

## Introduction

The Spartan™-II 2.5V Field-Programmable Gate Array family gives users high performance, abundant logic resources, and a rich feature set, all at an exceptionally low price. The six-member family offers densities ranging from 15,000 to 200,000 system gates, as shown in [Table 1](#). System performance is supported up to 200 MHz.

Spartan-II devices deliver more gates, I/Os, and features per dollar than other FPGAs by combining advanced process technology with a streamlined Virtex-based architecture. Features include block RAM (to 56K bits), distributed RAM (to 75,264 bits), 16 selectable I/O standards, and four DLLs. Fast, predictable interconnect means that successive design iterations continue to meet timing requirements.

The Spartan-II family is a superior alternative to mask-programmed ASICs. The FPGA avoids the initial cost, lengthy development cycles, and inherent risk of conventional ASICs. Also, FPGA programmability permits design upgrades in the field with no hardware replacement necessary (impossible with ASICs).

## Features

- Second generation ASIC replacement technology
  - Densities as high as 5,292 logic cells with up to 200,000 system gates
  - Streamlined features based on Virtex architecture
  - Unlimited reprogrammability
  - Very low cost
  - Advanced 0.18 micron process

- System level features
  - SelectRAM+™ hierarchical memory:
    - 16 bits/LUT distributed RAM
    - Configurable 4K bit block RAM
    - Fast interfaces to external RAM
  - Fully PCI compliant
  - Low-power segmented routing architecture
  - Full readback ability for verification/observability
  - Dedicated carry logic for high-speed arithmetic
  - Efficient multiplier support
  - Cascade chain for wide-input functions
  - Abundant registers/latches with enable, set, reset
  - Four dedicated DLLs for advanced clock control
  - Four primary low-skew global clock distribution nets
  - IEEE 1149.1 compatible boundary scan logic
- Versatile I/O and packaging
  - Pb-free package options
  - Low-cost packages available in all densities
  - Family footprint compatibility in common packages
  - 16 high-performance interface standards
  - Hot swap Compact PCI friendly
  - Zero hold time simplifies system timing
- Fully supported by powerful Xilinx development system
  - Foundation ISE Series: Fully integrated software
  - Alliance Series: For use with third-party tools
  - Fully automatic mapping, placement, and routing

Table 1: Spartan-II FPGA Family Members

Device	Logic Cells	System Gates (Logic and RAM)	CLB Array (R x C)	Total CLBs	Maximum Available User I/O <sup>(1)</sup>	Total Distributed RAM Bits	Total Block RAM Bits
XC2S15	432	15,000	8 x 12	96	86	6,144	16K
XC2S30	972	30,000	12 x 18	216	92	13,824	24K
XC2S50	1,728	50,000	16 x 24	384	176	24,576	32K
XC2S100	2,700	100,000	20 x 30	600	176	38,400	40K
XC2S150	3,888	150,000	24 x 36	864	260	55,296	48K
XC2S200	5,292	200,000	28 x 42	1,176	284	75,264	56K

### Notes:

1. All user I/O counts do not include the four global clock/user input pins. See details in [Table 2, page 3](#).

## General Overview

The Spartan-II family of FPGAs have a regular, flexible, programmable architecture of Configurable Logic Blocks (CLBs), surrounded by a perimeter of programmable Input/Output Blocks (IOBs). There are four Delay-Locked Loops (DLLs), one at each corner of the die. Two columns of block RAM lie on opposite sides of the die, between the CLBs and the IOB columns. These functional elements are interconnected by a powerful hierarchy of versatile routing channels (see [Figure 1](#)).

Spartan-II FPGAs are customized by loading configuration data into internal static memory cells. Unlimited reprogramming cycles are possible with this approach. Stored values in these cells determine logic functions and interconnections implemented in the FPGA. Configuration data can be read from an external serial PROM (master serial mode), or

written into the FPGA in slave serial, slave parallel, or Boundary Scan modes.

Spartan-II FPGAs are typically used in high-volume applications where the versatility of a fast programmable solution adds benefits. Spartan-II FPGAs are ideal for shortening product development cycles while offering a cost-effective solution for high volume production.

Spartan-II FPGAs achieve high-performance, low-cost operation through advanced architecture and semiconductor technology. Spartan-II devices provide system clock rates up to 200 MHz. Spartan-II FPGAs offer the most cost-effective solution while maintaining leading edge performance. In addition to the conventional benefits of high-volume programmable logic solutions, Spartan-II FPGAs also offer on-chip synchronous single-port and dual-port RAM (block and distributed form), DLL clock drivers, programmable set and reset on all flip-flops, fast carry logic, and many other features.

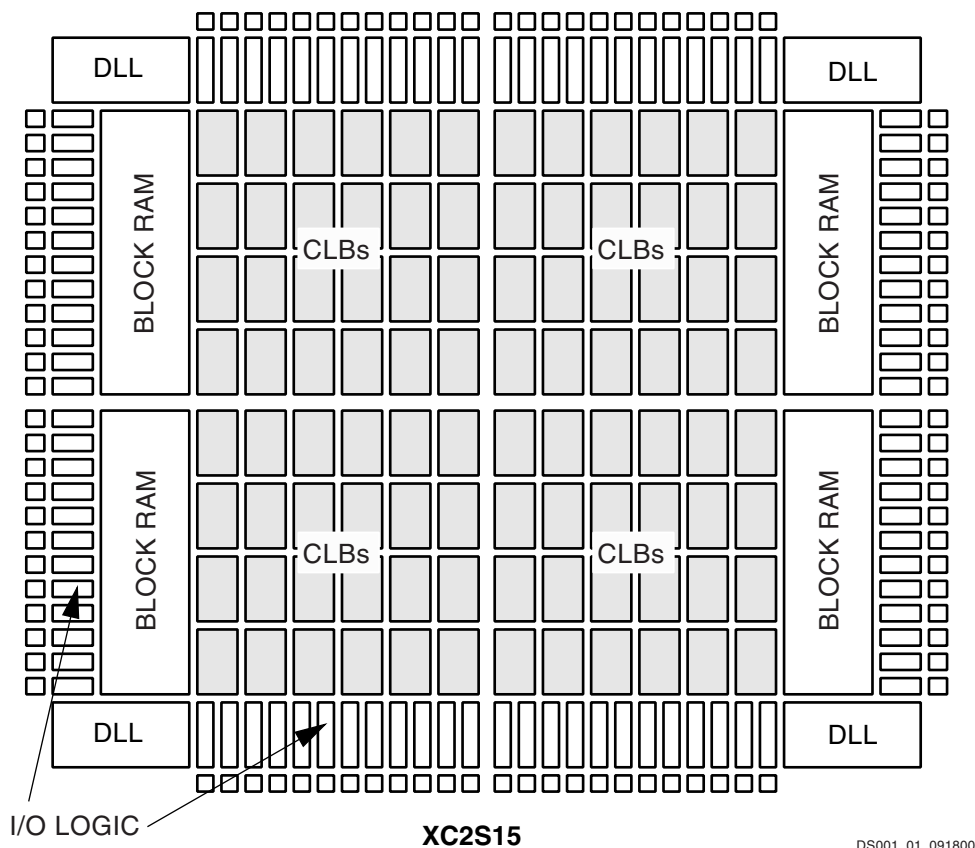


Figure 1: Basic Spartan-II Family FPGA Block Diagram

## Spartan-II Product Availability

Table 2 shows the maximum user I/Os available on the device and the number of user I/Os available for each device/package combination. The four global clock pins are usable as additional user I/Os when not used as a global clock pin. These pins are not included in user I/O counts.

Table 2: Spartan-II User I/O Chart<sup>(1)</sup>

Device	Maximum User I/O	Available User I/O According to Package Type					
		VQ100 VQG100	TQ144 TQG144	CS144 CSG144	PQ208 PQG208	FG256 FGG256	FG456 FGG456
XC2S15	86	60	86	(Note 2)	-	-	-
XC2S30	92	60	92	92	(Note 2)	-	-
XC2S50	176	-	92	-	140	176	-
XC2S100	176	-	92	-	140	176	(Note 2)
XC2S150	260	-	-	-	140	176	260
XC2S200	284	-	-	-	140	176	284

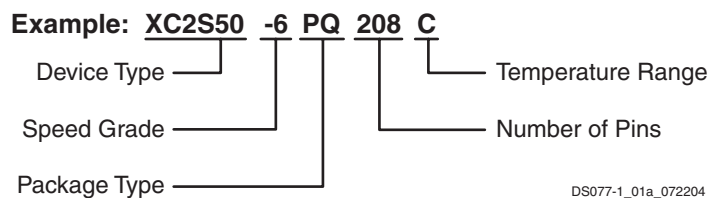
**Notes:**

1. All user I/O counts do not include the four global clock/user input pins.
2. Discontinued by [PDN2004-01](#).

## Ordering Information

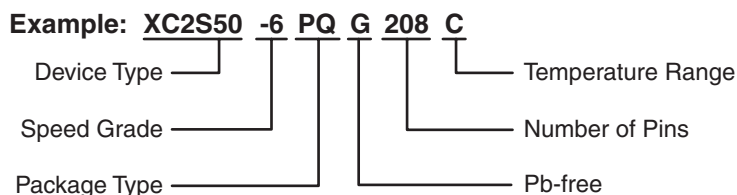
Spartan-II devices are available in both standard and Pb-free packaging options for all device/package combinations. The Pb-free packages include a special "G" character in the ordering code.

### Standard Packaging



DS077-1\_01a\_072204

### Pb-Free Packaging



DS077-1\_01b\_072204

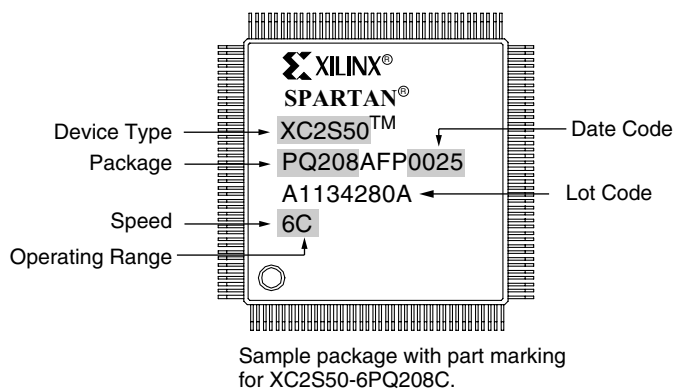
## Device Ordering Options

Device	Speed Grade		Number of Pins / Package Type		Temperature Range ( $T_J$ ) <sup>(2)</sup>	
	XC2S15	-5	Standard Performance	VQ(G)100	100-pin Plastic Very Thin QFP	C = Commercial
XC2S30	-6	Higher Performance <sup>(1)</sup>	CS(G)144	144-ball Chip-Scale BGA	I = Industrial	-40°C to +100°C
XC2S50			TQ(G)144	144-pin Plastic Thin QFP		
XC2S100			PQ(G)208	208-pin Plastic QFP		
XC2S150			FG(G)256	256-ball Fine Pitch BGA		
XC2S200			FG(G)456	456-ball Fine Pitch BGA		

#### Notes:

- The -6 speed grade is exclusively available in the Commercial temperature range.
- See [www.xilinx.com](http://www.xilinx.com) for information on automotive temperature range devices.

## Device Part Marking



ds001-1\_02\_090303

## Revision History

Date	Version No.	Description
09/18/00	2.0	Sectioned the Spartan-II Family data sheet into four modules. Added industrial temperature range information.
10/31/00	2.1	Removed Power down feature.
03/05/01	2.2	Added statement on PROMs.
11/01/01	2.3	Updated Product Availability chart. Minor text edits.
09/03/03	2.4	Added device part marking.
08/02/04	2.5	Added information on Pb-free packaging options and removed discontinued options.

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## The Spartan-II Family Data Sheet

DS001-1, *Spartan-II 2.5V FPGA Family: Introduction and Ordering Information* (Module 1)

DS001-2, *Spartan-II 2.5V FPGA Family: [Functional Description](#)* (Module 2)

DS001-3, *Spartan-II 2.5V FPGA Family: [DC and Switching Characteristics](#)* (Module 3)

DS001-4, *Spartan-II 2.5V FPGA Family: [Pinout Tables](#)* (Module 4)