

## Datasheet V028

confidential information final specification

#### 1 INTRODUCTION

**TC6000GN-x** is the new product designation of the previous **TC6000GN-P1**, where in the detail -x the used TCXO frequency is coded. More information about this can be found in chapter 6.3.

**TC6000GN-x** GPS module provides a high performance and low power GPS solution in a small form factor.

TC6000GN-x integrates a complete GPS receiver enabling RF to NMEA solutions that minimize the load on the host processor.

Features

- GPS all-in-one module
- GPS tracking&navigation sensitivity: -162dBm
- Dedicated GPS processing
- Low load on host CPU
- Standard NMEA 0183 interface
- Precision PPS Output
- Low power consumption (70mW at full operation)
- One single power supply (1.8V) needed
- Miniature 36 pin module (10x9.3x2.0) mm
- Evaluation Boards:
  - TC6000GN Starter Kit for testing on a PC
  - Plug-in Evaluation Module (TC6000GN-EM1 or TC6000GN-EM1-S) board for MSP-EXP430F5438, MSP-EXPF5529 or Stellaris LM3S9B96 EVB

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



## **Datasheet V028**

confidential information final specification

#### 2 <u>INDEX</u>

		-
1		1
2		2
3	DETAILED FEATURES	3
	3.1 Block diagram	3
1		د ۸
4	OVERTEM DEGULAREMENTE	4
5	SYSTEM REQUIREMENTS	4
	5.1 Real time clock (RTC)	4
6		4 5
0	GFS CORL	5
	6.2 GPS characteristics	5
	(*1)Note: TC6000GN is also available with other internal TCXO frequencies. Please see chapter 6.3 TCXO Frequency	for
	more information	6
	6.3 TCXO Frequency	7
	6.4 GPS Power Management Features	7
	6.5 GPS almanac and ephemeris data	/
	6.6 PUSh to FIX	8 8
	6.8 Fix Available	9
	6.9 GPS Antenna	9
7	ELECTRICAL SPECIFICATION	- 10
	7.1 Absolute Maximum Ratings	10
	7.2 Recommended Operating Conditions	10
_	7.3 GPS input characteristics	10
8	DEVICE PINOUT DIAGRAM	- 11
9	POWER MANAGEMENT	- 13
1	0 RTC CONNECTION	- 13
1	1 HARDWARE HOST INTERFACE	- 14
	11.1 GPS UART Interface details	14
1	2 NMEA DATA	- 14
1	3 PHYSICAL DIMENSIONS	- 15
1	4 RECOMMENDED PAD LAYOUT	- 16
1	5 MATERIAL INFORMATION	- 16
	15.1 Shield Material Information	16
1	6 RECOMMENDED SOLDERING REFLOW PROFILE	- 17
1	7 TAPE INFORMATION	- 18
1	8 REEL INFORMATION	- 19
19	9 ORDERING INFORMATION	- 20
2	0 CUSTOMER SPECIFIC FACTORY OPTIONS & part# assignment	- 21
2	1 ENVIRONMENTAL INFORMATION	- 22
2	2 Quality and Environmental Specifications	- 72
2	2 Quality and Environmental Specifications 3 DOCUMENT REVISION HISTORY	- 21
2		24 . 25
2		- 23
2	D KELATED DUCUMENTS	· 20



## **Datasheet V028**

confidential information final specification

#### 3 DETAILED FEATURES



3.1 Block diagram

(\*1)Note: TC6000GN-x is also available with other internal TCXO frequencies. Please see chapter 6.3 TCXO Frequency for more information.

#### 3.2 GPS Features

- Significantly improved TTFF at low signal power levels provides the consumer with a compelling GPS experience
- Improved acquisition performance to process position fixes in deep indoor conditions
- Reduced power consumption through improvements to RF architecture, software techniques, receiver core, and RF noise figure partitioning
- Improved tracking performance and minimized error in multi-path environments through increased IF bandwidth and higher sampling rates in tracking channels
- Standard NMEA output
- Precision 1PPS output
- GPS Fix indication output pin



## **Datasheet V028**

confidential information final specification

## 4 TYPICAL APPLICATION BLOCK DIAGRAM



#### 5 SYSTEM REQUIREMENTS

TC6000GN-x includes a complete GPS engine.

- GPS is fully processed without any host processing requirements
- Standard NMEA message output from the solution to the host
- RTC clock (32.768kHz) should be applied externally.

#### 5.1 Real time clock (RTC)

TC6000GN-x requires a real time clock input that will provide time information for GPS after an offtime. The clock signal of 32.768kHz is not on-module and has to be fed at pin RTC\_CLK . Additionally, the clock signal is needed for some other chip-internal purposes. See chapter *RTC Connection* for more details

#### 5.2 I/O levels

TC6000GN-x core and I/O sections work at 1.8V nominal. Absolute Maximum Ratings should not be exceeded

Should the TC6000GN-x be interfaced to a host with I/O at higher levels, level shifters should be used.

**No signals are allowed on the device I/Os in the absence of VDD\_IO voltage** because the most I/Os are **not** fail-safe. Not fail-safe means that the pins will draw undefined current from an external voltage applied to the pin, when no I/O power is supplied to the device. Only exception is RTC\_CLK.



## **Datasheet V028**

confidential information final specification

## 6 GPS CORE

#### 6.1 GPS core description

The TC6000GN-x GPS core is a high performance, low power GPS receiver with integrated RF frontend.

Due to high input sensitivity it can work directly with a passive antenna.

The very short TTFF (Time To First Fix) and improved acquisition performance at low signal power levels is achieved through an enhanced receiver core architecture.

The improved RF architecture and software techniques reduce the average power consumption. Minimized error in multi-path environments is achieved through increased IF bandwidth and higher sampling rates in tracking channels.

TC6000GN-x supports APM (adapted power management) schemes to lower the average power of the GPS core to below 27mW.

6.2 GPS characteristics								
Parameter	Min	Тур	Max	Unit	Note			
general								
Frequency		1575.42		MHz	GPS L1 C/A code			
Output data frequency	1/60	1	1	1/sec	Configurable			
Navigation&tracking sensitivity		-162	-163	dBm				
Acquisition sensitivity		-146	-147	dBm	autonomous			
TTFF hotstart			1	sec	All SV's@-130dBm			
TTFF hotstart			10	sec	All SV's @-155dBm			
TTFF autonomous cold start		34		sec	All SV's @-130dBm			
TTFF autonomous cold start		45		sec	All SV's @-142dBm			
Number of channels tracking		16						
Number of acquisition channels		40						
		Power co	onsumption					
GPS ACTIVE (acquisition)		68	78.6	mA	NMEA frequency = 1/sec			
GPS ACTIVE (tracking)		45	53.8	mA	NMEA frequency = 1/sec			
GPS ACTIVE (tracking)	15			mA	NMEA frequency=1/sec, -130dBm, APM feature active			
GPS shutdown		180		μA	GPS_RESET → GND			
GPS deep sleep (RTC running)		80		μΑ	PUSH_TO_FIX → GND			



## **Datasheet V028**

confidential information final specification

Accuracy							
Static position error CEP68					Normal open sky in Field		
	-	2	-	m	Horizontal position accuracy		
					using open sky roof-top antenna		
Static position error CEP95					Normal open sky in Field		
	-	3	-	m	Horizontal position accuracy		
					using open sky roof-top antenna		
Static position error CEP68					Simulator feed ,		
	-	-	2	m	IONO and TROPO errors oN		
					at -130 dBm power level		
Static position error CEP95					Simulator feed ,		
	-	-	3	m	IONO and TROPO errors oN		
					at -130 dBm power level		
dynamic position error					Simulator feed .		
CÉP68	-	-	3	m	IONO and TROPO errors oN		
					at -130 dBm power level		
dynamic position error					Simulator feed		
CÉP95	-	-	4	m	IONO and TROPO errors oN		
					at -130 dBm power level		
velocity error CEP68					Simulator feed ,		
	-	-	0.1	m/s	IONO and TROPO errors oN		
					at -130 dBm power level		
velocity error CEP95					Simulator feed ,		
	-	-	0.7	m/s	IONO and TROPO errors oN		
					at -130 dBm power level		
	I	Accuracy for	timepulse si	gnal			
1PPS pulse duration	-	1	-	msec			
1PPS time jitter					Pulse rising edge deviation from		
	_	_	100	nsoc	expected pulse time, measured		
			100	lisec	in a 300 seconds interval with		
					full 3D fix.		
1PPS rise and fall time			10	nsec	10%90%		
1PPS output impedance	-	10kΩ//20pF	-				
		Т	CXO				
TCXO output frequency	-	26.000 <sup>*1</sup>	-	MHz	±2.5 ppm		
TCXO output impedance	-	1MΩ//5pF	-	-			

(\*1)Note: TC6000GN is also available with other internal TCXO frequencies. Please see chapter 6.3 TCXO Frequency for more information.

ITAR limits						
Operation altitude	-5,000	-	18,288	m		
Operation velocity	-	-	514	m/s		
Operation acceleration	-	-	-	m/s <sup>2</sup>	No limit set	



## Datasheet V028

confidential information final specification

#### 6.3 TCXO Frequency

The TI chipset used in the TC6000GN has been designed with technical foresight to operate at different TCXO frequencies. The firmware recognizes the frequency of the TCXO used and sets its function parameters to this frequency. Thus the frequency of the TCXO has no influence on the function of the TC6000GN.

Part Number	TCXO Frequency [MHz]	MPN	in preparation / available
TC6000GN-A	13.000	4037735106345	in preparation
TC6000GN-B	16.368	4037735106352	in preparation
TC6000GN-C	19.200	4037735106369	in preparation
TC6000GN-D	26.000	4037735106376	available since Jan 1 <sup>th</sup> 2021
TC6000GN-P1	26.000	4037735105249	available until Dec 31 <sup>th</sup> 2020
TC6000GN-P1	26.000	4037735104327	available until Dec 31 <sup>th</sup> 2020
TC6000GN-E	32.736	4037735106383	in preparation
TC6000GN-F	38.400	4037735106390	available since Jan 1 <sup>th</sup> 2021
TC6000GN-G	52.000	4037735106406	in preparation

#### 6.4 GPS 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. TC6000GN-x architecture achieves both these 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 TC6000GN-x provides position, velocity and time (PVT) measurements without any host loading. This, coupled with the optional built-in power management option, reduces the overall system power budget.

Power management features

- APM feature provides overall GPS system power consumption of 27mW in tracking mode under open sky conditions.
- However same as for any GPS device the accuracy and stability will be lowered due to reduced activity of the positioning algorithms. Since working parameters of APM are not adjustable, a field test is recommended to confirm usability of power saving algorithm.
- Can provide PVT solution without any load on the host, allowing a reduction in overall system power consumption.
- Position update rates selectable by order option. Max of 1 Hz update rate.

#### 6.5 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 TC6000GN module. 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.



## Datasheet V028

confidential information final specification

#### 6.6 Push to Fix

The *Push to Fix* signal is used to initiate a GPS fix session. The signal is defined as active high when starting a GPS fix session. The session can be a cold, warm or host start fix, depending upon the availability and age of the assistance data.



#### 6.7 Pulse Per Second (PPS)

TC6000GN provide a so called Pulse Per Second (PPS) for timing purposes. After calculation of a 3D postion 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.







Datasheet V028

confidential information final specification

#### 6.8 Fix Available

The *FIX AVAILABLE* signal is used to indicate the availability of GPS postion 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.

State	Indication
Initial boot up	low
PUSH_TO_FIX low	low
PUSH_TO_FIX on and acquisition	Toggling (900ms low and 100ms high)
PUSH_TO_FIX on and loss of fix	Toggling (900ms low and 100ms high)
PUSH_TO_FIX on and position fix	continuously high

#### 6.9 GPS Antenna

TC6000GN 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 TC6000 GPS 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.** 



## **Datasheet V028**

confidential information final specification

## 7 ELECTRICAL SPECIFICATION

#### 7.1 Absolute Maximum Ratings

Parameter	Value	Unit
Supply voltage range: VBAT	-0.5 to 2.1	V
Supply voltage range: VDD_IO	-0.5 to 2.1	V
Input voltage to analog pins <sup>1</sup>	-0.5 to 2.1	V
Input voltage to all other pins	-0.5 to (VDD_I/O + 0.5)	V

7.2 Recommended Operating Conditions							
Parameter	Min	Тур	Max	Unit	Note		
VDD	1.7		1.95	V	Power-supply voltage		
VDD_IO	1.65		1.92	V	I/O power-supply voltage		
High lovel output voltage V	0.8 * V <sub>DD</sub>		V <sub>DD</sub>	V	IOUT = 4 mA		
	1,45		V <sub>DD</sub>	V	IOUT = 0.4  mA		
Low level output voltage $V_{\text{OL}}$	0		0.2*V <sub>DD</sub>	V	IOUT = 4 mA		
High-level input voltage $V_{IH}$	0.65x VDD_IO		VDD_IO	V			
Low-level input voltage $V_{\rm IL}$	0		0.35x VDD_IO	v			
Operating temperature	-40		85	°C	Full specified performance		
Storage temperature range	-40		85	°C			
			60	mVpp	0 MHz to 0.1 MHz		
			50	mVpp	0.1 MHz to 0.5 MHz		
Maximum ripple on VDD			30	mVpp	0.5 MHz to 1.7 MHz		
			25	mVpp	1.7 MHz to 2.5 MHz		
			15	mVpp	2.5 MHz to 3.3 MHz		
			5	mVpp	Greater than 3.3 MHz		

7.3 GPS input characteristics						
Parameter	Min	Тур	Max	Unit	Note	
Input impedance		62.7-j3.2		Ω		
Maximum input level	0			dBm	before destruction	
Input return loss	-10			dB		



## **Datasheet V028**

confidential information final specification

#### 8 DEVICE PINOUT DIAGRAM

TOP VIEW





	1	2	3	4	5	6
A	NU12	GPS_GND1	GPS_RF	GPS_GND2	FIX_AVAILABLE	PUSH_TO_FIX
в	NU1	NU2	NU3	NU4	NU5	GPS_PPS
с	DB_3	DB_4	GND3	NU13	NU11	NU6
D	DB_1	DB_2	GND1	NU7	NU8	NU9
E	TCXO_CLK	GND	GPS_UART_CTS	NU12	NU10	ON_THE_FLY_PRG
F	VBAT	VDD_IO	GPS_UART_TX	GPS_UART_RX	GPS_RESET	RTC_CLK



# **Datasheet V028**

confidential information final specification

NO	NAME	TYPE <sup>1</sup>	1 DESCRIPTION					
	· · · · · · · · · · · · · · · · · · ·	1	Power-Management Signals					
2F	VDD_IO	Р	1.8V I/O power supply voltage					
1F	VBAT	Р	1.8V main power supply voltage					
3D	GND1	Р	Common Ground					
2E	GND2	Р	Common Ground					
3C	GND3	P	Common Ground					
			Clock Signals					
1E	TCXO_CLK	0	TCXO_CLK signal output. This Pin delivers the high stable TCXO frequency for external components. Although the output is buffered, do not load this pin below 1MOhms // 5nF Leave onen if not used					
6F		1	Clock input: 32.768 kHz. Input for an external low frequency clock signal. A clock must be provided at this pin to operate the module. See chapter "RTC CONNECTION"					
			GPS Signals					
3A	GPS RF	Ana	GPS RF Input, direct connection of passive or active GPS antenna					
2A	GPS GND1	P	GPS RF Ground					
4A	GPS GND2	Р	GPS RF Ground					
6B	GPS_PPS	0	This output delivers a high-precision pulse-per-second signal that is synchronized to					
	_		the GPS time reference. The pulse precision is better than 1*10 <sup>-7</sup> seconds. Although					
			the output is buffered, do not load this pin below 10kOhms // 47pF (TBD). Leave open if not used .					
6E	ON_THE_FLY_PRG	I	This input determines operation after reset. Internally pulled up for normal operation.					
			pull low for re- programming firmware or reconfiguring the module. Leave open in					
64	PUSH TO FIX	т	Input signal to switch between operation and deep sleep mode, internally pulled down					
		1	pull high (with less than 4.7kOhm) during operation. pull low (or leave open) to set the module to deep sleep. Internal RTC continues to work in deep sleep.					
5A	FIX_AVAILABLE	0	This pin indicates a fix position.					
			Leave open if not used.					
5F	GPS_RESET	I	Main Reset for the receiver. Internally weak pulled down. Pull high with less than 100kObm for operation, pull to GND (or leave open) during power – up					
	1		NOT USED PINS DO NOT CONNECT					
1A	NU12		do not connect or connect to GND					
1B	NU1		do not connect or connect to GND					
2B	NU2		do not connect or connect to GND					
3B	NU3		do not connect or connect to GND					
4B	NU4		do not connect or connect to GND					
5B	NU5		do not connect or connect to GND					
5E	NU10		do not connect or connect to GND					
4D	NU7		do not connect or connect to GND					
5D	NU8		do not connect or connect to GND					
6D	NU9		do not connect or connect to GND					
5C	NU11		do not connect or connect to GND					
6C	NU6		do not connect or connect to GND					
4E	NU12		do not connect or connect to GND					
4C	NU13		do not connect or connect to GND					
			UARI					
3F	GPS_UART_TX	0	Main UART TX.					
4F	GPS_UART_RX	I	Main UART RX.					
3E	GPS_UART_CTS	I	Main UART CTS. CTS not used. Leave open					
10			I2C					
10			must be connected to DB_2					
20			must be connected to DB_1					
10			must be connected to DB_4					
20	UD_4		must be connected to DB_3					

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

NOTE: SOME PINS HAVE BEEN REDEFINED FROM STATIC CONNECTION TO NOT USED (NU) IN THIS V0.26 DATASHEET. THE CONNECTIONS ARE NOW MADE INTERNALLY.



## Datasheet V028

confidential information final specification

#### 9 POWER MANAGEMENT

For quick re-acquisition after power-on, the TC6000GN should stay tied to Vcc during off-times to keep it's RTC clock running. The module is put in sleep mode, by holding the PUSH\_TO\_FIX pin low. The pin may be controlled by the host controller or by another power management circuitry, which might be also a simple electromechanical switch.

A static low level on PUSH\_TO\_FIX will keep the TC6000GN-x in a deep sleep with power consumption below 100µA.

#### 10 RTC CONNECTION

The RTC\_CLK is a free-running clock that needs to be supplied from an external clock source. It is connected to the RTC\_CLK pin on the TC6000GN-x, and is a digital square wave signal in the range of 0 V to 1.8 V (nominal). The slow clock frequency is 32.768 kHz. RTC\_CLK has multiple functionalities:

- Used to maintain GPS time between sleep intervals
- For clock frequency detection at power-on reset, before TCXO\_CLK is available
- For power up sequencing.

Digital RTC Requirements							
Parameter	Min	Тур	Max	Unit	Note		
Input slow clock frequency		32,768		Hz			
Input slow clock accuracy			±200	ppm	Initial temperature + aging		
Input transition time			100	ns	t <sub>R</sub> /t <sub>F</sub> : 10% to 90%		
Frequency input duty cycle	20%	50%	80%				
V <sub>IH</sub>	0.65x VDD_IO		VDD_IO	V	Slow clock input voltage limits		
V <sub>IL</sub>	0		0.35xVDD_IO	V	Slow clock input voltage limits		
Load capacitance			10	pF	Capacitance on RTC_CLK pin		
Load resistance	1			MΩ	Resistance on RTC_CLK pin		



## Datasheet V028

confidential information final specification

#### 11 HARDWARE HOST INTERFACE

TC6000GN-x is connected to host system by a UART Interface. Since TC6000GN-x is used only to deliver NMEA to the host only a single data line from the module to the host is necessary. The interface is requires 1.8V I/O.

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.

#### **11.1 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.
- The maximum baud rate deviation supported is ±2%.

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

#### 12 <u>NMEA DATA</u>

The TC6000GN-x provides NMEA 0183 (National Marine Electronics Association) compatible data. The following table shows the available NMEA sentences All active NMEA sentences are sent at the selected rate

NMEA available sentences		
Type content		
\$GPRMC	Recommended Minimum Navigation Information	
\$GPGGA	Global Positioning System Fix Data, Time, Position and fix related data for a GPS receiver	
\$GPGSV	Satellites in view	
\$GPGLL	Geographic Position - Latitude/Longitude	
\$GPGSA	GPS DOP and active satellites	
\$GPVTG	Track made good and Ground speed	



**Datasheet V028** 

confidential information final specification



all units in mm tolerance :  $\pm 0.1$ mm for <5mm,  $\pm 0.2$ mm for  $\geq 5$ mm



**Datasheet V028** 

confidential information final specification

# $14 \underline{\mathsf{RECOMMENDED PAD LAYOUT}}_{\mathsf{TOP VIEW}}$

all units in mm

#### 15 MATERIAL INFORMATION

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

#### 15.1 Shield Material Information

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



**Datasheet V028** 

confidential information final specification

thickness :0.2mm

#### 16 RECOMMENDED SOLDERING REFLOW PROFILE



#### Notes:

1. TC6000GN-x should be soldered in upright soldering position. In case of head-over soldering, please prevent shielding / TC6000GN-x 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



## **Datasheet V028**

confidential information final specification

#### **17 TAPE INFORMATION**





## **Datasheet V028**

confidential information final specification

#### 18 REEL INFORMATION



no. of devices : 2000 pcs / reel



## **Datasheet V028**

confidential information final specification

### 19 ORDERING INFORMATION

Ordering information			
Туре	Part#	Laser marking	Description
TC6000GN-P1 no longer available since Jan.1 2021. See PCN201124 TC6000GN hardware change notification for more details.	4037735104327 4037735105249	TC6000GN GNS <yy cw=""> <serial#></serial#></yy>	GPS Module with standard options as defined default in chapter 20, TCXO frequency 26.000MHz
TC6000GN-D Successor for TC6000GN-P1 since Jan.1, 2021	4037735106376	TC6000GN-D GNS <yy cw=""> <serial#></serial#></yy>	GPS Module with standard options as defined default in chapter 20, TCXO frequency 26.000MHz
TC6000GN-F	4037735106390	TC6000GN-F GNS <yy cw=""> <serial#></serial#></yy>	GPS Module with standard options as defined default in chapter 20, TCXO frequency 38.400MHz
TC6000GN- <i>x</i>		TC6000GN- <i>x</i> GNS <yy cw=""> <serial#></serial#></yy>	TC6000GN- <i>x</i> with further TCXO frequencies are in preparation. Please see chapter <b>6.3 TCXO Frequency</b> for more information.
TC6000GN- <i>x</i> _ <options></options>	40377351xxxxx	TC6000GN GNS <yy cw=""> <serial#> <last 5="" digits<br="">of part#&gt;</last></serial#></yy>	GPS Module with user defined options. Part# will be assigned individually. See chapter 20 for option details.



Datasheet V028

**confidential information** final specification

#### 20 CUSTOMER SPECIFIC FACTORY OPTIONS & part # assignment

Some features of TC6000GN-x 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

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

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: 4037735104327

Туре	Default value	<b>Possible options</b>	Short	note
UART baudrate	9,600 baud	Baud=9600bps Baud=19200bps Baud=38400bps Baud=57600bps Baud=115200bps	9 19 38 57 115	The serial output baud rate.
APM feature	Not active	APM active APM not active	A	APM feature allows the GPS engine to save energy under good reception conditions. Please define A , if you wish to have APM activated.
GPS output rate	1 second (R1)	Rate is x seconds (x=1,2,3,4,5,10, 30,60)	R <x></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.

© GNS-Electronics GmbH 2013 - 2021 V 0.28, Jan 12<sup>th</sup> 2021



## Datasheet V028

confidential information final specification

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 :

#### TC6000GN-x 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. PPS shall be off:

TC6000GN-x 38;RMC;GGA;GLL;GSA;R5;/P

#### 21 ENVIRONMENTAL INFORMATION

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





## **Datasheet V028**

confidential information final specification

## 22 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 <sup>2</sup> , 8hrs/axis, X, Y, Z 8hrs for each 3 axis non- operating
Shock	ISO16750-3	Half-sinusoidal 50g, 6ms, 10time/face, $\pm X$ , $\pm Y$ and $\pm Z$ 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	+200V - Machine automatic final assembly
Moisture/Reflow Sensitivity	IPC/JEDEC J-STD-020D.1	MSL3
Śtorage (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 $^\circ\text{C}$ ± 5 $^\circ\text{C}$

#### **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 TC6000GN-x modules meet MSL Level 3 of the JEDEC specification J-STD-020D – 168 hours Floor Life (out of bag)  $\leq$  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".



# **Datasheet V028**

confidential information final specification

#### 23 DOCUMENT REVISION HISTORY

V0.1	Nov 2 2010	P.Skaliks	initial
V0.11	Jan 28 2011	P.Skaliks	Internal Objective - Product name extension P1, GPS features added, packing standard , solder profile, factory options
V0.12	Feb 22 2011	P.Skaliks	Objective - GPS features added, factory options,
V0.13	Apr 13,2011	P.Skaliks	reviewed April 13, flash options added
V0.15		P.Skaliks	Pin definitions reviewed and completed. CTS pindefinitionchanged (not connected) .Document Status changed to preliminary
V0.16		P.Skaliks	Pin definitions reviewed and corrected. Modified ordering instructions to short form, laser marking update
V0.18	Nov 2 2011	P.Skaliks	General review
V0.19	Jan 3 2012	M.Reiff	Related documents update
V0.20	May 18 2012	M.Reiff	Laser Marking confirmed; Operating temperature improved; RF input impendance corrected; Navigation sensitivity added; Additional information added for PUSH_TO_FIX, PPS_OUT and FIX_AVAILABLE signal;
V0.21	July 18 2012	W.Koch	Baud rate corrected to 57600 baud, page 20 "customer specific factory settings".
V0.22	Sep 5 2012	P.Skaliks	Format in table "factory option" and explanation for APM on pg 20
V0.23	Dec 6 2012	M.Reiff	Operating temperature deleted at "absolute maximum ratings"; Feature separator changed; Block diagram added
V0.24	Jun 16 2013	P.Skaliks	Corrected typo :thickness in chapter 13, added tolerance information
V0.25	Aug 9, 2013	P.Skaliks	The ordering information was revised
V0.26	Sep 10 2014	P.Skaliks	APM comment added, Outline information revised, Pin description revised
V0.27	July 19 2017	M.Heinzel	Revised Quality and Environmental Specifications New author -> GNS Electronics GmbH
V0.28	Jan 12 2021	M.Heinzel	New product name TC6000GN-x instead of TC6000GN-P1 Switching from unique TCXO to various TCXO frequencies Revision of order information Correction of some spelling mistakes Updated Environmental Information



## **Datasheet V028**

confidential information final specification

#### 24 PACKAGING

1 reel				
contents	2,000pcs			
GNS part#	2 x 655000003			
	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#	655000006			
dimensions	400mm x 480mm			
gross weight	1.321 kg	with full contents		
net weight	0.068 Kg			
air pressure level	<30mbar			
3 moisture indic	ator			
GNS part#	655000008			
dimensions	76mm x 51mm			
weight	0.001 Kg			
4 dry pack				
GNS part#	655000007			
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 TC6000GN-x )		
dimensions	400mm x 370mm x 360mm			
gross weight	11.6 kg	with full contents		
net weight	0.85 kg			



## **Datasheet V028**

confidential information final specification

#### 25 RELATED DOCUMENTS

Туре	description	Available from
TC6000GN-P1 design guide	Contains information about implementation of the module and antenna design	GNS - Electronics GmbH
TC6000GN_EM1_UserManual	Hardware manual for the EM1 Evalboard for TI experimenter boards	GNS - Electronics GmbH
TC6000GN_EM1_S_UserManual	Hardware manual for the EM1 Evalboard for TI experimenter boards	GNS - Electronics GmbH
TC6000GN-P1_StarterKit_User manual	Hardware manual for the GNS Starter Kit	GNS - Electronics GmbH
<i>GPS Antenna Connection Design</i> <i>Guide</i>	Design Guide to implement an GPS antenna to an application PCB	GNS - Electronics GmbH
TC6000GN StarterKit_TestGuide	A guide for testing TC6000GN against other GPS receivers	GNS - Electronics GmbH
<i>PCN201124 TC6000GN PCN</i> <i>hardware change notification</i>	Information about Switching from unique TCXO to various TCXO frequencies	GNS - Electronics GmbH

© GNS-ELECTRONICS GMBH 2021

THE INFORMATION IN THIS DOCUMENTATION DOES NOT FORM ANY QUOTATION OR CONTRACT. TECHNICAL DATA ARE DUE TO BE CHANGED WITHOUT NOTICE.

NO LIABILITY WILL BE ACCEPTED BY THE PUBLISHER FOR ANY CONSEQUENCE OF THIS DOCUMENT'S USE.

REPRODUCTION IN WHOLE OR IN PART IS PROHIBITED WITHOUT THE PRIOR WRITTEN CONSENT OF THE COPYRIGHT OWNER