Delivering DSP Performance with Xilinx FPGAs

Next-generation products that include digital signal processing (DSP) need to deliver more performance and flexibility than ever. Designers must also drive down bill of material (BOM) cost and power budgets, and get to market faster to keep pace with competitors.

Xilinx FPGAs meet these challenges with proven flexibility and the power to achieve unmatched system performance through massive hardware parallelism. The latest Xilinx FPGAs can deliver more than 5000 GMACs fixed-point and 1.3 TFLOPs floating-point system performance, putting them far beyond traditional DSPs in terms of total performance and performance per watt. This industry-leading silicon technology forms the basis of targeted design platforms that accelerate time to productivity and enable customers to focus on adding unique value.

Xilinx DSP Platforms

Xilinx DSP platforms are out-of-the-box platforms that streamline DSP development processes and improve productivity. Each platform includes development boards, IO daughter cards, design tools, plug-and-play IP, and proven reference designs. Designers have a choice of RTL and high-level design methodologies to extend and modify the designs to meet end-user requirements.

The Kintex-7 FPGA DSP Kit makes it easy to order the complete platform, and includes a high-speed analog FMC daughter card for flexibly interfacing to real-world signals.

Target Markets for Xilinx DSP Development Platforms

Xilinx DSP platforms enable a broad range of applications in multiple market segments including:

- Wireless communications
- Aerospace and Defense
- Instrumentation
- Medical imaging
- General-purpose DSP
Silicon
The Spartan-6, Virtex-6 and 7 series device families are optimized for DSP with just the right mix of hardware resources to satisfy the unique demands for price, performance, power efficiency, bandwidth, and I/O.

Spartan-6 FPGAs
- Optimized for low cost DSP with high-speed serial connectivity
- Delivers over 60 GMACs of DSP performance in low-cost FPGAs
- Target applications include wireless, defense, consumer video and medical equipment

Virtex-6 FPGAs
- Optimized for ultra high-performance DSP with low-power serial connectivity
- Up to 2,016 DSP macro blocks are available to deliver over 1,000 GMACs of DSP processing bandwidth
- Address the most demanding applications in wireless, aerospace and defense, 3D medical image processing and broadcast applications

Kintex-7 FPGAs
- Best price-performance ratio
- Delivers up 2,845 GMACs of DSP performance
- Target applications include LTE baseband, aerospace and defense and multi-mode radio

Virtex-7 FPGAs
- Highest system performance
- Delivers up 5,335 GMACs of DSP performance
- Target applications include medical imaging, RADAR and high-performance computing

The DSP48 Slice
Xilinx FPGAs include specialized arithmetic processing engines called DSP48 slices that deliver massive processing bandwidth. Key features include:
- Support for many independent functions including a multiply, multiply and accumulate (MACC), multiply-add, three-input add and barrel shift
- Pre-adder enables higher performance symmetric filters

Support for Industry Standard AMBA 4 AXI4 Interface
The Xilinx DSP Targeted Design platforms support the industry standard AXI4™ interface. Users can learn a single interface specification to create synchronized DSP datapaths and integrate those datapaths into complete systems.

DSP IP
Xilinx provides the industry’s largest portfolio of DSP, video and floating-point IP blocks that deliver exceptional efficiency/performance results. This IP supports the industry standard AXI interface that simplifies the creation of complex datapaths.

Tools
Xilinx DSP targeted design platforms support multiple design flows to ease FPGA-based signal processing design. Design flows are available from Xilinx and third-party partners allowing designs to be created using RTL, Simulink, MATLAB, and C/C++ and be synthesized to a Xilinx FPGA.

System Generator for DSP
Xilinx DSP platforms include System Generator for DSP, the industry's leading high-level tool for designing high-performance DSP systems using FPGAs. System Generator enables high-level models to be created using MATLAB and Simulink and provides automatic code generation, hardware co-simulation and system integration into RTL or embedded systems. System Generator supports the industry standard AXI4 interface that simplifies the creation of complex DSP datapaths and system integration of DSP datapaths into system designs.

High-Level Synthesis Design Flows
Xilinx works closely with third-party High-Level Synthesis providers to deliver easy to use design flows tightly integrated into our DSP Platforms. These flows enable traditional DSP programmers and hardware designers working from C/C++ executable specifications to easily target their designs to Xilinx FPGAs.
DSP Kits

The following kits provide everything needed to get started right out of the box, greatly improving designer productivity and saving development time.

**AVNET SPARTAN-6 FPGA DSP KIT**

Each Spartan-6 FPGA DSP Kit for high-volume DSP applications includes:

- Avnet Spartan-6 LX150T Development Board including Spartan-6 LX150T FPGA
- ISE Design Suite System Edition (including System Generator for DSP)
- Evaluation version of MathWorks MATLAB

**AVNET KINTEX-7 FPGA DSP KIT WITH HIGH-SPEED ANALOG**

The Kintex-7 FPGA DSP Kit for high-performance DSP applications includes:

- Xilinx KC705 Development Board including Kintex-7 XC7K325T-2FFG900C FPGA
- ISE Design Suite System Edition (including System Generator for DSP)
- Evaluation version of MathWorks MATLAB/Simulink Software.
- 4DSP FMC150 AD/DA featuring dual-channel 800 MSPS 16-bit DAC and dual-channel 250MSPS 14-bit ADC.

Each kit also includes:

- Performance tuned DSP Targeted Reference Designs that work with any of the supported design flows
- Third-party support for FMC I/O daughter cards and High-Level Synthesis design flows

**AVNET VIRTEX-6 FPGA DSP KIT WITH AD/DA**

Each Virtex-6 FPGA DSP Kit for high-performance DSP applications includes:

- Xilinx ML605 Development Board including Virtex-6 LX240T FPGA
- ISE Design Suite System Edition (including System Generator for DSP)
- Evaluation version of MathWorks MATLAB.
- 4DSP FMC150 AD/DA featuring dual-channel 800 MSPS 16-bit DAC and dual-channel 250MSPS 14-bit ADC.

**AVNET TEXAS INSTRUMENTS OMAP / SPARTAN-6 FPGA CO-PROCESSING KIT**

Spartan-6 Co-Processing Kit for performance acceleration and peripheral expansion applications includes:

- Avnet Spartan-6 LX45T Development Board with Xilinx Spartan-6 LX45T Device, Texas Instruments OMAP L-138 with C674X DSP core and ARM9 CPU
- ISE Design Suite System Edition (including System Generator for DSP)
- Evaluation version of Texas Instruments code composer studio
- Evaluation version of MathWorks MATLAB

Each kit also includes:

- Cables, power supply, and compact flash
- Getting Started Demo
Targeted Reference Designs

What is a Targeted Reference Design?
Each DSP kit comes with a DSP targeted reference that serves a number of valuable purposes, including the verification of working hardware and tool flows, as well as providing design sources that can be used as is or customized. Each reference design is a complete, integrated, and validated real-world system design that comes pre-configured and operational out of the box. The reference examples are modular in format to facilitate easy reuse and user customization. Flexibility is a key benefit here as you can use these design modules as-is in your own end products royalty free, or customize the sources to meet your own similar but unique requirements. Each example is a complete design that represents real market applications rather than a merely a subset of functionality. These reference designs help engineers be more productive:

- New FPGA Users - Simplifies their learning curve by allowing them to quickly evaluate the benefits of FPGA flexibility and performance
- Mainstream FPGA Users - Leverages their Xilinx platform expertise with technology integration and customizable modules to make them more productive
- Expert FPGA users - Delivers a holistic platform for development, customization, and system testing as well as validation of IP easing migration of next generation designs or upgrades

What DSP Targeted Reference Designs are delivered?
The Xilinx FPGA DSP kits all include Targeted Reference Designs integrated with the HW, SW Tools and IP. These designs will be different for each kit allowing customers to explore the highest performance, performance and cost/power optimizations as well as how to boost performance in a co-processing application. The various reference designs support the AMBA 4 AXI4 IP and interconnect standard and are available for download from the kit product pages on: www.xilinx.com/dsp.

DSP Kit Design Flow

1. GETTING STARTED
   - Read the Getting Started Guide
   - Connect the cables
   - Power-up the board
   - Load the reference designs
   - Demo up and running

2. EVALUATE
   - Evaluate reference design using interactive web-based user interface

3. CUSTOMIZE
   - Open the design tools
   - Customize the reference designs
   - Generate a new design
   - Download and run

Take the NEXT STEP

For more information about Xilinx solutions for Radio, please visit: www.xilinx.com/dsp

Corporate Headquarters
Xilinx, Inc.
2100 Logic Drive
San Jose, CA 95124
USA
Tel: 408-559-7778
www.xilinx.com

Europe
Xilinx Europe
One Logic Drive
Citywest Business Campus
Saggart, County Dublin
Ireland
Tel: +353-1-464-0311
www.xilinx.com

Japan
Xilinx K.K.
Art Village Osaki Central Tower 4F
1-2-2 Osaki, Shinagawa-ku
Tokyo 141-0032 Japan
Tel: +81-3-6744-7777
japan.xilinx.com

Asia Pacific Pte. Ltd.
Xilinx, Asia Pacific
5 Changi Business Park
Singapore 486040
Tel: +65-6407-3000
www.xilinx.com

© Copyright 2012 Xilinx, Inc. XILINX, the Xilinx logo, Virtex, Spartan, ISE and other designated brands included herein are trademarks of Xilinx in the United States and other countries. All other trademarks are the property of their respective owners.

Printed in the U.S.A. PN 2472-1