Software Defined Radio

**Benefits**

- Leverage scalable system configuration for diverse product lines
- Support rich functionality with expandable solution
- Decrease time to market with rapid build and simulation of system blocks
- Simplify design with flexible task allocation
- Leverage compatibility with MathWorks Simulink® (key to model-based development)

Software defined radio solutions based on Texas Instruments DSPs offer developers the flexibility to design a variety of wireless communication radios. These solutions include industry standard software and hardware development tools that will significantly reduce the time to market and cost of development.

Sundance’s SMT8096 development platform supports the design and development of a wide range of radio and waveform applications. It can be used for prototyping military and public safety communication radios, wireless base stations and for high-speed data acquisition applications. The SMT8096 is a rapid-prototyping solution package, comprised of an SMT310Q PCI Carrier hosting SMT395 DSP and SMT350 ADC/DAC modules. The SMT310Q is a quad-site module carrier developed to provide access to a Texas Instruments Module (TIM) over the PCI bus running at 33 MHz with a 32-bit data bus. The card has an on-board XDS510 compatible JTAG controller. This allows Code Composer Studio™ Development Tools and 3L Diamond applications to be used to debug and upload software to modules. The SMT395 is based on the 1 GHz 64-bit TMS320C6416T DSP enabling data pre-processing. The SMT350 is based on two 14-bit TI ADS5500 ADCs sampling at up to 125 MSPS and dual TI DAC5686 sampling at up to 500 MSPS. This unit is used for digital up conversion and down conversion.

The solution supports Windows® Operating System, VxWorks, QNX and Linux environments and includes full integration and compatibility with The MathWorks simulation and code generation tools and also the Celoxica DK-Suite of ESL tools via Sundance’s SMT6040 and SMT6050 Toolkits.

**System Example: Software Defined Radio**

**Target Applications**

- Military communications radios
- Public safety radios
- Next generation handsets
Software Defined Radio

Component Selection
A list of all suggested devices on the system block diagram follows:

- DSP: TMS320C6416T
- ADC: ADS5500
- DAC: DAC5686
- Clock Generator: CDC7005
- Power Management: TPS54610 DC/DC
- LVDS Cross point switch: SN65LVCP23
- PLL Clock Driver: CDCVF25081
- Power Management: TPS79533
- Clock Synchronizer: CDCM7005

Hardware

SMT350
ADC Inputs
- Input voltage range: 1 Vp-p
- Impedance: 50
- Bandwidth: 750 MHz
- External sampling clock inputs frequency range: 10-125 MHz
- External trigger inputs frequency range: 62.5 MHz max
- Output data width: 14 Bits
- Data format: 2’s compliment or offset binary
- SFDR: 82dB maximum
- SNR: 70dB maximum
- Maximum sampling frequency: 125 MHz

DAC Output
- Output voltage range: 1 Vp-p
- Impedance: 50
- External sampling clock inputs frequency range: 1-160 MHz
- External trigger inputs frequency range: 80 MHz max
- Output data width per channel: 16 Bits
- Data format: 2’s compliment or offset binary
- SFDR: 89dB maximum
- SNR: 80dB maximum
- Maximum input data rate: 160 MSPS
- Maximum sampling rate: 500 MSPS

Software Defined Radio

SMT395
This single-width TIM standard module is fitted with a TMS320C6416T DSP. The following list shows the main C6416T DSP characteristics:

- DMA / McBSP / Timer: 64 / 3 / 3
- On-chip memory: 1056k bytes
- Speed/Frequency: 1 GHz
- Other Peripherals: Viterbi and Turbo decoders
- EMIF Frequency: 133 MHz

Software
Software components utilized in the SMT8096 are from Sundance, 3L, The MathWorks and Celoxica®.
Every Sundance carrier board is shipped with:

- SMT6300, which will install the necessary device drivers for the SMT6001, which includes the device drivers, boot loader and configuration software for turn-key solutions.
- SMT6025, which is an efficient, ready-to-use, host side interface to Sundance hardware. It allows you to control Sundance carrier boards from the host as well as to exchange data between the host and TIMs on these carrier boards.

Contact Information for Questions/Support
To purchase this solution email: sales@sundance.com and for more general information: www.sundance.com
Sundance has provided answers to ‘Frequently asked questions’ at: http://www.sundance.com/edge/files/productpage.asp?STRFilter=STMT8096
Sundance also provides a range of Interactive forms to support customer inquiries:
- Technical or customer support questions: http://www.sundance.com/edge/files/forms.asp?subject=tech
- Direct contacts (phone, etc.) are available from: http://www.sundance.com/edge/files/contact.asp

Trade-off Analysis
This solution is defined for high-end, high-performance solutions. It is possible to reduce cost by selecting lower performance DSPs, for example, 600 MHz parts and/or lower spec ADC/DACs where the system demands lower sample rates resolutions or power consumptions.
Sundance supports multiple TIM modules and can offer a 600 MHz to 1 GHz TMS320C6416T solution or a 300 MHz TMS320C6713 solution. The choice of ADC/DAC Module could depend on the target market.

Getting Started
Tools
This SDR solution is a complete hardware and software development environment comprised of:

- SMT310Q PCI Carrier
- SMT395 DSP Module
- SMT368 FPGA Module
- SMT350 ADC/DAC Module
- SMT6001 Windows® Device Drivers
- SMT6025 Windows Host API
- Cables

Documentation
- All relevant technical documentation available from Sundance
- Sundance SMT8096 solution includes:
  - Product Manual
  - Application Note
  - Circuit Diagrams
  - MTBF Figures
  - Frequently asked questions
  - On-Line Help: www.sundance.com/docs/Sundance.chm
  - Support Forum: http://support.sundance.com/
  - Installation Wizard: http://support.sundance.com/updates/wizards/setup.exe

Technology for Innovators, the black/red banner and Code Composer Studio are trademarks of Texas Instruments. Windows is a registered trademark of Microsoft Corporation.
MathWorks, VxWorks, QNX and Celoxica trademarks are the property of their respective owners.

© 2005 Texas Instruments Incorporated
Printed in the U.S.A.
SPRT348A
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:

<table>
<thead>
<tr>
<th>Products</th>
<th>Applications</th>
<th>Products</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplifiers</td>
<td>amplifier.ti.com</td>
<td>Audio</td>
<td><a href="http://www.ti.com/audio">www.ti.com/audio</a></td>
</tr>
<tr>
<td>Data Converters</td>
<td>dataconverter.ti.com</td>
<td>Automotive</td>
<td><a href="http://www.ti.com/automotive">www.ti.com/automotive</a></td>
</tr>
<tr>
<td>DSP</td>
<td>dsp.ti.com</td>
<td>Broadband</td>
<td><a href="http://www.ti.com/broadband">www.ti.com/broadband</a></td>
</tr>
<tr>
<td>Interface</td>
<td>interface.ti.com</td>
<td>Digital Control</td>
<td><a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a></td>
</tr>
<tr>
<td>Logic</td>
<td>logic.ti.com</td>
<td>Military</td>
<td><a href="http://www.ti.com/military">www.ti.com/military</a></td>
</tr>
<tr>
<td>Power Mgmt</td>
<td>power.ti.com</td>
<td>Optical Networking</td>
<td><a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Telephony</td>
<td><a href="http://www.ti.com/telephony">www.ti.com/telephony</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Video &amp; Imaging</td>
<td><a href="http://www.ti.com/video">www.ti.com/video</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wireless</td>
<td><a href="http://www.ti.com/wireless">www.ti.com/wireless</a></td>
</tr>
</tbody>
</table>

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

Copyright © 2005, Texas Instruments Incorporated