Red Rapids

Signal FPGA™ RX2 12/1600

Model 376

- **Available in XMC, CCXMC, PCIe formats**
- **12-bit ADC with AC or DC coupled inputs**
- **Dual/single channel modes (1.6/3.2 GHz)**
- **Three Xilinx Kintex-7 FPGA size options**
- **Two banks of QDR II+ SRAM (32 Mbytes)**
- **On-board frequency synthesizer**
- **Temperature and current monitors**
- **PCI Express (PCIe) x8 Gen 2 bus**
- **Scatter-gather DMA bus master**
- **FPGA core library for data interfaces**
- **Windows, Linux, VxWorks drivers & API**
- **Reference design with source code**

FPGA Signal Processor

The Signal FPGA™ product family provides the ideal platform to rapidly field application specific signal acquisition and generation functions minus the expense of custom hardware development. All of the products share a common FPGA processing architecture and code base with different interface options tailored to a variety of market needs.

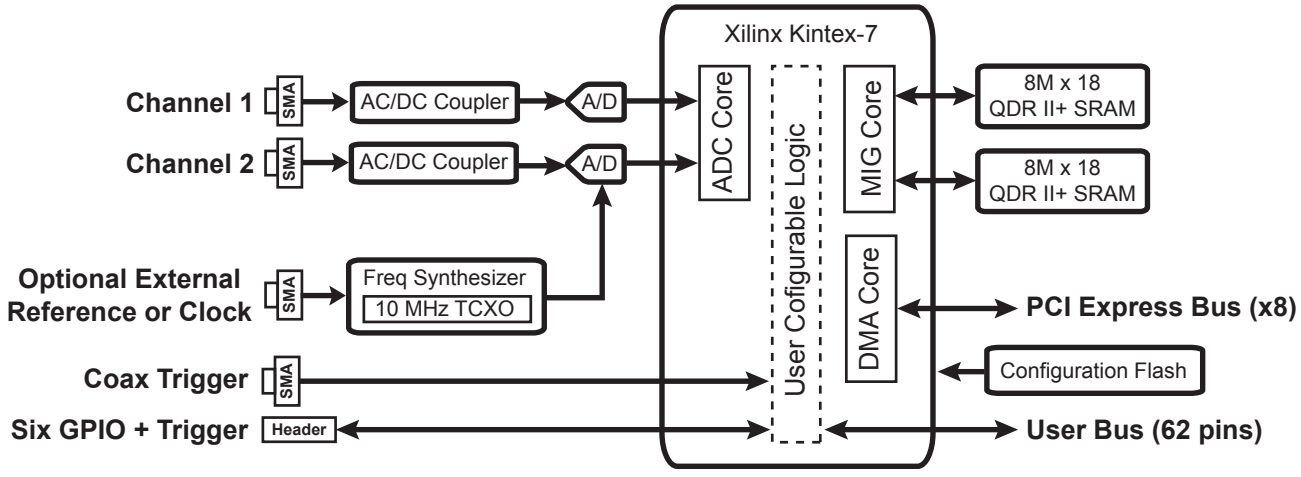
The Model 376 is designed around the Texas Instruments ADC12D1600 12-bit ADC. The 1.6 GHz sample clock is supplied by either the on-board frequency synthesizer or an external source. The frequency synthesizer can be phase locked to the local 10 MHz TCXO or an external reference can be used to achieve system-wide phase coherence.

The Model 376 is available as a PCI Express mezzanine card (XMC), conduction cooled mezzanine card (CCXMC), or half-length PCI Express (PCIe) adapter card. The CCXMC can be mounted to any VITA 20-2001 compliant host without modification. All form factors offer four lane (x4) or eight lane (x8) bus operation at Gen 2 performance. An optional user defined parallel bus is also available on the XMC P4 connector or a rear facing connector on the PCIe adapter.

The FPGA is selected from the Xilinx Kintex-7 platforms. A variety of size and speed grade options are offered to optimize the price/performance ratio over a wide range of applications. The FPGA communicates with the host processor through an integrated endpoint block for PCI Express, leaving the majority of logic uncommitted for customer applications.

The Model 376 includes 32 Mbytes of QDR II+ SRAM operating at 500 MHz. The SRAM interfaces to the FPGA through separate 18-bit read and write ports to achieve a combined 8 Gbytes/sec data transfer rate. This allows high-speed signal acquisition independent of PCIe bus throughput.

A general purpose I/O (GPIO) header provides six bidirectional signals to communicate with external hardware. The GPIO header also includes a 50 ohm terminated trigger input to synchronize with an external event or clock source.



Red Rapids

Signal FPGA™ RX2 12/1600

Model 376

The GPIO header also provides the JTAG connections to the FPGA. The JTAG port is used to program the configuration flash memory or connect the Xilinx ChipScope tool for debug.

A 50 ohm terminated coaxial input offers a second trigger source that provides controlled impedance through the cable interconnect.

The Model 376 monitors both power consumption and temperature for ultimate visibility into the actual operating characteristics of a specific FPGA design. Current measurements are available on all of the primary voltage supplies. Temperature sensors monitor the FPGA die temperature, ADC die temperature, and four other locations on the card.

The Kintex-7 FPGA is supported by a robust set of development tools from Xilinx. Creation of user configuration code follows the standard design flow. Cores are provided in VHDL source code for interfaces to the ADC and command/status utility functions. Pregenerated Xilinx Coregen functions are supplied for the SRAM interface and PCI Express Endpoint block. The EZDMA2 core from PLDA is supplied with the product in EDIF netlist format at no additional charge.

The EZDMA2 core manages data transfers between the Model 376 and host memory. The DMA engine allows the receiver to automatically initiate a PCI burst transaction when a channel requires service. High performance DMA techniques are supported by both the hardware and software to optimize data transfer efficiency. Memory fragmentation problems are eliminated by supporting thousands of scatter-gather DMA buffers in host memory.

The Signal FPGA ships with diagnostic firmware preloaded in the PROM to quickly verify hardware and software integrity when it is installed on the host computer. The diagnostic software performs a snapshot signal capture on all receiver channels simultaneously. The data from each channel is stored in a separate disk file for analysis. A verification utility is also provided to analyze the data and report the characteristics of the signal that was captured.

Typical Applications

- **Multi-channel wideband signal acquisition**
- **Electronic intelligence (ELINT) collection**
- **Software defined radio**
- **Algorithm prototyping**
- **Signal recorder**

Specification Summary

Receiver Performance

Preliminary characteristics*:
- Full power bandwidth: 2.8 GHz
- SNR: 58 dB (First Nyquist typical)
- SFDR: 68 dBc (First Nyquist typical)
- Channel isolation: 80 dB (typical)

Phase noise: -100 dBc/Hz (10 kHz offset)
Internal reference: 10 MHz +/- 1.0 ppm

**Subject to change.*

Hardware

Format: XMC, CCXMC, half-length PCIe
PCIe: x4 or x8 Gen 2
GPIO: 6-bit LVTTL or 3-bit LVDS
Optional external reference or sample clock
Coaxial trigger (50 ohm terminated)
GPIO trigger (50 ohm terminated)
User bus: 62-bit LVTTL or 24-bit LVDS
Power dissipation: 10 to 20 Watts
Airflow: 250 LFM at 35 degrees C

Software

Adapter driver: Linux, Windows, VxWorks
FastApp interpreter and C code generator
Signal Stream Lite application example

Build Options

Kintex-7 FPGA:
- XC7K160T, XC7K325T, XC7K410T
- Speed/temp grades: -L2E, -3E, -2I

Synthesizer frequency:
- 1.6 GHz (Maximum ADC specification)
- 1.33 GHz (1 GHz IF sampling)
- Programmable (Degraded phase noise)

Depopulate memory for cost/power benefit
Conformal coat for harsh environments

Red Rapids
797 North Grove Rd, Suite 101
Richardson, TX 75081
Phone: 972-671-9570
Fax: 972-671-9572
www.redrapids.com

Red Rapids reserves the right to alter product specifications or discontinue any product without notice. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement. This product is not designed, authorized, or warranted for use in a life-support system or other critical application. All trademarks and registered trademarks are the property of their respective owners. (© 2013 Red Rapids, Inc.)