

Digilent Nexys2 Board Reference Manual

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Overview

The Nexys2 circuit board is a complete, ready-to-use circuit development platform based on a Xilinx Spartan 3E FPGA. Its on-board high-speed USB2 port, 16Mbytes of RAM and ROM, and several I/O devices and ports make it an ideal platform for digital systems of all kinds, including embedded processor systems based on Xilinx's MicroBlaze. The USB2 port provides board power and a programming interface, so the Nexys2 board can be used with a notebook computer to create a truly portable design station.

The Nexys2 brings leading technologies to a platform that anyone can use to gain digital design experience. It can host countless FPGA-based digital systems, and designs can easily grow beyond the board using any or all of the five expansion connectors. Four 12-pin Peripheral Module (Pmod) connectors can accommodate up to eight low-cost Pmods to add features like motor control, A/D and D/A conversion, audio circuits, and a host of sensor and actuator interfaces. All user-accessible signals on the Nexys2 board are ESD and short-circuit protected, ensuring a long operating life in any environment.

The Nexys2 board is fully compatible with all versions of the Xilinx ISE tools, including the free WebPack. Now anyone can build real digital systems for less than the price of a textbook.

Power Supplies

The Nexys2 board input power input bus can be driven from a USB cable, from a 5VDC-15VDC, center positive, 2.1mm wall-plug supply, or from a battery pack. A shorting block loaded on the "power select" jumper selects the power source. The USB circuitry is always powered from the USB cable – if no USB cable is attached, the USB circuitry is left unpowered.



- 500K-gate Xilinx Spartan 3E FPGA
- USB2-based FPGA configuration and high-speed data transfers (using the free Adept Suite Software)
- USB-powered (batteries and/or wall-plug can also be used)
- 16MB of Micron PSDRAM & 16MB of Intel StrataFlash ROM
- Xilinx Platform Flash for nonvolatile FPGA configurations
- Efficient switch-mode power supplies (good for battery powered applications)
- 50MHz oscillator plus socket for second oscillator
- 60 FPGA I/O's routed to expansion connectors (one high-speed Hirose FX2 connector and four 6-pin headers)
- 8 LEDs, 4-digit 7-seg display, 4 buttons, 8 slide switches
- Ships in a plastic carry case with USB cable

Figure 1: Nexys2 block diagram and features

Digilent Nexys Board Reference Manual

Lazaros S. Iliadis, Chrisina Jayne



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FPGA-BASED Hardware Accelerators Ioulia Skliarova, Valery Sklyarov, 2019-05-30 This book suggests and describes a number of fast parallel circuits for data vector processing using FPGA based hardware accelerators Three primary areas are covered searching sorting and counting in combinational and iterative networks These include the application of traditional structures that rely on comparators swappers as well as alternative networks with a variety of core elements such as adders logical gates and look up tables The iterative technique discussed in the book enables the sequential reuse of relatively large combinational blocks that execute many parallel operations with small propagation delays For each type of network discussed the main focus is on the step by step development of the architectures proposed from initial concepts to synthesizable hardware description language specifications Each type of network is taken through several stages including modeling the desired functionality in software the retrieval and automatic conversion of key functions leading to specifications for optimized hardware modules The resulting specifications are then synthesized implemented and tested in FPGAs using commercial design environments and prototyping boards The methods proposed can be used in a range of data processing applications including traditional sorting the extraction of maximum and minimum subsets from large data sets communication time data processing finding frequently occurring items in a set and Hamming weight distance counters comparators The book is intended to be a valuable support material for university and industrial engineering courses that involve FPGA based circuit and system design

Engineering Applications of Neural Networks Lazaros S. Iliadis, Chrisina Jayne, 2011-09-15 The two volume set IFIP AICT 363 and 364 constitutes the refereed proceedings of the 12th International Conference on Engineering Applications of Neural Networks EANN 2011 and the 7th IFIP WG 12.5 International Conference AIAI 2011 held jointly in Corfu Greece in September 2011 The 52 revised full papers and 28 revised short papers presented together with 31 workshop papers were carefully reviewed and selected from 150 submissions The first volume includes the papers that were accepted for presentation at the EANN 2011 conference They are organized in topical sections on computer vision and robotics self organizing maps classification pattern recognition financial and management applications of AI fuzzy systems support vector machines learning and novel algorithms reinforcement and radial basis function ANN machine learning evolutionary genetic algorithms optimization Web applications of ANN spiking ANN feature extraction minimization medical applications of AI environmental and earth applications of AI multi layer ANN and bioinformatics The volume also contains the accepted papers from the Workshop on Applications of Soft Computing to Telecommunication ASCOTE 2011 the Workshop on Computational Intelligence Applications in Bioinformatics CIAB 2011 and the Second Workshop on Informatics and Intelligent Systems Applications for Quality of Life Information Services ISQLIS 2011

Synthesis and Optimization of FPGA-Based Systems Valery Sklyarov, Ioulia Skliarova, Alexander Barkalov, Larysa Titarenko, 2014-03-14 The book is composed of two parts The first part introduces the concepts of the design of digital

systems using contemporary field programmable gate arrays FPGAs Various design techniques are discussed and illustrated by examples The operation and effectiveness of these techniques is demonstrated through experiments that use relatively cheap prototyping boards that are widely available The book begins with easily understandable introductory sections continues with commonly used digital circuits and then gradually extends to more advanced topics The advanced topics include novel techniques where parallelism is applied extensively These techniques involve not only core reconfigurable logical elements but also use embedded blocks such as memories and digital signal processing slices and interactions with general purpose and application specific computing systems Fully synthesizable specifications are provided in a hardware description language VHDL and are ready to be tested and incorporated in engineering designs A number of practical applications are discussed from areas such as data processing and vector based computations e g Hamming weight counters comparators The second part of the book covers the more theoretical aspects of finite state machine synthesis with the main objective of reducing basic FPGA resources minimizing delays and achieving greater optimization of circuits and systems

FPGA Prototyping by SystemVerilog Examples Pong P. Chu, 2018-04-18 A hands on introduction to FPGA prototyping and SoC design This is the successor edition of the popular FPGA Prototyping by Verilog Examples text It follows the same learning by doing approach to teach the fundamentals and practices of HDL synthesis and FPGA prototyping The new edition uses a coherent series of examples to demonstrate the process to develop sophisticated digital circuits and IP intellectual property cores integrate them into an SoC system on a chip framework realize the system on an FPGA prototyping board and verify the hardware and software operation The examples start with simple gate level circuits progress gradually through the RT register transfer level modules and lead to a functional embedded system with custom I O peripherals and hardware accelerators Although it is an introductory text the examples are developed in a rigorous manner and the derivations follow the strict design guidelines and coding practices used for large complex digital systems The book is completely updated and uses the SystemVerilog language which absorbs the Verilog language It presents the hardware design in the SoC context and introduces the hardware software co design concept Instead of treating examples as isolated entities the book integrates them into a single coherent SoC platform that allows readers to explore both hardware and software programmability and develop complex and interesting embedded system projects The new edition Adds four general purpose IP cores which are multi channel PWM pulse width modulation controller I2C controller SPI controller and XADC Xilinx analog to digital converter controller Introduces a music synthesizer constructed with a DDFS direct digital frequency synthesis module and an ADSR attack decay sustain release envelope generator Expands the original video controller into a complete stream based video subsystem that incorporates a video synchronization circuit a test pattern generator an OSD on screen display controller a sprite generator and a frame buffer Provides a detailed discussion on blocking and nonblocking statements and coding styles Describes basic concepts of software hardware co design with Xilinx MicroBlaze MCS soft core processor

Provides an overview of bus interconnect and interface circuit Presents basic embedded system software development Suggests additional modules and peripherals for interesting and challenging projects FPGA Prototyping by SystemVerilog Examples makes a natural companion text for introductory and advanced digital design courses and embedded system courses It also serves as an ideal self teaching guide for practicing engineers who wish to learn more about this emerging area of interest FPGA Prototyping by VHDL Examples Pong P. Chu,2018-01-25 A hands on introduction to FPGA prototyping and SoC design This Second Edition of the popular book follows the same learning by doing approach to teach the fundamentals and practices of VHDL synthesis and FPGA prototyping It uses a coherent series of examples to demonstrate the process to develop sophisticated digital circuits and IP intellectual property cores integrate them into an SoC system on a chip framework realize the system on an FPGA prototyping board and verify the hardware and software operation The examples start with simple gate level circuits progress gradually through the RT register transfer level modules and lead to a functional embedded system with custom I O peripherals and hardware accelerators Although it is an introductory text the examples are developed in a rigorous manner and the derivations follow strict design guidelines and coding practices used for large complex digital systems The new edition is completely updated It presents the hardware design in the SoC context and introduces the hardware software co design concept Instead of treating examples as isolated entities the book integrates them into a single coherent SoC platform that allows readers to explore both hardware and software programmability and develop complex and interesting embedded system projects The revised edition Adds four general purpose IP cores which are multi channel PWM pulse width modulation controller I2C controller SPI controller and XADC Xilinx analog to digital converter controller Introduces a music synthesizer constructed with a DDFS direct digital frequency synthesis module and an ADSR attack decay sustain release envelop generator Expands the original video controller into a complete stream based video subsystem that incorporates a video synchronization circuit a test pattern generator an OSD on screen display controller a sprite generator and a frame buffer Introduces basic concepts of software hardware co design with Xilinx MicroBlaze MCS soft core processor Provides an overview of bus interconnect and interface circuit Introduces basic embedded system software development Suggests additional modules and peripherals for interesting and challenging projects The FPGA Prototyping by VHDL Examples Second Edition makes a natural companion text for introductory and advanced digital design courses and embedded system course It also serves as an ideal self teaching guide for practicing engineers who wish to learn more about this emerging area of interest **Frontiers of Quality Electronic Design (QED)** Ali Iranmanesh,2023-01-11 Quality Electronic Design QED s landscape spans a vast region where territories of many participating disciplines and technologies overlap This book explores the latest trends in several key topics related to quality electronic design with emphasis on Hardware Security Cybersecurity Machine Learning and application of Artificial Intelligence AI The book includes topics in nonvolatile memories NVM Internet of Things IoT FPGA and Neural Networks

Advances in Fuzzy Logic Systems Elmer Dadios, 2023-12-20 Fuzzy logic systems have been a hot topic in the scientific and academic community for more than half a century. The idea of making machines behave and make decisions like humans do is astounding. The development and implementation of fuzzy logic systems can be seen in various real physical applications in daily human life. The methods employed using fuzzy logic have resulted in innovative technologies. This book provides insights into understanding the principles and concepts behind the advances of fuzzy logic systems. It presents ideas concerning fuzzy logic systems and their technological applications. The book is arranged into two sections on theories and foundations of fuzzy logic systems and implementations of fuzzy logic systems in service to the community.

The FPGA Programming Handbook Frank Bruno, Guy Eschemann, 2024-04-26 Develop solid FPGA programming skills in SystemVerilog and VHDL by crafting practical projects: VGA controller, microprocessor, calculator, keyboard, and amplify your know-how with insider industry knowledge all in one handbook. Purchase of the print or Kindle book includes a free eBook in PDF format.

Key Features: Explore a wide range of FPGA applications, grasp their versatility, and master Xilinx FPGA tool flow. Master the intricacies of SystemVerilog and VHDL to develop robust and efficient hardware circuits. Refine skills with CPU, VGA, and calculator projects for practical expertise in real-world applications.

Book Description: In today's tech-driven world, Field Programmable Gate Arrays (FPGAs) are the foundation of many modern systems. Transforming ideas into reality demands a deep dive into FPGA architecture, tools, and design principles. This FPGA book is your essential companion to FPGA development with SystemVerilog and VHDL, tailored for both beginners and those looking to expand their knowledge. In this edition, you will gain versatility in FPGA design, opening doors to diverse opportunities and projects in the field. Go beyond theory with structured hands-on projects starting from simple LED control and progressing to advanced microcontroller applications, highly sought after in today's FPGA job market. You will go from basic Boolean logic circuits to a resource-optimized calculator showcasing your hardware design prowess. Elevate your knowledge by designing a VGA controller, demonstrating your ability to synthesize complex hardware systems. Use this handbook as your FPGA development guide, mastering intricacies, igniting creativity, and emerging with the expertise to craft hardware circuits using SystemVerilog and VHDL. This isn't just another technical manual; it's your exhilarating journey to master both theory and practice, accelerating your FPGA design skills to soaring new heights. Grab your copy today and start this exciting journey.

What you will learn: Understand the FPGA architecture and its implementation. Get to grips with writing SystemVerilog and VHDL RTL. Make FPGA projects using SystemVerilog and VHDL programming. Work with computer math basics, parallelism, and pipelining. Explore the advanced topics of AXI and keyboard interfacing with PS 2. Discover how you can implement a VGA interface in your projects. Explore the PMOD connectors, SPI, and UART using Nexys A7 board. Implement an embedded microcontroller in the FPGA. Who this book is for: This FPGA design book is for embedded system developers, engineers, and programmers who want to learn FPGA design using SystemVerilog or VHDL programming from scratch. FPGA designers looking to gain hands-on experience with

real world projects will also find this book useful Whether you are new to FPGA development or seeking to enhance your skills this book provides a solid foundation and practical experience in FPGA design **Digital Logic M.**

Rafiquzzaman, Steven A. McNinch, 2019-09-11 Digital Logic with an Introduction to Verilog and FPGA Based Design provides basic knowledge of field programmable gate array FPGA design and implementation using Verilog a hardware description language HDL commonly used in the design and verification of digital circuits Emphasizing fundamental principles this student friendly textbook is an ideal resource for introductory digital logic courses Chapters offer clear explanations of key concepts and step by step procedures that illustrate the real world application of FPGA based design Designed for beginning students familiar with DC circuits and the C programming language the text begins by describing of basic terminologies and essential concepts of digital integrated circuits using transistors Subsequent chapters cover device level and logic level design in detail including combinational and sequential circuits used in the design of microcontrollers and microprocessors Topics include Boolean algebra and functions analysis and design of sequential circuits using logic gates FPGA based implementation using CAD software tools and combinational logic design using various HDLs with focus on Verilog

Diseño de sistemas empotrados de 8 bits en FPGAs con Xilinx ISE y Picoblaze Francisco Poza González, Luis Jacobo Álvarez Ruiz de Ojeda, 2012-01-01 Este libro est dirigido a todos aquellos profesionales de la Electrónica tanto docentes como técnicos que deseen introducirse en el diseño de sistemas basados en microprocesadores de 8 bits empotrados embedded en FPGAs Field Programmable Gate Arrays En l se estudia el microprocesador de 8 bits Picoblaze de Xilinx para su implementación mediante FPGAs de las familias Spartan y Virtex de Xilinx Para poder trabajar con estos microprocesadores es necesario aprender el manejo de la herramienta ISE de Xilinx Este libro tiene su origen en la documentación elaborada para la impartición de varios cursos de posgrado sobre sistemas empotrados de 8 bits de Xilinx para el diseño de aplicaciones empotradas en FPGAs que se celebraron en el Departamento de Tecnología Electrónica de la Universidad de Vigo en los años 2005 a 2008 más información en http://www.dte.uvigo.es/logica_programable/cursos.htm Este libro tiene un nivel básico y para seguirlo el lector debe disponer de software gratuito de Xilinx y poseer los siguientes conocimientos previos Nivel básico del lenguaje VHDL Manejo de la herramienta ISE para el diseño con FPGAs Conocimientos de microprocesadores Nivel básico de lenguaje ensamblador Manejo básico del sistema operativo Windows En el libro se incluyen las presentaciones en Powerpoint utilizadas para explicar los siguientes apartados Teoría Introducción al diseño de Sistemas en un Circuito S O C Arquitectura de las FPGAs de la familia Spartan Microprocesador Picoblaze Arquitectura y juego de instrucciones Laboratorio Herramienta ISE Herramientas software del microprocesador Picoblaze Realización de circuitos de acoplamiento y periféricos para el microprocesador Picoblaze Diseño de sistemas digitales basados en el microprocesador Picoblaze Práctica Ejemplo básico con interrupción Reloj digital Sistema de gestión basado en RS232 Sistema de visualización con LCD

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