

The Ultimate System Integration Platform



THE MOST COMPREHENSIVE IN PRODUCTION NOW!

One Family—Multiple Platforms

The Virtex®-5 family of FPGAs offers a choice of five new platforms, each delivering an optimized balance of high-performance logic, serial connectivity, signal processing, and embedded processing:



Optimized for high-performance logic



Optimized for high-performance logic with low-power serial connectivity



Optimized for DSP and memory-intensive applications, with low-power serial connectivity



Optimized for embedded processing and memory-intensive applications, with highest-speed serial connectivity



Optimized for ultra high-bandwidth applications, such as bridging, switching, and aggregation in wired telecommunications and data communications systems

All platforms are backed by complete solutions including design tools, IP, development boards, protocol-specific characterization reports, training, services, support, and more.

Discover how this new family delivers even higher performance, lower power, and lower system cost than previous-generation, Virtex-4 FPGAs.

Meet Your Performance Targets Easily

- Achieve a two speed-grade performance gain with new ExpressFabric™ technology
- 550 MHz clocking technology and performance-tuned IP blocks
- 1.25 Gbps LVDS I/O: up to 600 pin pairs (1,200 I/Os)
- 580 GMACS performance from DSP48E slices
- 190 GFLOPS of single-precision, and 65 GFLOPS of double-precision floating-point DSP performance
- 1,100 DMIPS per PowerPC® 440 processor block with high-bandwidth, low-latency interfaces

Optimize I/O Bandwidth, Power and Cost with Easy-to-Use High-Speed Serial Solutions

- RocketIO™ GTP transceivers in the LXT and SXT platforms deliver lowest-power serial connectivity: less than 100 mW (typ) per transceiver at 3.75 Gbps
- RocketIO GTX transceivers in the FXT platform deliver highest-performance serial connectivity: 150 Mbps – 6.5 Gbps
- First FPGA family with hardened PCI Express® endpoint blocks and Tri-mode Ethernet MACs

Beat Your Power Budget while Maximizing Performance

- 35% lower dynamic power with 65nm ExpressFabric technology and power-saving IP blocks including PCI Express endpoint, Gigabit Ethernet MAC, and PowerPC 440 processor
- Further reduce dynamic power consumption by an average 10% with interactive power analysis tools
- Simplify design with no need to select different power supply voltages for high performance versus low power
- Reduce system complexity and cost through fewer power supply rails, fewer regulators, and reduced board area

Build Highest-Performance Processing Systems Easily

- Achieve highest throughput with enhanced PowerPC 440 processor block
- Accelerate processing performance with custom co-processors
- Increase DSP algorithm performance with built-in DSP48E slices

SIVE 65nm FPGA SOLUTION—

Reduce Cost through System Integration with Domain-Optimized Platform FPGAs

- Choose a smaller device: 65nm process shrinks die size and new 6-input LUT increases utilization efficiency
- Meet aggressive performance targets in the least expensive speed grade
- Reduce part count with built-in, low-power transceivers
- Increase logic efficiency with built-in PCI Express endpoint and Ethernet MAC blocks
- Integrate embedded processing systems with industry-standard PowerPC 440 processor blocks
- Select smaller heat sinks, fans, and power supplies enabled by reduced power consumption
- Reduce component cost in volume production with Virtex®-5 EasyPath™ FPGAs

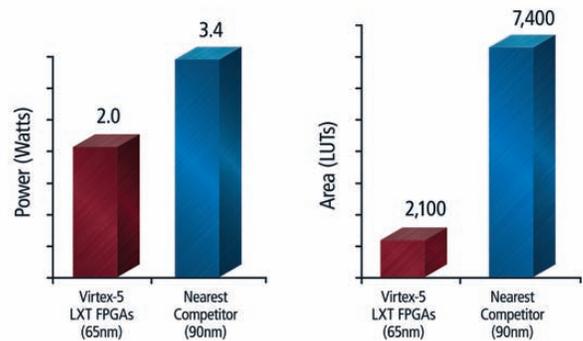
Bring Your Product to Market Faster with Proven Development and Verification Tools

- Achieve maximum FPGA performance using ISE® software featuring Fmax technology and PlanAhead™ design analysis tools
- Design faster and reduce risk with over 125 pre-verified IP cores
- Reach timing closure quickly using new SmartCompile technology that shrinks incremental runtimes
- Optimize designs in less time with SmartXplorer and ExploreAhead tools that leverage multiple compute platforms
- Speed verification with new FAST simulation models and IEEE IP encrypted models for hard IP
- Reduce debug cycle time with the real-time verification capabilities of ChipScope™ Pro tools
- Build complete embedded processing systems with Platform Studio and Embedded Development Kit
- Implement DSP algorithms modeled using MATLAB® and Simulink® in custom hardware using System Generator for DSP

Finish Your Design Ahead of Schedule with Expert Training and Services

- Ensure your team has all the tools they need with Xilinx Productivity Advantage (XPA) Program, a bundled solution including software, education, and IP cores
- Accelerate product development with Titanium on-site dedicated engineering from Xilinx
- Ramp your design team with QuickStart!, Xilinx professionally delivered training coupled with on-site dedicated engineering

Power consumption and logic resources required to implement an 8-lane PCIe endpoint



*5VLX30T vs. 2SGX60D: the smallest devices available from each vendor capable of implementing a x8 PCI Express interfaces.
Power consumption estimates from Xilinx tool v9.2 and competitor tool v7.2 SPI*

VIRTEX-5 EASYPATH DEVICES

The conversion-free cost-reduction path for volume production.

- EasyPath™ devices offer a seamless, low risk path to volume production that eliminates the design complexity and the cost of conversion and re-qualification associated with ASICs and structured ASICs
- 12 weeks from design completion to volume production
- Maintain the flexibility to revert back to standard Virtex-5 FPGAs if system changes are required.



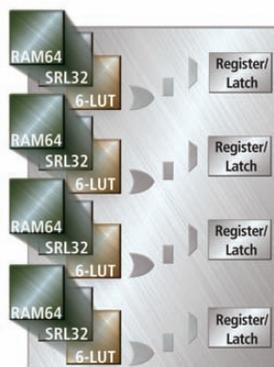
THE ULTIMATE SYSTEM INTEGRATION PLATFORM

65nm ExpressFabric Technology



Achieve highest performance, most efficient utilization on 65nm triple-oxide process

- 30% higher speed, 35% lower dynamic power, and 45% less area than the previous generation
- Industry's first LUT with six independent inputs for fewer logic levels
- Flexible LUTs are configurable as logic, distributed RAM, or shift registers
- Advanced diagonally symmetric interconnect enables shortest, fastest routing
- From 20,000 to 330,000 logic cells for system-level integration

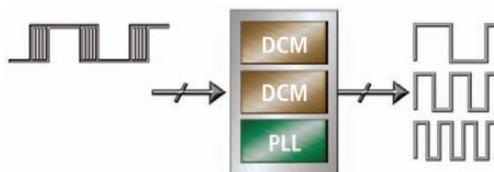


550 MHz Clocking Technology



Achieve highest speeds with high-precision, low-jitter clocking

- 12 DCMs provide phase control of less than 30 ps for better design margin
- 6 PLLs reduce reference clock jitter by more than 2x
- Differential global clocking ensures low skew and jitter



The Right Memory for Any Application



Distributed RAM—Small

- Build 256-bit memory per CLB
- 64 bits per LUT

550 MHz, 36 Kbit Block RAM—Medium

- Configure Block RAM as multi-rate FIFO
- Built-in ECC for high-reliability systems
- Automatic power conservation circuitry

High-Performance External Memories—Large

- ChipSync™ technology for reliable interfaces
- Achieve data bandwidth up to 389 Gbps

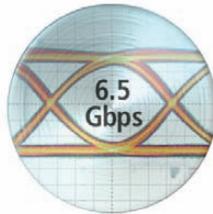


RocketIO GTX Transceivers: 150 Mbps–6.5 Gbps

LX LXT SXT FXT TXT

Implement serial protocols at highest line rates

- Flexible SERDES supports multi-rate applications
- Powerful transmit and receive equalization techniques (transmit pre-emphasis, receive linear equalization, and DFE) for best signal integrity at high line rates
- Integrated “gear box” provides flexible encoding and saves logic resources: 8b/10b, 64b/66b, and 64b/67b
- Designed to work with integrated PCIe and Ethernet MAC blocks
- Low power consumption: less than 200 mW (typ) at 6.5 Gbps

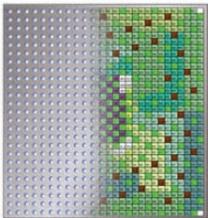


Sparse Chevron Packaging Technology

LX LXT SXT FXT TXT

Keep system noise under control and simplify PCB layout

- Unique PWR/GND pin pattern minimizes crosstalk and reduces PCB layers
- On-substrate bypass capacitors shrink PCB area

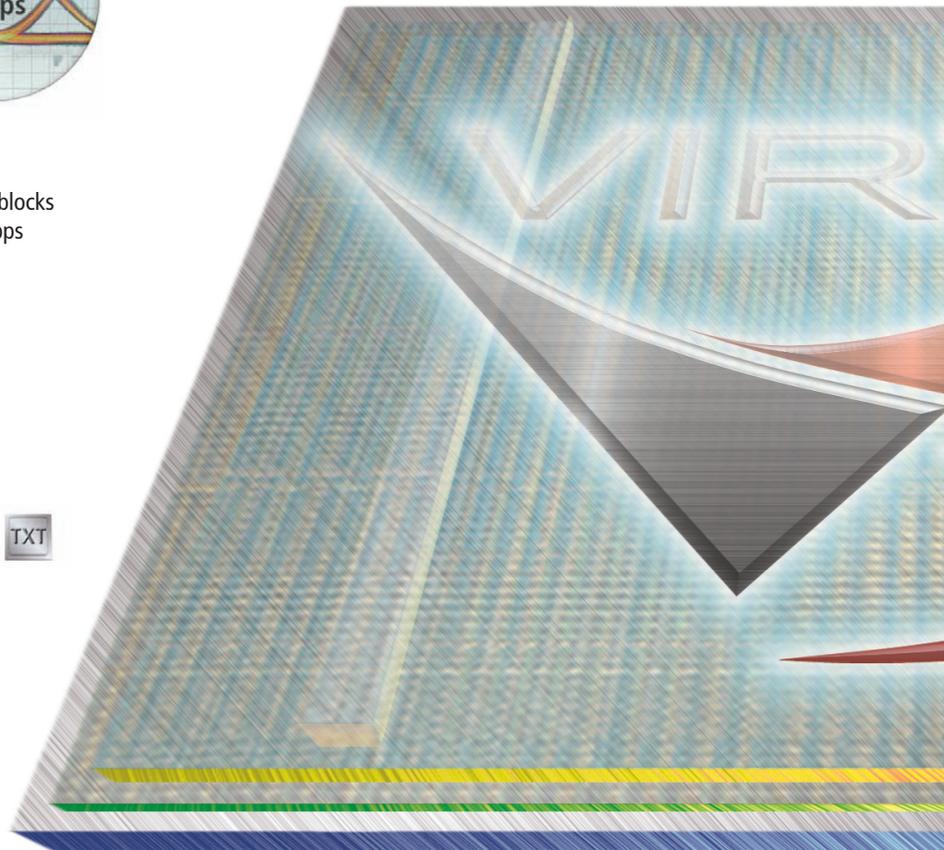


RocketIO GTP Transceivers: 100 Mbps–3.75 Gbps

LX LXT SXT FXT TXT

Implement serial protocols at lowest power

- Flexible SERDES supports multi-rate applications
- Designed to work with integrated PCIe® and Ethernet MAC blocks
- 77% lower power consumption: less than 100 mW (typ) at 3.75 Gbps
- Cross-platform pin compatibility makes it easy to migrate to GTX transceivers for design upgrades



Enhanced Configuration and Bitstream Protection

LX LXT

Reduce system cost, increase reliability, and safeguard your design

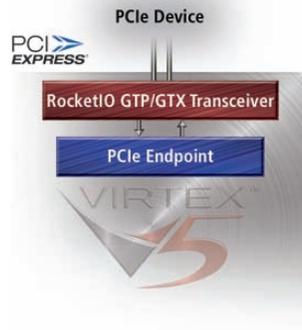
- Configure with commodity SPI and parallel flash memory
- Easier partial reconfiguration and smaller frame size
- Greater reliability for in-system reconfiguration with multi-bitstream management
- Protect your designs with 256-bit AES (Advanced Encryption Standard) security

PCI Express Endpoint Block: x1/x4/x8-lane

LX LXT SXT FXT TXT

Reduce power and cost with built-in support for ubiquitous serial connectivity standard

- Included on PCI-SIG® integrators list after successfully completing the rigorous testing procedures of the Compliance Workshop
- Up to four endpoint blocks in a single Virtex-5 FXT FPGA
- Works with RocketIO GTP/GTX transceivers to deliver full PCIe endpoint function
- Built-in hard IP frees user logic resources and reduces power

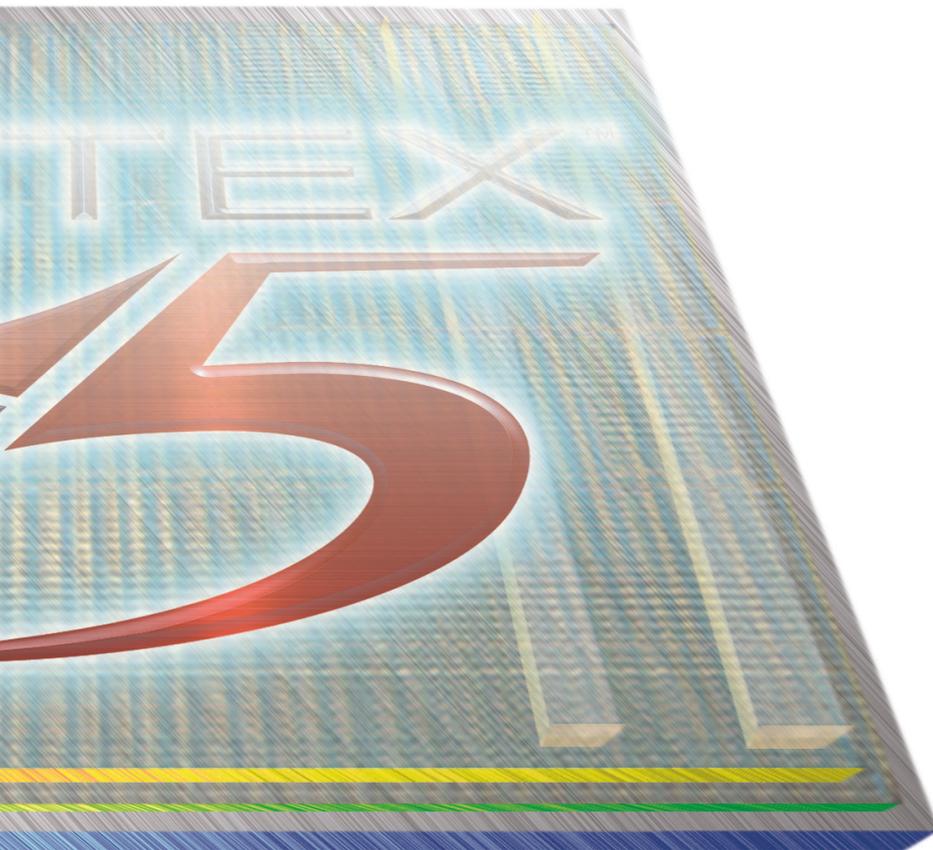
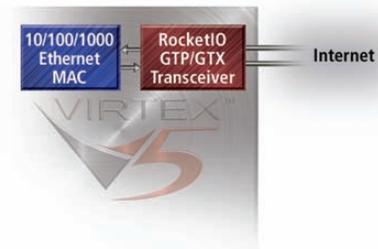


Ethernet Media Access Controller: 10/100/1000 Mbps

LX LXT SXT FXT TXT

Simplify network connectivity with an integrated tri-mode Ethernet MAC

- UNH-verified compliance
- Up to eight Ethernet MAC blocks in a single device
- Built-in hard IP frees user logic resources and reduces power

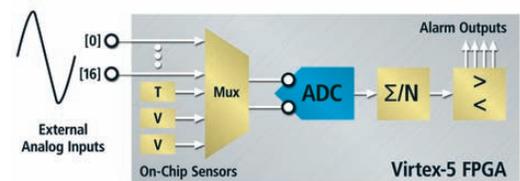


System Monitor and Analog-to-Digital Converter

LX LXT SXT FXT TXT

Simplify system management and diagnostics

- Fully specified 10-bit, 200k samples/s ADC with programmable monitoring functions (sequencing, averaging, alarms)
- Simplify the implementation and reduce the cost of environmental monitoring
- On-chip temperature and supply voltage sensors
- 17 user-selectable external inputs
- Analog measurements accessible via JTAG at any time



SXT FXT TXT

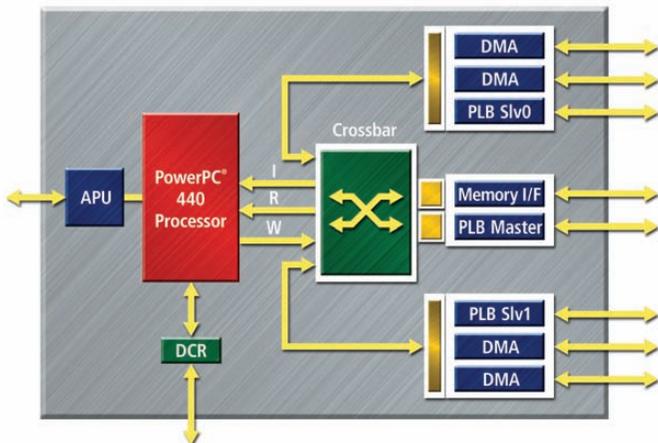


IBM PowerPC 440 processor block with APU Controller and High-bandwidth Crossbar Switch

LX LXT SXT FXT TXT

Build area-efficient, high-performance embedded systems with an industry-standard architecture

- 1,100 DMIPS @ 550MHz; achieve 2,200 DMIPS using a single FPGA with two processors
- Innovative 5x2, 128-bit crossbar switch minimizes latency and enables point-to-point connectivity
- Simultaneous memory bus and Processor Local Bus (PLB) access maximizes throughput
- Integrated DMA channels, PLB interfaces, and dedicated memory interface minimize logic required
- Auxiliary Processor Unit (APU) controller provides added connectivity for co-processing offload

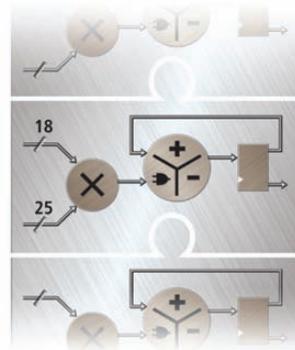


550 MHz DSP48E slice

LX LXT SXT FXT TXT

Achieve up to 580 GMACS performance using DSP48E slices

- 1,056 DSP48E slices in Virtex-5 SX240T device
- Enhanced slice with a 25x18 multiplier, 48-bit adder, and 48-bit accumulator (cascadable to 96 bits) enables single- and double-precision floating-point and high precision filters with fewer slices
- Configurable for DSP, arithmetic, and bit-wise logic
- Enables efficient adder-chain architectures
- 40% lower power consumption: 1.38mW/100MHz at a 38% toggle rate

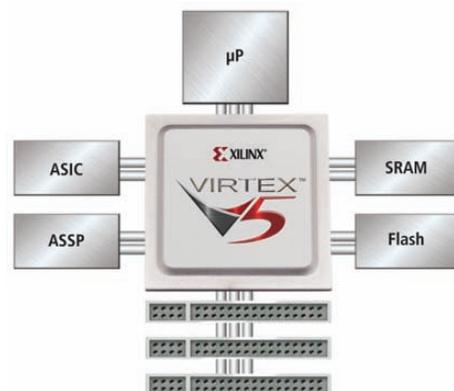


1.25 Gbps SelectIO™ Interface with ChipSync Source-Synchronous Technology

LX LXT SXT FXT TXT

Implement industry-standard and custom protocols

- Simplify board design with built-in input delay and new output delay circuits that compensate for unequal trace lengths
- Adaptive delay setting recalibrates automatically to compensate for changing operating conditions
- Interface to popular standards with 1.25 Gbps differential or 800 Mbps single-ended I/O
- Digitally controlled impedance improves signal integrity, reduces component count, and shrinks board size



A SOLUTION FOR DESIGN CHALLENGE

Implement Parallel Networking and System Interface Standards

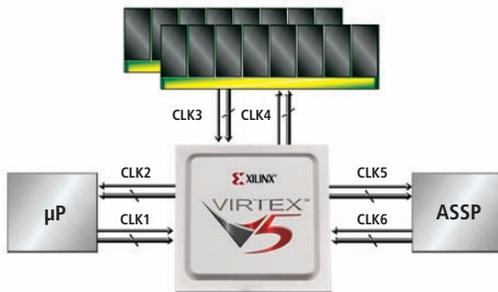
SelectIO technology, combined with pre-verified IP cores, make it easy to support all popular interface standards

- 1.25 Gbps LVDS, 800 Mbps single-ended
- Interface or bridge to virtually any external component
- Support multiple electrical standards in the same device with 35 individually configurable I/O banks
- Design with PCI™, RapidIO, XSBI, SPI4.2, and more
- Configure I/Os to support HSTL, LVDS (SDR and DDR), and more, at voltages from 1.2V to 3.3V

Simplify Source-Synchronous Interfacing

ChipSync technology in every SelectIO technology block provides precise control over critical timing for high-performance source-synchronous interfaces

- Achieve performance targets and simplify PCB layout with flexible per-bit deskew
- Synchronize incoming data to FPGA internal clock with built-in Serializer/Deserializer



Source-Synchronous Interface Support Built into all I/Os

Build Highest-Bandwidth Memory Interfaces

ChipSync technology and the Memory Interface Generator tool make it easy to build reliable interfaces to the latest high-performance memories, including:

Memory Interface	Data Rate (Mbps)	Data Width (# of bits)	Bandwidth (Gbps)
DDR SDRAM	400	576	230
DDR2 SDRAM	667	576	384
DDR3 SDRAM	800	384	307
QDR II SRAM	600	2 x 324	389
RLDRAM II	600	648	389

Accelerate Development with Complete Serial Solutions

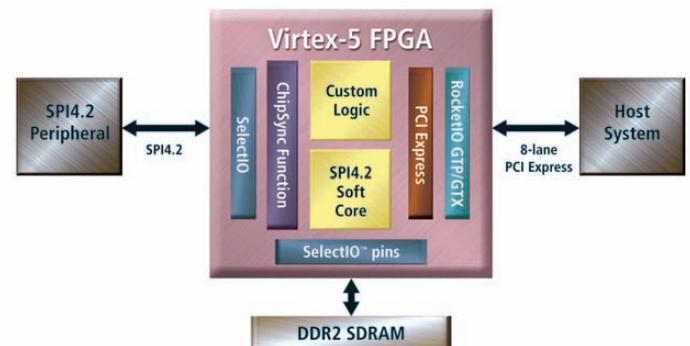
Build chip-to-chip, board-to-board, and box-to-box applications quickly and easily

- Obtain assured compliance with popular standards such as Gigabit Ethernet, PCI Express, OC-48, XAUI, SRIO, and HD-SDI
- Reduce design time with integrated interface blocks and pre-verified IP
- Implement custom solutions
- Reduce pin/trace count to simplify board design and reduce manufacturing cost
- Start designing with ready-to-use solution kits including protocol-specific characterization reports, boards, and simulation models

Bridge Protocols

Protect your investment by interfacing easily to legacy ASSPs or ASICs

- Reduce design time with built-in support for PCI Express and Ethernet
- Implement other popular protocols with pre-verified IP
- Connect external peripheral components to any processor with standards-compliant I/O
- Virtex-5 TXT devices enable the industry's first single-FPGA 100G Ethernet MAC solution



Simplify Protocol Bridging

EVERY PLATFORM

Create Highest-Performance DSP Systems

Increase DSP algorithm performance

- Build single or multi-rate filters for high-sample-rate applications in wireless RF or HD video systems with cascadable DSP48E slices
- Perform fine-granularity data shifting, control, and small bit-width arithmetic functions efficiently in programmable logic fabric
- Free up DSP processor CPU cycles by off-loading algorithmic-intensive tasks to the FPGA co-processor
- Obtain highest memory-to-logic ratio with Virtex-5 SXT platform for efficiently implementing memory-intensive functions in video processing and medical imaging

Optimize DSP power consumption and cost

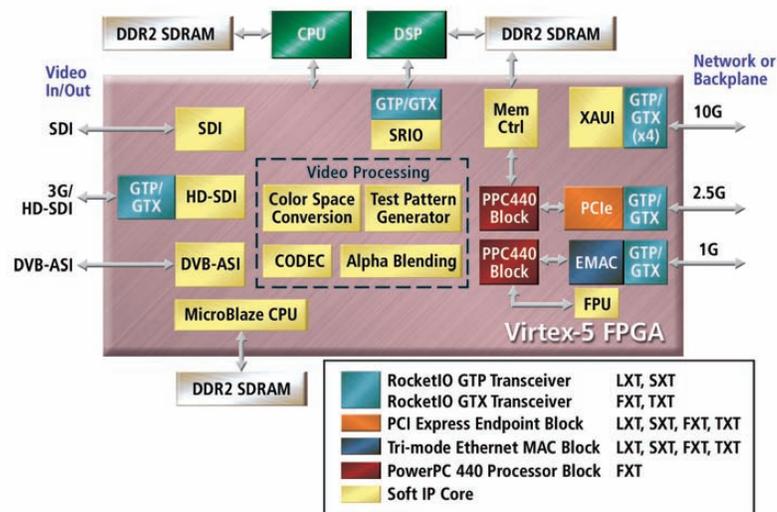
- Achieve efficient implementation with Xilinx algorithm/IP core support for base functions (e.g. FFT, filters), wireless functions (e.g. DDC, DUC, CFR, DPD) or video/imaging functions (e.g. CODECS)
- Use power-efficient Virtex-5 FPGAs in military manpack or handheld software defined radios

Build flexible, high-bandwidth interfaces

- Simplify design with built-in support for PCI Express interfaces
- Obtain complete Xilinx solutions for market-specific interfaces such as CPRI™ and OBSAI for wireless or SDI and HD-SDI for professional broadcast systems
- Build high-bandwidth interfaces to DSP processors using Xilinx IP and reference designs for serial RapidIO, VLYNQ™ interface products, or EMIF interfaces when using FPGAs as DSP co-processors

Increase DSP Design Productivity

- Develop DSP custom hardware using MATLAB and Simulink design environments
- Accelerate DSP system verification up to 1000x using hardware co-simulation
- Gain immediate FPGA expertise from a Xilinx application specific on-site engineer, improving your design productivity and accelerating your time-to-market with Titanium Dedicated Engineering.



System Integration Design Example: Video-Over-IP

Build SoC Designs with High-Performance Embedded Processing

Create customized embedded systems that meet your unique and exacting requirements

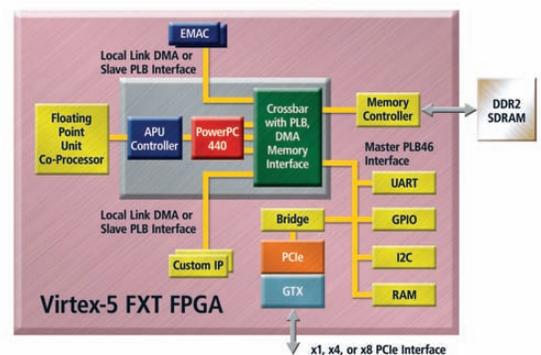
- Integrate high-speed programmable logic with the flexibility of software to optimize performance, power, and cost
- Design system-on-chip functionality with real-time processing capabilities using processor blocks incorporating industry-standard PowerPC 440 processor cores built into Virtex-5 FXT devices
- Implement control functions efficiently in all Virtex-5 FPGAs using MicroBlaze™ soft processors

Achieve highest throughput with enhanced PowerPC 440 processor blocks

- Get non-blocking pipelined point-to-point access to TEMAC, PCIe blocks, and FPGA logic
- Offload PLB with a dedicated memory interface port that provides up to 128-bit data transfer per cycle
- Maximize data transfer rates with highly pipelined transmit and receive scatter-gather DMA channels
- Optimize system performance through user-selectable port prioritization and operating frequencies

Accelerate system performance

- Offload CPU-intensive operations such as video processing, 3D data processing, and floating-point math
- Create custom co-processors in the FPGA logic
- Optimize hardware/software partitioning with the PowerPC 440 processor block Auxiliary Processor Unit (APU) controller
- Implement double/single-precision arithmetic operations using IEEE 754-compatible Floating Point Unit option



Embedded PowerPC 440 Processor System Design Example

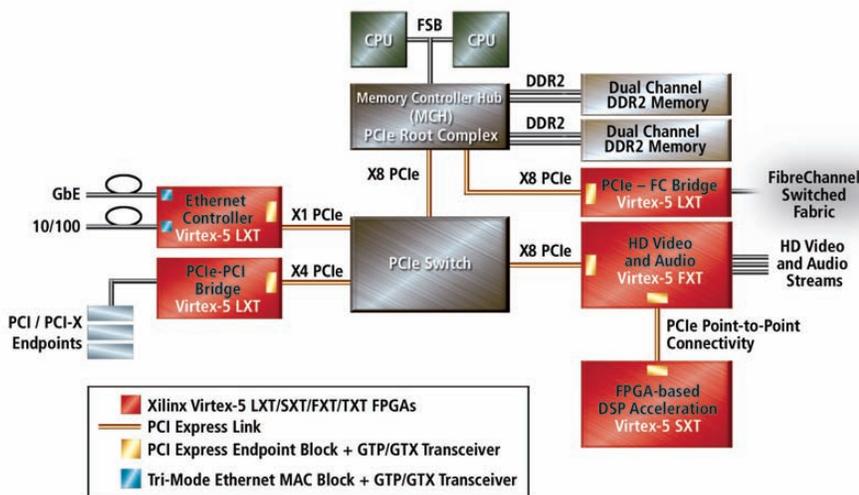
Streamline Embedded Development and Empower Innovation

- Accelerate processing design with the award winning Platform Studio tool suite
- Increase productivity with design wizards, customizable IP, and integrated HW/SW kits
- Simplify system-level debug using Eclipse SDK and ChipScope Pro integrated bus analyzer
- Leverage broad ecosystem support from industry leaders in real-time O/S, design, debug, and trace technologies
- Provide your team with expert advice and training at the most critical project stage with QuickStart! for Embedded designs

Implement PCI Express Technology with Reduced Cost, Power, and Complexity

Minimize design risk with hardened PCIe blocks for building next-generation graphics, storage, networking, and I/O devices

- Integrate multiple functions into a single PCIe technology-enabled FPGA
- Preserve software investment and extend infrastructure life with scalable bandwidth (x1, x4, x8)
- Re-target designs without changing your PCIe interface implementation as your project evolves
- Experience a shorter development cycle with QuickStart! for PCIe designs: an on-site Xilinx dedicated engineer will assist your team with expert advice and training



Application of PCI Express Technology in a Server System



Accelerate development with ready-to-use solution kits

- Protocol compliance reports
- Device characterization
- Reference designs
- Development boards
- Simulation models
- Pre-verified IP
- Development tools
- User documentation
- Partner solutions

Corporate Headquarters

Xilinx, Inc.
2100 Logic Drive
San Jose, CA 95124
USA
Tel: +1-408-559-7778
Web: www.xilinx.com

Europe

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

Asia Pacific Pte. Ltd.

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

XILINX[®]
www.xilinx.com

©2006-2008 Xilinx Inc. All rights reserved. Xilinx, the Xilinx logo, Virtex, Spartan, ISE, and other designated brands are trademarks of Xilinx Inc. CPRI is a trademark of Siemens AG; PCI-SIG, PCIe, PCI Express, and PCI are trademarks of PCI-SIG; PowerPC is a trademark of IBM Corp; VLYNQ is a trademark of Texas Instruments; and are used with permission. All other trademarks are the property of their respective owners.

Printed in U.S.A. PN 0010938-7

TAKE THE NEXT STEP

Visit us online at www.xilinx.com/virtex5

ONE FAMILY MULTIPLE

VIRTEX-5 FAMILY		VIRTEX-5 LX Optimized for High-performance Logic						VIRTEX-5 LXT Optimized for High-performance Logic with Low-power Serial Connectivity				
Part Number		LX30	LX50	LX85	LX110	LX155	LX220	LX330	LX20T	LX30T	LX50T	LX85T
		XC5VLX30	XC5VLX50	XC5VLX85	XC5VLX110	XC5VLX155	XC5VLX220	XC5VLX330	XC5VLX20T	XC5VLX30T	XC5VLX50T	XC5VLX85T
EasyPath Cost Reduction Solutions ¹		–	–	XCE5VLX85	XCE5VLX110	XCE5VLX155	XCE5VLX220	XCE5VLX330	–	–	–	XCE5VLX85T
Slices ²		4,800	7,200	12,960	17,280	24,320	34,560	51,840	3,120	4,800	7,200	12,960
Logic Resources	Logic Cells ³	30,720	46,080	82,944	110,592	155,648	221,184	331,776	19,968	30,720	46,080	82,944
	CLB Flip-Flops	19,200	28,800	51,840	69,120	97,280	138,240	207,360	12,480	19,200	28,800	51,840
Memory Resources	Maximum Distributed RAM (Kbits)	320	480	840	1,120	1,640	2,280	3,420	210	320	480	840
	Block RAM/FIFO w/ECC (36 Kbits each)	32	48	96	128	192	192	288	26	36	60	108
	Total Block RAM (Kbits)	1,152	1,728	3,456	4,608	6,912	6,912	10,368	936	1,296	2,160	3,888
Clock Resources	Digital Clock Manager (DCM)	4	12	12	12	12	12	12	2	4	12	12
	Phase Locked Loop (PLL)	2	6	6	6	6	6	6	1	2	6	6
I/O Resources ⁴	Maximum Single-Ended Pins	400	560	560	800	800	800	1,200	172	360	480	480
	Maximum Differential I/O Pairs	200	280	280	400	400	400	600	86	180	240	240
I/O Standards		HT, LVDS, LVDSEXT, RSDS, BLVDS, ULVDS, LVPECL, LVC MOS33, LVC MOS25, LVC MOS18, LVC MOS15, LVC MOS12, LVTTTL, PCI33, PCI66,										
Embedded Hard IP Resources ⁵	DSP48E Slices	32	48	48	64	128	128	192	24	32	48	48
	PowerPC 440 Processor Blocks	–	–	–	–	–	–	–	–	–	–	–
	PCI Express Endpoint Blocks	–	–	–	–	–	–	–	1	1	1	1
	10/100/1000 Ethernet MAC Blocks	–	–	–	–	–	–	–	2	4	4	4
	RocketIO GTP Low-Power Transceivers	–	–	–	–	–	–	–	4	8	12	12
	RocketIO GTX High-Speed Transceivers	–	–	–	–	–	–	–	–	–	–	–
Speed Grades	Commercial	-1,-2,-3	-1,-2,-3	-1,-2,-3	-1,-2,-3	-1,-2,-3	-1,-2	-1,-2	-1,-2	-1,-2,-3	-1,-2,-3	-1,-2,-3
	Industrial	-1,-2	-1,-2	-1,-2	-1,-2	-1,-2	-1,-2	-1	-1,-2	-1,-2	-1,-2	-1,-2
Configuration	Configuration Memory (Mbits)	8.4	12.6	21.9	29.2	41.1	53.2	79.8	6.3	9.4	14.1	23.4
Package ⁶		Area										Available
FFA Packages (FF): flip-chip fine-pitch BGA (1.0 mm ball spacing)												
	FF324	19 x 19 mm	220	220								
	FF676	27 x 27 mm	400	440	440	440						
	FF1153	35 x 35 mm		560	560	800	800					
	FF1760	42.5 x 42.5 mm				800	800	800	1,200			
	FF323	19 x 19 mm								172 (4)	172 (4)	
	FF665	27 x 27 mm									360 (8)	360 (8)
	FF1156	35 x 35 mm										480 (12)
	FF1738	42.5 x 42.5 mm										480 (12)
	FF1759	42.5 x 42.5 mm										

Notes: ¹ EasyPath solutions provide a conversion-free path for volume production.
² A single Virtex-5 FPGA CLB comprises two slices, with each containing four 6-input LUTs and four Flip-Flops (twice the number found in Virtex-4 FPGA slice), for a total of eight 6-LUTs and eight Flip-Flops per CLB.
³ Virtex-5 FPGA logic cell ratings reflect the increased logic capacity offered by the new 6-input LUT architecture.
⁴ Digitally Controlled Impedance (DCI) is available on I/Os of all devices.
⁵ One system monitor block included in all devices.
⁶ All products available Pb-free and RoHS compliant packaging.
⁷ Available I/O for each device-package combination: number of SelectIO interface pins (number of RocketIO transceivers).

