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)
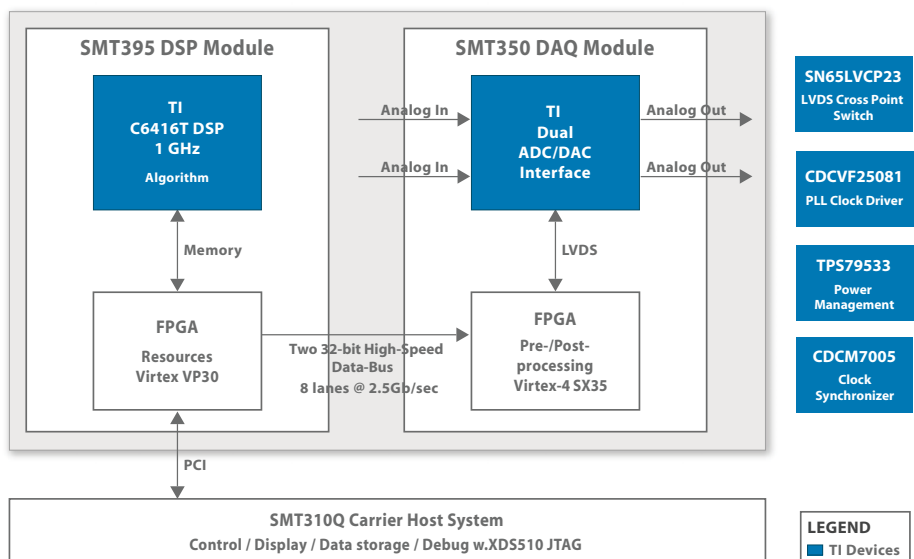
SUNDANCE   SUNDANCE

Target Applications

- Military communications radios
- Public safety radios
- Next generation handsets

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

SMT395 DSP Module	SMT350 DAQ Module
TI C6416T DSP 1 GHz — Algorithm	TI Dual ADC/DAC Interface
Memory	LVDS
FPGA Resources Virtex VP30	FPGA Pre-/Post-processing Virtex-4 SX35

Analog In / Analog In — Analog Out / Analog Out

Two 32-bit High-Speed Data-Bus 8 lanes @ 2.5Gb/sec

PCI

SMT310Q Carrier Host System
Control / Display / Data storage / Debug w.XDS510 JTAG

SN65LVCP23 LVDS Cross Point Switch

CDCVF25081 PLL Clock Driver

TPS79533 Power Management

CDCM7005 Clock Synchronizer

LEGEND
TI Devices

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

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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.

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

TEXAS INSTRUMENTS

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