Analog IO						
Item	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**	**Remarks**
Input voltage	V_I			VCore	V	
Output voltage	V_O			VCore	V	

7.5 Current Consumption (Core)							
Item	**State**	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**	**Remarks**
Max load		MAX			50	mA	
Satellite acquisition	S0 : Exec	GNS_{ACQ}		19		mA	
Satellite tracking		GNS_{TRK}		12	18	mA	GPS 8-ch tracking
Idle	S1 : Idle	IDLE		3		mA	Waiting for command
Sleep0	S2 : Sleep0	SLP_0		0.3	3	mA	
Sleep1, Sleep2 w/ ext. RTC clock	S3 : Sleep1, S4 : Sleep2	SLP_1, SLP_2		0.04	0.5	mA	
Sleep1, Sleep2 w/o ext. RTC clock				0.07			

7.6 RF_IN input characteristics					
Parameter	**Min**	**Typ**	**Max**	**Unit**	**Note**
Input impedance		59.2 - j10.5		Ω	@ 1.575 GHz
Maximum input level	0			dBm	before destruction
Input return loss	-10			dB	

7.7 RTC Clock characteristics					
Item	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**
Input Frequency	F_{in}	-	32.768	-	kHz
Frequency Tolerance	F_{IN_T}	-300	-	300	ppm
Duty Cycle	D_C	5	-	95	%
RTC_CLK HIGH Voltage		0.7 x Vcore	-	Vcore + 0.3	V
RTC_CLK LOW Voltage		-0.3	-	0.3 x Vcore	V

8 DEVICE PINOUT DIAGRAM

TOP VIEW
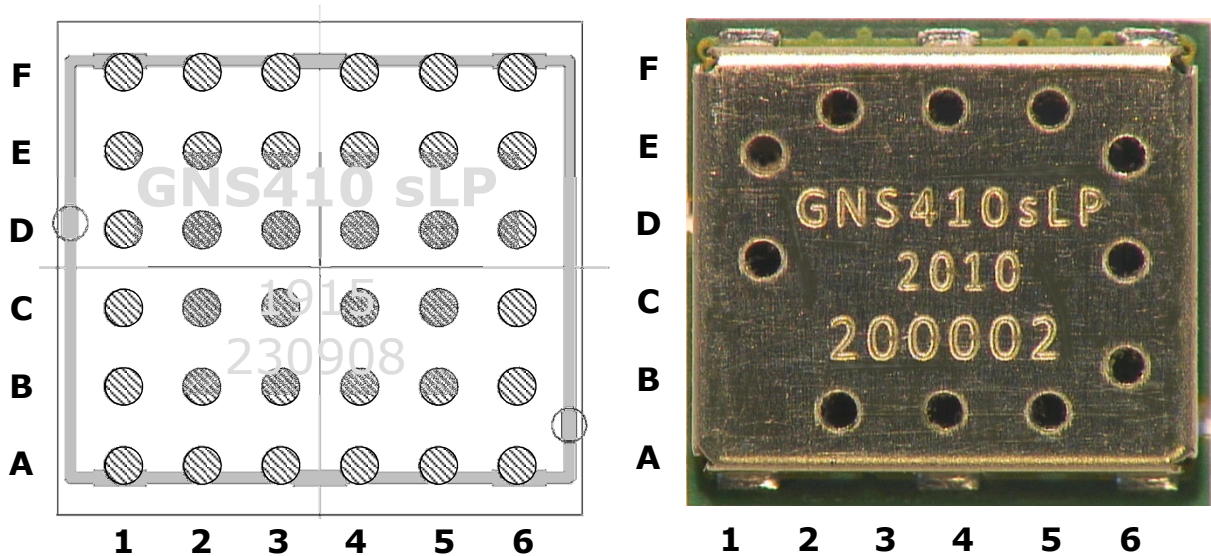
	1	2	3	4	5	6
F	VCORE	VDD_IO	UART_TX	UART_RX	NRESET	RTC_CLKI
E	TCXO_CLKO	GND	UART_CTS	NU_4E	NU_5E	NU_6E
D	NU_1D	NU_2D	GND	NU_4D	NU_5D	NU_6D
C	NU_1C	NU_2C	GND	NU_4C	NU_5C	NU_6C
B	NU_1B	NU_2B	NU_3B	NU_4B	NU_5B	1PPS_OUT
A	NU_1A	RF_GND	RF_IN	RF_GND	FIX_AVAILABLE	BOOT_REC
	1	**2**	**3**	**4**	**5**	**6**

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	8.1 Pin Description		
NO	**NAME**	**TYPE[1]**	**DESCRIPTION**
		Power-Management Signals	
2F	VDD_IO	P	GNS410sLP : 1.8V I/O power supply voltage
			GNS413sLP : 3.3V I/O power supply voltage
1F	VCORE	P	1.8V main power supply voltage (GNSS core voltage)
3D	GND	P	Common Ground
2E	GND	P	Common Ground
3C	GND	P	Common Ground
		Clock Signals	
1E	TCXO_CLKO	O2	TCXO_CLK signal output. This Pin delivers the high stable TCXO frequency of 26.000 MHz for external components. Although the output is buffered, do not load this pin below 20kOhms // 10pF (TBD). Leave open if not used.
6F	RTC_CLKI	I2	Clock input: 32.768 kHz. External input for internal RC oscillator. The RTC_CLKI should be tied with GND if an external RTC clock isn't used.
		GPS Signals	
3A	RF_IN	ANA	GNSS RF Input, direct connection of passive or active GNSS antenna
2A	RF_GND	ANA	GNSS RF Ground
4A	RF_GND	ANA	GNSS RF Ground
6B	1PPS_OUT	O1	This output delivers a high-precision pulse-per-second signal that is synchronized to the GNSS time reference. The pulse precision is better than $1*10^{-7}$ seconds. Leave open if not used.
6A	BOOT_REC	I2	BOOT Recovery Pin. The pin is used to start the internal bootloader. Tie to GND during normal operation.
5A	FIX_AVAILABLE	O1	This pin indicates a fix position. Leave open if not used.
5F	NRESET	I2	Reset input, LOW active. Pull up (or leave open) during operation.
		UART	
3F	UART_TX	O1	Main UART TX.
4F	UART_RX	I1	Main UART RX.
3E	UART_CTS	I1	Main UART CTS.
		NOT USED PINs	
1A	NU_1A		Not used , internally not connected
1B	NU_1B		Not used , internally not connected
1C	NU_1C		Not used , internally not connected
1D	NU_1D		Not used , internally not connected
2B	NU_2B		Not used , internally not connected
2C	NU_2C		Not used , internally not connected
2D	NU_2D		Not used , internally not connected
3B	NU_3B		Not used , internally not connected
4B	NU_4B		Not used , internally not connected
4C	NU_4C		Not used , internally not connected
4D	NU_4D		Not used , internally not connected
4E	NU_4E		Not used , internally not connected
5B	NU_5B		Not used , internally not connected
5C	NU_5C		Not used , internally not connected
5D	NU_5D		Not used , internally not connected
5E	NU_5E		Not used , internally not connected
6C	NU_6C		Not used , internally not connected
6D	NU_6D		Not used , internally not connected
6E	NU_6E		Not used , internally not connected

(1) I1 = INPUT (VDD_IO DOMAIN); I2 = INPUT (VCORE DOMAIN);
O1 = OUTPUT (VDD_IO DOMAIN); O2 = OUTPUT (VCORE DOMAIN);
P = POWER PIN; ANA = ANALOG PIN.

9 HARDWARE HOST INTERFACE

GNS41xsLP is connected to the host system via a UART. NMEA data but also commands and responses are transmitted via this interface.
The interface voltage domain is VDD_IO.

The idle state of the lines is positive voltage. To interface a standard RS232 UART (e.g. a PC serial interface), please add an inverting level shifter. To interface processors that have a different interfacing voltage level, level shifters are required.

9.1   GPS UART Interface details
- The UART interface is used to send NMEA messages and control data.
- The default baud rate is 9600, other baud rates can be selected by ordering option.

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

9.2 GPS UART AC characteristics
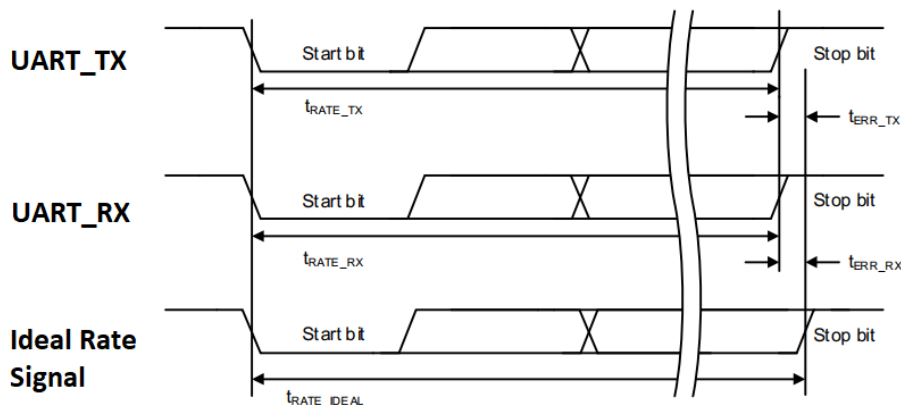
GPS UART Error Tolerance						
Item	Symbol	Min.	Typ.	Max	Unit	Remarks
UART Error Rate (except TX @ 115.2 kbps)	R_{BRT_ERR}	-1		1	%	T_{err_TX} / t_{RATE_IDEAL} T_{err_RX} / t_{RATE_IDEAL}
UART Error Rate (TX @ 115.2 kbps)	$R_{BRT\_ERR\_FD\_TX}$	-4		4	%	T_{err_TX} / t_{RATE_IDEAL}

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10 NMEA DATA

The GNS41xsLP outputs below sentences of NMEA0183 (ver.4.00) compliant sentences.
All active NMEA sentences are sent at the selected rate

NMEA available sentences			
Header	**Talker ID** *Note1	**Type**	**Content** *Note2
$	GP : Using only GPS for positioning GL : Using only GLONASS for positioning GA : Using only Galileo for positioning BD : Using only BeiDou for positioning GQ : Using only QZS for positioning GN : Using combined satellite systems for positioning	RMC	Recommended Minimum Navigation Information
	GP	GGA	Global Positioning System Fix Data, Time, Position and fix related data for a GPS receiver
	GP : Using only GPS for positioning GL : Using only GLONASS for positioning GA : Using only Galileo for positioning BD : Using only BeiDou for positioning GQ : Using only QZS for positioning	GSV	Satellites in view
	GP : Using only GPS for positioning GL : Using only GLONASS for positioning GA : Using only Galileo for positioning BD : Using only BeiDou for positioning GQ : Using only QZS for positioning GN : Using combined satellite systems for positioning	GLL	Geographic Position - Latitude/Longitude
	GP : Using only GPS for positioning GL : Using only GLONASS for positioning GA : Using only Galileo for positioning BD : Using only BeiDou for positioning GQ : Using only QZS for positioning GN : Using combined satellite systems for positioning	GSA	GPS DOP and active satellites
	GP : Using only GPS for positioning GL : Using only GLONASS for positioning GA : Using only Galileo for positioning BD : Using only BeiDou for positioning GQ : Using only QZS for positioning GN : Using combined satellite systems for positioning	VTG	Track made good and Ground speed

Note1: The Talker ID depends on the preset and currently receivable satellite systems.
Note2: For more detailed information on the individual sentences please refer to the NMEA specification.
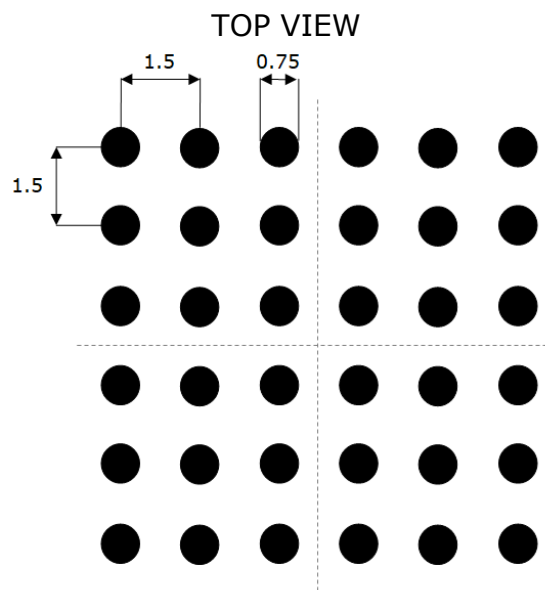
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11 PHYSICAL DIMENSIONS

TOP VIEW
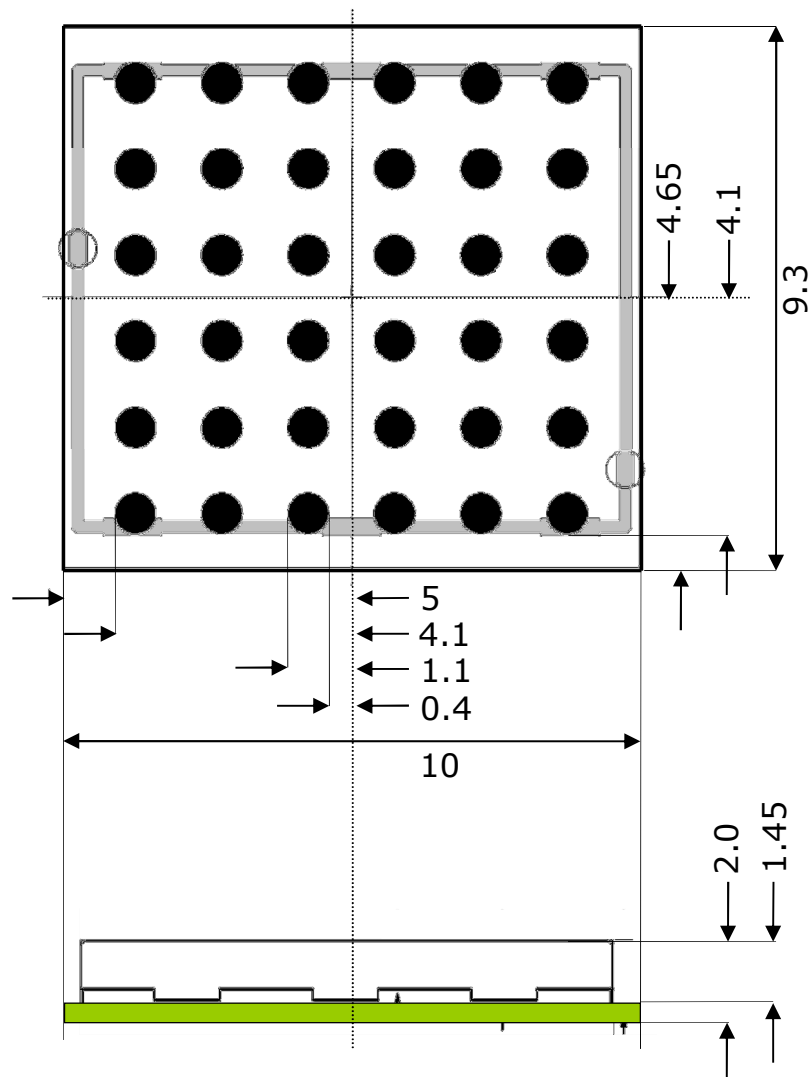
all units in mm
tolerance : ±0.1mm for <5mm, ±0.2mm for ≥5mm

12 RECOMMENDED PAD LAYOUT

TOP VIEW

all units in mm

13 MATERIAL INFORMATION

Contact surface : gold over nickel

13.1   Shield Material Information

"German Silver " , CuNi18Zn27
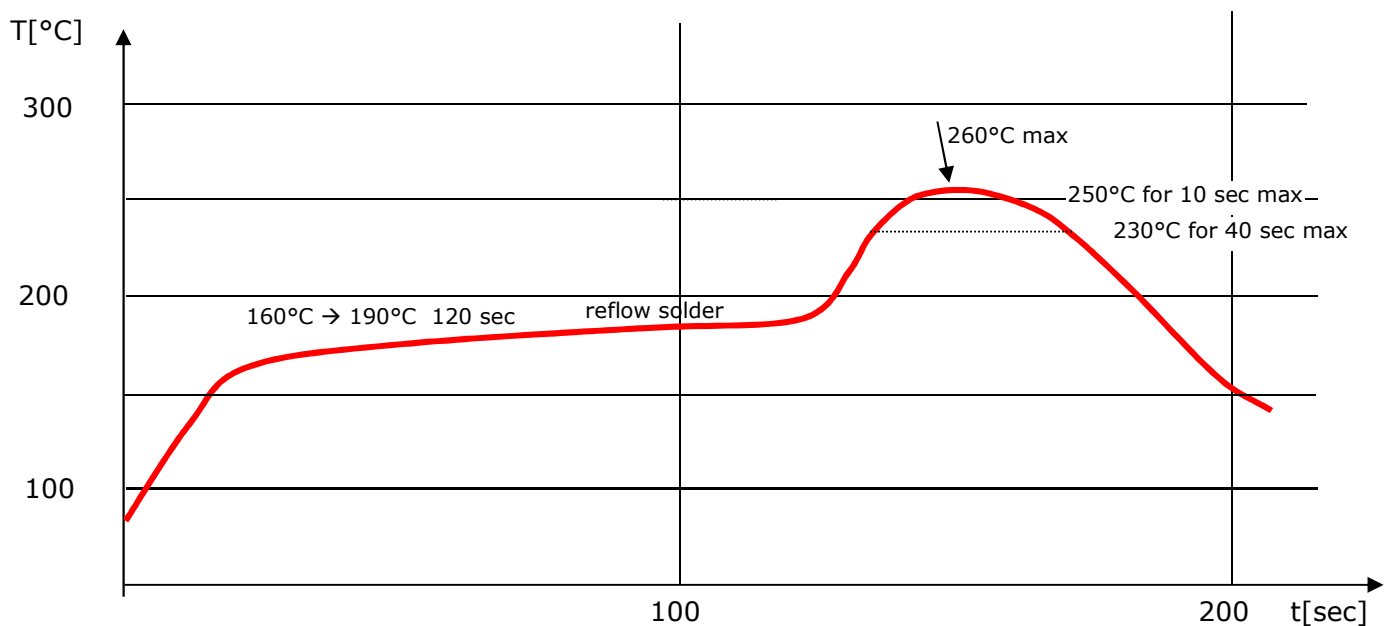Cu: 53.5..56.5%
Ni : 16.5..19.5%
Zn : 24..30%
thickness :0.2mm

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14 RECOMMENDED SOLDERING REFLOW PROFILE

Notes:
1. GNS41xsLP should be soldered in upright soldering position. In case of head-over soldering, please prevent shielding / GNS41xsLP 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

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15 TAPE INFORMATION
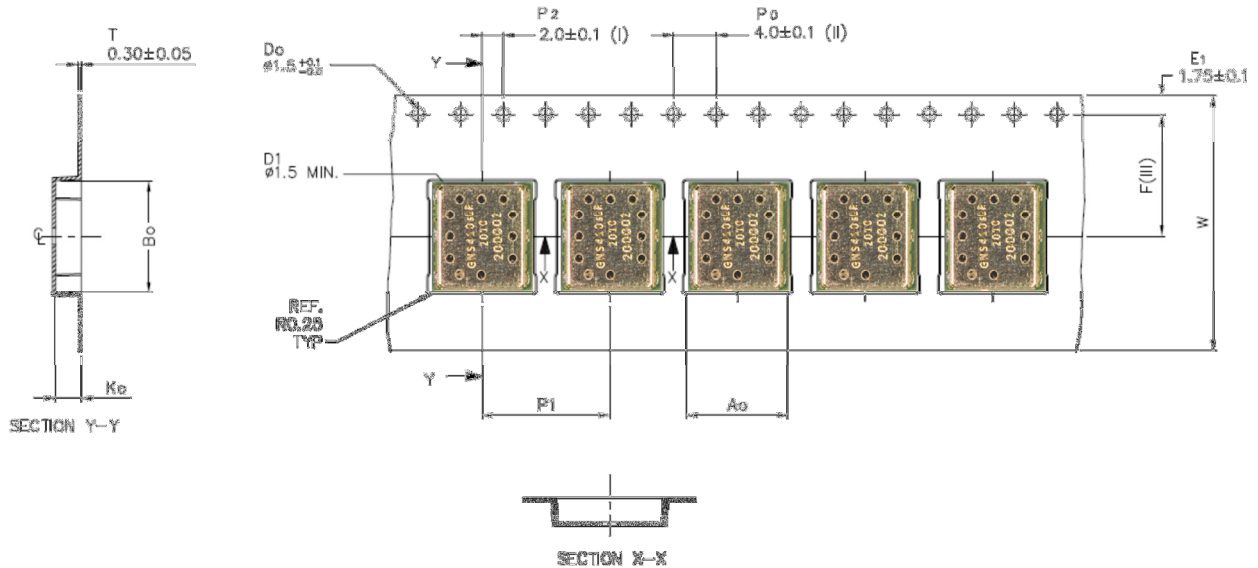
Ao	9.80	+/−	0.1
Bo	10.50	+/−	0.1
Ko	2.40	+/−	0.1
F	11.50	+/−	0.1
P₁	12.00	+/−	0.1
W	24.00	+/−	0.3

Forming format : Flatbed
Estimated max. length : 60 meter/22B3 reel

(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.

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16 <u>REEL INFORMATION</u>
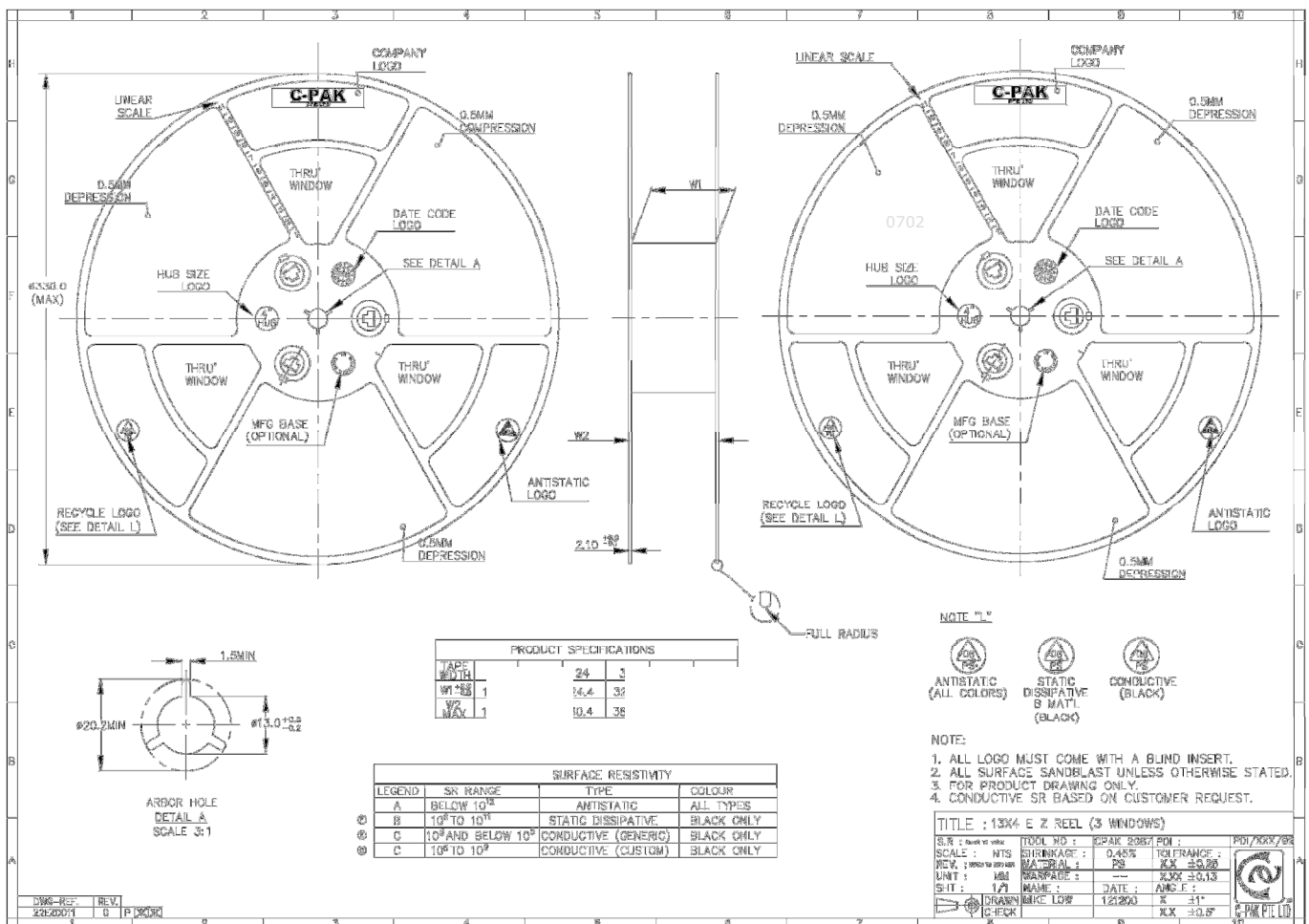
no. of devices : 2000 pcs / reel

17 ORDERING INFORMATION

Ordering information			
Type	**Part#**	**Laser marking**	**Description**
GNS410sLP	4037735106147	GNS410sLP yy cw <serial#>	GNSS Module (VDD_IO = 1.8V) with standard options as defined default in chapter 19
GNS413sLP	4037735106161	GNS413sLP yy cw <serial#>	GNSS Module (VDD_IO = 3.3V) with standard options as defined default in chapter 19
GNS410sLP _<options>	40377351xxxxx	GNS410sLP yy cw xxxxx <serial#>	GPS Module with user defined options. Part# will be assigned individually. See chapter 19 for option details.
GNS413sLP _<options>	40377351xxxxx	GNS413sLP yy cw xxxxx <serial#>	GPS Module with user defined options. Part# will be assigned individually. See chapter 19 for option details.

GNSS Module GNS410sLP/ GNSS Module GNS413sLP

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18 CUSTOMER SPECIFIC FACTORY OPTIONS & part# assignment

Some features of GNS41xsLP are factory presets, that should be added to your order information. Customers should define the options with the help of the following options table.

In case of an order, GNS will assign a new part#, then.
This part# is valid for all following orders.

Customer specific ordering options				
Type	**Default Value**	**options**	**Short**	**note**
UART baudrate	9,600 baud	Baud=9600bps Baud=19200bps Baud=38400bps Baud=57600bps Baud=115200bps Baud=230400bps Baud=460800bps	9 19 38 57 115 230 460	The serial output baud rate.
GPS output rate	1 second	Rate is x seconds (x=1,2,3,4,5,10, 30,60)	R<x>	This option is useful to optimize transfer times by lowering the rate of NMEA messages. Has no influence on the GPS engine activity.
NMEA selection	All 6 types	All combinations possible	RMC GGA GSV GLL GSA VTG	saving unused NMEAs. Please specify all types that should be available.
GSV output rate	1	GSV=1 GSV=5	G1 G5	GSV rate can be selected as a <u>multiple</u> of the GPS output rate. This option is used to reduce average data transfer. G5 with a rate of 1 will produce GSV output every 5 seconds.
Pulse per second output	active (on)	PPS on PPS off	/P	Activates or deactivates the hardware precision pulse per second. Since active is default, please define /P (no PPS) if PPS should not be available.

Just replace <options> by the **Short** options given in the table below.
Please use a semicolon "**;**" for separating the options.

Notes:

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1. You do not need to specify option values that are shown to be default.
2. If you do not wish any customized options, the part# will be the above mentioned
default: 4037735106147 resp. 4037735106161

For example, if you wish to have a baudrate of 115.2k, and only RMC (once per second) and GSV (every 5 seconds) as output data, please order as follows : **GNS410sLP 115;RMC;GSV;G5**

In another example, Baud Rate is 38400bps, all NMEA sentences except GSV and VTG should be sent at a rate of once per 5 seconds: **GNS410sLP 38;RMC;GGA;GLL;GSA;R5**

19 ENVIRONMENTAL INFORMATION

This product is free of environmental hazardous substances and complies to 2015/863/EU. (RoHS 3 directive).

RoHS 3
COMPLIANT
2015/863/EU

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19.1   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 ℃, +25 ℃, +85 ℃, operating
Damp Heat	ETSI EN 300 019-2-7 specification T 7.3	+70 ℃, 80% RH, 96 hrs, non-operating
Thermal Shock	ETSI EN 300 019-2-7 specification T 7.3 E	-40 ℃ ... +85 ℃, 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
ESD Sensitivity	JEDEC, JESD22-A114 ESD Sensitivity Testing Human Body Model (HBM). Class 2	+2000V - Human hand assembly
	JEDEC, JESD22-A115 ESD Sensitivity Testing Machine Model (MM), Class B	+250V - Machine automatic final assembly
Moisture/Reflow Sensitivity	IPC/JEDEC J-STD-020	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 ℃ ± 5 ℃

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 GNS41xsLP 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".

20 DOCUMENT REVISION HISTORY

V1.0	Mar 13 2020	M.Heinzel	initial
V1.1	Mar 18 2020	M.Heinzel	Corrections in feature list (page1) & chapter 7.5 (**current consumption)**
V1.2	Mar 26 2020	M.Heinzel	Corrections in chapter 7.2 (Recommended Operating Conditions) Corrections in chapter 3.1 (Block diagram)
V1.3	Apr 6 2020	M.Heinzel	Chapter 3.1 Block Diagram : LNA added Corrections in Chapter 7.1 Absolute Maximum Ratings Corrections in Chapter 9 Hardware Host Interface
V1.4	May 14 2020	M.Heinzel	Chapter 7.1 Vcore Voltage corrected Chapter 7.7 RTC Clock Characteristics added
V1.5	May 26 2020	M.Heinzel	Corrections in feature list (page1)
V1.6	Jun 9 2020	M.Heinzel	Chapter 6.1 Add. information to supported satellite systems

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21 PACKAGING

1 reel		
contents	2,000pcs	
GNS part#	2 x 6550000003 1x 6550000011	
dimensions	dia: 330mm thickness:30.4mm	
gross weight	1.195 Kg	with full contents
net weight	0.246 Kg	
2 vacuum bag		
GNS part#	6550000006	
dimensions	400mm x 480mm	
gross weight	1.321 kg	with full contents
net weight	0.068 Kg	
air pressure level	<30mbar	
3 moisture indicator		
GNS part#	6550000008	
dimensions	76mm x 51mm	
weight	0.001 Kg	
4 dry pack		
GNS part#	6550000007	
dimensions	145mm x 140mm	
weight	0.068 Kg	
5 Box for reel		
GNS part#	6550000012	
dimensions	350 mm x 350mm x 47mm	
gross weight	1.5357 kg	with full contents
net weight	0.184 kg	
6 Outer box		
contents	max 7 box for reel	(14,000 pcs GNS41xsLP)
dimensions	400mm x 370mm x 360mm	
gross weight	11.6 kg	with full contents
net weight	0.85 kg	

22 RELATED DOCUMENTS

Type	description		Available from
GNS41xsLP design guide	Contains information about implementation of the module and antenna design		GNS - Electronics GmbH
GNS41xsLP_StarterKit_User manual	Hardware manual for the GNS Starter Kit		GNS - Electronics GmbH