Introduction to Xilinx Spartan-3E Starter Kit

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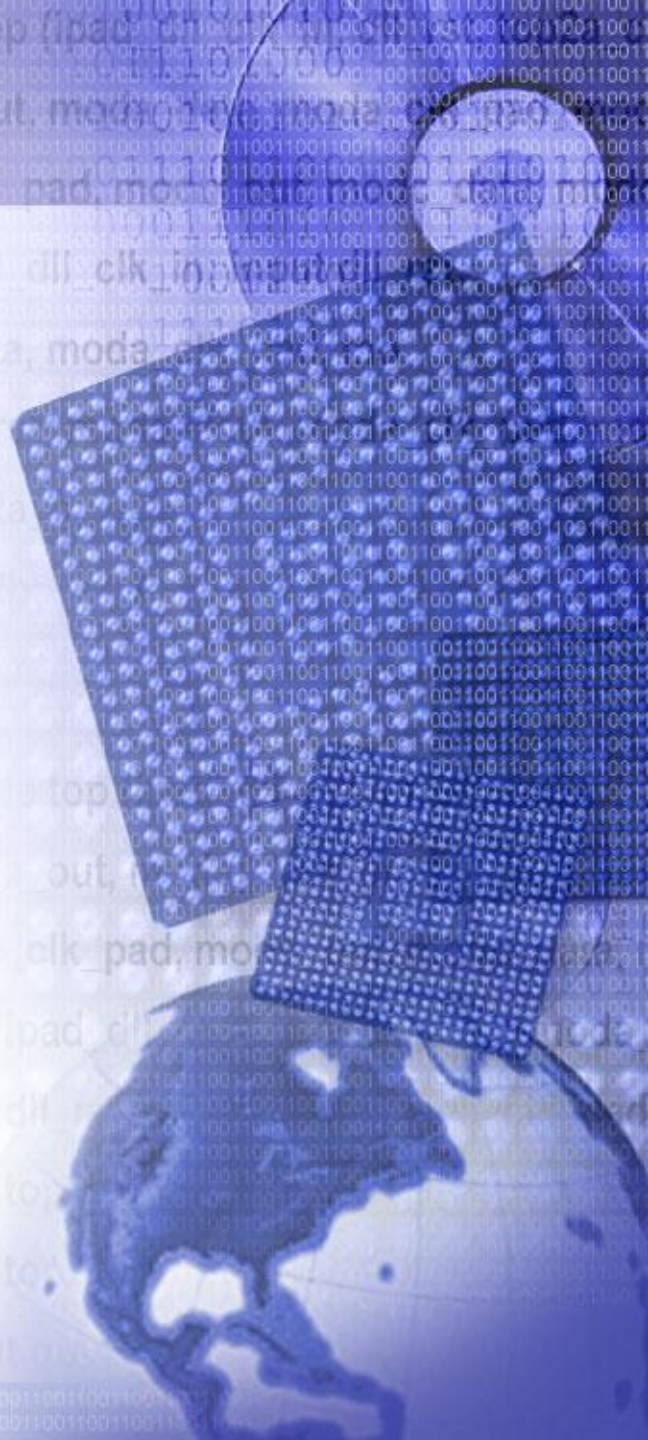


Agenda

- Overview
- Memory / Configuration Features
- Connectivity Features
- Misc. Features
- Documentation, Software, Reference Designs
- Summary

Spartan-3E Starter Kit Overview

- A full-featured Spartan-3E FPGA development board solution
- Instant access to the full capabilities of the Spartan-3E FPGA family

- Complete kit includes
  - Starter Kit Board
  - Power Supply
  - Evaluation Software & Resource CD
  - USB Cable (for programming)
- International versions available

Resale: US$149

www.xilinx.com/s3estarter

Order from Xilinx Online Store, or your local Xilinx Distributor

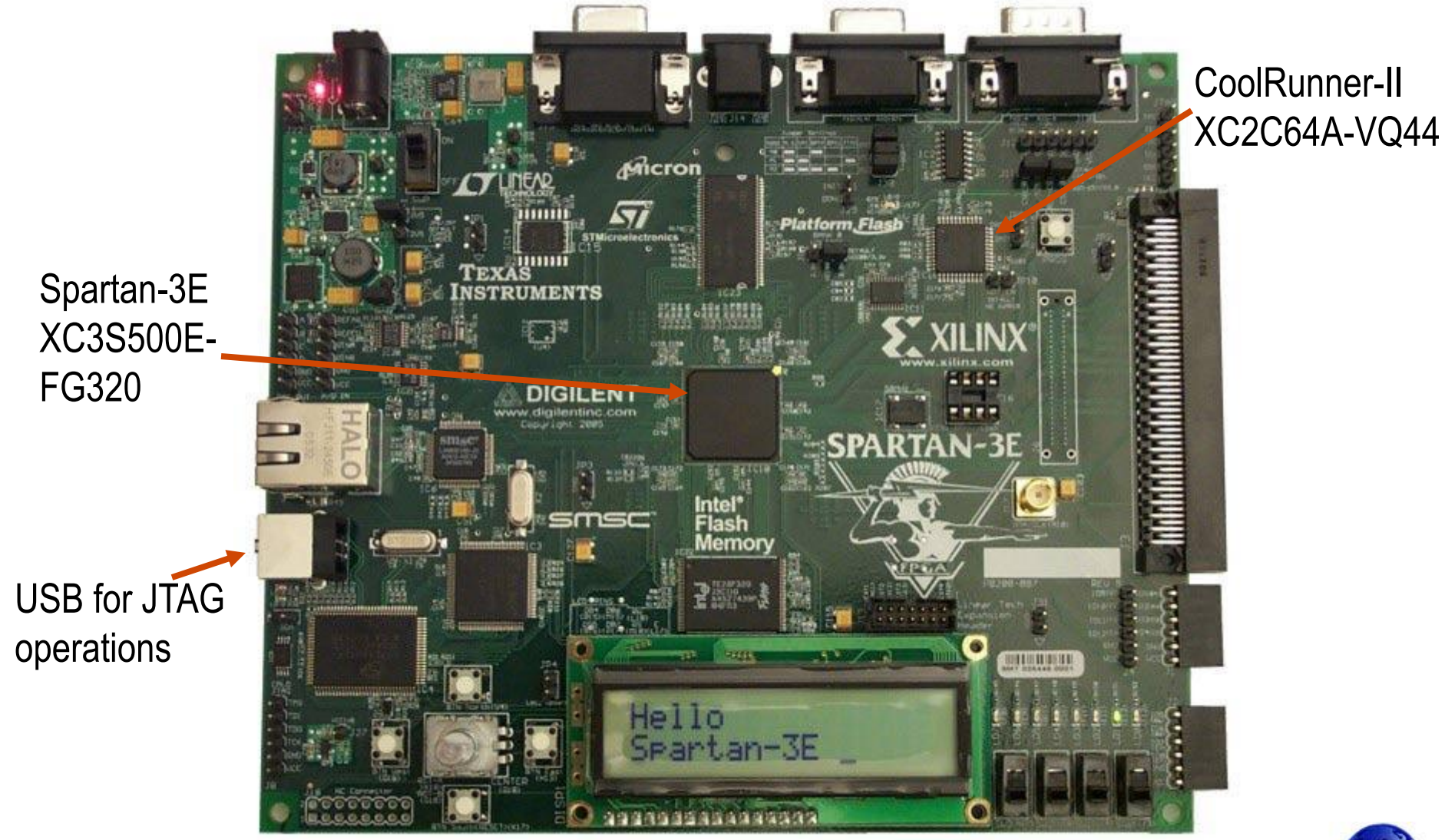
Starter Kit Board Features

- **Xilinx Devices**
  - Spartan-3E XC3S500E-4FG320
  - CoolRunner-II XC64-VQ44
- **Memory**
  - Xilinx Platform Flash XCF04S-VO20
  - 128Mbit Intel® StrataFlash
  - 16Mbit STMicro® SPI serial Flash
  - 32Mx16 (64Mbytes) Micron© DDR SDRAM
- **Connectivity**
  - Xilinx Embedded USB Programming Capability
  - SMsC™ Ethernet 10/100 PHY
  - 100-Pin Hirose Expansion Connector
  - Three 6-Pin Expansion Connectors
  - VGA, RS-232, PS/2, SMA
- **Other**
  - 50 MHz Oscillator
  - Rotary Encoder, Four Momentary-Contact Push Buttons, Four Slide Switches
  - 16 Character 2-Line LCD, 8 LEDs
  - A/D and D/A
  - Secure EEPROM

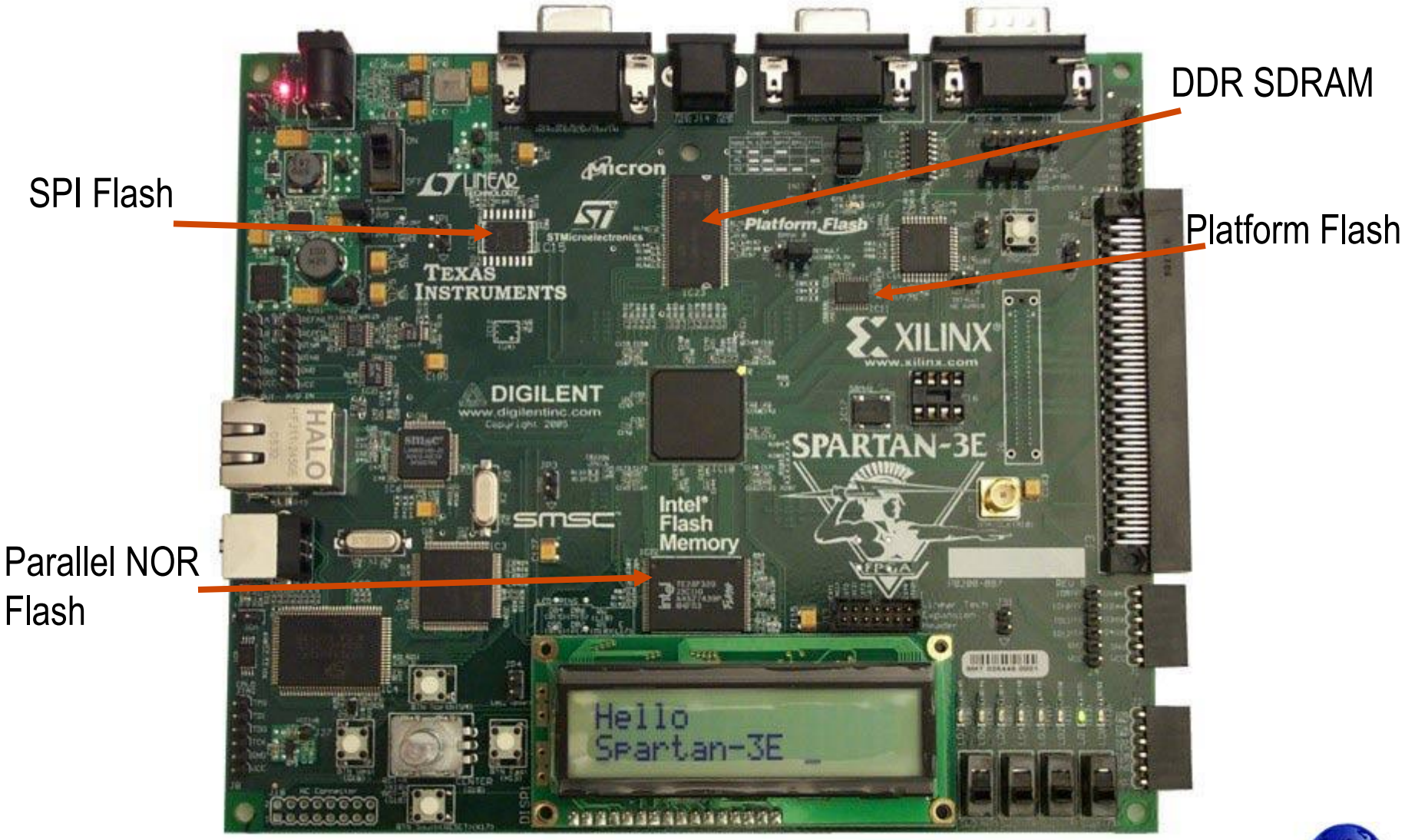
Xilinx Devices

- Spartan-3E, XC3S500E-FG320
  - 232 user I/O: 176 Bidirectional, 56 Input-only arrange in 4 I/O Banks
  - 4 DCMs, 20 BRAM blocks, 1,164 CLBs
  - Pin compatible with larger-density XC3S1200E or 1600E
- CoolRunner™-II, XC2C64A-VQ44
  - Used for glue logic for the configuration circuitry. Can be used for more complex board functions, such as a “Configuration-Watchdog Timer” or similar controller for ISP functions.
- Platform Flash, XCF04S-VO20
  - One of three possible FPGA configuration storage devices
  - Extra 1.8Mbits provided for possible code or data storage
- Embedded Platform USB Cable Circuit
  - Simple standard USB cable (included) for all JTAG operations with the Xilinx ISE tools: iMPACT, Chipscope, and EDK

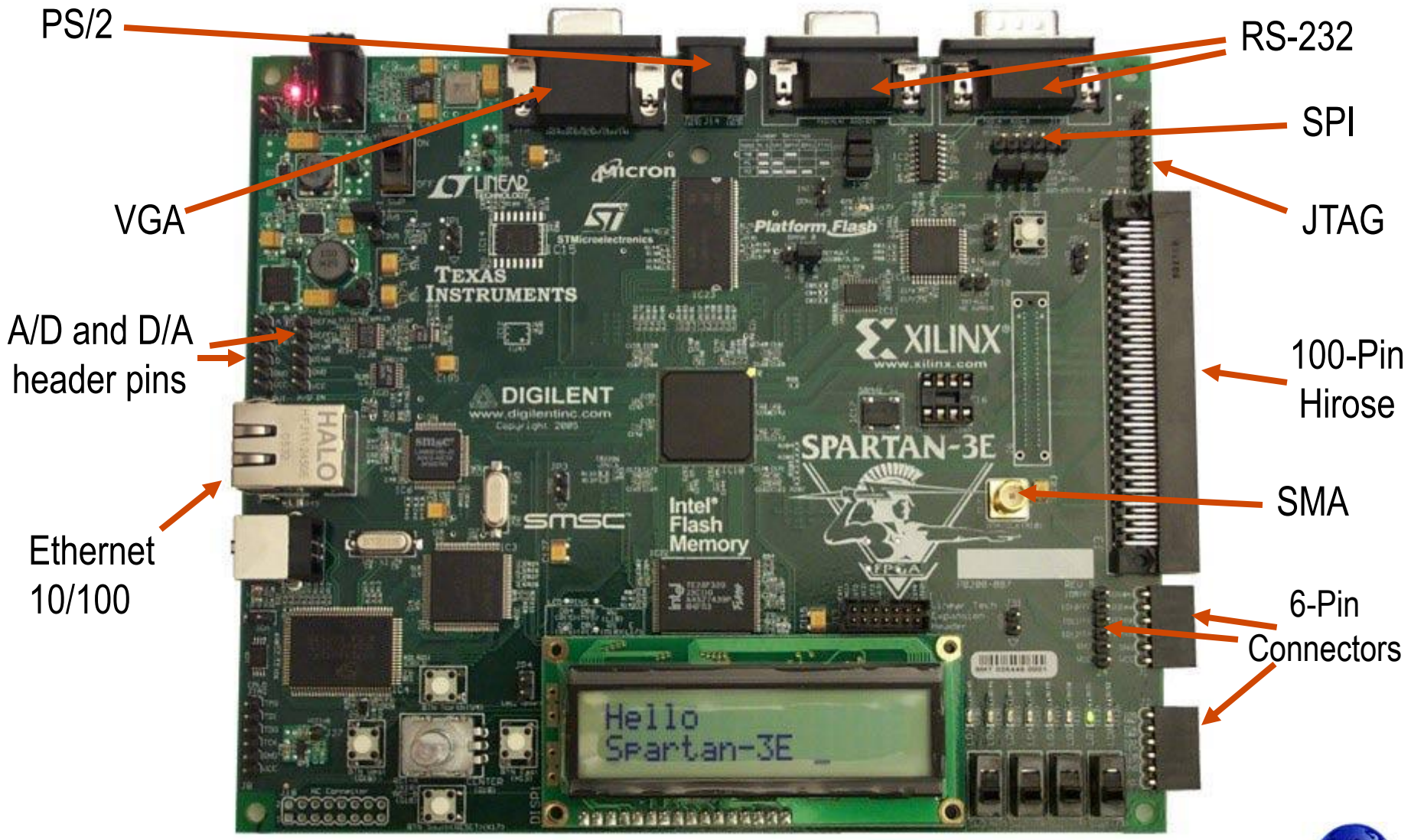
Spartan-3E FPGA & CoolRunner-II CPLD



Easy Memory Interfaces



Spartan-3E Excels at Bridging



Complete Documentation

- Getting Started
  - 3 quick and easy steps to jumpstart your design

- 164-page User's Guide
  - Complete technical manual on all features and capabilities
  - Delivered via web
    www.xilinx.com/s3estarter

Evaluation Software Included

- 60-Day Evaluation Licenses for Full-Featured Tools
  - ISE *Foundation* is the Xilinx complete logic design environment
  - The Embedded Development Kit (EDK) bundle is an integrated software solution for creating MicroBlaze-based embedded processing systems

- Free ISE WebPACK
  - ISE *WebPACK* offers HDL synthesis and simulation, implementation, device fitting, and JTAG programming

“How To”, “Can Do” Reference Designs

- Demonstrates various features and capabilities
  - LCD display control
  - StrataFlash, SPI programmer
  - Rotary encoder interface
  - Frequency counter
  - PicoBlaze examples
  - MicroBlaze examples
  - And more …
- Documentation and source files are included
- Linked from www.xilinx.com/s3estarter

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Home : Products & Services : Development Boards : Spartan-3E Starter Kit : Spartan-3E Starter Kit Board Design Examples

Spartan-3E Starter Kit Board Design Examples

Below are example designs created for the Spartan™-3E Starter Kit board to demonstrate various features or capabilities. Documentation and source files are included. These example designs are provided with the Limitations described below.

Do you have a reference design for the Spartan-3E Starter Kit Board? Share the wealth of your knowledge and design prowess! Please send us a description of why your design is relevant along with usable documentation and the design files to s3estarter@xilinx.com. If the design is suitable, we will post it here.

Description	Features Used	Software Version	Doc	Files
Initial Design for the Spartan-3E Starter Kit Board This is the design shipped with the board. The embedded PicoBlaze™ controller scrolls messages on the character LCD screen. The rotary pushbutton switch controls whether the switches or the rotary button controls the LEDs.	PicoBlaze, LCD, Rotary Encoder, LEDs	ISE 8.1i		
Rotary Encoder Interface Demonstrates how to use the rotary encoder portion of the rotary pushbutton switch.	Rotary Encoder	ISE 8.1i		
PicoBlaze Amplifier and A/D Converter Controller Demonstrates the fundamental operation the Linear Technology LTC6912-1 programmable gain amplifier and the	PicoBlaze, LCD, Amplifier, A/D	ISE 8.1i		

Demonstrating New Features and Improved Capabilities

- Spartan-3E FPGAs configure from commodity Flash memory
  - Fully supports easy-to-use Xilinx Platform Flash
  - SPI serial Flash
  - Parallel NOR Flash support primarily for MicroBlaze embedded applications
- Improved support for embedded systems applications
  - Low-end support for 32-bit MicroBlaze RISC core
  - Efficient 8-bit PicoBlaze controller core
- Low-cost, space efficient FPGA power solution from Texas Instruments

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Memory: DDR SDRAM

- Micron MT46V32M16TG-6TF (512Mbit)
  - 32M-deep, 16-bit data path
  - 66-pin TSOP package
    - Industry standard package, can drop in up to 1GB device
  - Simple point-to-point series termination
  - DDR SDRAM requires 2.5V
    - Spartan-3E FPGAs have four I/O banks to support different I/O standards
    - FPGA I/O Bank 3 dedicated for this purpose
    - Voltage supply to FPGA I/O Bank 3 and DDR SDRAM provided by 2.5V switching regulator

Configuration Features (cont.)

- Xilinx Platform Flash
  - XCF04S-VO20 connected for MS mode
    - Extra space for design/code storage - XAPP482, XAPP544, XAPP694
  - 2nd XCF04S-VO20 Footprint to allow for two XCF04S in series for configuration of optional XC3S1600E drop-in
- Parallel NOR x8/x16 Flash PROM
  - Intel StrataFlash 128Mbit Flash PROM, upgradeable to 256Mbit
    - Extra space for design/code storage
  - Wired to allow CPLD to optionally control multiple configurations
    - CPLD controls A20-A24, but also connected to S3E general IO
    - A0-A19 controls only the lowest 8Mbit – which is enough for Multiboot for XC3S500E (2.624Mbits) or 1200E (3.833Mbits), and single boot of XC3S1600E (5.958Mbits)

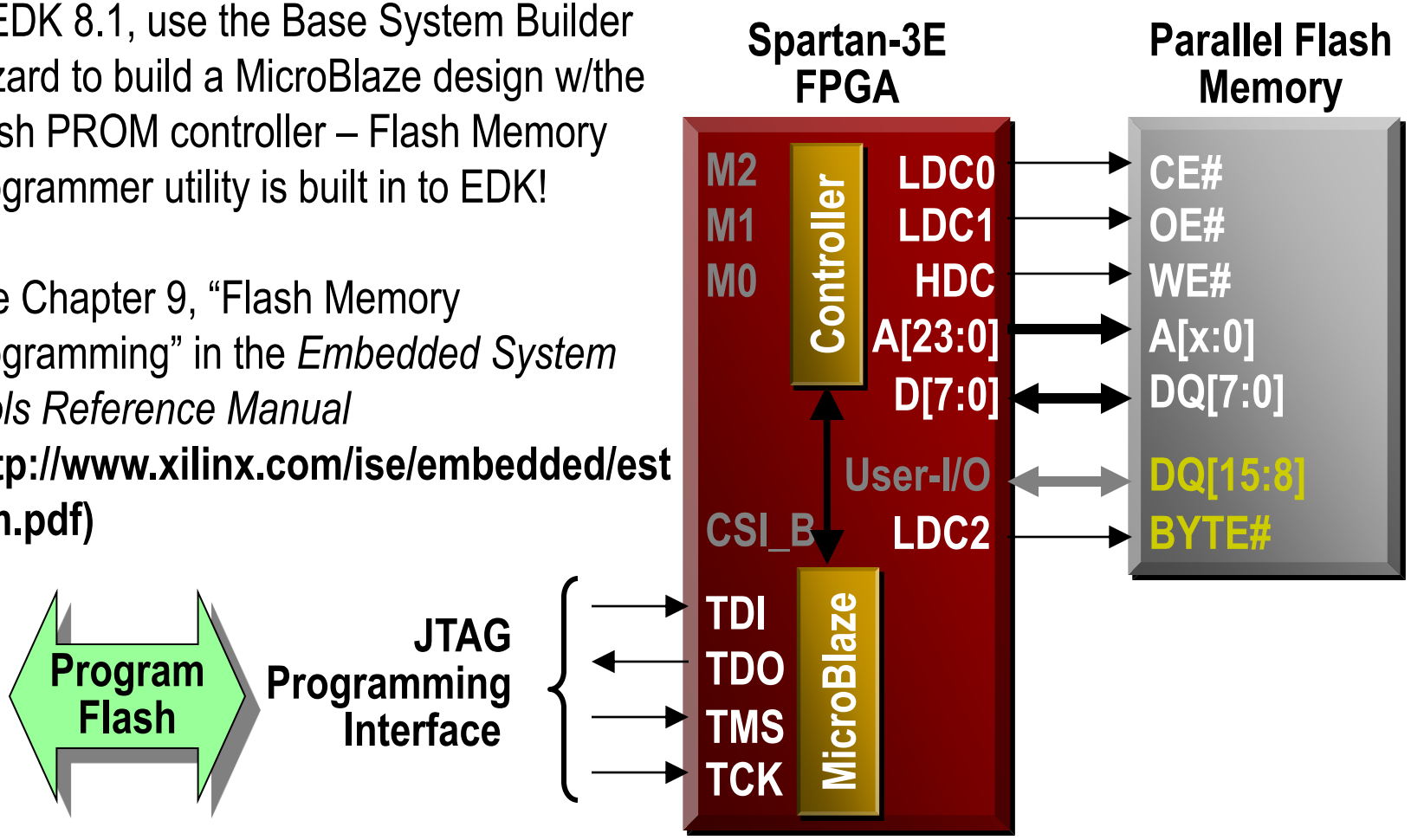
Configuring the Intel StrataFlash™ Parallel NOR Flash PROM

- Xilinx EDK Flash Memory Programming utility
  - Included CD
- Xilinx PicoBlaze RS-232 StrataFlash™ Programmer reference design
  - Available at www.xilinx.com/s3estarter

Flash Memory Programmer

In EDK 8.1, use the Base System Builder Wizard to build a MicroBlaze design w/the Flash PROM controller – Flash Memory Programmer utility is built in to EDK!

See Chapter 9, "Flash Memory Programming" in the *Embedded System Tools Reference Manual* **(http://www.xilinx.com/ise/embedded/est_rm.pdf)**



Configuring the STMicroelectronics SPI Flash PROM

- Available now: PicoBlaze SPI Flash Programmer for the Spartan-3E Starter Kit Board
  - Available at www.xilinx.com/s3estarter
- Coming soon: SPI programming support in the upcoming 8.2i rev of the Xilinx ISE iMPACT configuration tool
  - For STMicroelectronics and Atmel Flash PROMs only

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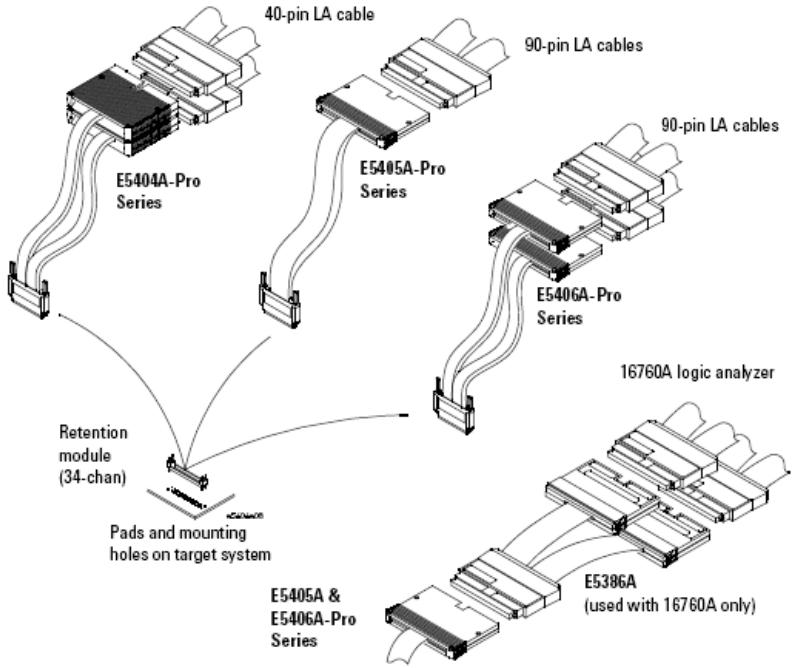
Ethernet PHY

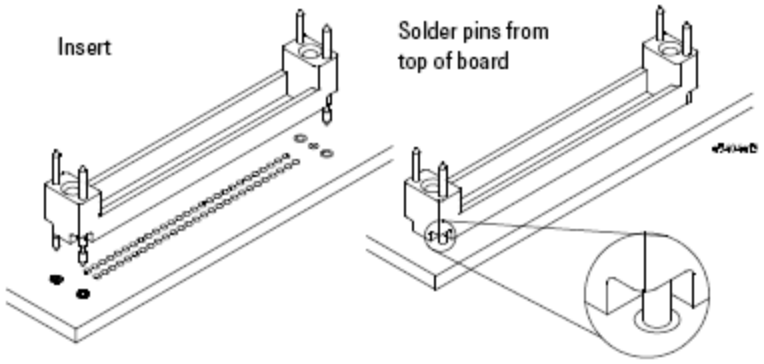
- Ethernet 10/100 PHY IC
  - SMSC LAN83C185
    - High Perf, Low Power
    - TQFP-64
    - Standard MII Port

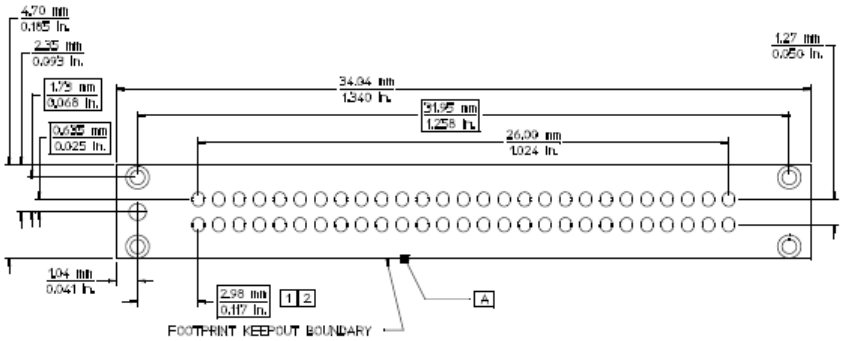
  Single Port 10Base-T RJ-45 Connector w/LEDs
    - Halo HFJ11

ChipScope Board Connectors

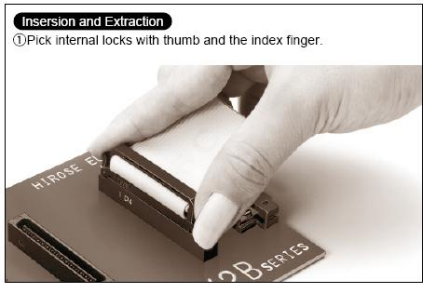
- ChipScope™ Connector Landing
  - Agilent 5404/6A Pro Series Probes with Soft Touch connector, or Tektronix P69xx Probe Modules with D-Max technology
    - Industry Standard (between the two so far)
    - 16 FPGA IOs shared with FX2 Connector

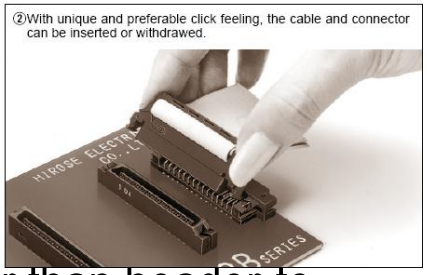






Hirose FX2 Board Connectors





- Hirose FX2 edge-connector
  - Male, right-angle, 100-pin edge connector, 500mA/pin
  - Reasonable performance – 45mOhms max at 100mA
  - Versatile
    - Board-to-board connectors available
    - Board-to-cable connectors (and cables) available
    - www.hirose-connectors.com
  - Easy to use: one-handed lock/removal operation – much nicer than header-to-header connections
  - Inexpensive!
  - 38 IO (3 on GCLK pins) + 5 Input-only.
  - 15 are differential IO, and 2 are differential Input-only
    - Possible to do 8 channel differential input+clock, 8 channel output
  - Pins take up most of Bank0
  - 741G125 tristateable buffer allows for off-board connection into JTAG chain

6-pin Connectors

- Three 0.1” 1x6 Header Pin Connectors
  - 1 male straight-lead, 2 female right-angle edge connectors
    - Signals: IO/IO/IO/IO/Gnd/Vcc3v3
  - Can be used as test points, or a way to bridge to another board using cables/flying leads
- Digilent sells a variety of very inexpensive daughter boards (Peripheral Modules) that can plug in:
  - Dual 12bit A/D, Dual 8bit D/A, Dual H-Bridge Amps, Amplified Speaker board, 4 Pushbuttons, 4 Slide switches, RS232, 4 Open Collector, 4 Digital Input (w/Schmitt-Trigger inv, protection diodes, and debounce filters), 6 Screw-terminals
  - ~$8-$25, order online at www.digilentinc.com

RS232, VGA, PS2, and SPI

- RS232 Port Connectors
  - Maxim MAX3232 3.3V PHY
  - Both Female (DCE) DB9 and Male (DTE) DB9
- VGA Port Connector
  - Red, Green, Blue, HS, and VS
  - Female DB15 Connector
- PS2 Port Connector
  - Data, Clock, Ground and 5V
  - 8-pin PS2 Connector
- SPI Off-board connector
  - 1x6 .1” header connector

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Power Supplies

- Texas Instruments TPS75003
  - Developed for Xilinx Spartan-3 families
    - 1.2V Switcher @ 3A
      - Solely for Vccint, and has 1x2 header w/jumper, and 1x1 header
    - 2.5V LDO @ 300mA
      - Solely for Vccaux, and has 1x2 header w/jumper, and 1x1 header
    - 3.3V Switcher @3A
      - Several devices on board
- Linear LTC3412
  - 2.5V Switcher for DDR SDRAM
    - Also powers Vcco3 (SDRAM interface), and optional to Vcco0 (for LVDS)
  - Resistor divider to provide 1.25 Vref to SDRAM and S3E
- Linear LTC1844ES5
  - 1.8V LDO from 3.3V to power CPLD

Clocks

- 50 MHz LVTTL Oscillator
  - Routed to S3E GCLK in Bank 0, and Coolrunner-II
- Osc Socket routed to S3E GCLK in Bank 0
- SMA to S3E GCLK in Bank 0
- 25MHz XTAL for Ethernet Phy

A/D, Amp, and D/A

- SPI-compatible A/D
  - LTC1407A-1: 14bit 3Msps Sampling ADC, +/-1.25 Input
  - Low Power, and also has Nap and Sleep modes
- SPI-compatible Programmable-gain Amplifier (for A/D)
  - LTC6912-1: Programmable Gain Amplifier
  - 2-ch ideal for amplifying audio into A/D
  - Hardware or software shutdown modes
- SPI-compatible D/A
  - LTC2624: Quad 12bit DAC
  - Separate reference for each DAC, options on board for these
- All on the same SPI bus with the SPI Flash PROM

Secure EEPROM and LCD

- Secure EEPROM
  - Dallas Semiconductor/Maxim DS2432 (1Kbit protected 1-wire EEPROM with SHA-1 engine)
    - XAPP780, security through bitstream authentication
- 2x16 character LCD Display
  - Industry standard processor and interface
  - Similar to other Xilinx boards

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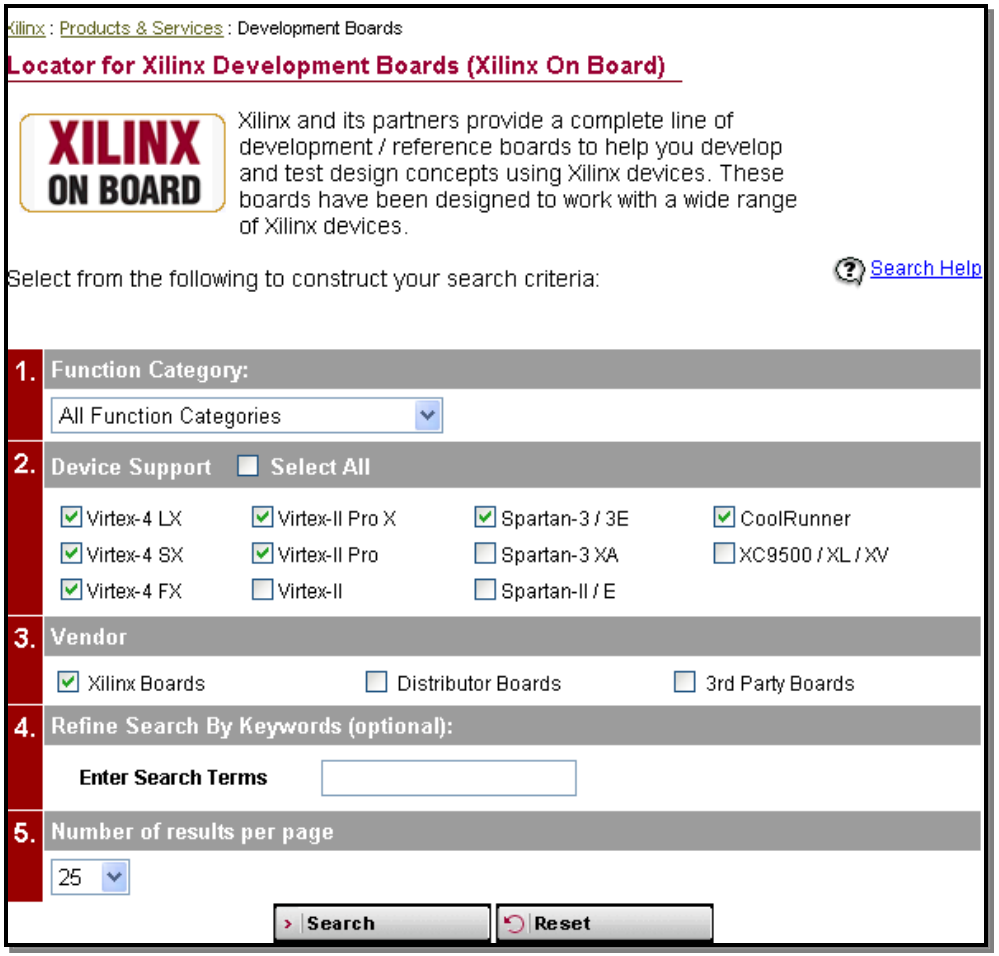
Application Notes

- Configuring Spartan-3E Xilinx FPGAs with SPI Flash Memories
  - (XAPP445)
- Configuring Spartan-3E from Platform Flash
  - Bootloading MicroBlaze from Platform Flash (XAPP482)
  - Reading Data from Platform Flash (XAPP694)
  - Reading and writing data to Platform Flash (XAPP544)
- Configuring Spartan-3E in BPI mode from Intel StrataFlash
  - Configuring S-3E and booting MicroBlaze from the same flash device (XAPP447 – TBD release)
  - Multi-Boot configuration (S3E Data Sheet)
- FPGA IFF Copy Protection Using Dallas Semiconductor/Maxim DS2432 Secure EEPROMs (XAPP780)
- Remote FPGA Reconfiguration Using MicroBlaze (XAPP441)
  - Using CPLD, DDR SDRAM, and Ethernet port

More Development Kits Available

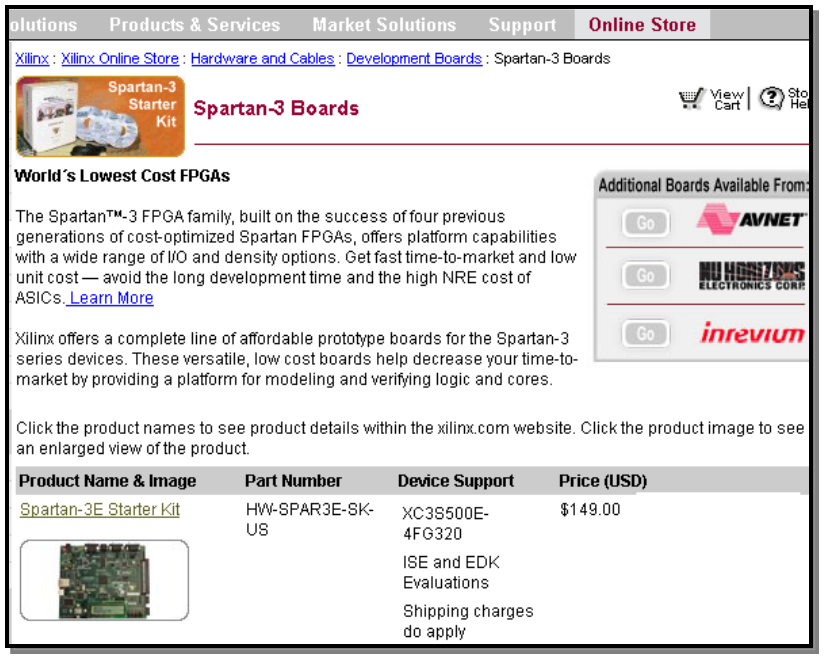
- Xilinx On Board
  - Complete listing of development and reference boards
  - Xilinx, Distributor, 3rd Party



www.xilinx.com/xob

Summary

- The Spartan-3E Starter Kit is the latest low-cost, full featured development platform from Xilinx
- Begin your design today and purchase a Starter Kit at:
  - www.xilinx.com/s3estarter



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