Global Positioning System (GPS) Receiver

Benefits

- Reduce board space with software signal correlator, eliminating the need for hardware correlator
- Increase design flexibility with software supporting multiple tasks on the receiver DSP
- Improve functionality with support for multiple Radio Frequency (RF) front-ends
- Enable portable applications with low-power DSP-based solution minimizing board space

SPIRIT CORP
DSP Software Source

Telephony algorithms provided by SPIRIT-DSP

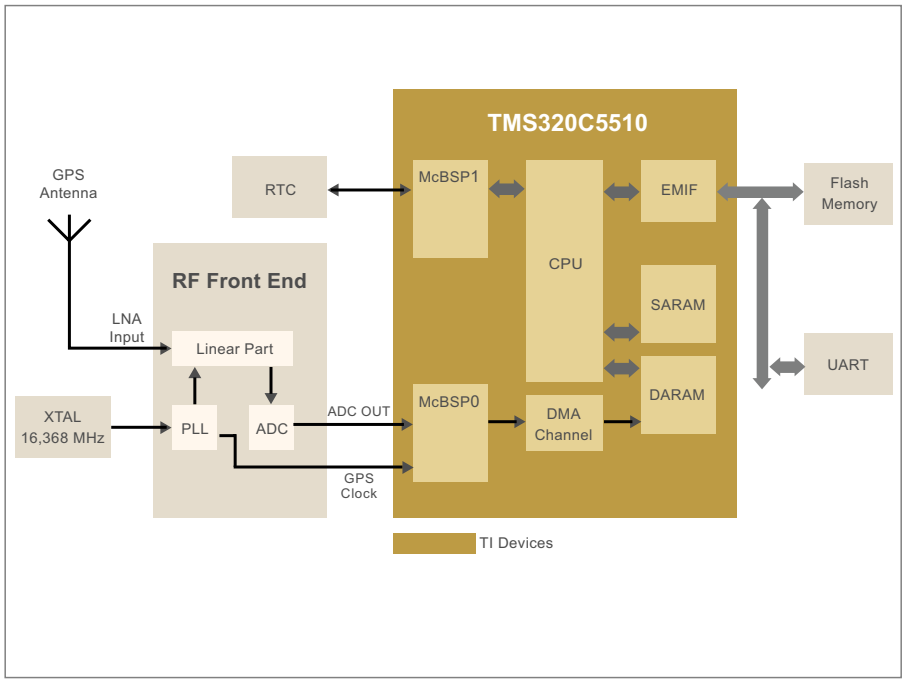
Target Applications

- **Automatic vehicle location and fleet tracking devices**
- **Car security systems**
- **Mobile handheld devices, such as PDAs, where position location capability is a distinguishing, but not a primary importance feature**
- **Maritime navigation systems**
- **Applications with high-accuracy position location, velocity estimation and time synchronization requirements**

Telecom solutions based on Texas Instruments DSPs offer developers the flexibility to design a variety of products. These solutions include low-power DSPs and comprehensive, field-proven software supporting industry standards and development tools, which significantly cut power consumption, reduce development time, minimize board space, and enable wired and wireless data, voice, telephony and connectivity functions.

For developers of 12-channel GPS receivers, SPIRIT has developed a software solution based on the TI OMAP™ and TMS320C55x™ DSP platforms. The software package includes a 12-channel correlator, signal search and detection algorithms, and a signal tracking and navigation task solution. The receiver requires signal input from a GPS antenna and calculates coordinates, velocity and time. An 8-channel version of the receiver is also available.

System Example: 12-Channel SW GPS Receiver Portable Device



Global Positioning System (GPS) Receiver

Functional Description

Hardware
• TI TRF5101 Front-end transceiver performs GPS signals receiving, amplification, pass band filtering and digitization
• TI C5510 DSP performs all necessary processing including signal correlation
• Real-Time Clock (RTC) is used for time storing between receivers on/off
• Flash memory is used for storing of the GPS almanac and programs
• UART is utilized for communication of the receiver with other devices
H/W Performance
• Up to 12 channels during signal search
• Frequency: L1, C/A-code
• Position accuracy: 8 m (rms)
• Velocity accuracy: 0.05 m/sec
• Timing accuracy: 100 ns or less
• Sensitivity: -140 dBm (tracking)
• Reacquisition time: 2 sec or less
• Hot start: 10 sec
• Warm start: 30 sec
• Cold start: 60 sec
• Power Consumption: <=250 mW
• Advanced signal processing algorithms: Phase Locked Loop, Delay Locked Loop and Kalman Filtering which forecast frequencies and delays of potential visible satellites
Performance
Implementation of the 12-channel software GPS requires about 150 MIPS. Main allocation of MIPS consumption is initial signal processing:
• Unpacking of signals from RF Front-end (17 MIPS)
• Signal correlation (about 5.5 MIPS per correlation channel)
• Preparing of channel reference signal (7 MIPS)
Data memory: 270 kBytes
Program Memory: 40 kBytes
Main part of memory is used by SW correlator:
• Input signal buffer (42 kBytes)
• Unpacked channel reference signals (11 kBytes per channel)
• Buffer for unpacked channel reference signal (22 kBytes)
• GPS PRN codes storing (22 kBytes)

Component Selection

Hardware

- TI TMS320VC5510 or TI OMAP5910 DSP Processors
  TRF5101 RF Transceiver
- TCXO, 10.000 MHz crystal device
- Real-Time Clock (RTC): A lot of RTC chips are present in the market; good choice is MAXIM DS1339 in a µSOP package
- UART driver: MAX2338
- Flash memory: any kind of flash memory can be used including serial flash memory chips and parallel, recommended size is 64 Kbytes

Software

- SW GPS software from SPIRIT

Getting Started – Development Tools

Tools

- TMS320VC5510 DSP Starter Kit (DSK)

Documentation

- TMS320VC5510 Fixed-Point Digital Signal Processor Data Manual, SPRS076F
- OMAP5910 Dual-Core Processor Data Manual, SPRS197A
- SW GPS Datasheet
- Complete schematics of a GPS receiver based on Texas Instruments TMS320C55x™ DSP chip and TRF5101 RF Front-end (usage of any other appropriated RF Front-end is possible)
- Software in object code form for C55x™ DSPs
- Software in object code form for OMAP™ processors

Additional documentation and support is available from Spirit Corp

Contact Information for Questions/Support

To purchase this solution or for more information, please contact Spirit Corp. at: biz@spiritdsp.com

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265