XILINX®

IP Solutions: System-Level Designs for FPGAs

Background

Designers everywhere are using Xilinx FPGAs to implement system-level functions in demanding applications including communications, high-speed networking, image processing, and computing. Xilinx offers the industry's largest selection of intellectual property (IP) cores, which serves as the foundation for accomplishing complex system-on-a-chip designs. Xilinx cores are pre-defined, tested, and verified to ensure correct functionality. In addition, Xilinx cores utilize Smart-IP technology to predetermine the implementation providing optimal and predictable performance and utilization.

The broadest selection of industry-standard solutions offered by Xilinx comprise two IP sources: LogiCORE™ and AllianceCORE™. The LogiCORE program being the most successful in the industry, offers cores exclusively for Xilinx FPGAs. These cores are sold and supported by Xilinx. The AllianceCORE program provides a broad selection of third-party cores customized for use with Xilinx FPGAs and CPLDs.

Smart-IP Core Design Methodology

Smart-IP technology is a combination of several features designed to deliver highest performance, predictability, and flexibility when implementing IP with Xilinx FPGAs.

Smart-IP technology ensures constant core performance regardless of its position in the FPGA device; maintained performance when multiple cores are integrated in the same FPGA device; and no performance degradation when migrating to larger devices.

Xilinx IP Center on the Web

The Xilinx IP Center offers a comprehensive list of LogiCORE and AllianceCORE products, reference designs, and application notes. It also provides access to AllianceCORE partners and to partners from the Xperts consultants program.

All cores, reference designs, and design reuse tools from Xilinx are delivered over the Internet; the latest versions of these products are available for download from the Xilinx IP Center at **www.xilinx.com/ipcenter**.

CORE Generator System™

The Xilinx CORE Generator system generates and delivers parameterizable cores optimized for Xilinx FPGAs. You use the Xilinx CORE Generator system to design high-density

Xilinx FPGA devices and achieve high-performance results, while reducing your design time.

CORE Generator Features:

- Simple, intuitive operation – Select a core, enter parameters, and generate
- Compatible with VHDL, Verilog, and Schematic top-level design flows
- Cores are delivered with a logic design plus an optimal floorplan or layout
- Performance is independent of FPGA device size
- Performance stays constant as more cores are added
- Optimal results as measured against the best hand-packed design
- Data sheet and VHDL behavioral model with each core
- Ready access to intellectual property from Xilinx and Xilinx partners
- Predictable and repeatable results: core performance is specified in advance
- PC and Workstation platforms supported

CORE Generator Benefits:

- Faster time-to-market
- Fast core generation time with proprietary Xilinx software
- Reduced place and route time with preplaced Cores
- Less engineering required with predesigned cores
- Facilitates design reuse
- Build your design out of cores
- Simpler documentation with larger parameterizable building blocks
- Optimal core layout produces lower power dissipation

Xilinx Design Reuse

The need for design resuse has been apparent for many years; no company likes to put many man years of effort into a design that can be used only once. Today, thousands of designers are creating intellectual property (IP) on a huge scale, targeting the widely popular million-gate Virtex™ FPGA family which is ideally suited to support design reuse. For the latest most detailed information on Xilinx Design Reuse function, visit:

www.xilinx.com/ipcenter/designreuse/index.htm.

Xilinx PCI Solutions

PCI (Peripheral Component Interconnect) has become one of the most popular bus standards, not only for personal computers, but also for industrial computers, communication switches, routers, and instrumentation. It solves a wide range of compatibility problems and performance limitations that were encountered with the older ISA and VME standards.

However, PCI is also a significant design challenge; the stringent electrical, functional, and timing specifications are difficult to meet in any technology-and the standard keeps evolving to meet the dynamic needs of our industry. That's why you need a flexible PCI solution that will meet both your current and future requirements, while guaranteeing full PCI compliance with no limitations on performance or functionality.

Our first LogiCORE PCI product was released in January, 1996. Now, our PCI cores have been proven in over 1000 customer designs, clearly demonstrating that Real-PCI from Xilinx is the most flexible and cost-effective solution for your fully-compliant, high-performance PCI system.

Visit the Xilinx IP-Center for more details and datasheets on individual products, **www.xilinx.com/ipcenter.**

Features:

- **Real Compliance - all LogiCORE PCI products are:**
    - Fully verified using our industry-proven testbench that simulates over six million unique PCI cycles
    - Hardware verified
    - PCI cores and FPGAs characterized together for guaranteed maximum, minimum and hold timing
    - Smart-IP technology to maintain timing guarantees for every core implementation
- **Real Flexibility**
    - Supports Xilinx standard off-the-shelf PCI-compliant FPGAs
    - Range of device sizes and packages to choose from for most cost-effective solution
    - Integrates a fully-compliant target/initiator PCI interface, scalable dual-port FIFOs, customizable, DMA channels, and 7,000 to 2 million custom gates
    - Flexible source code Reference Designs available to exemplify back-end designs and accelerate time to market
    - Re-configurable FPGAs allows accommodation of future changes in the PCI standard or feature requirements
- **Real Performance**
    - Supports up to 66 MHz PCI systems
    - Operates at maximum throughput, with zero wait-state bursts
    - Full 32-bit and 64-bit data path

- **Real Availability**
    - All LogiCORE PCI products available from Xilinx IP-Center on the Internet (**www.xilinx.com/pci**) to give users instant access to latest versions
    - Easy and quick configuration via web-based configuration tool.
    - Generates unique netlists, implementation constraint files, simulation models and instantiation code for VHDL and Verilog
    - Design Kits available with 64-bit and 32-bit prototyping boards, driver development tools and Reference Designs
    - PCI training classes (3-4 days) available. See **support.xilinx.com** for details
    - Specially trained XPERTS partners available for design services such as retargeting to untested devices, integration, or core customization.

PCI Design Kits

Ballyinx 64/66 PCI Prototyping Board from Nallatech

The 64-bit Design Kit includes Ballyinx 64/66 PCI prototyping board with a XCV300-6 BG432 device that allows designers to quickly evaluate the performance of the Xilinx 64/66 PCI core in their system. In addition, the board demonstrates how to build a universal 3.3V and 5V PCI card. By incorporating Nallatech's DIME standard for modular expandability, the prototyping board can be used in a wide variety of system solutions including FPGA-based DSP.

HotPCI 32/33 PCI Prototyping Board from Virtual Computer Corporation

The 32-bit PCI Design Kit includes HotPCI 32/33 PCI prototyping board with an XCS40-4 PQ240 device that allows designers to quickly evaluate the performance of the Xilinx 32/33 PCI core in their system. The board includes 8x128K SRAM and is reconfigurable from the PCI bus.

SoftICE Driver Suite from Compuware

The Xilinx PCI Design Kits includes a standard license of Compuware's NuMega SoftICE Driver suite that accelerate the development and debugging of Windows device drivers. The SoftICE Drive Suite includes all versions of SoftICE, including SoftICE for Windows 2000/NT, SoftICE for Windows 95, SoftICE for Windows 3.1, and SoftICE for DOS along with DriveWorks, VtoolsD, and DriverAgent.

PCI Training

To further complete the Xilinx PCI solution, Xilinx offers a three-day PCI course for customers who are planning PCI systems. The course will give an introduction to the PCI standard, and will cover configuration and integration of core, system integration, verification and debug. More information can be found at **support.xilinx.com**.

Table 1: PCI Solutions Ordering Information

Product part number	Description	Accessible Design Files	Prototyping Board	Driver Development Tools	Miscellaneous
DO-DI-PCI32-S	32-bit PCI for Spartan family	PCI32 Spartan-II PCI32 Spartan-XL PCI32 Spartan	No	No	All design files and docs delivered over the Internet
DO-DI-PCI32-DK	32-bit PCI Design Kit	Same as DO-DI-PCI32-S *plus:* PCI32 Virtex-E PCI32 Virtex PCI32 4000XLA	VCC HotPCI board with XCS40 PQ208	Compuware NuMega SoftICE Driver Suite	PCI Systems Architecture Text Book Printed Design Guide
DO-DI-PCI64	64/32-bit 33/66 MHz PCI	Same as DO-DI-PCI32-DK *plus:* PCI64/66 Virtex-E PCI64/66 Virtex PCI64 Spartan-II	No	No	All design files and docs delivered over the Internet
DO-DI-PCI64-DK	64-bit 66 MHz Design Kit	Same as DO-DI-PCI64	Nallatech Ballyinx 64-bit 66 MHz PCI Prototyping Card with XCV300 BG432	Compuware NuMega SoftICE Driver Suite	PCI Systems Architecture Text Book Printed Design Guide
DX-DI-M2DK-DK	Upgrade from DO-DI-PCIM (obsolete) to DO-DI-PCI32-DK[1]				
DX-DI-S2DK-DK	Upgrade from DO-DI-PCIS (obsolete) to DO-DI-PCI32-DK[1]				
DX-DI-PCI32-DK	Upgrade from DO-DI-PCI32-S to DO-DI-PCI32-DK[1]				
DX-DI-PCI64	Upgrade from DO-DI-PCI32-DK to DO-DI-PCI64[1]				
DX-DI-PCI64-DK	Upgrade from DO-DI-PCI64 to DO-DI-PCI64-DK[1]				

Note 1: Requires a valid maintenance contract

Xilinx DSP Solutions

With Xilinx DSP, users can combine ASIC-like performance and integration with the flexibility of a DSP processor implementation. By utilizing parallel computing techniques in a Xilinx FPGA, users can achieve radical performance advantage over fixed processors. The Xilinx FGA implementation will at the same time maintain maximum flexibility and the shortest time-to-market, which is lost using an ASIC implementation. Until now, tools to automate the design process have been lacking and only experienced FPGA designers have completed most designs manually.

With the introduction of Xilinx' CORE Generator System for DSP, complex parameterized DSP building blocks can be implemented automatically with the performance and density of a hand-tuned implementation. LogiCORE DSP modules can be used with VHDL-, Verilog- or schematic-based design methodologies.

Higher-level DSP cores and DSP prototyping boards are available from our AllianceCORE partners.

DSP system level modeling tools are available to mathematically model LogiCORE based FPGA designs and aid in determining optimal core parameters.

The Xilinx DSP Solution consists of:

- Standard Xilinx FPGA components - Virtex-E, Virtex, Spartan-II, Spartan-XL, Spartan and XC4000

- DSP parameterizable LogiCORE and AllianceCORE FPGA products, e.g., FIR Filters, FFTs, Reed-Solomon FEC cores, and Multipliers, supporting high-performance applications such as wireless communication, digital networking, image processing, DVB, and HDTV.
- DSP system level tools integration
- DSP starter kit
- Regional dedicated DSP Field Applications Engineers
- DSP Ph.D. level support
- Acquiring LogiCORE Products

Features

- ASIC-like DSP performance through parallel processing, for example:
  - 128-tap FIR filter, 8-bit data, 12-bit coefficients, 120 MSPS
  - 1024 point complex FFT, 16-bit input, 35 μs transform time
- Re-configurable FPGAs allows accommodation of specification and feature changes late in the design process and in end users' products
- Cost-effective implementation saves cost over Application Specific Standard Products (ASSP)
- Integrates DSP functions with memory, control and glue logic into single-chip solutions

- Xilinx LogiCORE includes Smart-IP technology to maintain timing independently of surrounding logic and device size

- Wide range of device sizes and packages to choose from for most cost-effective solution

- All LogiCORE PCI products available from Xilinx IP-Center on the Internet (**www.xilinx.com/pci**) to give users instant access to latest versions

- Easy and quick configuration via CORE generator or web-based configuration tool

- Generates unique netlists, implementation constraint files, simulation models and instantiation code for VHDL and Verilog

- Specially trained XPERTS partners available for design services such as retargeting to untested devices, integration, or core customization

Table 2: DSP Solutions Ordering Information

Product part number	Description	Accessible Design Files	Prototyping Board	Miscellaneous
DO-DI-RSE	Reed-Solomon Encoder	Parameterizable encoder for: • Virtex-E • Virtex • Spartan-II • Spartan-XL • Spartan • XC4000XLA	No	All design files and docs delivered over the Internet
DO-DI-RSD	Reed-Solomon Decoder	Parameterizable decoder for: • Virtex-E • Virtex • Spartan-II • Spartan-XL • Spartan • XC4000XLA	No	All design files and docs delivered over the Internet

Note 1: Free LogiCORE DSP modules such as FIR filters, multipliers, and FFTs are available for download to all Xilinx SW customers from Xilinx IP-Center. These cores are installed and configured with the Xilinx CORE generator.

AllianceCORE Products

Through the AllianceCORE program, Xilinx is expanding the availability of high quality cores for programmable logic by sharing what has been learned with leading third-party core developers.

The AllianceCORE program is a cooperative effort between Xilinx and independent third-party core developers. It is designed to produce a broad selection of industry-standard solutions dedicated for use in Xilinx programmable logic.

Xilinx takes an active role with its partners in the process of productizing AllianceCORE products. This is unique to the AllianceCORE program. Because the process is so involved, we work closely with our partners to select the right cores first which helps raise the quality and usability of the cores that are offered. A core must meet a minimum set of criteria before it can receive the AllianceCORE label.

Table 3: Xilinx AllianceCORE Products

Standard Bus Products
Generic Bus Arbiter
CAN Bus Interface
XF-TWSI Two-Wire Serial Interface (IIC) Master Only
XF-TWSI-MS Two-Wire Serial Interface (IIC) Master & Slave
IEEE 1394 FireWire Link Layer Core
IEEE 1394 FireWire Evaluation Board
Communications and Networking
Asynchronous Transfer Mode
IMA 8-Channel Inverse Multiplexing for ATM
IMA 32-Channel Inverse Multiplexing for ATM
Distributed Sample Scrambler
Distributed Sample Descrambler
Cell Assembler (CC-201)
Cell Delineation (CC-200)
CRC10 Generator and Verifier (CC-130)
CRC32 Generator and Verifier (CC-131)
UTOPIA Level 2 Slave Transmitter
UTOPIA Level 2 Slave Receiver
UTOPIA Level 2 Master (CC-140f)
UTOPIA Level 2 Slave on-chip FIFO (CC-141f)
UTOPIA Level 2 Slave off-chip FIFO (CC-143s)
Ethernet
10/100 Mbps Fast Ethernet MAC
10/100 Mbps Fast Ethernet MAC Core Evaluation Board
HDLC
Single-Channel XF-HDLC Controller
Single-Channel PPP8 HDLC Controller
Single-Channel HDLC Controller Core
Forward Error Correction
Reed Solomon Decoder
Reed-Solomon Encoder
Reed Solomon Decoder
Reed-Solomon Encoder
Convolutional Encoder
Viterbi Decoder
Telecommunications
Noisy Transmission Channel Model
ADPCM Codec
XF-MOD-DVB Satellite Modulator
X-3DES Triple Data Encryption Standard Cryptoprocessor
X-DES Data Encryption Standard Cryptoprocessor

Table 3: Xilinx AllianceCORE Products (Continued)

XF-DES Data Encryption Standard
MT1FT1 Framer
DSP Functions
Video and Image Processing
X_DCT/IDCT Discrete/Inverse Discrete Cosine Transform
X_JPEG JPEG Codec
YCrCb2RGB Color Space Converter
RGB2YCrCb Color Space Converter
DSP Core Development Tool
GVA-270 Virtex-E DSP Hardware Accelerator Board
GVA-220 DSP Hardware Accelerator Board
GVA-250 Virtex DSP Hardware Accelerator Board
GVA-200 DSP Hardware Accelerator Board
GVA-100 DSP Prototyping Board
Processor Products
C2901 Microprocessor Slice
C2910a Microprogram Controller
Flip805x-PR 8051/2 Core
V8 uRISC 8-bit RISC Microprocessor
Intellicore™ Prototyping System
Processor Peripherals
M8237 DMA Controller
M8254 Programmable Timer
C8255A Peripheral Interface
M8255 Programmable Peripheral Interface
XF-8255 Programmable Peripheral Interface
XF-8256 Multifunction Microprocessor Support Controller
C8259A Programmable Interrupt Controller
M8259 Programmable Interrupt Controller
XF-8279 Programmable Keyboard Display Interface
SDRAM Controller
DRAM Controller
200 MHz SDRAM Controller
UARTs
C_UART Compact UART
XF-8250 Asynchronous Communications Element
C8251 Programmable Communications Interface
C16450 UART
M16450 UART
C16550 UART with FIFOs
M16550A UART with RAM
C6850 Asynchronous Communications Interface Adapter (ACIA)
Generic Core Development Tools
Microprocessor-Based Core Evaluation Card

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XPERTS

Xilinx Program for Engineering Resources from Third Parties

Xilinx customers can take advantage of XPERTS, a world-wide program giving customers access to Xilinx-certified experts in Xilinx architecture, PCI designs, new design methodologies, customer or third-party IP customization and integration, and system level design. Partners (Table 4) have experience and expertise in delivering turn-key system designs for communications, networking, video and medical imaging and computer applications. Their experience with various standards and large systems design will complement your internal expertise to deliver the right product, at the right time and lowest cost.

Table 4: XPERTS Partners

XPERTS Partners	Telecom & Datacom	Networking	Imaging & Video
Advanced Digital Designs	X		X
Andraka Consulting			X
Applied Micro Technology Inc.	X		
Baranti			X
BARCO SILEX			X
Bottom Line Technologies Inc.			X
Comit Systems			X
DesignPRO Inc.	X		
Synchronous Design Solutions	X		
Dillon Engineering			X
ECLA Inc.		X	
Electronic Design Associates Inc.			X
Enator Elektroniksystem AB	X		X
EuroMIPS Systems	X		
GERPI	X		
Integrated Intellectual Property Inc. (I2P)		X	X
LP Technology Inc.	X		X
MultiVideo Designs			X
North Pole Engineering		X	X
Northwest Logic Design			X
Perigee			X
PLC 2	X		
Polybus		X	X
Rapid Prototypes Inc.			X
Roman-Jones Inc.			X
SECAD			X
Silicon & Software Systems	X		X
SO-LOGIC			X
SPEAR Technology CC			X
Synchronous Design Solutions	X		
Syntera Digital Solutions	X		
Thomas Design			X

Table 5: Xilinx LogiCORE Products

General-Purpose Cores
Asynchronous FIFOs (BlockRAM & Distributed RAM)
Memory Compilers (BlockRAM & Distributed RAM)
Multipliers (variable, parallel)
Multipliers (constant coefficient, loadable)
Divider
Counter
Accumulator
Adder-Subtractor
Comparator
Shift Register (Flip-Flop based)
Shift Register (RAM based)
Decoder (Binary)
Gate (bus output with control bit)
Gate (Single output)
Gate (bus output)
Multiplexer (Bit)
Multiplexer (Bus)
Multiplexer (BUFE based slice)
Multiplexer (BUFT based slice)
Register (Flip-Flop Based)
Latch (LD based)
Two's Complement

Table 5: Xilinx LogiCORE Products (Continued)

DSP and Communication Cores
FIR Filters, Distributed Arithmetic
FFT, Complex, High-performance, 1024 point
FFT, Complex, High-performance, 256-point
FFT, Complex, High-performance, 64-point
FFT, Complex, High-performance, 16-point
Reed Solomon Encoder, parameterizable
Reed Solomon Decoder, parameterizable
DDS (NCO)
Sine/Cosine Look Up Table

Interface Cores
PCI 64-bit, 33-66 MHz
PCI64 Design Kit (incl. Virtex prototyping board and driver development tools)
PCI 32-bit, 33 MHz
PCI32 Design Kit (incl. Spartan-II prototyping board and driver development tools)

Reference Designs
SDRAM Controller
ZBT RAM Controller
Double Data Rate RAM Controller
PCI64 Bridge Reference Designs
PCI32 Bridge Reference Designs
PCI Power Management Reference Design
PCI32 Asynchronous FIFO Reference Designs
PCI64 Asynchronous FIFO Reference Designs

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