GNS TC6000GN–EM1 EvalKit for TI microcontroller boards   manual

The GNS TC6000GN-EM1 Evaluation Board has been designed to support developers during design-in of the TC6000GN-P1 GPS stand alone module solution. The examples are shown as block diagrams to explain the approaches. Reference Layouts are included whenever needed at the GNS forum Link: www.forum.gns-gmbh.com .
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Introduction

Together with a Texas Instruments MSP-EXP430F5438, MSP-EXP430F5529 or Stellaris LM3S9B96 Cortex M3 EVB (all not included) and a dedicated test firmware, the TC6000GN-EM1 evaluation board provides a plug-and-play solution to demonstrate the performance and functionality of the TC6000GN-P1 GPS module.
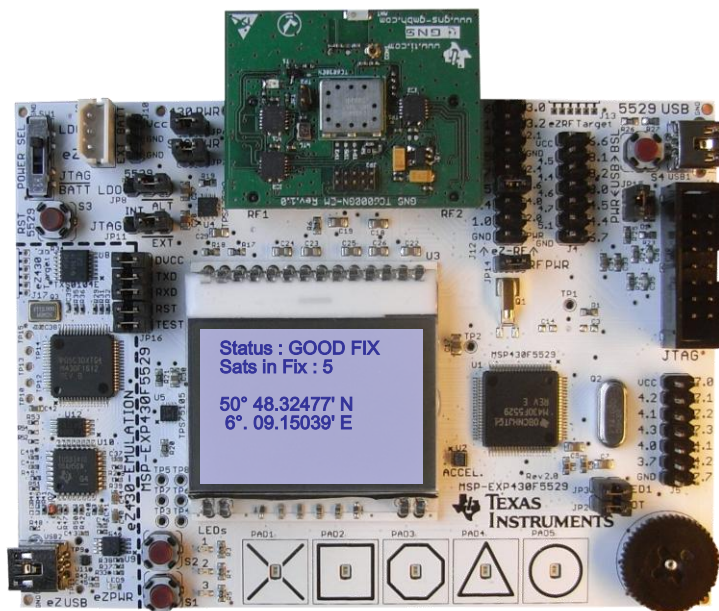
For technical specification, please refer to the **TC6000GN-P1 datasheet**.

For application information and GPS antenna layout implementation, the **TC6000GN Design Guide** and "**GPS Antenna Connection" Design Guide** are available. Applications were two GPS antennas should be used, a special GPS antenna evaluation board "GPS SPDT switch" can be ordered.
The specific documents and reference layout in Gerber-file format are available for download at http://www.forum.gns-gmbh.com/ .

This document describes the TC6000GN-EM1 EvalKit hardware in detail.

Since the test FW is provided in source code, it can be easily used to start a GPS development on it. As a further feature, the test FW routes all GPS data (NMEA) directly to the USB port, which can be connected to a PC.

TC6000GN-EM1 connected to MSP-EXP430F5529

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1 Description of the TC6000GN-EM1 EvalKit Hardware

FEATURES

- Tiny plug-in board that directly matches to the MSP-EXP430F5529, MSP-EXP430F5438 or Stellaris LM3S9B96 Cortex M3 EVB RF1 and RF2 connectors
- Murata micro-coax connector on board
- 3.2x1.6mm GPS chip antenna on board
- GPS active antenna 3.3V DC supply via Murata micro-coax connector
- GPS-fix LED indicator
- Test firmware (source provided) for demonstration & FW development
- Test FW outputs GPS status and Position solution on LC Display.
- Battery or USB powered

The TC6000GN-EM1 board is equipped with direct plug-in connectors for the MSP-EXP430F5438, MSP-EXP430F5529 board or Stellaris LM3S9B96 Cortex M3 EVB. An on board 32.768kHz oscillator for the GPS RTC and internal level shifters to adapt to the MSP-EXP430 and Stellaris boards' signal levels of 3.3V are also included.
The external SMA GPS antenna connector provides 3.3V DC to supply an active GPS antenna for system- and performance tests.
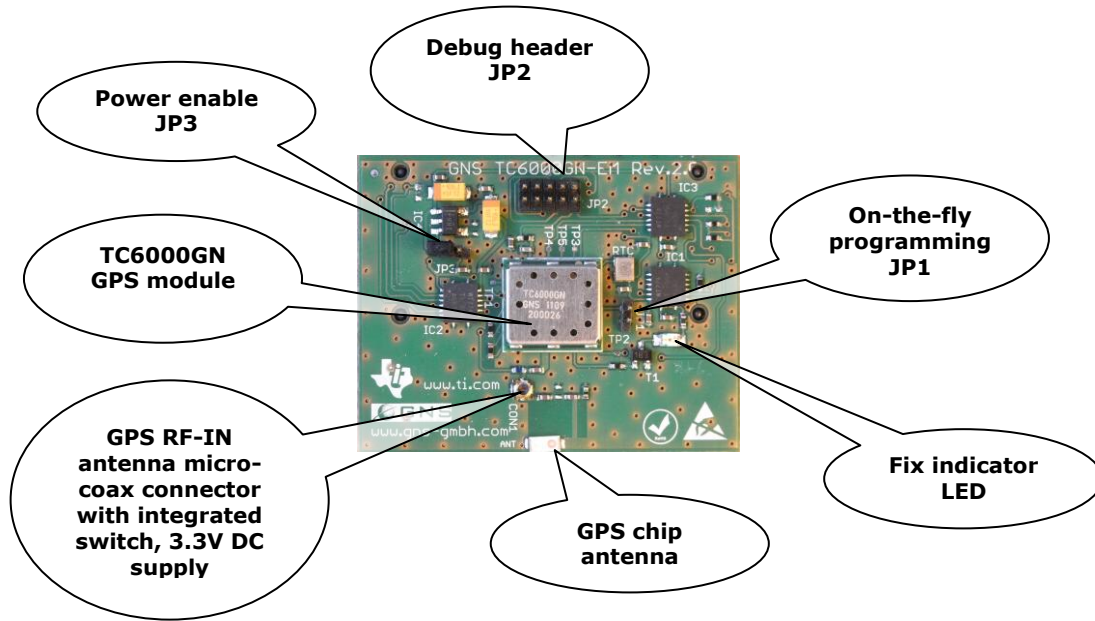
2 Package Content

- GNS TC6000GN-EM1 plug-in board
- CD with documentation

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TI microcontroller boards

3 TC6000GN-EM1 Board Layout

Description of LED status indicator:

LED status indicator	Comment
double blinking	Boot-up sequence finished
blinking	GPS engine is acquisition mode. Almanac- and Ephemeris- data will be received. User position will be calculated.
on	User position is calculated (position fix)

JUMPER DESCRIPTION

| CONNECTOR	PIN	SIGNAL	DESCRIPTION
JP1	1	ON_THE_FLY_PRG	This jumper must be connected to GND pin1&2, when the TC6000GN-P1 should be reprogrammed with new firmware.
	2	GND	
JP2	1	3V3	3V3 POWER SUPPLY
	2	LDO enable	LDO enable pin connect to pin 1 (3.3V) to activate TC6000GN module. To deactivate connect pin 1 (GND).

TEST POINT DESCRIPTION

TEST POINT	SIGNAL	DESCRIPTION
TP1	TCXO_CLK	1.8Volt 26MHz TXCO clock signal
TP2	PUSH_TO_FIX	Signal to switch between operation and deep sleep mode. internally pulled down. pull high during operation. pull low to set the module to deep sleep. Internal RTC continues to work in deep sleep.
TP3	GPS_RESET	Signal to reset TC6000GN from the host
TP4	GPS_TX	UART TX output from device
TP5	GPS_RX	UART RX receive input to device
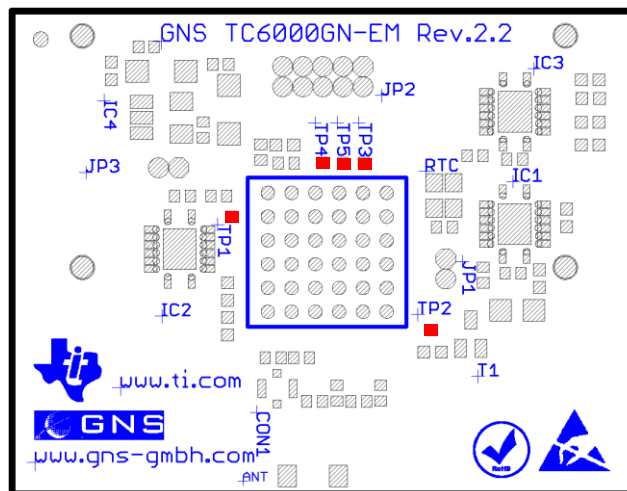
4 TC6000GN-EM1 Board Block Diagram
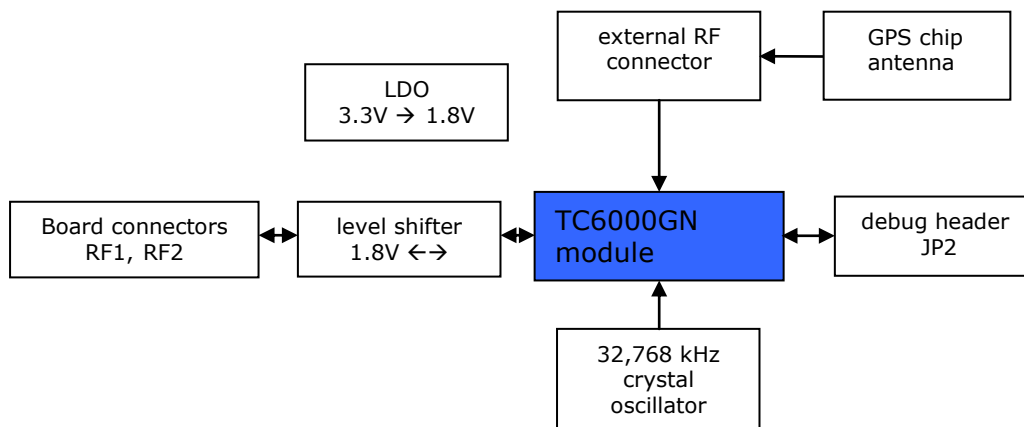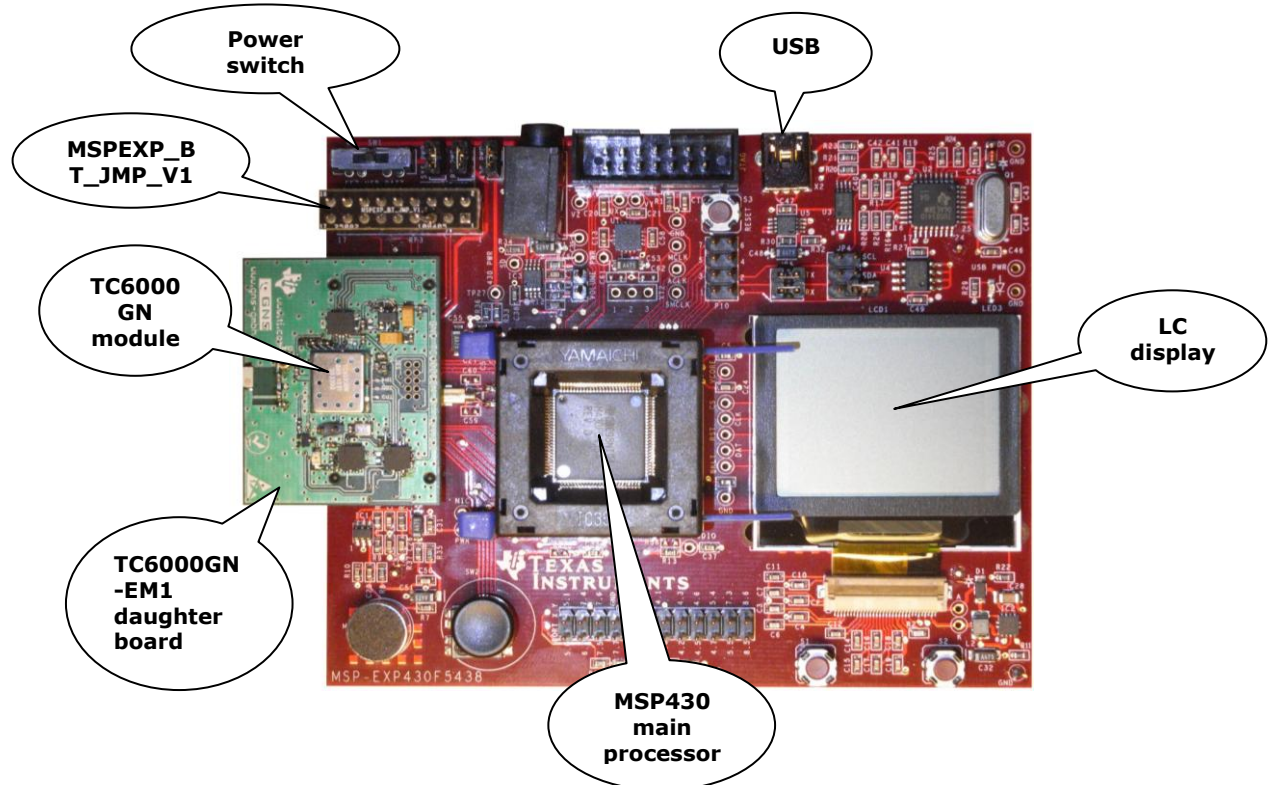
5 TC6000GN-EM1 on Texas Instruments Experimental Boards

5.1   TI's MSP EXP430F5438 board.

For more information for the F5438board,
visit http://www.ti.com/tool/msp-exp430f5438

5.2   Getting started ….

1. Make sure the microcontroller MSP430F5438 is installed.
2. Plug in the multi jumper (MSPEXP_BT_JMP_V1.0, must be separately ordered from TI or GNS) to the MSP-EXP430F5438 board to set up the correct HW I/O configuration. Place pin 18 in left-upper position as shown above!
3. Place the TC6000GN-EM1 as shown. When position is correct, please press it down until the connectors are fully inserted.
4. Power the board through battery / wall adaptor (refer to the board user guide)
5. For installing the firmware on the MSP-EXP430F5438 board, please connect your PC to the board by using TI's USB Debug Interface box. MSP-EXP430F5438 Firmware and firmware installation guide will be provided by GNS on request or firmware can be programmed by user, refer to [5].
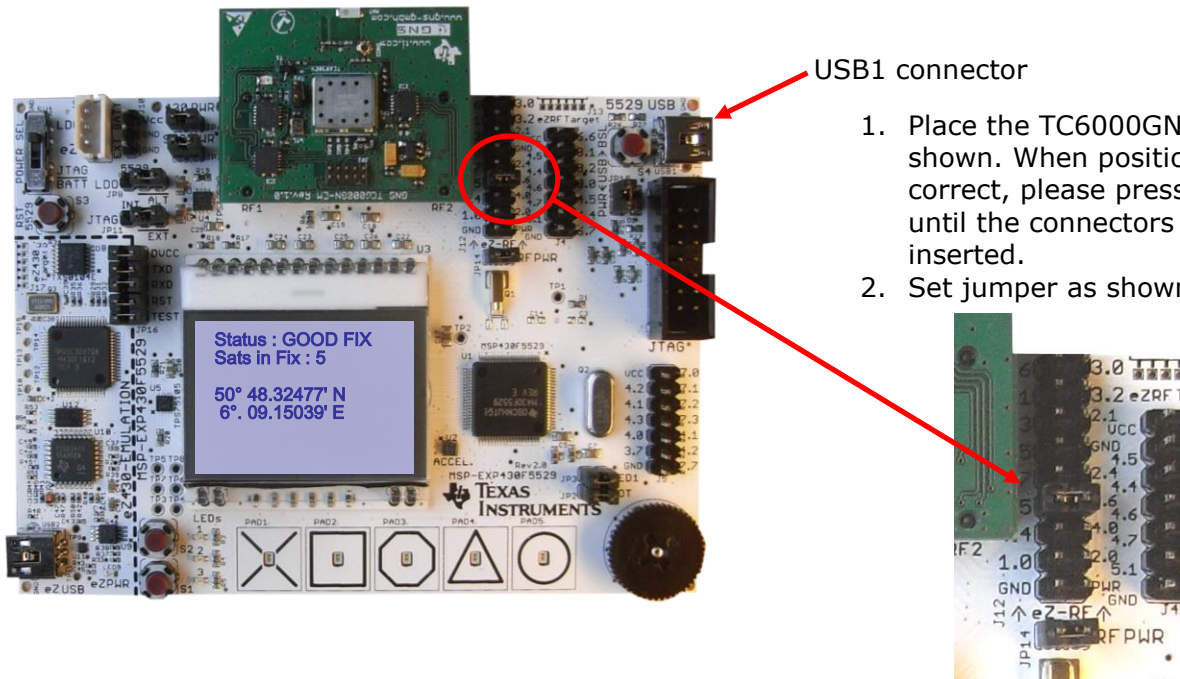
5.3   Using TI's MSP-EXP430F5529 board

For more information and User manual for the F5529 board,
visit http://www.ti.com/tool/msp-exp430f5529

USB1 connector

1. Place the TC6000GN-EM1 as shown. When position is correct, please press it down until the connectors are fully inserted.
2. Set jumper as shown

3. The board will be powered through USB1. No external power supply is needed.
4. For installing the firmware on the MSP-EXP430F5529 board, please connect your PC to the board by using USB1 connector. Please refer to TI documentation for firmware installation and usage[6].

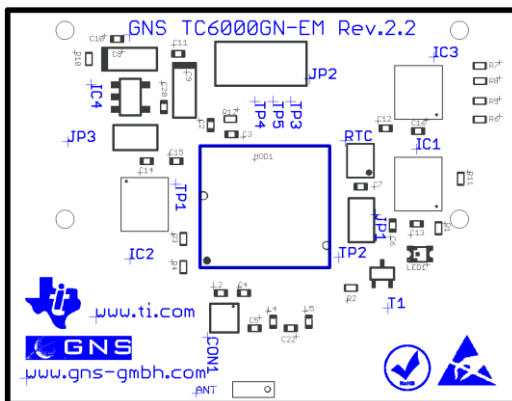## 5.4   Update TC6000GN-P1 module using the MSP-EXP430F5529 board

To perform a firmware update on the TC6000GN-P1 module by using the MSP-EXP430F5529 board, refer to [4], placeing PRG_ON_THE_FLY jumper (1.27mm) at JP1 pin1&2.
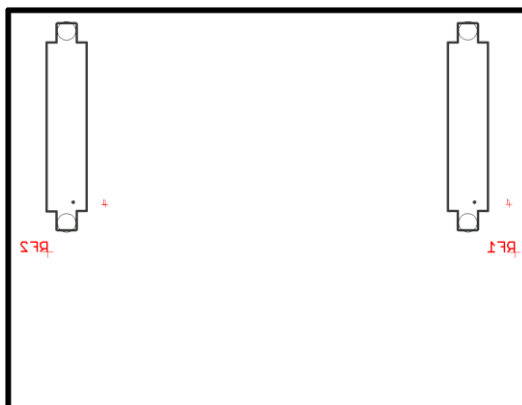

Place jumper!

6 TC6000GN-EM1 Hardware

6.1   Assembly Drawing Top Side

Dimensions:
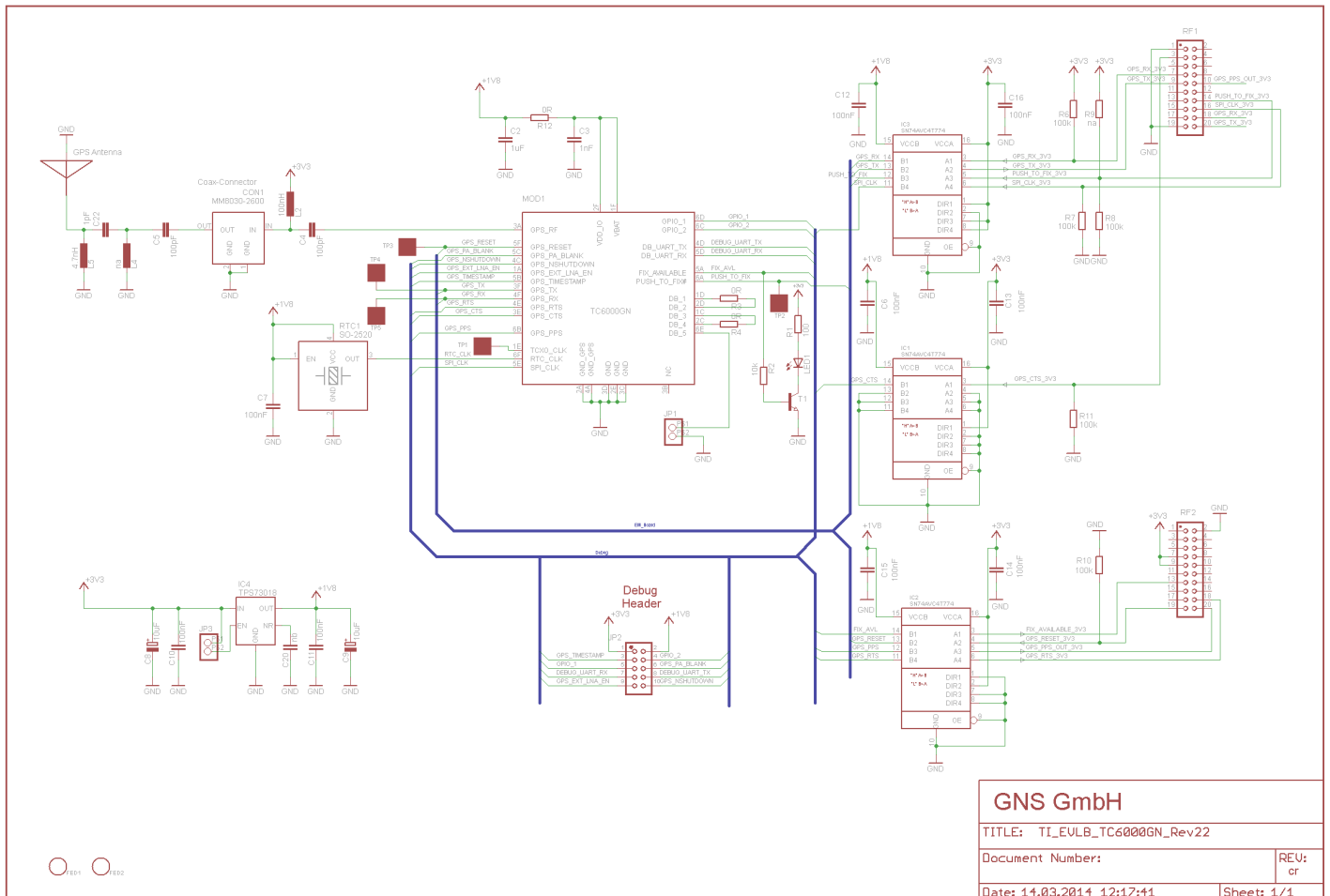39.3mm x 30.4mm

6.2   Assembly Drawing Bottom Side

6.3   TC6000GN-EM1 Schematic

GNS GmbH

TITLE: TI_EVLB_TC6000GN_Rev22

Document Number: REV: cr

Date: 14.03.2014 12:17:41   Sheet: 1/1

6.4   TC6000GN-EM1 Bill Of Material

Qty	Device	Value, Type	Board reference
1	Transistor NPN	BC846 SOT323	T1
1	LED green	CHIPLED-0805	LED1
2	Connector	PINHD-1X2_RM1.27	JP1, JP3
1	Connector	PINHD-2X5_RM1.27	JP2
2	Board2board conn	SFM-110-02-L-D-A	RF1, RF2
1	TC6000GN	TC6000GN	MOD1
1	Resistor	10k size 0402	R2
5	Resistor	100k size 0402	R6, R7, R8, R10, R11
3	Resistor	0R size 0402	R3, R4, R12
1	Resistor	100R size 0402	R1
9	Capacitor	100nF size 0402	C6, C7, C10, C11, C12, C13, C14, C15, C16
1	Capacitor	1nF size 0402	C3
1	Capacitor	1uF size 0402	C2
1	Inductor	100nH size 0402	L2
1	Oscillator	SO2520	RTC1
3	Level shifter	SN74AVC4T774	IC1, IC2, IC3
1	LDO	TPS73018	IC4
1	MM8030-2600	Micro-Coax Connector	Con1
1	Inductor	4.7nH size 0402	L5
2	Capacitor	10uF tantal	C8, C9
1	Capacitor	1pF size 0402	C22
2	Capacitor	100pF size 0402	C4, C5
1	GPS Antenna	AH316M	ANT1
1	Resistor	not assembled	R9
1	Capacitor	not assembled	C20
1	Inductor	not assembled	L4

6.5   Micro-Coax Connector

TC6000GN-EM1 uses the Murata micro-coax connector "MM8030-2600" to provide the possibility to inject GPS signals from a GPS simulator or to use an active GPS antenna. The MM8030 implements connector and switch functionality in one item.
Is no connector placed, the on-board GPS chip antenna will be used for receiving GPS signals.
Is a connector placed the signal path to the on-board GPS chip antenna is disconnected and connected to the Murata measurement probe "MXHQ87WA3000", which had to be used for connecting the MM8030-2600. The measurement probe must be separately ordered from Murata.
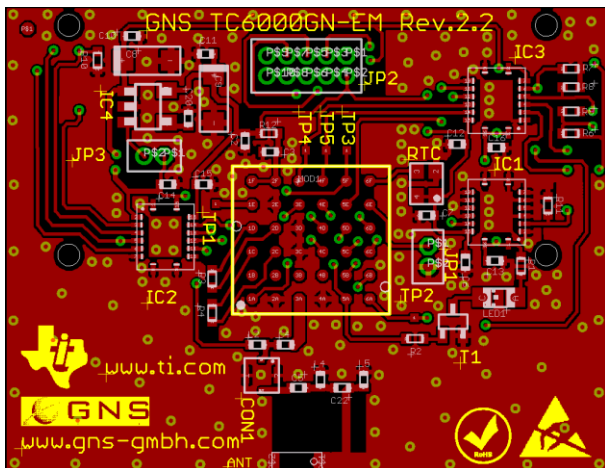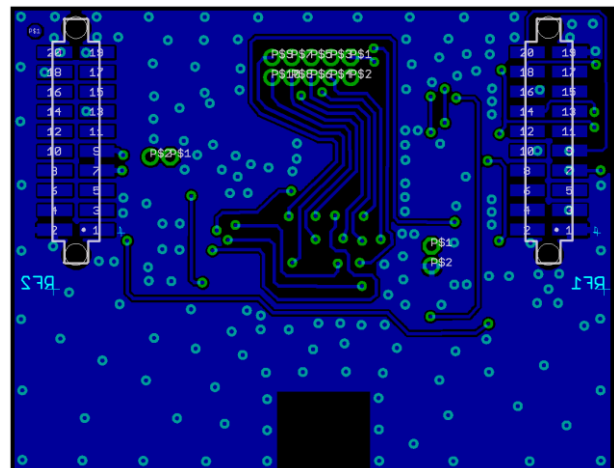
6.6   PCB Layout TOP/BOTTOM Layer

TOP Layer   Bottom Layer

6.7   Environmental Information

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

6.8   TC6000GN-EM1 Connector Pin Assignment

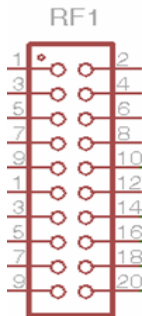### 6.8.1 Board to Board Connector RF1

All signal pins are connected to TC6000GN-P1 module through level shifters. The level shifters will adapt the 1.8V module levels to the 3.3V MSP-EXP430 and Stellaris board levels.
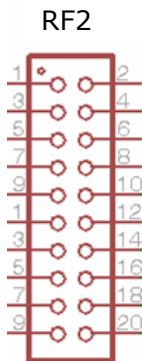

RF1 Connector		
Pin #	Pin Name	Description
1	GND	Common Ground
3	NC	
5	NC	
7	UART Rx	Input; main UART receive; logic level = 3.3V
9	UART Tx	Output; main UART NMEA transmit; logic level = 3.3V
11	NC	
13	NC	
15	NC	
17	NC	
19	GND	Common Ground
2	NC	
4	NC	
6	NC	
8	NC	
10	GPS PPS OUT	Output; precision pulse per second. Available only, when 3D fix is available. logic level = 3.3V
12	NC	
14	PUSH TO FIX	Input; set to high for normal operation, set to low for sleep times (RTC keeps working)
16	NC	
18	UART Rx	Input; duplicates Pin 7
20	UART Tx	Output; duplicates Pin 9

6.8.2 Board to Board Connector RF2

RF2

RF2 Connector		
Pin #	Pin Name	Description
1	NC	
3	NC	
5	NC	
7	Vcc	Input; 3.3V power supply
9	Vcc	Input; 3.3V power supply
11	NC	
13	FIX AVAILABLE	Output; Blinking once a second during acquisition, steady high during tracking
15	NC	
17	NC	
19	GPS RESET	Input; Must be set high by the controller to allow operation
2	GND	Common Ground
4	NC	
6	NC	
8	NC	
10	NC	
12	NC	
14	NC	
16	NC	
18	NC	
20	GPS PPS OUT	Output; precision pulse per second. Available only, when 3D fix is available. logic level = 3.3V

7 ORDERING INFORMATION

Ordering information		
Type	**Part#**	**Description**
TC6000GN-EM1	4037735104372	Evaluation Kit for TI microcontroller boards

8 GPS Antenna Switch Evaluation Board

GNS offers an GPS antenna evaluation board to switch between an passive GPS chip antenna and an active or passive GPS antenna input. It can be used for verifying GPS signal strength estimation at special GPS application conditions.
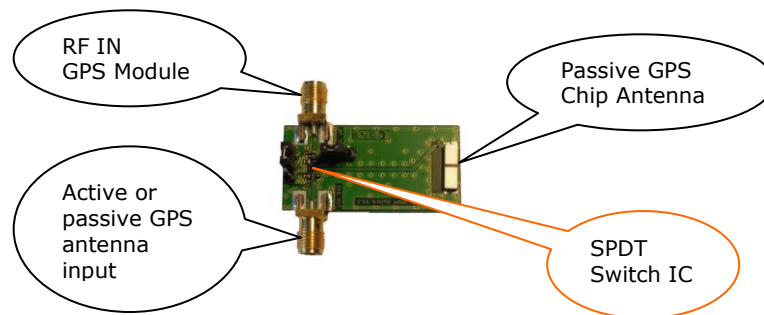
GNS part#: 4037735104549 „GPS_SPDT_Switch"

For more information and User manual for the GPS_SPDT_Switch evaluation board, visit: www.forum.gns-gmbh.com

9 RELATED DOCUMENTS

Type	description	Ref	Available from
TC6000GN-P1_DesignGuide	Contains information about implementation of the module and antenna design	[1]	www.forum.gns-gmbh.com
TC6000GN-P1 data sheet	Data sheet for TC6000GN-P1 module	[2]	www.forum.gns-gmbh.com
TC6000GN StarterKit_TestGuide	A guide for testing TC6000GN against other GPS receivers	[3]	www.forum.gns-gmbh.com
CC4000 firmware update	Wiki that explains update of TC6000GN-EM1 board on a MSP430F5529 experimenter board	[4]	http://processors.wiki.ti.com/index.php/CC4000_Firmware_Update
MSP430 software for TC6000GN	Wiki that explains the MSP430 software and links to source code downloads	[5]	http://processors.wiki.ti.com/index.php/CC4000_MCU_SW_Description
MSP430 Getting Started Guide	Wiki that explains how to setup and run the MSP430F5529 experimental board using the GNS TC6000GN-EM1 evaluation board	[6]	http://processors.wiki.ti.com/index.php/CC4000_GPS_MSP-EXP430F5529_Getting_Started_Guide
GPS Antenna Connection Design Guide	Design Guide to implement an GPS antenna to an application PCB	[7]	www.forum.gns-gmbh.com

DOCUMENT REVISION HISTORY

date	version	author	comment
04/13/2012	V1.0	MR	Initial document
03/14/2014	V1.1	MR	High resolution schematic picture added