

## Module 1: Introduction and Ordering Information

DS557 (v4.1) April 1, 2011

- Introduction
- Features
- Architectural Overview
- Configuration Overview
- In-system Flash Memory Overview
- General I/O Capabilities
- Supported Packages and Package Marking
- Ordering Information

## Module 2: Functional Description

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The functionality of the Spartan®-3AN FPGA family is described in the following documents:

- [UG331: Spartan-3 Generation FPGA User Guide](#)
  - Clocking Resources
  - Digital Clock Managers (DCMs)
  - Block RAM
  - Configurable Logic Blocks (CLBs)
    - Distributed RAM
    - SRL16 Shift Registers
    - Carry and Arithmetic Logic
  - I/O Resources
  - Embedded Multiplier Blocks
  - Programmable Interconnect
  - ISE® Design Tools and IP Cores
  - Embedded Processing and Control Solutions
  - Pin Types and Package Overview
  - Package Drawings
  - Powering FPGAs
  - Power Management
- [UG332: Spartan-3 Generation Configuration User Guide](#)
  - Configuration Overview
  - Configuration Pins and Behavior
  - Bitstream Sizes
  - Detailed Descriptions by Mode
    - Self-contained In-System Flash mode
    - Master Serial Mode using Platform Flash PROM
    - Master SPI Mode using Commodity Serial Flash
    - Master BPI Mode using Commodity Parallel Flash
    - Slave Parallel (SelectMAP) using a Processor
    - Slave Serial using a Processor
    - JTAG Mode
  - ISE iMPACT Programming Examples
  - MultiBoot Reconfiguration
  - Design Authentication using Device DNA
- [UG333: Spartan-3AN In-System Flash User Guide](#)
- [UG334: Spartan-3AN Starter Kit User Guide](#)

## Module 3: DC and Switching Characteristics

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- DC Electrical Characteristics
  - Absolute Maximum Ratings
  - Supply Voltage Specifications
  - Recommended Operating Conditions
- Switching Characteristics
  - I/O Timing
  - Configurable Logic Block (CLB) Timing
  - Multiplier Timing
  - Block RAM Timing
  - Digital Clock Manager (DCM) Timing
  - Suspend Mode Timing
  - Device DNA Timing
  - Configuration and JTAG Timing

## Module 4: Pinout Descriptions

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- Pin Descriptions
- Package Overview
- Pinout Tables
- Footprint Diagrams

*Table 1: Production Status of Spartan-3AN FPGAs*

| Spartan-3AN FPGA | Status     |
|------------------|------------|
| XC3S50AN         | Production |
| XC3S200AN        | Production |
| XC3S400AN        | Production |
| XC3S700AN        | Production |
| XC3S1400AN       | Production |

Additional information on the Spartan-3AN family can be found at <http://www.xilinx.com/products/spartan3a/3an.htm>.

## Introduction

The Spartan®-3AN FPGA family combines the best attributes of a leading edge, low cost FPGA with nonvolatile technology across a broad range of densities. The family combines all the features of the Spartan-3A FPGA family plus leading technology in-system Flash memory for configuration and nonvolatile data storage.

The Spartan-3AN FPGAs are part of the Extended Spartan-3A family, which also includes the Spartan-3A FPGAs and the higher density Spartan-3A DSP FPGAs. The Spartan-3AN FPGA family is excellent for space-constrained applications such as blade servers, medical devices, automotive infotainment, telematics, GPS, and other small consumer products. Combining FPGA and Flash technology minimizes chip count, PCB traces and overall size while increasing system reliability.

The Spartan-3AN FPGA internal configuration interface is completely self-contained, increasing design security. The family maintains full support for external configuration. The Spartan-3AN FPGA is the world's first nonvolatile FPGA with MultiBoot, supporting two or more configuration files in one device, allowing alternative configurations for field upgrades, test modes, or multiple system configurations.

## Features

- The new standard for low cost nonvolatile FPGA solutions
- Eliminates traditional nonvolatile FPGA limitations with the advanced 90 nm Spartan-3A device feature set
  - Memory, multipliers, DCMs, SelectIO, hot swap, power management, etc.
- Integrated robust configuration memory
  - Saves board space
  - Improves ease-of-use
  - Simplifies design
  - Reduces support issues
- Plentiful amounts of nonvolatile memory available to the user
  - Up to 11+ Mb available
  - MultiBoot support
  - Embedded processing and code shadowing
  - Scratchpad memory
- Robust 100K Flash memory program/erase cycles
- 20 years Flash memory data retention
- Security features provide bitstream anti-cloning protection
  - Buried configuration interface
  - Unique Device DNA serial number in each device for design Authentication to prevent unauthorized copying
  - Flash memory sector protection and lockdown
- Configuration watchdog timer automatically recovers from configuration errors
- Suspend mode reduces system power consumption
  - Retains all design state and FPGA configuration data
  - Fast response time, typically less than 100 μs
- Full hot-swap compliance
- Multi-voltage, multi-standard SelectIO™ interface pins
  - Up to 502 I/O pins or 227 differential signal pairs
  - LVCMOS, LVTTTL, HSTL, and SSTL single-ended signal standards
  - 3.3V, 2.5V, 1.8V, 1.5V, and 1.2V signaling
  - Up to 24 mA output drive
  - 3.3V ±10% compatibility and hot swap compliance
  - 622+ Mb/s data transfer rate per I/O
  - DDR/DDR2 SDRAM support up to 400 Mb/s
  - LVDS, RSDS, mini-LVDS, PPDS, and HSTL/SSTL differential I/O
- Abundant, flexible logic resources
  - Densities up to 25,344 logic cells
  - Optional shift register or distributed RAM support
  - Enhanced 18 x 18 multipliers with optional pipeline
- Hierarchical SelectRAM™ memory architecture
  - Up to 576 Kbits of dedicated block RAM
  - Up to 176 Kbits of efficient distributed RAM
- Up to eight Digital Clock Managers (DCMs)
- Eight global clocks and eight additional clocks per each half of device, plus abundant low-skew routing
- Complete Xilinx® ISE® and WebPACK™ software development system support
- [MicroBlaze™](#) and [PicoBlaze™](#) embedded processor cores
- Fully compliant 32-/64-bit 33 MHz PCI™ technology support
- Low-cost QFP and BGA Pb-free (RoHS) packaging options
  - Pin-compatible with the same packages in the Spartan-3A FPGA family

Table 2: Summary of Spartan-3AN FPGA Attributes

| Device     | System Gates | Equivalent Logic Cells | CLBs  | Slices | Distributed RAM Bits <sup>(1)</sup> | Block RAM Bits <sup>(1)</sup> | Dedicated Multipliers | DCMs | Maximum User I/O | Maximum Differential I/O Pairs | Bitstream Size <sup>(1)</sup> | In-System Flash Bits |
|------------|--------------|------------------------|-------|--------|-------------------------------------|-------------------------------|-----------------------|------|------------------|--------------------------------|-------------------------------|----------------------|
| XC3S50AN   | 50K          | 1,584                  | 176   | 704    | 11K                                 | 54K                           | 3                     | 2    | 144              | 64                             | 427K                          | 1M                   |
| XC3S200AN  | 200K         | 4,032                  | 448   | 1,792  | 28K                                 | 288K                          | 16                    | 4    | 195              | 90                             | 1,168K                        | 4M                   |
| XC3S400AN  | 400K         | 8,064                  | 896   | 3,584  | 56K                                 | 360K                          | 20                    | 4    | 311              | 142                            | 1,842K                        | 4M                   |
| XC3S700AN  | 700K         | 13,248                 | 1,472 | 5,888  | 92K                                 | 360K                          | 20                    | 8    | 372              | 165                            | 2,669K                        | 8M                   |
| XC3S1400AN | 1400K        | 25,344                 | 2,816 | 11,264 | 176K                                | 576K                          | 32                    | 8    | 502              | 227                            | 4,644K                        | 16M                  |

### Notes:

1. By convention, one Kb is equivalent to 1,024 bits and one Mb is equivalent to 1,024 Kb.

## Architectural Overview

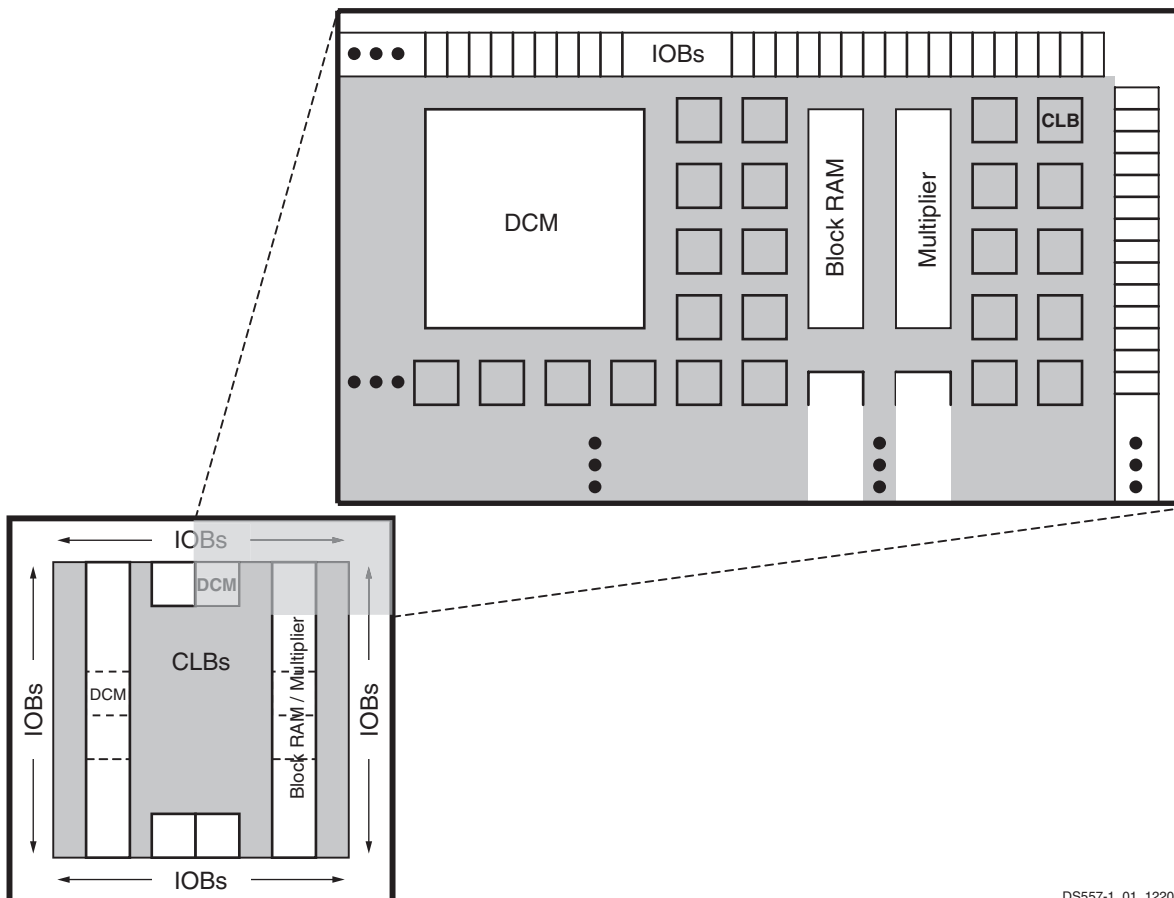
The Spartan-3AN FPGA architecture is compatible with that of the Spartan-3A FPGA. The architecture consists of five fundamental programmable functional elements:

- **Configurable Logic Blocks (CLBs)** contain flexible Look-Up Tables (LUTs) that implement logic plus storage elements used as flip-flops or latches.
- **Input/Output Blocks (IOBs)** control the flow of data between the I/O pins and the internal logic of the device. IOBs support bidirectional data flow plus 3-state operation. They support a variety of signal standards, including several high-performance differential standards. Double Data-Rate (DDR) registers are included.
- **Block RAM** provides data storage in the form of 18-Kbit dual-port blocks.
- **Multiplier Blocks** accept two 18-bit binary numbers as inputs and calculate the product.

- **Digital Clock Manager (DCM) Blocks** provide self-calibrating, fully digital solutions for distributing, delaying, multiplying, dividing, and phase-shifting clock signals.

These elements are organized as shown in Figure 1. A dual ring of staggered IOBs surrounds a regular array of CLBs. Each device has two columns of block RAM except for the XC3S50AN, which has one column. Each RAM column consists of several 18-Kbit RAM blocks. Each block RAM is associated with a dedicated multiplier. The DCMs are positioned in the center with two at the top and two at the bottom of the device. The XC3S50AN has DCMs only at the top, while the XC3S700AN and XC3S1400AN add two DCMs in the middle of the two columns of block RAM and multipliers.

The Spartan-3AN FPGA features a rich network of traces that interconnect all five functional elements, transmitting signals among them. Each functional element has an associated switch matrix that permits multiple connections to the routing.



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**Notes:**

1. The XC3S700AN and XC3S1400AN have two additional DCMs on both the left and right sides as indicated by the dashed lines. The XC3S50AN has only two DCMs at the top and only one Block RAM/Multiplier column.

Figure 1: Spartan-3AN Family Architecture

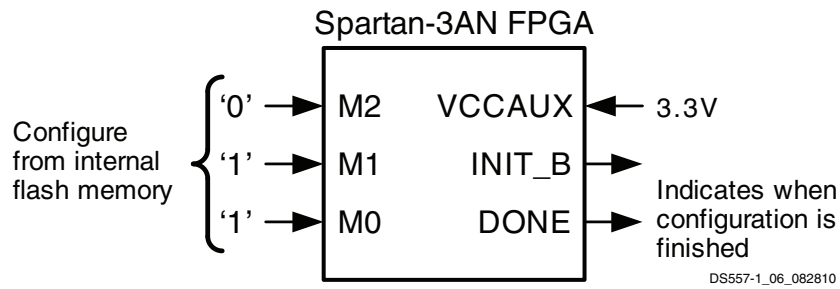


Figure 2: Spartan-3AN FPGA Configuration Interface from Internal SPI Flash Memory

## Configuration

Spartan-3AN FPGAs are programmed by loading configuration data into robust, reprogrammable, static CMOS configuration latches (CCLs) that collectively control all functional elements and routing resources. The FPGA's configuration data is stored on-chip in nonvolatile Flash memory, or externally in a PROM or some other nonvolatile medium, either on or off the board. After applying power, the configuration data is written to the FPGA using any of seven different modes:

- Configure from internal SPI Flash memory (Figure 2)
  - Completely self-contained
  - Reduced board space
  - Easy-to-use configuration interface
- Master Serial from a Xilinx Platform Flash PROM
- Serial Peripheral Interface (SPI) from an external industry-standard SPI serial Flash
- Byte Peripheral Interface (BPI) Up from an industry-standard x8 or x8/x16 parallel NOR Flash
- Slave Serial, typically downloaded from a processor
- Slave Parallel, typically downloaded from a processor
- Boundary-Scan (JTAG), typically downloaded from a processor or system tester

The MultiBoot feature stores multiple configuration files in the on-chip Flash, providing extended life with field upgrades. MultiBoot also supports multiple system solutions with a single board to minimize inventory and simplify the addition of new features, even in the field. Flexibility is maintained to do additional MultiBoot configurations via the external configuration method.

The Spartan-3AN device authentication protocol prevents cloning. Design cloning, unauthorized overbuilding, and complete reverse engineering have driven device security requirements to higher and higher levels. Authentication moves the security from bitstream protection to the next generation of design-level security protecting both the design and embedded microcode. The authentication algorithm is entirely user defined, implemented using FPGA logic. Every product, generation, or design can have a different algorithm and functionality to enhance security.

## In-System Flash Memory

Each Spartan-3AN FPGA contains abundant integrated SPI serial Flash memory, shown in Table 3, used primarily to store the FPGA's configuration bitstream. However, the Flash memory array is large enough to store at least two MultiBoot FPGA configuration bitstreams or nonvolatile data required by the FPGA application, such as code-shadowed MicroBlaze processor applications.

Table 3: Spartan-3AN Device In-System Flash Memory

| Part Number | Total Flash Memory (Bits) | FPGA Bitstream (Bits) | Additional Flash Memory (Bits) <sup>(1)</sup> |
|-------------|---------------------------|-----------------------|---|
| XC3S50AN    | 1,081,344                 | 437,312               | 642,048                                       |
| XC3S200AN   | 4,325,376                 | 1,196,128             | 3,127,872                                     |
| XC3S400AN   | 4,325,376                 | 1,886,560             | 2,437,248                                     |
| XC3S700AN   | 8,650,752                 | 2,732,640             | 5,917,824                                     |
| XC3S1400AN  | 17,301,504                | 4,755,296             | 12,545,280                                    |

### Notes:

1. Aligned to next available page location.

After configuration, the FPGA design has full access to the in-system Flash memory via an internal SPI interface; the control logic is implemented with FPGA logic. Additionally, the FPGA application itself can store nonvolatile data or provide live, in-system Flash updates.

The Spartan-3AN device in-system Flash memory supports leading-edge serial Flash features.

- Small page size (264 or 528 bytes) simplifies nonvolatile data storage
- Randomly accessible, byte addressable
- Up to 66 MHz serial data transfers
- SRAM page buffers
  - Read Flash data while programming another Flash page
  - EEPROM-like byte write functionality
  - Two buffers in most devices, one in XC3S50AN
- Page, Block, and Sector Erase

- Sector-based data protection and security features
  - Sector Protect: Write- and erase-protect a sector (changeable)
  - Sector Lockdown: Sector data is unchangeable (permanent)
- 128-byte Security Register
  - Separate from FPGA's unique Device DNA identifier
  - 64-byte factory-programmed identifier unique to the in-system Flash memory
  - 64-byte one-time programmable, user-programmable field
- 100,000 Program/Erase cycles
- 20-year data retention
- Comprehensive programming support
  - In-system prototype programming via JTAG using Xilinx [Platform Cable USB](#) and iMPACT software
  - Product programming support using BPM Microsystems programmers with appropriate programming adapter
  - Design examples demonstrating in-system programming from a Spartan-3AN FPGA application

## I/O Capabilities

The Spartan-3AN FPGA SelectIO interface supports many popular single-ended and differential standards. [Table 4](#) shows the number of user I/Os as well as the number of differential I/O pairs available for each device/package combination. Some of the user I/Os are unidirectional, input-only pins as indicated in [Table 4](#).

Spartan-3AN FPGAs support the following single-ended standards:

- 3.3V low-voltage TTL (LVTTTL)
- Low-voltage CMOS (LVCMOS) at 3.3V, 2.5V, 1.8V, 1.5V, or 1.2V
- 3.3V PCI at 33 MHz or 66 MHz
- HSTL I, II, and III at 1.5V and 1.8V, commonly used in memory applications
- SSTL I and II at 1.8V, 2.5V, and 3.3V, commonly used for memory applications

Spartan-3AN FPGAs support the following differential standards:

- LVDS, mini-LVDS, RSDS, and PPDS I/O at 2.5V or 3.3V
- Bus LVDS I/O at 2.5V
- TMDS I/O at 3.3V
- Differential HSTL and SSTL I/O
- LVPECL inputs at 2.5V or 3.3V

Table 4: Available User I/Os and Differential (Diff) I/O Pairs

| Package <sup>(1)</sup> | TQ144<br>TQG144                         |                          | FT256<br>FTG256           |                          | FG400<br>FGG400           |                           | FG484<br>FGG484           |                           | FG676<br>FGG676           |                            |
|------------------------|---|--------------------------|---------------------------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|----------------------------|
|                        | 20 x 20 <sup>(2)</sup>                  |                          | 17 x 17                   |                          | 21 x 21                   |                           | 23 x 23                   |                           | 27 x 27                   |                            |
| Device <sup>(3)</sup>  | User                                    | Diff                     | User                      | Diff                     | User                      | Diff                      | User                      | Diff                      | User                      | Diff                       |
| XC3S50AN               | <b>108</b> <sup>(4)</sup><br><i>(7)</i> | <b>50</b><br><i>(24)</i> | <b>144</b><br><i>(32)</i> | <b>64</b><br><i>(32)</i> | –                         | –                         | –                         | –                         | –                         | –                          |
| XC3S200AN              | –                                       | –                        | <b>195</b><br><i>(35)</i> | <b>90</b><br><i>(50)</i> | –                         | –                         | –                         | –                         | –                         | –                          |
| XC3S400AN              | –                                       | –                        | <b>195</b><br><i>(35)</i> | <b>90</b><br><i>(50)</i> | <b>311</b><br><i>(63)</i> | <b>142</b><br><i>(78)</i> | –                         | –                         | –                         | –                          |
| XC3S700AN              | –                                       | –                        | –                         | –                        | –                         | –                         | <b>372</b><br><i>(84)</i> | <b>165</b><br><i>(93)</i> | –                         | –                          |
| XC3S1400AN             | –                                       | –                        | –                         | –                        | –                         | –                         | <b>375</b><br><i>(87)</i> | <b>165</b><br><i>(93)</i> | <b>502</b><br><i>(94)</i> | <b>227</b><br><i>(131)</i> |

**Notes:**

1. See [Pb and Pb-Free Packaging, page 7](#) for details on Pb and Pb-free packaging options.
2. The footprint for the TQ(G)144 (22 mm x 22 mm) package is larger than the package body.
3. Each Spartan-3AN FPGA has a pin-compatible Spartan-3A FPGA equivalent, although Spartan-3A FPGAs do not have internal SPI flash and offer more part/package combinations.
4. The number shown in **bold** indicates the maximum number of I/O and input-only pins. The number shown in *italics* indicates the number of input-only pins. The differential (Diff) input-only pin count includes both differential pairs on input-only pins and differential pairs on I/O pins within I/O banks that are restricted to differential inputs.

## Package Marking

Figure 3 provides a top marking example for Spartan-3AN FPGAs in the quad-flat packages. Figure 4 shows the top marking for Spartan-3AN FPGAs in BGA packages. The markings for the BGA packages are nearly identical to those for the quad-flat packages, except that the marking is rotated with respect to the ball A1 indicator.

The “5C” and “4I” Speed Grade/Temperature Range part combinations may be dual marked as “5C/4I”. Devices with the dual mark can be used as either -5C or -4I devices. Devices with a single mark are only guaranteed for the marked speed grade and temperature range.

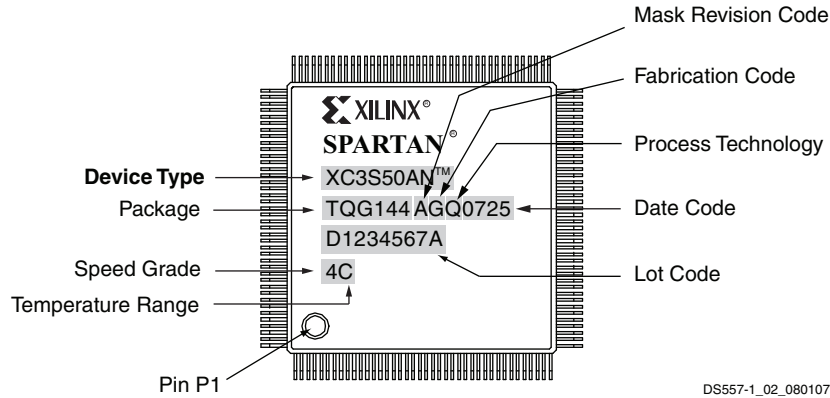


Figure 3: Spartan-3AN FPGA QFP Package Marking Example

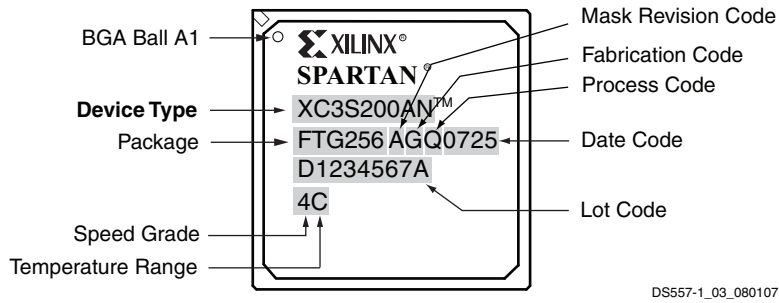


Figure 4: Spartan-3AN FPGA BGA Package Marking Example



## Pb and Pb-Free Packaging

Spartan-3AN FPGAs are available in both leaded (Pb) and Pb-free packaging options (see [Table 5](#)). The Pb-free packages are available for all devices and include a 'G' character in the ordering code. Leaded (non-Pb-free) packages are available for selected devices. The ordering code for the leaded devices does not have an extra 'G'. Leaded and Pb-free devices have the same pin-out.

Table 5: Pb and Pb-Free Package Options

| Pins       |       |       | 144     |                        | 256     |       | 400     |        | 484     |        | 676     |        |
|------------|-------|-------|---------|------------------------|---------|-------|---------|--------|---------|--------|---------|--------|
| Type       |       |       | TQFP    |                        | FTBGA   |       | FBGA    |        | FBGA    |        | FBGA    |        |
| Material   |       |       | Pb-Free | Pb                     | Pb-Free | Pb    | Pb-Free | Pb     | Pb-Free | Pb     | Pb-Free | Pb     |
| Device     | Speed | Range | TQG144  | TQ144                  | FTG256  | FT256 | FGG400  | FG400  | FGG484  | FG484  | FGG676  | FG676  |
| XC3S50AN   | -4    | C, I  | ✓       | SCD4100 <sup>(1)</sup> | ✓       | ✓     |         |        |         |        |         |        |
|            | -5    | C     | ✓       | Note 2                 | ✓       | ✓     |         |        |         |        |         |        |
| XC3S200AN  | -4    | C, I  |         |                        | ✓       | ✓     |         |        |         |        |         |        |
|            | -5    | C     |         |                        | ✓       | ✓     |         |        |         |        |         |        |
| XC3S400AN  | -4    | C, I  |         |                        | ✓       | ✓     | ✓       | ✓      |         |        |         |        |
|            | -5    | C     |         |                        | ✓       | ✓     | ✓       | Note 2 |         |        |         |        |
| XC3S700AN  | -4    | C, I  |         |                        |         |       |         |        | ✓       | ✓      |         |        |
|            | -5    | C     |         |                        |         |       |         |        | ✓       | Note 2 |         |        |
| XC3S1400AN | -4    | C, I  |         |                        |         |       |         |        | ✓       | ✓      | ✓       | ✓      |
|            | -5    | C     |         |                        |         |       |         |        | ✓       | ✓      | ✓       | Note 2 |

**Notes:**

1. To order a Pb package for the XC3S50AN -4 option, append SCD4100 to the part number (XC3S50AN-4TQ144C4100).
2. For Pb packaging for these options, contact your Xilinx sales representative.

## Ordering Information

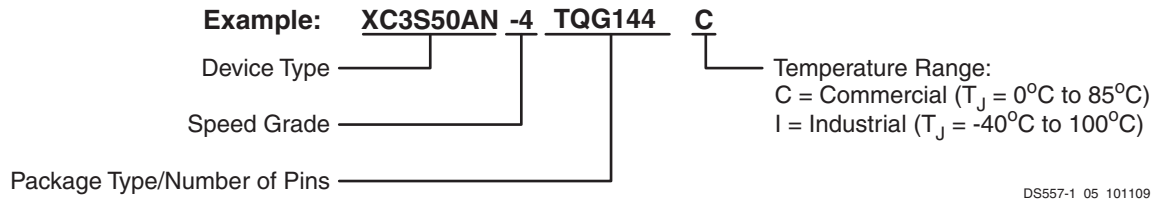


Figure 5: Device Numbering Format

| Device     | Speed Grade                        | Package Type / Number of Pins |  | Temperature Range ( $T_J$ ) |   |
|------------|------------------------------------|-------------------------------|--|-----------------------------|---|
| XC3S50AN   | -4 Standard Performance            | TQ144/<br>TQG144              | 144-pin Thin Quad Flat Pack (TQFP)               | C                           | Commercial ( $0^{\circ}\text{C}$ to $85^{\circ}\text{C}$ )    |
| XC3S200AN  | -5 High Performance <sup>(1)</sup> | FT256/<br>FTG256              | 256-ball Fine-Pitch Thin Ball Grid Array (FTBGA) | I                           | Industrial ( $-40^{\circ}\text{C}$ to $100^{\circ}\text{C}$ ) |
| XC3S400AN  |                                    | FG400/<br>FGG400              | 400-ball Fine-Pitch Ball Grid Array (FBGA)       |                             |   |
| XC3S700AN  |                                    | FG484/<br>FGG484              | 484-ball Fine-Pitch Ball Grid Array (FBGA)       |                             |   |
| XC3S1400AN |                                    | FG676/<br>FGG676              | 676-ball Fine-Pitch Ball Grid Array (FBGA)       |                             |   |

**Notes:**

1. The -5 speed grade is exclusively available in the Commercial temperature range.
2. See [Table 4](#) and [Table 5](#) for available package combinations.

## Revision History

The following table shows the revision history for this document.

| Date     | Version | Revision   |
|----------|---------|--|
| 02/26/07 | 1.0     | Initial release.   |
| 08/16/07 | 2.0     | Updated for Production release of initial device.  |
| 09/12/07 | 2.0.1   | Noted that only dual-mark devices are guaranteed for both -4I and -5C.   |
| 12/12/07 | 3.0     | Updated to Production status with Production release of final family member, XC3S50AN. Noted that non-Pb-free packages may be available for selected devices.  |
| 06/02/08 | 3.1     | Minor updates.   |
| 11/19/09 | 3.2     | Updated document throughout to reflect availability of Pb package options. Added references to the Extended Spartan-3A family. Removed table note 2 from <a href="#">Table 2</a> . In <a href="#">Table 4</a> , added Pb packages, added table note 4, and updated table note 2. Added <a href="#">Table 5</a> .   |
| 12/02/10 | 4.0     | Updated <a href="#">Notice of Disclaimer</a> .   |
| 04/01/11 | 4.1     | In <a href="#">Table 2</a> , revised the Maximum Differential I/O Pairs and Maximum User I/O values for the XC3S50AN. In <a href="#">Table 4</a> , added packages to the XC3S50AN, XC3S400AN, and XC3S1400AN. Updated <a href="#">Pb and Pb-Free Packaging</a> section and <a href="#">Table 5</a> to include the new device/package combinations for the XC3S50AN, XC3S400AN, and XC3S1400AN. |



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## Spartan-3AN FPGA Design Documentation

The functionality of the Spartan®-3AN FPGA family is described in the following documents. The topics covered in each guide are listed below:

- [DS706: Extended Spartan-3A Family Overview](#)
- [UG331: Spartan-3 Generation FPGA User Guide](#)
  - Clocking Resources
  - Digital Clock Managers (DCMs)
  - Block RAM
  - Configurable Logic Blocks (CLBs)
    - Distributed RAM
    - SRL16 Shift Registers
    - Carry and Arithmetic Logic
  - I/O Resources
  - Embedded Multiplier Blocks
  - Programmable Interconnect
  - ISE® Design Tools
  - IP Cores
  - Embedded Processing and Control Solutions
  - Pin Types and Package Overview
  - Package Drawings
  - Powering FPGAs
  - Power Management
- [UG332: Spartan-3 Generation Configuration User Guide](#)
  - Configuration Overview
    - Configuration Pins and Behavior
    - Bitstream Sizes
  - Detailed Descriptions by Mode
    - Master Serial Mode using Xilinx® Platform Flash
    - Master SPI Mode using SPI Serial Flash PROM
    - Internal Master SPI Mode
    - Master BPI Mode using Parallel NOR Flash
    - Slave Parallel (SelectMAP) using a Processor
    - Slave Serial using a Processor
    - JTAG Mode
  - ISE iMPACT Programming Examples
  - MultiBoot Reconfiguration
  - Design Authentication using Device DNA

- [UG333: Spartan-3AN FPGA In-System Flash User Guide](#)

- For FPGA applications that write to or read from the In-System Flash memory after configuration
- SPI\_ACCESS interface
- In-System Flash memory architecture
- Read, program, and erase commands
- Status registers
- Sector Protection and Sector Lockdown features
- Security Register with Unique Identifier

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## Spartan-3AN FPGA Starter Kit

For specific hardware examples, please see the Spartan-3AN FPGA Starter Kit board web page, which has links to various design examples and the user guide.

- **Spartan-3AN FPGA Starter Kit Board Page**  
<http://www.xilinx.com/s3anstarter>
- [UG334: Spartan-3AN FPGA Starter Kit User Guide](#)

## Related Product Families

The Spartan-3AN FPGA family is generally compatible with the Spartan-3A FPGA family.

- [DS529: Spartan-3A FPGA Family Data Sheet](#)

## Revision History

The following table shows the revision history for this document.

| Date     | Version | Revision  |
|----------|---------|---|
| 02/26/07 | 1.0     | Initial release.  |
| 08/16/07 | 2.0     | Updated for Production release of initial device.   |
| 09/12/07 | 2.0.1   | Minor updates to text.  |
| 09/24/07 | 2.1     | Added note that In-System Flash commands were not supported by simulation until ISE 10.1 software.  |
| 12/12/07 | 3.0     | Updated to Production status with Production release of final family member, XC3S50AN. Noted that SPI_ACCESS simulation is supported in ISE 10.1 software. Updated links.                                 |
| 06/02/08 | 3.1     | Minor updates.  |
| 11/19/09 | 3.2     | In the <a href="#">Spartan-3AN FPGA Design Documentation</a> section, added link to <a href="#">DS706</a> , <i>Extended Spartan-3A Family Overview</i> and removed references to older software versions. |
| 12/02/10 | 4.0     | Updated link to sign up for Alerts and updated <a href="#">Notice of Disclaimer</a> .   |
| 04/01/11 | 4.1     | Added the FT(G)256 package selection for the XC3S50AN and XC3S400AN devices and the FG(G)484 package selection for the XC3S1400AN device throughout this data sheet.                                      |

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## DC Electrical Characteristics

In this section, specifications can be designated as Advance, Preliminary, or Production. These terms are defined as follows:

**Advance:** Initial estimates are based on simulation, early characterization, and/or extrapolation from the characteristics of other families. Values are subject to change. Use as estimates, not for production.

**Preliminary:** Based on characterization. Further changes are not expected.

**Production:** These specifications are approved once the silicon has been characterized over numerous production lots. Parameter values are considered stable with no future changes expected.

All parameter limits are representative of worst-case supply voltage and junction temperature conditions. **Unless otherwise noted, the published parameter values apply to all Spartan®-3AN devices. AC and DC characteristics are specified using the same numbers for both commercial and industrial grades.**

## Absolute Maximum Ratings

Stresses beyond those listed under [Table 6: Absolute Maximum Ratings](#) might cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions beyond those listed under the Recommended Operating Conditions is not implied. Exposure to absolute maximum conditions for extended periods of time adversely affects device reliability.

Table 6: Absolute Maximum Ratings

| Symbol      | Description  | Conditions                                | Min   | Max             | Units |
|-------------|--|---|-------|-----------------|-------|
| $V_{CCINT}$ | Internal supply voltage                                    |   | -0.5  | 1.32            | V     |
| $V_{CCAUX}$ | Auxiliary supply voltage                                   |   | -0.5  | 3.75            | V     |
| $V_{CCO}$   | Output driver supply voltage                               |   | -0.5  | 3.75            | V     |
| $V_{REF}$   | Input reference voltage                                    |   | -0.5  | $V_{CCO} + 0.5$ | V     |
| $V_{IN}$    | Voltage applied to all User I/O pins and dual-purpose pins | Driver in a high-impedance state          | -0.95 | 4.6             | V     |
|             | Voltage applied to all Dedicated pins                      |   | -0.5  | 4.6             | V     |
| $I_{IK}$    | Input clamp current per I/O pin                            | $-0.5V < V_{IN} < (V_{CCO} + 0.5V)^{(1)}$ | -     | $\pm 100$       | mA    |
| $V_{ESD}$   | Electrostatic Discharge Voltage                            | Human body model                          | -     | $\pm 2000$      | V     |
|             |  | Charged device model                      | -     | $\pm 500$       | V     |
|             |  | Machine model                             | -     | $\pm 200$       | V     |
| $T_J$       | Junction temperature                                       |   | -     | 125             | °C    |
| $T_{STG}$   | Storage temperature  |   | -65   | 150             | °C    |

### Notes:

- Upper clamp applies only when using PCI IOSTANDARDS.
- For soldering guidelines, see [UG112: Device Package User Guide](#) and [XAPP427: Implementation and Solder Reflow Guidelines for Pb-Free Packages](#).

## Power Supply Specifications

**Table 7: Supply Voltage Thresholds for Power-On Reset**

| Symbol       | Description                               | Min | Max | Units |
|--------------|---|-----|-----|-------|
| $V_{CCINTT}$ | Threshold for the $V_{CCINT}$ supply      | 0.4 | 1.0 | V     |
| $V_{CCAUXT}$ | Threshold for the $V_{CCAUX}$ supply      | 1.0 | 2.0 | V     |
| $V_{CCO2T}$  | Threshold for the $V_{CCO}$ Bank 2 supply | 1.0 | 2.0 | V     |

**Notes:**

- When configuring from the In-System Flash,  $V_{CCAUX}$  must be in the recommended operating range; on power-up make sure  $V_{CCAUX}$  reaches at least 3.0V before INIT\_B goes High to indicate the start of configuration.  $V_{CCINT}$ ,  $V_{CCAUX}$ , and  $V_{CCO}$  supplies to the FPGA can be applied in any order if this requirement is met. However, an external configuration source might have specific requirements. Check the data sheet for the attached configuration source. Apply  $V_{CCINT}$  last for lowest overall power consumption (see the chapter called "Powering Spartan-3 Generation FPGAs" in [UG331](#) for more information).
- To ensure successful power-on,  $V_{CCINT}$ ,  $V_{CCO}$  Bank 2, and  $V_{CCAUX}$  supplies must rise through their respective threshold-voltage ranges with no dips at any point.

**Table 8: Supply Voltage Ramp Rate**

| Symbol       | Description   | Min | Max | Units |
|--------------|---|-----|-----|-------|
| $V_{CCINTR}$ | Ramp rate from GND to valid $V_{CCINT}$ supply level      | 0.2 | 100 | ms    |
| $V_{CCAUXR}$ | Ramp rate from GND to valid $V_{CCAUX}$ supply level      | 0.2 | 100 | ms    |
| $V_{CCO2R}$  | Ramp rate from GND to valid $V_{CCO}$ Bank 2 supply level | 0.2 | 100 | ms    |

**Notes:**

- When configuring from the In-System Flash,  $V_{CCAUX}$  must be in the recommended operating range; on power-up make sure  $V_{CCAUX}$  reaches at least 3.0V before INIT\_B goes High to indicate the start of configuration.  $V_{CCINT}$ ,  $V_{CCAUX}$ , and  $V_{CCO}$  supplies to the FPGA can be applied in any order if this requirement is met. However, an external configuration source might have specific requirements. Check the data sheet for the attached configuration source. Apply  $V_{CCINT}$  last for lowest overall power consumption (see the chapter called "Powering Spartan-3 Generation FPGAs" in [UG331](#) for more information).
- To ensure successful power-on,  $V_{CCINT}$ ,  $V_{CCO}$  Bank 2, and  $V_{CCAUX}$  supplies must rise through their respective threshold-voltage ranges with no dips at any point.

**Table 9: Supply Voltage Levels Necessary for Preserving CMOS Configuration Latch (CCL) Contents and RAM Data**

| Symbol      | Description  | Min | Units |
|-------------|--|-----|-------|
| $V_{DRINT}$ | $V_{CCINT}$ level required to retain CMOS Configuration Latch (CCL) and RAM data | 1.0 | V     |
| $V_{DRAUX}$ | $V_{CCAUX}$ level required to retain CMOS Configuration Latch (CCL) and RAM data | 2.0 | V     |

## General Recommended Operating Conditions

Table 10: General Recommended Operating Conditions

| Symbol          | Description                                 |                       | Min                      | Nominal | Max             | Units |   |
|-----------------|---|-----------------------|--------------------------|---------|-----------------|-------|---|
| $T_J$           | Junction temperature                        | Commercial            | 0                        | –       | 85              | °C    |   |
|                 |   | Industrial            | –40                      | –       | 100             | °C    |   |
| $V_{CCINT}$     | Internal supply voltage                     |                       | 1.14                     | 1.20    | 1.26            | V     |   |
| $V_{CCO}^{(1)}$ | Output driver supply voltage                |                       | 1.10                     | –       | 3.60            | V     |   |
| $V_{CCAUX}$     | Auxiliary supply voltage                    | $V_{CCAUX} = 3.3V$    | 3.00                     | 3.30    | 3.60            | V     |   |
| $V_{IN}^{(2)}$  | Input voltage                               | PCI IOSTANDARD        | –0.5                     | –       | $V_{CCO} + 0.5$ | V     |   |
|                 |   | All other IOSTANDARDS | IP or IO_#               | –0.5    | –               | 4.10  | V |
|                 |   |                       | IO_Lxxy_# <sup>(3)</sup> | –0.5    | –               | 4.10  | V |
| $T_{IN}$        | Input signal transition time <sup>(4)</sup> |                       | –                        | –       | 500             | ns    |   |

### Notes:

1. This  $V_{CCO}$  range spans the lowest and highest operating voltages for all supported I/O standards. [Table 13](#) lists the recommended  $V_{CCO}$  range specific to each of the single-ended I/O standards, and [Table 15](#) lists that specific to the differential standards.
2. See [XAPP459](#), *Eliminating I/O Coupling Effects when Interfacing Large-Swing Single-Ended Signals to User I/O Pins on Spartan-3 Families*.
3. For single-ended signals that are placed on a differential-capable I/O,  $V_{IN}$  of –0.2V to –0.5V is supported but can cause increased leakage between the two pins. See *Parasitic Leakage* in [UG331](#), *Spartan-3 Generation FPGA User Guide*.
4. Measured between 10% and 90%  $V_{CCO}$ . Follow [Signal Integrity](#) recommendations.

## General DC Characteristics for I/O Pins

Table 11: General DC Characteristics of User I/O, Dual-Purpose, and Dedicated Pins

| Symbol          | Description   | Test Conditions  |   | Min                    | Typ  | Max   | Units     |
|-----------------|---|--|---|------------------------|------|-------|-----------|
| $I_L^{(2)}$     | Leakage current at User I/O, Input-only, Dual-Purpose, and Dedicated pins, FPGA powered   | Driver is in a high-impedance state, $V_{IN} = 0V$ or $V_{CCO}$ max, sample-tested |   | -10                    | -    | +10   | $\mu A$   |
| $I_{HS}$        | Leakage current on pins during hot socketing, FPGA unpowered  | All pins except INIT_B, PROG_B, DONE, and JTAG pins when PUDC_B = 1.               |   | -10                    | -    | +10   | $\mu A$   |
|                 |   | INIT_B, PROG_B, DONE, and JTAG pins or other pins when PUDC_B = 0.                 |   | Add $I_{HS} + I_{RPU}$ |      |       | $\mu A$   |
| $I_{RPU}^{(3)}$ | Current through pull-up resistor at User I/O, Dual-Purpose, Input-only, and Dedicated pins. Dedicated pins are powered by $V_{CCAUX}^{(4)}$ | $V_{IN} = GND$   | $V_{CCO}$ or $V_{CCAUX} = 3.0V$ to $3.6V$ | -151                   | -315 | -710  | $\mu A$   |
|                 |   |  | $V_{CCO} = 2.3V$ to $2.7V$                | -82                    | -182 | -437  | $\mu A$   |
|                 |   |  | $V_{CCO} = 1.7V$ to $1.9V$                | -36                    | -88  | -226  | $\mu A$   |
|                 |   |  | $V_{CCO} = 1.4V$ to $1.6V$                | -22                    | -56  | -148  | $\mu A$   |
|                 |   |  | $V_{CCO} = 1.14V$ to $1.26V$              | -11                    | -31  | -83   | $\mu A$   |
| $R_{PU}^{(3)}$  | Equivalent pull-up resistor value at User I/O, Dual-Purpose, Input-only, and Dedicated pins (based on $I_{RPU}$ per Note 3)                 | $V_{IN} = GND$   | $V_{CCO} = 3.0V$ to $3.6V$                | 5.1                    | 11.4 | 23.9  | $k\Omega$ |
|                 |   |  | $V_{CCO} = 2.3V$ to $2.7V$                | 6.2                    | 14.8 | 33.1  | $k\Omega$ |
|                 |   |  | $V_{CCO} = 1.7V$ to $1.9V$                | 8.4                    | 21.6 | 52.6  | $k\Omega$ |
|                 |   |  | $V_{CCO} = 1.4V$ to $1.6V$                | 10.8                   | 28.4 | 74.0  | $k\Omega$ |
|                 |   |  | $V_{CCO} = 1.14V$ to $1.26V$              | 15.3                   | 41.1 | 119.4 | $k\Omega$ |
| $I_{RPD}^{(3)}$ | Current through pull-down resistor at User I/O, Dual-Purpose, Input-only, and Dedicated pins  | $V_{IN} = V_{CCO}$   | $V_{CCAUX} = 3.0V$ to $3.6V$              | 167                    | 346  | 659   | $\mu A$   |
| $R_{PD}^{(3)}$  | Equivalent pull-down resistor value at User I/O, Dual-Purpose, Input-only, and Dedicated pins (based on $I_{RPD}$ per Note 3)               | $V_{CCAUX} = 3.0V$ to $3.6V$   | $V_{IN} = 3.0V$ to $3.6V$                 | 5.5                    | 10.4 | 20.8  | $k\Omega$ |
|                 |   |  | $V_{IN} = 2.3V$ to $2.7V$                 | 4.1                    | 7.8  | 15.7  | $k\Omega$ |
|                 |   |  | $V_{IN} = 1.7V$ to $1.9V$                 | 3.0                    | 5.7  | 11.1  | $k\Omega$ |
|                 |   |  | $V_{IN} = 1.4V$ to $1.6V$                 | 2.7                    | 5.1  | 9.6   | $k\Omega$ |
|                 |   |  | $V_{IN} = 1.14V$ to $1.26V$               | 2.4                    | 4.5  | 8.1   | $k\Omega$ |
| $I_{REF}$       | $V_{REF}$ current per pin   | All $V_{CCO}$ levels   |   | -10                    | -    | +10   | $\mu A$   |
| $C_{IN}$        | Input capacitance   | -  |   | -                      | -    | 10    | pF        |
| $R_{DT}$        | Resistance of optional differential termination circuit within a differential I/O pair. Not available on Input-only pairs.                  | $V_{CCO} = 3.3V \pm 10\%$  | LVDS_33, MINI_LVDS_33, RSDS_33            | 90                     | 100  | 115   | $\Omega$  |
|                 |   | $V_{CCO} = 2.5V \pm 10\%$  | LVDS_25, MINI_LVDS_25, RSDS_25            | 90                     | 110  | -     | $\Omega$  |

**Notes:**

- The numbers in this table are based on the conditions set forth in Table 10.
- For single-ended signals that are placed on a differential-capable I/O,  $V_{IN}$  of  $-0.2V$  to  $-0.5V$  is supported but can cause increased leakage between the two pins. See *Parasitic Leakage* in UG331, *Spartan-3 Generation FPGA User Guide*.
- This parameter is based on characterization. The pull-up resistance  $R_{PU} = V_{CCO} / I_{RPU}$ . The pull-down resistance  $R_{PD} = V_{IN} / I_{RPD}$ .
- $V_{CCAUX}$  must be 3.3V on Spartan-3AN FPGAs.  $V_{CCAUX}$  for Spartan-3A FPGAs can be either 3.3V or 2.5V.



## Quiescent Current Requirements

Table 12: Spartan-3AN FPGA Quiescent Supply Current Characteristics

| Symbol              | Description                                 | Device     | Typical <sup>(2)</sup> | Commercial Maximum <sup>(2)</sup> | Industrial Maximum <sup>(2)</sup> | Units |
|---------------------|---|------------|------------------------|-----------------------------------|-----------------------------------|-------|
| I <sub>CCINTQ</sub> | Quiescent V <sub>CCINT</sub> supply current | XC3S50AN   | 2                      | 20                                | 30                                | mA    |
|                     |   | XC3S200AN  | 7                      | 50                                | 70                                | mA    |
|                     |   | XC3S400AN  | 10                     | 85                                | 125                               | mA    |
|                     |   | XC3S700AN  | 13                     | 120                               | 185                               | mA    |
|                     |   | XC3S1400AN | 24                     | 220                               | 310                               | mA    |
| I <sub>CCOQ</sub>   | Quiescent V <sub>CCO</sub> supply current   | XC3S50AN   | 0.2                    | 2                                 | 3                                 | mA    |
|                     |   | XC3S200AN  | 0.2                    | 2                                 | 3                                 | mA    |
|                     |   | XC3S400AN  | 0.3                    | 3                                 | 4                                 | mA    |
|                     |   | XC3S700AN  | 0.3                    | 3                                 | 4                                 | mA    |
|                     |   | XC3S1400AN | 0.3                    | 3                                 | 4                                 | mA    |
| I <sub>CCAUXQ</sub> | Quiescent V <sub>CCAUX</sub> supply current | XC3S50AN   | 3.1                    | 8.1                               | 10.1                              | mA    |
|                     |   | XC3S200AN  | 5.1                    | 12.1                              | 15.1                              | mA    |
|                     |   | XC3S400AN  | 5.1                    | 18.1                              | 24.1                              | mA    |
|                     |   | XC3S700AN  | 6.1                    | 28.1                              | 34.1                              | mA    |
|                     |   | XC3S1400AN | 10.1                   | 50.1                              | 58.1                              | mA    |

### Notes:

- The numbers in this table are based on the conditions set forth in [Table 10](#).
- Quiescent supply current is measured with all I/O drivers in a high-impedance state and with all pull-up/pull-down resistors at the I/O pads disabled. The internal SPI Flash is deselected (CSB = High); the internal SPI Flash current is consumed on the V<sub>CCAUX</sub> supply rail. Typical values are characterized using typical devices at room temperature (T<sub>J</sub> of 25°C at V<sub>CCINT</sub> = 1.2V, V<sub>CCO</sub> = 3.3V, and V<sub>CCAUX</sub> = 3.3V). The maximum limits are tested for each device at the respective maximum specified junction temperature and at maximum voltage limits with V<sub>CCINT</sub> = 1.26V, V<sub>CCO</sub> = 3.6V, and V<sub>CCAUX</sub> = 3.6V. The FPGA is programmed with a “blank” configuration data file (that is, a design with no functional elements instantiated). For conditions other than those described above (for example, a design including functional elements), measured quiescent current levels will be different than the values in the table.
- There are two recommended ways to estimate the total power consumption (quiescent plus dynamic) for a specific design: a) The [Spartan-3AN FPGA XPower Estimator](#) provides quick, approximate, typical estimates, and does not require a netlist of the design, and b) XPower Analyzer uses a netlist as input to provide maximum estimates as well as more accurate typical estimates. For more information on power for the In-System Flash memory, see the Power Management chapter of [UG333](#).
- The maximum numbers in this table indicate the minimum current each power rail requires in order for the FPGA to power-on successfully.
- For information on the power-saving Suspend mode, see [XAPP480: Using Suspend Mode in Spartan-3 Generation FPGAs](#). Suspend mode typically saves 40% total power consumption compared to quiescent current.

## Single-Ended I/O Standards

Table 13: Recommended Operating Conditions for User I/Os Using Single-Ended Standards

| IOSTANDARD Attribute        | V <sub>CCO</sub> for Drivers <sup>(2)</sup> |         |         | V <sub>REF</sub>                                     |         |         | V <sub>IL</sub>          | V <sub>IH</sub> <sup>(3)</sup> |
|-----------------------------|---|---------|---------|--|---------|---------|--------------------------|--------------------------------|
|                             | Min (V)                                     | Nom (V) | Max (V) | Min (V)  | Nom (V) | Max (V) | Max (V)                  | Min (V)                        |
| LVTTL                       | 3.0   | 3.3     | 3.6     | V <sub>REF</sub> is not used for these I/O standards |         |         | 0.8                      | 2.0                            |
| LVC MOS33 <sup>(4)</sup>    | 3.0   | 3.3     | 3.6     |  |         |         | 0.8                      | 2.0                            |
| LVC MOS25 <sup>(4)(5)</sup> | 2.3   | 2.5     | 2.7     |  |         |         | 0.7                      | 1.7                            |
| LVC MOS18                   | 1.65  | 1.8     | 1.95    |  |         |         | 0.4                      | 0.8                            |
| LVC MOS15                   | 1.4   | 1.5     | 1.6     |  |         |         | 0.4                      | 0.8                            |
| LVC MOS12                   | 1.1   | 1.2     | 1.3     |  |         |         | 0.4                      | 0.7                            |
| PCI33_3 <sup>(6)</sup>      | 3.0   | 3.3     | 3.6     |  |         |         | 0.3 • V <sub>CCO</sub>   | 0.5 • V <sub>CCO</sub>         |
| PCI66_3 <sup>(6)</sup>      | 3.0   | 3.3     | 3.6     |  |         |         | 0.3 • V <sub>CCO</sub>   | 0.5 • V <sub>CCO</sub>         |
| HSTL_I                      | 1.4   | 1.5     | 1.6     | 0.68   | 0.75    | 0.9     | V <sub>REF</sub> – 0.1   | V <sub>REF</sub> + 0.1         |
| HSTL_III                    | 1.4   | 1.5     | 1.6     | –  | 0.9     | –       | V <sub>REF</sub> – 0.1   | V <sub>REF</sub> + 0.1         |
| HSTL_I_18                   | 1.7   | 1.8     | 1.9     | 0.8  | 0.9     | 1.1     | V <sub>REF</sub> – 0.1   | V <sub>REF</sub> + 0.1         |
| HSTL_II_18                  | 1.7   | 1.8     | 1.9     | –  | 0.9     | –       | V <sub>REF</sub> – 0.1   | V <sub>REF</sub> + 0.1         |
| HSTL_III_18                 | 1.7   | 1.8     | 1.9     | –  | 1.1     | –       | V <sub>REF</sub> – 0.1   | V <sub>REF</sub> + 0.1         |
| SSTL18_I                    | 1.7   | 1.8     | 1.9     | 0.833  | 0.900   | 0.969   | V <sub>REF</sub> – 0.125 | V <sub>REF</sub> + 0.125       |
| SSTL18_II                   | 1.7   | 1.8     | 1.9     | 0.833  | 0.900   | 0.969   | V <sub>REF</sub> – 0.125 | V <sub>REF</sub> + 0.125       |
| SSTL2_I                     | 2.3   | 2.5     | 2.7     | 1.13   | 1.25    | 1.38    | V <sub>REF</sub> – 0.150 | V <sub>REF</sub> + 0.150       |
| SSTL2_II                    | 2.3   | 2.5     | 2.7     | 1.13   | 1.25    | 1.38    | V <sub>REF</sub> – 0.150 | V <sub>REF</sub> + 0.150       |
| SSTL3_I                     | 3.0   | 3.3     | 3.6     | 1.3  | 1.5     | 1.7     | V <sub>REF</sub> – 0.2   | V <sub>REF</sub> + 0.2         |
| SSTL3_II                    | 3.0   | 3.3     | 3.6     | 1.3  | 1.5     | 1.7     | V <sub>REF</sub> – 0.2   | V <sub>REF</sub> + 0.2         |

**Notes:**

- Descriptions of the symbols used in this table are as follows:  
V<sub>CCO</sub> – the supply voltage for output drivers  
V<sub>REF</sub> – the reference voltage for setting the input switching threshold  
V<sub>IL</sub> – the input voltage that indicates a Low logic level  
V<sub>IH</sub> – the input voltage that indicates a High logic level
- In general, the V<sub>CCO</sub> rails supply only output drivers, not input circuits. The exceptions are for LVC MOS25 inputs and for PCI™ I/O standards.
- For device operation, the maximum signal voltage (V<sub>IH</sub> max) can be as high as V<sub>IN</sub> max. See Table 6.
- There is approximately 100 mV of hysteresis on inputs using LVC MOS33 and LVC MOS25 I/O standards.
- All Dedicated pins (PROG\_B, DONE, SUSPEND, TCK, TDI, TDO, and TMS) draw power from the V<sub>CCAUX</sub> rail and use the LVC MOS33 standard. The Dual-Purpose configuration pins use the LVC MOS standard before the User mode. When using these pins as part of a standard 2.5V configuration interface, apply 2.5V to the V<sub>CCO</sub> lines of Banks 0, 1, and 2 at power-on as well as throughout configuration.
- For information on PCI IP solutions, see [www.xilinx.com/pci](http://www.xilinx.com/pci). The PCI IOSTANDARD is not supported on input-only pins. The PCIX IOSTANDARD is available and has equivalent characteristics but no PCI-X IP is supported.

Table 14: DC Characteristics of User I/Os Using Single-Ended Standards

| IOSTANDARD Attribute    | Test Conditions      |                      |                         | Logic Level Characteristics |                        |
|-------------------------|----------------------|----------------------|-------------------------|-----------------------------|------------------------|
|                         | I <sub>OL</sub> (mA) | I <sub>OH</sub> (mA) | V <sub>OL</sub> Max (V) | V <sub>OH</sub> Min (V)     |                        |
| LVTTL <sup>(3)</sup>    | 2                    | 2                    | -2                      | 0.4                         | 2.4                    |
|                         | 4                    | 4                    | -4                      |                             |                        |
|                         | 6                    | 6                    | -6                      |                             |                        |
|                         | 8                    | 8                    | -8                      |                             |                        |
|                         | 12                   | 12                   | -12                     |                             |                        |
|                         | 16                   | 16                   | -16                     |                             |                        |
|                         | 24                   | 24                   | -24                     |                             |                        |
| LVCMOS33 <sup>(3)</sup> | 2                    | 2                    | -2                      | 0.4                         | V <sub>CCO</sub> - 0.4 |
|                         | 4                    | 4                    | -4                      |                             |                        |
|                         | 6                    | 6                    | -6                      |                             |                        |
|                         | 8                    | 8                    | -8                      |                             |                        |
|                         | 12                   | 12                   | -12                     |                             |                        |
|                         | 16                   | 16                   | -16                     |                             |                        |
|                         | 24 <sup>(5)</sup>    | 24                   | -24                     |                             |                        |
| LVCMOS25 <sup>(3)</sup> | 2                    | 2                    | -2                      | 0.4                         | V <sub>CCO</sub> - 0.4 |
|                         | 4                    | 4                    | -4                      |                             |                        |
|                         | 6                    | 6                    | -6                      |                             |                        |
|                         | 8                    | 8                    | -8                      |                             |                        |
|                         | 12                   | 12                   | -12                     |                             |                        |
|                         | 16 <sup>(5)</sup>    | 16                   | -16                     |                             |                        |
|                         | 24 <sup>(5)</sup>    | 24                   | -24                     |                             |                        |
| LVCMOS18 <sup>(3)</sup> | 2                    | 2                    | -2                      | 0.4                         | V <sub>CCO</sub> - 0.4 |
|                         | 4                    | 4                    | -4                      |                             |                        |
|                         | 6                    | 6                    | -6                      |                             |                        |
|                         | 8                    | 8                    | -8                      |                             |                        |
|                         | 12 <sup>(5)</sup>    | 12                   | -12                     |                             |                        |
|                         | 16 <sup>(5)</sup>    | 16                   | -16                     |                             |                        |
| LVCMOS15 <sup>(3)</sup> | 2                    | 2                    | -2                      | 0.4                         | V <sub>CCO</sub> - 0.4 |
|                         | 4                    | 4                    | -4                      |                             |                        |
|                         | 6                    | 6                    | -6                      |                             |                        |
|                         | 8 <sup>(5)</sup>     | 8                    | -8                      |                             |                        |
|                         | 12 <sup>(5)</sup>    | 12                   | -12                     |                             |                        |
| LVCMOS12 <sup>(3)</sup> | 2                    | 2                    | -2                      | 0.4                         | V <sub>CCO</sub> - 0.4 |
|                         | 4 <sup>(5)</sup>     | 4                    | -4                      |                             |                        |
|                         | 6 <sup>(5)</sup>     | 6                    | -6                      |                             |                        |
| PCI33_3 <sup>(4)</sup>  | 1.5                  | -0.5                 | 10% V <sub>CCO</sub>    | 90% V <sub>CCO</sub>        |                        |
| PCI66_3 <sup>(4)</sup>  | 1.5                  | -0.5                 | 10% V <sub>CCO</sub>    | 90% V <sub>CCO</sub>        |                        |

Table 14: DC Characteristics of User I/Os Using Single-Ended Standards (Cont'd)

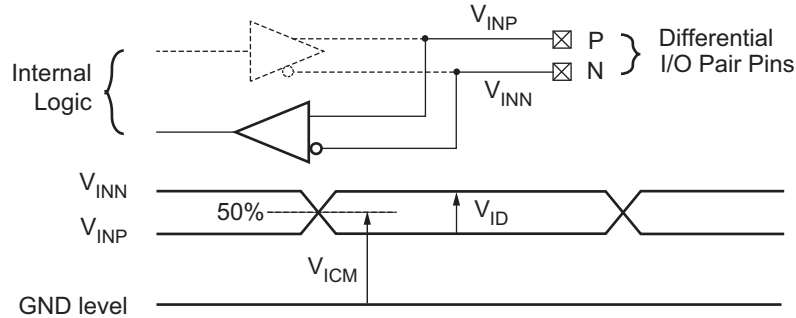
| IOSTANDARD Attribute      | Test Conditions      |                      | Logic Level Characteristics |                         |
|---------------------------|----------------------|----------------------|-----------------------------|-------------------------|
|                           | I <sub>OL</sub> (mA) | I <sub>OH</sub> (mA) | V <sub>OL</sub> Max (V)     | V <sub>OH</sub> Min (V) |
| HSTL_I <sup>(5)</sup>     | 8                    | -8                   | 0.4                         | V <sub>CCO</sub> - 0.4  |
| HSTL_III <sup>(5)</sup>   | 24                   | -8                   | 0.4                         | V <sub>CCO</sub> - 0.4  |
| HSTL_I_18                 | 8                    | -8                   | 0.4                         | V <sub>CCO</sub> - 0.4  |
| HSTL_II_18 <sup>(5)</sup> | 16                   | -16                  | 0.4                         | V <sub>CCO</sub> - 0.4  |
| HSTL_III_18               | 24                   | -8                   | 0.4                         | V <sub>CCO</sub> - 0.4  |
| SSTL18_I                  | 6.7                  | -6.7                 | V <sub>TT</sub> - 0.475     | V <sub>TT</sub> + 0.475 |
| SSTL18_II <sup>(5)</sup>  | 13.4                 | -13.4                | V <sub>TT</sub> - 0.603     | V <sub>TT</sub> + 0.603 |
| SSTL2_I                   | 8.1                  | -8.1                 | V <sub>TT</sub> - 0.61      | V <sub>TT</sub> + 0.61  |
| SSTL2_II <sup>(5)</sup>   | 16.2                 | -16.2                | V <sub>TT</sub> - 0.81      | V <sub>TT</sub> + 0.81  |
| SSTL3_I                   | 8                    | -8                   | V <sub>TT</sub> - 0.6       | V <sub>TT</sub> + 0.6   |
| SSTL3_II                  | 16                   | -16                  | V <sub>TT</sub> - 0.8       | V <sub>TT</sub> + 0.8   |

Notes:

- The numbers in this table are based on the conditions set forth in Table 10 and Table 13.
- Descriptions of the symbols used in this table are as follows:  
 I<sub>OL</sub> — the output current condition under which V<sub>OL</sub> is tested  
 I<sub>OH</sub> — the output current condition under which V<sub>OH</sub> is tested  
 V<sub>OL</sub> — the output voltage that indicates a Low logic level  
 V<sub>OH</sub> — the output voltage that indicates a High logic level  
 V<sub>CCO</sub> — the supply voltage for output drivers  
 V<sub>TT</sub> — the voltage applied to a resistor termination
- For the LVCMOS and LVTTL standards: the same V<sub>OL</sub> and V<sub>OH</sub> limits apply for the Fast, Slow and QUIETIO slew attributes.
- Tested according to the relevant PCI specifications. For information on PCI IP solutions, see [www.xilinx.com/products/design\\_resources/conn\\_central/protocols/pci\\_pcix.htm](http://www.xilinx.com/products/design_resources/conn_central/protocols/pci_pcix.htm). The PCIX IOSTANDARD is available and has equivalent characteristics but no PCI-X IP is supported.
- These higher-drive output standards are supported only on FPGA banks 1 and 3. Inputs are unrestricted. See the chapter "Using I/O Resources" in UG331.

## Differential I/O Standards

### Differential Input Pairs



$$V_{ICM} = \text{Input common mode voltage} = \frac{V_{INP} + V_{INN}}{2}$$

$$V_{ID} = \text{Differential input voltage} = |V_{INP} - V_{INN}|$$

DS529-3\_10\_012907

Figure 6: Differential Input Voltages

Table 15: Recommended Operating Conditions for User I/Os Using Differential Signal Standards

| IOSTANDARD Attribute             | $V_{CCO}$ for Drivers <sup>(1)</sup> |         |         | $V_{ID}$ |          |          | $V_{ICM}$ <sup>(2)</sup> |         |                    |
|----------------------------------|--------------------------------------|---------|---------|----------|----------|----------|--------------------------|---------|--------------------|
|                                  | Min (V)                              | Nom (V) | Max (V) | Min (mV) | Nom (mV) | Max (mV) | Min (V)                  | Nom (V) | Max (V)            |
| LVDS_25 <sup>(3)</sup>           | 2.25                                 | 2.5     | 2.75    | 100      | 350      | 600      | 0.3                      | 1.25    | 2.35               |
| LVDS_33 <sup>(3)</sup>           | 3.0                                  | 3.3     | 3.6     | 100      | 350      | 600      | 0.3                      | 1.25    | 2.35               |
| BLVDS_25 <sup>(4)</sup>          | 2.25                                 | 2.5     | 2.75    | 100      | 300      | –        | 0.3                      | 1.3     | 2.35               |
| MINI_LVDS_25 <sup>(3)</sup>      | 2.25                                 | 2.5     | 2.75    | 200      | –        | 600      | 0.3                      | 1.2     | 1.95               |
| MINI_LVDS_33 <sup>(3)</sup>      | 3.0                                  | 3.3     | 3.6     | 200      | –        | 600      | 0.3                      | 1.2     | 1.95               |
| LVPECL_25 <sup>(5)</sup>         | Inputs Only                          |         |         | 100      | 800      | 1000     | 0.3                      | 1.2     | 1.95               |
| LVPECL_33 <sup>(5)</sup>         | Inputs Only                          |         |         | 100      | 800      | 1000     | 0.3                      | 1.2     | 2.8 <sup>(6)</sup> |
| RSDS_25 <sup>(3)</sup>           | 2.25                                 | 2.5     | 2.75    | 100      | 200      | –        | 0.3                      | 1.2     | 1.5                |
| RSDS_33 <sup>(3)</sup>           | 3.0                                  | 3.3     | 3.6     | 100      | 200      | –        | 0.3                      | 1.2     | 1.5                |
| TMDS_33 <sup>(3,4,7)</sup>       | 3.14                                 | 3.3     | 3.47    | 150      | –        | 1200     | 2.7                      | –       | 3.23               |
| PPDS_25 <sup>(3)</sup>           | 2.25                                 | 2.5     | 2.75    | 100      | –        | 400      | 0.2                      | –       | 2.3                |
| PPDS_33 <sup>(3)</sup>           | 3.0                                  | 3.3     | 3.6     | 100      | –        | 400      | 0.2                      | –       | 2.3                |
| DIFF_HSTL_I_18 <sup>(8)</sup>    | 1.7                                  | 1.8     | 1.9     | 100      | –        | –        | 0.8                      | –       | 1.1                |
| DIFF_HSTL_II_18 <sup>(8,9)</sup> | 1.7                                  | 1.8     | 1.9     | 100      | –        | –        | 0.8                      | –       | 1.1                |
| DIFF_HSTL_III_18 <sup>(8)</sup>  | 1.7                                  | 1.8     | 1.9     | 100      | –        | –        | 0.8                      | –       | 1.1                |
| DIFF_HSTL_I <sup>(8)</sup>       | 1.4                                  | 1.5     | 1.6     | 100      | –        | –        | 0.68                     | –       | 0.9                |
| DIFF_HSTL_III <sup>(8)</sup>     | 1.4                                  | 1.5     | 1.6     | 100      | –        | –        | –                        | 0.9     | –                  |
| DIFF_SSTL18_I <sup>(8)</sup>     | 1.7                                  | 1.8     | 1.9     | 100      | –        | –        | 0.7                      | –       | 1.1                |
| DIFF_SSTL18_II <sup>(8,9)</sup>  | 1.7                                  | 1.8     | 1.9     | 100      | –        | –        | 0.7                      | –       | 1.1                |
| DIFF_SSTL2_I <sup>(8)</sup>      | 2.3                                  | 2.5     | 2.7     | 100      | –        | –        | 1.0                      | –       | 1.5                |
| DIFF_SSTL2_II <sup>(8,9)</sup>   | 2.3                                  | 2.5     | 2.7     | 100      | –        | –        | 1.0                      | –       | 1.5                |
| DIFF_SSTL3_I <sup>(8)</sup>      | 3.0                                  | 3.3     | 3.6     | 100      | –        | –        | 1.1                      | –       | 1.9                |

Table 15: Recommended Operating Conditions for User I/Os Using Differential Signal Standards (Cont'd)

| IOSTANDARD Attribute         | V <sub>CCO</sub> for Drivers <sup>(1)</sup> |         |         | V <sub>ID</sub> |          |          | V <sub>ICM</sub> <sup>(2)</sup> |         |         |
|------------------------------|---|---------|---------|-----------------|----------|----------|---------------------------------|---------|---------|
|                              | Min (V)                                     | Nom (V) | Max (V) | Min (mV)        | Nom (mV) | Max (mV) | Min (V)                         | Nom (V) | Max (V) |
| DIFF_SSTL3_II <sup>(8)</sup> | 3.0   | 3.3     | 3.6     | 100             | –        | –        | 1.1                             | –       | 1.9     |

**Notes:**

1. The V<sub>CCO</sub> rails supply only differential output drivers, not input circuits.
2. V<sub>ICM</sub> must be less than V<sub>CCAUX</sub>.
3. These true differential output standards are supported only on FPGA banks 0 and 2. Inputs are unrestricted. See the “Using I/O Resources” chapter in [UG331](#).
4. See [External Termination Requirements for Differential I/O, page 22](#).
5. LVPECL is supported on inputs only, not outputs. Requires V<sub>CCAUX</sub> = 3.3V ± 10%.
6. LVPECL\_33 maximum V<sub>ICM</sub> = V<sub>CCAUX</sub> - (V<sub>ID</sub> / 2)
7. Requires V<sub>CCAUX</sub> = 3.3V ± 10% for inputs. (V<sub>CCAUX</sub> - 300 mV) ≤ V<sub>ICM</sub> ≤ (V<sub>CCAUX</sub> - 37 mV)
8. V<sub>REF</sub> inputs are used for the DIFF\_SSTL and DIFF\_HSTL standards. The V<sub>REF</sub> settings are the same as for the single-ended versions in [Table 13](#). Other differential standards do not use V<sub>REF</sub>.
9. These higher-drive output standards are supported only on FPGA banks 1 and 3. Inputs are unrestricted. See the “Using I/O Resources” chapter in [UG331](#).

**Differential Output Pairs**

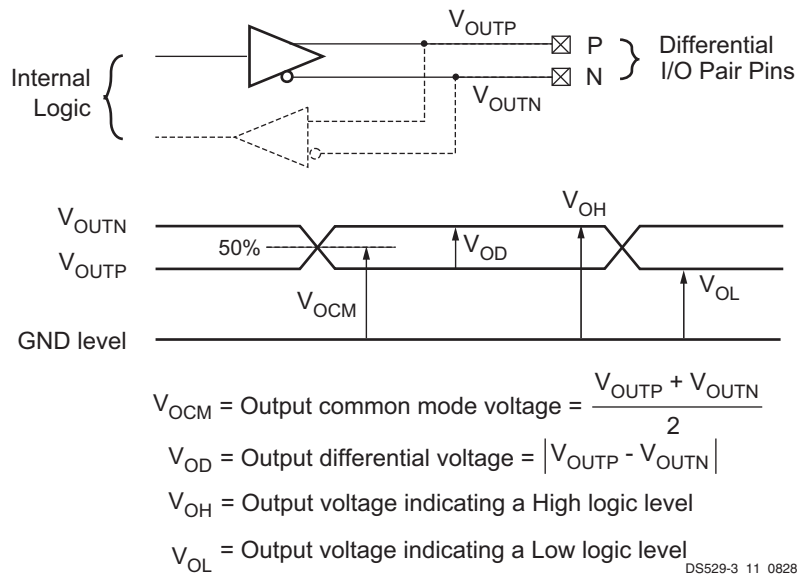


Figure 7: Differential Output Voltages

Table 16: DC Characteristics of User I/Os Using Differential Signal Standards

| IOSTANDARD Attribute | V <sub>OD</sub> |          |          | V <sub>OCM</sub>         |         |                          | V <sub>OH</sub>         | V <sub>OL</sub>         |
|----------------------|-----------------|----------|----------|--------------------------|---------|--------------------------|-------------------------|-------------------------|
|                      | Min (mV)        | Typ (mV) | Max (mV) | Min (V)                  | Typ (V) | Max (V)                  | Min (V)                 | Max (V)                 |
| LVDS_25              | 247             | 350      | 454      | 1.125                    | –       | 1.375                    | –                       | –                       |
| LVDS_33              | 247             | 350      | 454      | 1.125                    | –       | 1.375                    | –                       | –                       |
| BLVDS_25             | 240             | 350      | 460      | –                        | 1.30    | –                        | –                       | –                       |
| MINI_LVDS_25         | 300             | –        | 600      | 1.0                      | –       | 1.4                      | –                       | –                       |
| MINI_LVDS_33         | 300             | –        | 600      | 1.0                      | –       | 1.4                      | –                       | –                       |
| RSDS_25              | 100             | –        | 400      | 1.0                      | –       | 1.4                      | –                       | –                       |
| RSDS_33              | 100             | –        | 400      | 1.0                      | –       | 1.4                      | –                       | –                       |
| TMDS_33              | 400             | –        | 800      | V <sub>CCO</sub> – 0.405 | –       | V <sub>CCO</sub> – 0.190 | –                       | –                       |
| PPDS_25              | 100             | –        | 400      | 0.5                      | 0.8     | 1.4                      | –                       | –                       |
| PPDS_33              | 100             | –        | 400      | 0.5                      | 0.8     | 1.4                      | –                       | –                       |
| DIFF_HSTL_I_18       | –               | –        | –        | –                        | –       | –                        | V <sub>CCO</sub> – 0.4  | 0.4                     |
| DIFF_HSTL_II_18      | –               | –        | –        | –                        | –       | –                        | V <sub>CCO</sub> – 0.4  | 0.4                     |
| DIFF_HSTL_III_18     | –               | –        | –        | –                        | –       | –                        | V <sub>CCO</sub> – 0.4  | 0.4                     |
| DIFF_HSTL_I          | –               | –        | –        | –                        | –       | –                        | V <sub>CCO</sub> – 0.4  | 0.4                     |
| DIFF_HSTL_III        | –               | –        | –        | –                        | –       | –                        | V <sub>CCO</sub> – 0.4  | 0.4                     |
| DIFF_SSTL18_I        | –               | –        | –        | –                        | –       | –                        | V <sub>TT</sub> + 0.475 | V <sub>TT</sub> – 0.475 |
| DIFF_SSTL18_II       | –               | –        | –        | –                        | –       | –                        | V <sub>TT</sub> + 0.475 | V <sub>TT</sub> – 0.475 |
| DIFF_SSTL2_I         | –               | –        | –        | –                        | –       | –                        | V <sub>TT</sub> + 0.61  | V <sub>TT</sub> – 0.61  |
| DIFF_SSTL2_II        | –               | –        | –        | –                        | –       | –                        | V <sub>TT</sub> + 0.81  | V <sub>TT</sub> – 0.81  |
| DIFF_SSTL3_I         | –               | –        | –        | –                        | –       | –                        | V <sub>TT</sub> + 0.6   | V <sub>TT</sub> – 0.6   |
| DIFF_SSTL3_II        | –               | –        | –        | –                        | –       | –                        | V <sub>TT</sub> + 0.8   | V <sub>TT</sub> – 0.8   |

**Notes:**

1. The numbers in this table are based on the conditions set forth in [Table 10](#) and [Table 15](#).
2. See [External Termination Requirements for Differential I/O](#), page 22.
3. Output voltage measurements for all differential standards are made with a termination resistor (R<sub>T</sub>) of 100Ω across the N and P pins of the differential signal pair.
4. At any given time, no more than two of the following differential output standards can be assigned to an I/O bank: LVDS\_25, RSDS\_25, MINI\_LVDS\_25, PPDS\_25 when V<sub>CCO</sub>=2.5V, or LVDS\_33, RSDS\_33, MINI\_LVDS\_33, TMDS\_33, PPDS\_33 when V<sub>CCO</sub> = 3.3V

External Termination Requirements for Differential I/O

LVDS, RSDS, MINI\_LVDS, and PPDS I/O Standards

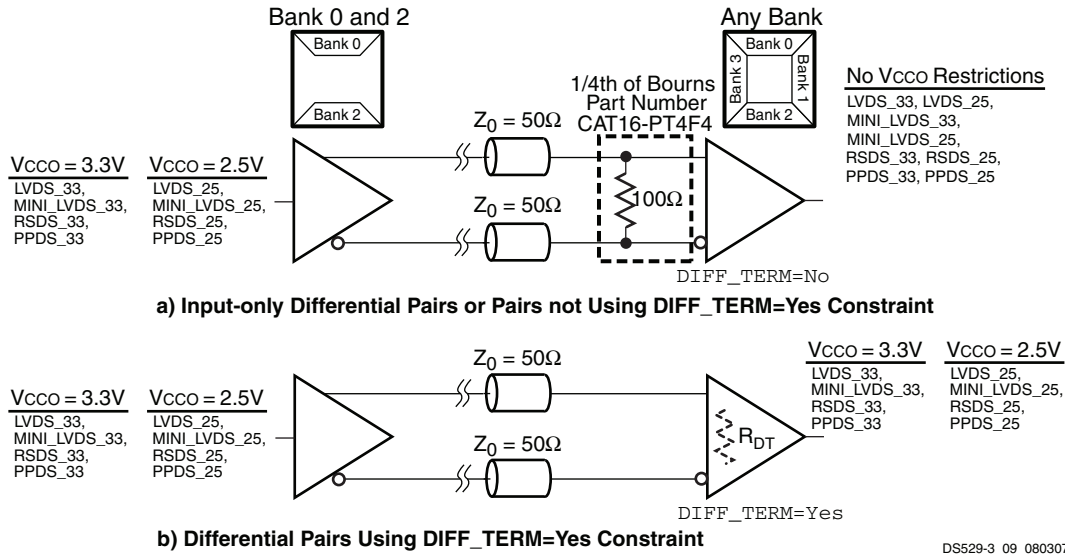


Figure 8: External Input Termination for LVDS, RSDS, MINI\_LVDS, and PPDS I/O Standards

BLVDS\_25 I/O Standard

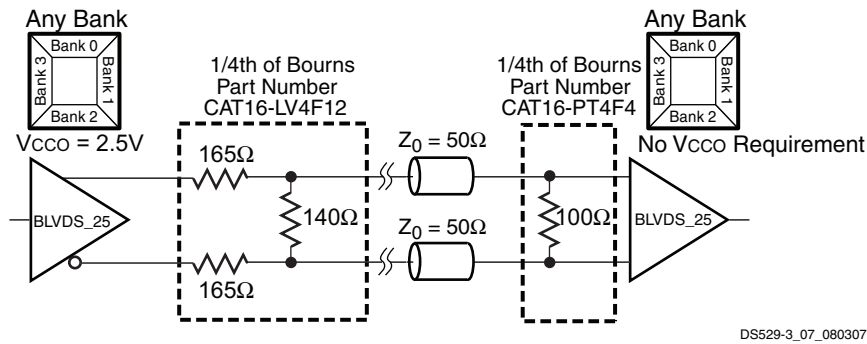


Figure 9: External Output and Input Termination Resistors for BLVDS\_25 I/O Standard

TMDS\_33 I/O Standard

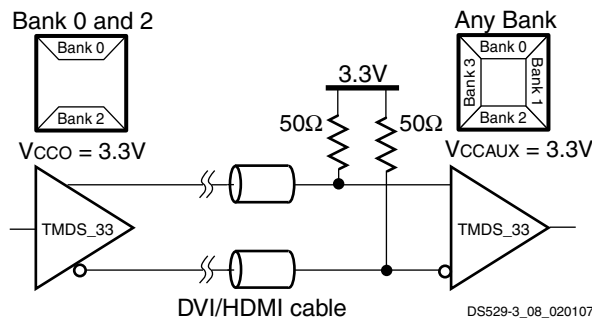


Figure 10: External Input Resistors Required for TMDS\_33 I/O Standard



## Device DNA Read Endurance

Table 17: Device DNA Identifier Memory Characteristics

| Symbol     | Description   | Minimum    | Units       |
|------------|---|------------|-------------|
| DNA_CYCLES | Number of READ operations or JTAG ISC_DNA read operations. Unaffected by HOLD or SHIFT operations | 30,000,000 | Read cycles |

## In-System Flash Memory Data Retention, Program/Write Endurance

Table 18: In-System Flash (ISF) Memory Characteristics

| Symbol           | Description  | Minimum <sup>(1)</sup> | Units  |
|------------------|--|------------------------|--------|
| ISF_RETENTION    | Data retention   | 20                     | Years  |
| ISF_ACTIVE       | Time that the ISF memory is selected and active. SPI_ACCESS design primitive pins CSB = Low, CLK toggling                                | 2                      | Years  |
| ISF_PAGE_CYCLES  | Number of program/erase cycles, per ISF memory page  | 100,000                | Cycles |
| ISF_PAGE_REWRITE | Number of cumulative random (non-sequential) page erase/program operations within a sector before pages must be rewritten                | 10,000                 | Cycles |
| ISF_SPR_CYCLES   | Number of program/erase cycles for Sector Protection Register  | 10,000                 | Cycles |
| ISF_SEC_CYCLES   | Number of program cycles for Sector Lockdown Register per sector, user-programmable field in Security Register, and Power-of-2 Page Size | 1                      | Cycle  |

**Notes:**

1. Minimum value at which functionality is still guaranteed. Do not exceed these values.

## Switching Characteristics

All Spartan-3AN FPGAs ship in two speed grades: -4 and the higher performance -5. Switching characteristics in this document are designated as Preview, Advance, Preliminary, or Production, as shown in Table 19. Each category is defined as follows:

**Preview:** These specifications are based on estimates only and should not be used for timing analysis.

**Advance:** These specifications are based on simulations only and are typically available soon after establishing FPGA specifications. Although speed grades with this designation are considered relatively stable and conservative, some under-reporting might still occur.

**Preliminary:** These specifications are based on complete early silicon characterization. Devices and speed grades with this designation are intended to give a better indication of the expected performance of production silicon. The probability of under-reporting preliminary delays is greatly reduced compared to Advance data.

**Production:** These specifications are approved once enough production silicon of a particular device family member has been characterized to provide full correlation between speed files and devices over numerous production lots. There is no under-reporting of delays, and customers receive formal notification of any subsequent changes. Typically, the slowest speed grades transition to Production before faster speed grades.

## Software Version Requirements

Production-quality systems must use FPGA designs compiled using a speed file designated as PRODUCTION status. FPGA designs using a less mature speed file designation should only be used during system prototyping or pre-production qualification. FPGA designs with speed files designated as Preview, Advance, or Preliminary should not be used in a production-quality system.

Whenever a speed file designation changes, as a device matures toward Production status, rerun the latest Xilinx® ISE® software on the FPGA design to ensure that the FPGA design incorporates the latest timing information and software updates.

In some cases, a particular family member (and speed grade) is released to Production at a different time than when the speed file is released with the Production label. Any labeling discrepancies are corrected in subsequent speed file releases. See Table 19 for devices that can be considered to have the Production label.

All parameter limits are representative of worst-case supply voltage and junction temperature conditions. **Unless otherwise noted, the published parameter values apply to all Spartan-3AN devices. AC and DC characteristics are specified using the same numbers for both commercial and industrial grades.**

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Timing parameters and their representative values are selected for inclusion either because they are important as general design requirements or they indicate fundamental device performance characteristics. The Spartan-3AN speed files (v1.41), part of the Xilinx Development Software, are the original source for many but not all of the values. The speed grade designations for these files are shown in Table 19. For more complete, more precise, and worst-case data, use the values reported by the Xilinx static timing analyzer (TRACE in the Xilinx development software) and back-annotated to the simulation netlist.

Table 19: Spartan-3AN Family v1.41 Speed Grade Designations

| Device     | Preview | Advance | Preliminary | Production |
|------------|---------|---------|-------------|------------|
| XC3S50AN   |         |         |             | -4, -5     |
| XC3S200AN  |         |         |             | -4, -5     |
| XC3S400AN  |         |         |             | -4, -5     |
| XC3S700AN  |         |         |             | -4, -5     |
| XC3S1400AN |         |         |             | -4, -5     |

Table 20 provides the recent history of the Spartan-3AN speed files.

Table 20: Spartan-3AN Speed File Version History

| Version | ISE Release | Description  |
|---------|-------------|--|
| 1.41    | ISE 10.1.03 | Updated for Spartan-3A family. No change to data for Spartan-3AN family.   |
| 1.40    | ISE 10.1.02 | Updated for Spartan-3A family. No change to data for Spartan-3AN family.   |
| 1.39    | ISE 10.1    | Updated for Spartan-3A family. No change to data for Spartan-3AN family.   |
| 1.38    | ISE 9.2.03i | Updated to Production. No change to data.  |
| 1.37    | ISE 9.2.01i | Updated pin-to-pin setup and hold times, TMDS output adjustment, multiplier setup/hold times, and block RAM clock width. |
| 1.36    | ISE 9.2i    | Added -5 speed grade, updated to Advance.  |
| 1.34    | ISE 9.1.03i | Updated pin-to-pin timing.   |
| 1.32    | ISE 9.1.01i | Preview speed files for -4 speed grade.  |

## I/O Timing

### Pin-to-Pin Clock-to-Output Times

Table 21: Pin-to-Pin Clock-to-Output Times for the IOB Output Path

| Symbol                       | Description   | Conditions  | Device     | Speed Grade |      | Units |
|------------------------------|---|---|------------|-------------|------|-------|
|                              |   |   |            | -5          | -4   |       |
|                              |   |   |            | Max         | Max  |       |
| <b>Clock-to-Output Times</b> |   |   |            |             |      |       |
| T <sub>ICKOFDCM</sub>        | When reading from the Output Flip-Flop (OFF), the time from the active transition on the Global Clock pin to data appearing at the Output pin. The DCM is in use. | LVCMOS25 <sup>(2)</sup> , 12 mA output drive, Fast slew rate, with DCM <sup>(3)</sup> | XC3S50AN   | 3.18        | 3.42 | ns    |
|                              |   |   | XC3S200AN  | 3.21        | 3.27 | ns    |
|                              |   |   | XC3S400AN  | 2.97        | 3.33 | ns    |
|                              |   |   | XC3S700AN  | 3.39        | 3.50 | ns    |
|                              |   |   | XC3S1400AN | 3.51        | 3.99 | ns    |
| T <sub>ICKOF</sub>           | When reading from OFF, the time from the active transition on the Global Clock pin to data appearing at the Output pin. The DCM is not in use.                    | LVCMOS25 <sup>(2)</sup> , 12 mA output drive, Fast slew rate, without DCM             | XC3S50AN   | 4.59        | 5.02 | ns    |
|                              |   |   | XC3S200AN  | 4.88        | 5.24 | ns    |
|                              |   |   | XC3S400AN  | 4.68        | 5.12 | ns    |
|                              |   |   | XC3S700AN  | 4.97        | 5.34 | ns    |
|                              |   |   | XC3S1400AN | 5.06        | 5.69 | ns    |

**Notes:**

1. The numbers in this table are tested using the methodology presented in [Table 30](#) and are based on the operating conditions set forth in [Table 10](#) and [Table 13](#).
2. This clock-to-output time requires adjustment whenever a signal standard other than LVCMOS25 is assigned to the Global Clock Input or a standard other than LVCMOS25 with 12 mA drive and Fast slew rate is assigned to the data Output. If the former is true, *add* the appropriate Input adjustment from [Table 26](#). If the latter is true, *add* the appropriate Output adjustment from [Table 29](#).
3. DCM output jitter is included in all measurements.

Pin-to-Pin Setup and Hold Times

Table 22: Pin-to-Pin Setup and Hold Times for the IOB Input Path (System Synchronous)

| Symbol             | Description  | Conditions   | Device     | Speed Grade |       | Units |
|--------------------|--|--|------------|-------------|-------|-------|
|                    |  |  |            | -5          | -4    |       |
|                    |  |  |            | Min         | Min   |       |
| <b>Setup Times</b> |  |  |            |             |       |       |
| T <sub>PSDCM</sub> | When writing to the Input Flip-Flop (IFF), the time from the setup of data at the Input pin to the active transition at a Global Clock pin. The DCM is in use. No Input Delay is programmed. | LVCMOS25 <sup>(2)</sup> , IFD_DELAY_VALUE = 0, with DCM <sup>(4)</sup> | XC3S50AN   | 2.45        | 2.68  | ns    |
|                    |  |  | XC3S200AN  | 2.59        | 2.84  | ns    |
|                    |  |  | XC3S400AN  | 2.38        | 2.68  | ns    |
|                    |  |  | XC3S700AN  | 2.38        | 2.57  | ns    |
|                    |  |  | XC3S1400AN | 1.91        | 2.17  | ns    |
| T <sub>PSFD</sub>  | When writing to IFF, the time from the setup of data at the Input pin to an active transition at the Global Clock pin. The DCM is not in use. The Input Delay is programmed.                 | LVCMOS25 <sup>(2)</sup> , IFD_DELAY_VALUE = 5, without DCM             | XC3S50AN   | 2.55        | 2.76  | ns    |
|                    |  |  | XC3S200AN  | 2.32        | 2.76  | ns    |
|                    |  |  | XC3S400AN  | 2.21        | 2.60  | ns    |
|                    |  |  | XC3S700AN  | 2.28        | 2.63  | ns    |
|                    |  |  | XC3S1400AN | 2.33        | 2.41  | ns    |
| <b>Hold Times</b>  |  |  |            |             |       |       |
| T <sub>PHDCM</sub> | When writing to IFF, the time from the active transition at the Global Clock pin to the point when data must be held at the Input pin. The DCM is in use. No Input Delay is programmed.      | LVCMOS25 <sup>(3)</sup> , IFD_DELAY_VALUE = 0, with DCM <sup>(4)</sup> | XC3S50AN   | -0.36       | -0.36 | ns    |
|                    |  |  | XC3S200AN  | -0.52       | -0.52 | ns    |
|                    |  |  | XC3S400AN  | -0.33       | -0.29 | ns    |
|                    |  |  | XC3S700AN  | -0.17       | -0.12 | ns    |
|                    |  |  | XC3S1400AN | -0.07       | 0.00  | ns    |
| T <sub>PHFD</sub>  | When writing to IFF, the time from the active transition at the Global Clock pin to the point when data must be held at the Input pin. The DCM is not in use. The Input Delay is programmed. | LVCMOS25 <sup>(3)</sup> , IFD_DELAY_VALUE = 5, without DCM             | XC3S50AN   | -0.63       | -0.58 | ns    |
|                    |  |  | XC3S200AN  | -0.56       | -0.56 | ns    |
|                    |  |  | XC3S400AN  | -0.42       | -0.42 | ns    |
|                    |  |  | XC3S700AN  | -0.80       | -0.75 | ns    |
|                    |  |  | XC3S1400AN | -0.69       | -0.69 | ns    |

Notes:

1. The numbers in this table are tested using the methodology presented in Table 30 and are based on the operating conditions set forth in Table 10 and Table 13.
2. This setup time requires adjustment whenever a signal standard other than LVCMOS25 is assigned to the Global Clock Input or the data Input. If this is true of the Global Clock Input, subtract the appropriate adjustment from Table 26. If this is true of the data Input, add the appropriate Input adjustment from the same table.
3. This hold time requires adjustment whenever a signal standard other than LVCMOS25 is assigned to the Global Clock Input or the data Input. If this is true of the Global Clock Input, add the appropriate Input adjustment from Table 26. If this is true of the data Input, subtract the appropriate Input adjustment from the same table. When the hold time is negative, it is possible to change the data before the clock's active edge.
4. DCM output jitter is included in all measurements.

Input Setup and Hold Times

Table 23: Setup and Hold Times for the IOB Input Path

| Symbol               | Description  | Conditions              | IFD_DELAY_VALUE | Device     | Speed Grade |      | Units |
|----------------------|--|-------------------------|-----------------|------------|-------------|------|-------|
|                      |  |                         |                 |            | -5          | -4   |       |
|                      |  |                         |                 |            | Min         | Min  |       |
| <b>Setup Times</b>   |  |                         |                 |            |             |      |       |
| T <sub>IOPICK</sub>  | Time from the setup of data at the Input pin to the active transition at the ICLK input of the Input Flip-Flop (IFF). No Input Delay is programmed.  | LVCMOS25 <sup>(2)</sup> | 0               | XC3S50AN   | 1.56        | 1.58 | ns    |
|                      |  |                         |                 | XC3S200AN  | 1.71        | 1.81 | ns    |
|                      |  |                         |                 | XC3S400AN  | 1.30        | 1.51 | ns    |
|                      |  |                         |                 | XC3S700AN  | 1.34        | 1.51 | ns    |
|                      |  |                         |                 | XC3S1400AN | 1.36        | 1.74 | ns    |
| T <sub>IOPICKD</sub> | Time from the setup of data at the Input pin to the active transition at the ICLK input of the Input Flip-Flop (IFF). The Input Delay is programmed. | LVCMOS25 <sup>(2)</sup> | 1               | XC3S50AN   | 2.16        | 2.18 | ns    |
|                      |  |                         |                 |            | 3.10        | 3.12 | ns    |
|                      |  |                         |                 |            | 3.51        | 3.76 | ns    |
|                      |  |                         |                 |            | 4.04        | 4.32 | ns    |
|                      |  |                         |                 |            | 3.88        | 4.24 | ns    |
|                      |  |                         |                 |            | 4.72        | 5.09 | ns    |
|                      |  |                         |                 |            | 5.47        | 5.94 | ns    |
|                      |  |                         |                 |            | 5.97        | 6.52 | ns    |
|                      |  |                         | 1               | XC3S200AN  | 2.05        | 2.20 | ns    |
|                      |  |                         |                 |            | 2.72        | 2.93 | ns    |
|                      |  |                         |                 |            | 3.38        | 3.78 | ns    |
|                      |  |                         |                 |            | 3.88        | 4.37 | ns    |
|                      |  |                         |                 |            | 3.69        | 4.20 | ns    |
|                      |  |                         |                 |            | 4.56        | 5.23 | ns    |
|                      |  |                         |                 |            | 5.34        | 6.11 | ns    |
|                      |  |                         |                 |            | 5.85        | 6.71 | ns    |
|                      |  |                         | 1               | XC3S400AN  | 1.79        | 2.02 | ns    |
|                      |  |                         |                 |            | 2.43        | 2.67 | ns    |
|                      |  |                         |                 |            | 3.02        | 3.43 | ns    |
|                      |  |                         |                 |            | 3.49        | 3.96 | ns    |
|                      |  |                         |                 |            | 3.41        | 3.95 | ns    |
|                      |  |                         |                 |            | 4.20        | 4.81 | ns    |
|                      |  |                         |                 |            | 4.96        | 5.66 | ns    |
|                      |  |                         |                 |            | 5.44        | 6.19 | ns    |

Table 23: Setup and Hold Times for the IOB Input Path (Cont'd)

| Symbol               | Description  | Conditions              | IFD_<br>DELAY_<br>VALUE | Device     | Speed Grade |       | Units |
|----------------------|--|-------------------------|-------------------------|------------|-------------|-------|-------|
|                      |  |                         |                         |            | -5          | -4    |       |
|                      |  |                         |                         |            | Min         | Min   |       |
| T <sub>IOICKD</sub>  | Time from the setup of data at the Input pin to the active transition at the ICLK input of the Input Flip-Flop (IFF). The Input Delay is programmed.                 | LVCMOS25 <sup>(2)</sup> | 1                       | XC3S700AN  | 1.82        | 1.95  | ns    |
|                      |  |                         |                         |            | 2.62        | 2.83  | ns    |
|                      |  |                         |                         |            | 3.32        | 3.72  | ns    |
|                      |  |                         |                         |            | 3.83        | 4.31  | ns    |
|                      |  |                         |                         |            | 3.69        | 4.14  | ns    |
|                      |  |                         |                         |            | 4.60        | 5.19  | ns    |
|                      |  |                         |                         |            | 5.39        | 6.10  | ns    |
|                      |  |                         |                         |            | 5.92        | 6.73  | ns    |
|                      |  |                         | 1                       | XC3S1400AN | 1.79        | 2.17  | ns    |
|                      |  |                         |                         |            | 2.55        | 2.92  | ns    |
|                      |  |                         |                         |            | 3.38        | 3.76  | ns    |
|                      |  |                         |                         |            | 3.75        | 4.32  | ns    |
|                      |  |                         |                         |            | 3.81        | 4.19  | ns    |
|                      |  |                         |                         |            | 4.39        | 5.09  | ns    |
|                      |  |                         |                         |            | 5.16        | 5.98  | ns    |
|                      |  |                         |                         |            | 5.69        | 6.57  | ns    |
| <b>Hold Times</b>    |  |                         |                         |            |             |       |       |
| T <sub>IOICKP</sub>  | Time from the active transition at the ICLK input of the Input Flip-Flop (IFF) to the point where data must be held at the Input pin. No Input Delay is programmed.  | LVCMOS25 <sup>(3)</sup> | 0                       | XC3S50AN   | -0.66       | -0.64 | ns    |
|                      |  |                         |                         | XC3S200AN  | -0.85       | -0.65 | ns    |
|                      |  |                         |                         | XC3S400AN  | -0.42       | -0.42 | ns    |
|                      |  |                         |                         | XC3S700AN  | -0.81       | -0.67 | ns    |
|                      |  |                         |                         | XC3S1400AN | -0.71       | -0.71 | ns    |
| T <sub>IOICKPD</sub> | Time from the active transition at the ICLK input of the Input Flip-Flop (IFF) to the point where data must be held at the Input pin. The Input Delay is programmed. | LVCMOS25 <sup>(3)</sup> | 1                       | XC3S50AN   | -0.88       | -0.88 | ns    |
|                      |  |                         |                         |            | -1.33       | -1.33 | ns    |
|                      |  |                         |                         |            | -2.05       | -2.05 | ns    |
|                      |  |                         |                         |            | -2.43       | -2.43 | ns    |
|                      |  |                         |                         |            | -2.34       | -2.34 | ns    |
|                      |  |                         |                         |            | -2.81       | -2.81 | ns    |
|                      |  |                         |                         |            | -3.03       | -3.03 | ns    |
|                      |  |                         |                         |            | -3.83       | -3.57 | ns    |
|                      |  |                         | 1                       | XC3S200AN  | -1.51       | -1.51 | ns    |
|                      |  |                         |                         |            | -2.09       | -2.09 | ns    |
|                      |  |                         |                         |            | -2.40       | -2.40 | ns    |
|                      |  |                         |                         |            | -2.68       | -2.68 | ns    |
|                      |  |                         |                         |            | -2.56       | -2.56 | ns    |
|                      |  |                         |                         |            | -2.99       | -2.99 | ns    |
|                      |  |                         |                         |            | -3.29       | -3.29 | ns    |
|                      |  |                         |                         |            | -3.61       | -3.61 | ns    |

Table 23: Setup and Hold Times for the IOB Input Path (Cont'd)

| Symbol                       | Description  | Conditions              | IFD_<br>DELAY_<br>VALUE | Device     | Speed Grade |       | Units |    |
|------------------------------|--|-------------------------|-------------------------|------------|-------------|-------|-------|----|
|                              |  |                         |                         |            | -5          | -4    |       |    |
|                              |  |                         |                         |            | Min         | Min   |       |    |
| T <sub>IOICKPD</sub>         | Time from the active transition at the ICLK input of the Input Flip-Flop (IFF) to the point where data must be held at the Input pin. The Input Delay is programmed. | LVCMOS25 <sup>(3)</sup> | 1                       | XC3S400AN  | -1.12       | -1.12 | ns    |    |
|                              |  |                         |                         |            | 2           | -1.70 | -1.70 | ns |
|                              |  |                         |                         |            | 3           | -2.08 | -2.08 | ns |
|                              |  |                         |                         |            | 4           | -2.38 | -2.38 | ns |
|                              |  |                         |                         |            | 5           | -2.23 | -2.23 | ns |
|                              |  |                         |                         |            | 6           | -2.69 | -2.69 | ns |
|                              |  |                         |                         |            | 7           | -3.08 | -3.08 | ns |
|                              |  |                         |                         |            | 8           | -3.35 | -3.35 | ns |
|                              |  |                         | 2                       | XC3S700AN  | -1.67       | -1.67 | ns    |    |
|                              |  |                         |                         |            | 2           | -2.27 | -2.27 | ns |
|                              |  |                         |                         |            | 3           | -2.59 | -2.59 | ns |
|                              |  |                         |                         |            | 4           | -2.92 | -2.92 | ns |
|                              |  |                         |                         |            | 5           | -2.89 | -2.89 | ns |
|                              |  |                         |                         |            | 6           | -3.22 | -3.22 | ns |
|                              |  |                         |                         |            | 7           | -3.52 | -3.52 | ns |
|                              |  |                         |                         |            | 8           | -3.81 | -3.81 | ns |
|                              |  |                         | 3                       | XC3S1400AN | -1.60       | -1.60 | ns    |    |
|                              |  |                         |                         |            | 2           | -2.06 | -2.06 | ns |
|                              |  |                         |                         |            | 3           | -2.46 | -2.46 | ns |
|                              |  |                         |                         |            | 4           | -2.86 | -2.86 | ns |
|                              |  |                         |                         |            | 5           | -2.88 | -2.88 | ns |
|                              |  |                         |                         |            | 6           | -3.24 | -3.24 | ns |
|                              |  |                         |                         |            | 7           | -3.55 | -3.55 | ns |
|                              |  |                         |                         |            | 8           | -3.89 | -3.89 | ns |
| <b>Set/Reset Pulse Width</b> |  |                         |                         |            |             |       |       |    |
| T <sub>RPW_IOB</sub>         | Minimum pulse width to SR control input on IOB   | –                       | –                       | All        | 1.33        | 1.61  | ns    |    |

Notes:

1. The numbers in this table are tested using the methodology presented in Table 30 and are based on the operating conditions set forth in Table 10 and Table 13.
2. This setup time requires adjustment whenever a signal standard other than LVCMOS25 is assigned to the data Input. If this is true, add the appropriate Input adjustment from Table 26.
3. These hold times require adjustment whenever a signal standard other than LVCMOS25 is assigned to the data Input. If this is true, subtract the appropriate Input adjustment from Table 26. When the hold time is negative, it is possible to change the data before the clock's active edge.

Table 24: Sample Window (Source Synchronous)

| Symbol            | Description  | Maximum   | Units |
|-------------------|--|---|-------|
| T <sub>SAMP</sub> | Setup and hold capture window of an IOB flip-flop. | The input capture sample window value is highly specific to a particular application, device, package, I/O standard, I/O placement, DCM usage, and clock buffer. Please consult the appropriate Xilinx Answer Record for application-specific values. <ul style="list-style-type: none"> <li>• Answer Record <a href="#">30879</a></li> </ul> | ps    |



Input Propagation Times

Table 25: Propagation Times for the IOB Input Path

| Symbol                   | Description   | Conditions              | DELAY_VALUE        | Device     | Speed Grade |      | Units |
|--------------------------|---|-------------------------|--------------------|------------|-------------|------|-------|
|                          |   |                         |                    |            | -5          | -4   |       |
|                          |   |                         |                    |            | Max         | Max  |       |
| <b>Propagation Times</b> |   |                         |                    |            |             |      |       |
| T <sub>IOPI</sub>        | The time it takes for data to travel from the Input pin to the I output with no input delay programmed  | LVCMOS25 <sup>(2)</sup> | IBUF_DELAY_VALUE=0 | XC3S50AN   | 1.04        | 1.12 | ns    |
|                          |   |                         |                    | XC3S200AN  | 0.87        | 0.87 | ns    |
|                          |   |                         |                    | XC3S400AN  | 0.65        | 0.72 | ns    |
|                          |   |                         |                    | XC3S700AN  | 0.92        | 0.92 | ns    |
|                          |   |                         |                    | XC3S1400AN | 0.96        | 1.21 | ns    |
| T <sub>IOPID</sub>       | The time it takes for data to travel from the Input pin to the I output with the input delay programmed | LVCMOS25 <sup>(2)</sup> | 1                  | XC3S50AN   | 1.79        | 2.07 | ns    |
|                          |   |                         | 2                  |            | 2.13        | 2.46 | ns    |
|                          |   |                         | 3                  |            | 2.36        | 2.71 | ns    |
|                          |   |                         | 4                  |            | 2.88        | 3.21 | ns    |
|                          |   |                         | 5                  |            | 3.11        | 3.46 | ns    |
|                          |   |                         | 6                  |            | 3.45        | 3.84 | ns    |
|                          |   |                         | 7                  |            | 3.75        | 4.19 | ns    |
|                          |   |                         | 8                  |            | 4.00        | 4.47 | ns    |
|                          |   |                         | 9                  |            | 3.61        | 4.11 | ns    |
|                          |   |                         | 10                 |            | 3.95        | 4.50 | ns    |
|                          |   |                         | 11                 |            | 4.18        | 4.67 | ns    |
|                          |   |                         | 12                 |            | 4.75        | 5.20 | ns    |
|                          |   |                         | 13                 |            | 4.98        | 5.44 | ns    |
|                          |   |                         | 14                 |            | 5.31        | 5.95 | ns    |
|                          |   |                         | 15                 |            | 5.62        | 6.28 | ns    |
|                          |   |                         | 16                 |            | 5.86        | 6.57 | ns    |
|                          |   |                         | 1                  | XC3S200AN  | 1.57        | 1.65 | ns    |
|                          |   |                         | 2                  |            | 1.87        | 1.97 | ns    |
|                          |   |                         | 3                  |            | 2.16        | 2.33 | ns    |
|                          |   |                         | 4                  |            | 2.68        | 2.96 | ns    |
|                          |   |                         | 5                  |            | 2.87        | 3.19 | ns    |
|                          |   |                         | 6                  |            | 3.20        | 3.60 | ns    |
|                          |   |                         | 7                  |            | 3.57        | 4.02 | ns    |
|                          |   |                         | 8                  |            | 3.79        | 4.26 | ns    |
|                          |   |                         | 9                  |            | 3.42        | 3.86 | ns    |
|                          |   |                         | 10                 |            | 3.79        | 4.25 | ns    |
|                          |   |                         | 11                 |            | 4.02        | 4.55 | ns    |
|                          |   |                         | 12                 |            | 4.62        | 5.24 | ns    |
| 13                       | 4.86  | 5.53                    | ns                 |            |             |      |       |
| 14                       | 5.18  | 5.94                    | ns                 |            |             |      |       |

Table 25: Propagation Times for the IOB Input Path (Cont'd)

| Symbol             | Description   | Conditions              | DELAY_VALUE | Device     | Speed Grade |      | Units |
|--------------------|---|-------------------------|-------------|------------|-------------|------|-------|
|                    |   |                         |             |            | -5          | -4   |       |
|                    |   |                         |             |            | Max         | Max  |       |
| T <sub>IOPID</sub> | The time it takes for data to travel from the Input pin to the I output with the input delay programmed | LVCMOS25 <sup>(2)</sup> | 15          | XC3S200AN  | 5.43        | 6.24 | ns    |
|                    |   |                         | 16          |            | 5.75        | 6.59 | ns    |
|                    |   |                         | 1           | XC3S400AN  | 1.32        | 1.43 | ns    |
|                    |   |                         | 2           |            | 1.67        | 1.83 | ns    |
|                    |   |                         | 3           |            | 1.90        | 2.07 | ns    |
|                    |   |                         | 4           |            | 2.33        | 2.52 | ns    |
|                    |   |                         | 5           |            | 2.60        | 2.91 | ns    |
|                    |   |                         | 6           |            | 2.94        | 3.20 | ns    |
|                    |   |                         | 7           |            | 3.23        | 3.51 | ns    |
|                    |   |                         | 8           |            | 3.50        | 3.85 | ns    |
|                    |   |                         | 9           |            | 3.18        | 3.55 | ns    |
|                    |   |                         | 10          |            | 3.53        | 3.95 | ns    |
|                    |   |                         | 11          |            | 3.76        | 4.20 | ns    |
|                    |   |                         | 12          |            | 4.26        | 4.67 | ns    |
|                    |   |                         | 13          |            | 4.51        | 4.97 | ns    |
|                    |   |                         | 14          |            | 4.85        | 5.32 | ns    |
|                    |   |                         | 15          |            | 5.14        | 5.64 | ns    |
|                    |   |                         | 16          |            | 5.40        | 5.95 | ns    |
|                    |   |                         | 1           | XC3S700AN  | 1.84        | 1.87 | ns    |
|                    |   |                         | 2           |            | 2.20        | 2.27 | ns    |
|                    |   |                         | 3           |            | 2.46        | 2.60 | ns    |
|                    |   |                         | 4           |            | 2.93        | 3.15 | ns    |
|                    |   |                         | 5           |            | 3.21        | 3.45 | ns    |
|                    |   |                         | 6           |            | 3.54        | 3.80 | ns    |
|                    |   |                         | 7           |            | 3.86        | 4.16 | ns    |
|                    |   |                         | 8           |            | 4.13        | 4.48 | ns    |
|                    |   |                         | 9           |            | 3.82        | 4.19 | ns    |
|                    |   |                         | 10          |            | 4.17        | 4.58 | ns    |
|                    |   |                         | 11          |            | 4.43        | 4.89 | ns    |
|                    |   |                         | 12          |            | 4.95        | 5.49 | ns    |
|                    |   |                         | 13          |            | 5.22        | 5.83 | ns    |
|                    |   |                         | 14          |            | 5.57        | 6.21 | ns    |
|                    |   |                         | 15          |            | 5.89        | 6.55 | ns    |
|                    |   |                         | 16          |            | 6.16        | 6.89 | ns    |
|                    |   |                         | 1           | XC3S1400AN | 1.95        | 2.18 | ns    |
|                    |   |                         | 2           |            | 2.29        | 2.59 | ns    |
|                    |   |                         | 3           |            | 2.54        | 2.84 | ns    |
|                    |   |                         | 4           |            | 2.96        | 3.30 | ns    |

Table 25: Propagation Times for the IOB Input Path (Cont'd)

| Symbol             | Description  | Conditions              | DELAY_VALUE       | Device     | Speed Grade |      | Units |
|--------------------|--|-------------------------|-------------------|------------|-------------|------|-------|
|                    |  |                         |                   |            | -5          | -4   |       |
|                    |  |                         |                   |            | Max         | Max  |       |
| T <sub>IOPID</sub> | The time it takes for data to travel from the Input pin to the I output with the input delay programmed                      | LVCMOS25 <sup>(2)</sup> | 5                 | XC3S1400AN | 3.17        | 3.52 | ns    |
|                    |  |                         | 6                 |            | 3.52        | 3.92 | ns    |
|                    |  |                         | 7                 |            | 3.82        | 4.18 | ns    |
|                    |  |                         | 8                 |            | 4.10        | 4.57 | ns    |
|                    |  |                         | 9                 |            | 3.84        | 4.31 | ns    |
|                    |  |                         | 10                |            | 4.20        | 4.79 | ns    |
|                    |  |                         | 11                |            | 4.46        | 5.06 | ns    |
|                    |  |                         | 12                |            | 4.87        | 5.51 | ns    |
|                    |  |                         | 13                |            | 5.07        | 5.73 | ns    |
|                    |  |                         | 14                |            | 5.43        | 6.08 | ns    |
|                    |  |                         | 15                |            | 5.73        | 6.33 | ns    |
|                    |  |                         | 16                |            | 6.01        | 6.77 | ns    |
| T <sub>IOPLI</sub> | The time it takes for data to travel from the Input pin through the IFF latch to the I output with no input delay programmed | LVCMOS25 <sup>(2)</sup> | IFD_DELAY_VALUE=0 | XC3S50AN   | 1.70        | 1.81 | ns    |
|                    |  |                         |                   | XC3S200AN  | 1.85        | 2.04 | ns    |
|                    |  |                         |                   | XC3S400AN  | 1.44        | 1.74 | ns    |
|                    |  |                         |                   | XC3S700AN  | 1.48        | 1.74 | ns    |
|                    |  |                         |                   | XC3S1400AN | 1.50        | 1.97 | ns    |

Table 25: Propagation Times for the IOB Input Path (Cont'd)

| Symbol              | Description   | Conditions              | DELAY_VALUE | Device    | Speed Grade |      | Units |
|---------------------|---|-------------------------|-------------|-----------|-------------|------|-------|
|                     |   |                         |             |           | -5          | -4   |       |
|                     |   |                         |             |           | Max         | Max  |       |
| T <sub>IOPLID</sub> | The time it takes for data to travel from the Input pin through the IFF latch to the I output with the input delay programmed | LVCMOS25 <sup>(2)</sup> | 1           | XC3S50AN  | 2.30        | 2.41 | ns    |
|                     |   |                         | 2           |           | 3.24        | 3.35 | ns    |
|                     |   |                         | 3           |           | 3.65        | 3.98 | ns    |
|                     |   |                         | 4           |           | 4.18        | 4.55 | ns    |
|                     |   |                         | 5           |           | 4.02        | 4.47 | ns    |
|                     |   |                         | 6           |           | 4.86        | 5.32 | ns    |
|                     |   |                         | 7           |           | 5.61        | 6.17 | ns    |
|                     |   |                         | 8           |           | 6.11        | 6.75 | ns    |
|                     |   |                         | 1           | XC3S200AN | 2.19        | 2.43 | ns    |
|                     |   |                         | 2           |           | 2.86        | 3.16 | ns    |
|                     |   |                         | 3           |           | 3.52        | 4.01 | ns    |
|                     |   |                         | 4           |           | 4.02        | 4.60 | ns    |
|                     |   |                         | 5           |           | 3.83        | 4.43 | ns    |
|                     |   |                         | 6           |           | 4.70        | 5.46 | ns    |
|                     |   |                         | 7           |           | 5.48        | 6.33 | ns    |
|                     |   |                         | 8           |           | 5.99        | 6.94 | ns    |
|                     |   |                         | 1           | XC3S400AN | 1.93        | 2.25 | ns    |
|                     |   |                         | 2           |           | 2.57        | 2.90 | ns    |
|                     |   |                         | 3           |           | 3.16        | 3.66 | ns    |
|                     |   |                         | 4           |           | 3.63        | 4.19 | ns    |
|                     |   |                         | 5           |           | 3.55        | 4.18 | ns    |
|                     |   |                         | 6           |           | 4.34        | 5.03 | ns    |
|                     |   |                         | 7           |           | 5.09        | 5.88 | ns    |
|                     |   |                         | 8           |           | 5.58        | 6.42 | ns    |
|                     |   |                         | 1           | XC3S700AN | 1.96        | 2.18 | ns    |
|                     |   |                         | 2           |           | 2.76        | 3.06 | ns    |
|                     |   |                         | 3           |           | 3.45        | 3.95 | ns    |
|                     |   |                         | 4           |           | 3.97        | 4.54 | ns    |
|                     |   |                         | 5           |           | 3.83        | 4.37 | ns    |
|                     |   |                         | 6           |           | 4.74        | 5.42 | ns    |
|                     |   |                         | 7           |           | 5.53        | 6.33 | ns    |
|                     |   |                         | 8           |           | 6.06        | 6.96 | ns    |

Table 25: Propagation Times for the IOB Input Path (Cont'd)

| Symbol              | Description   | Conditions              | DELAY_VALUE | Device     | Speed Grade |      | Units |
|---------------------|---|-------------------------|-------------|------------|-------------|------|-------|
|                     |   |                         |             |            | -5          | -4   |       |
|                     |   |                         |             |            | Max         | Max  |       |
| T <sub>IOPLID</sub> | The time it takes for data to travel from the Input pin through the IFF latch to the I output with the input delay programmed | LVCMOS25 <sup>(2)</sup> | 1           | XC3S1400AN | 1.93        | 2.40 | ns    |
|                     |   |                         | 2           |            | 2.69        | 3.15 | ns    |
|                     |   |                         | 3           |            | 3.52        | 3.99 | ns    |
|                     |   |                         | 4           |            | 3.89        | 4.55 | ns    |
|                     |   |                         | 5           |            | 3.95        | 4.42 | ns    |
|                     |   |                         | 6           |            | 4.53        | 5.32 | ns    |
|                     |   |                         | 7           |            | 5.30        | 6.21 | ns    |
|                     |   |                         | 8           |            | 5.83        | 6.80 | ns    |

**Notes:**

1. The numbers in this table are tested using the methodology presented in [Table 30](#) and are based on the operating conditions set forth in [Table 10](#) and [Table 13](#).
2. This propagation time requires adjustment whenever a signal standard other than LVCMOS25 is assigned to the data Input. When this is true, *add* the appropriate Input adjustment from [Table 26](#).

Input Timing Adjustments

Table 26: Input Timing Adjustments by IOSTANDARD

| Convert Input Time from LVCMOS25 to the Following Signal Standard (IOSTANDARD) | Add the Adjustment Below |      | Units |
|--|--------------------------|------|-------|
|  | Speed Grade              |      |       |
|  | -5                       | -4   |       |
| <b>Single-Ended Standards</b>  |                          |      |       |
| LVTTTL   | 0.62                     | 0.62 | ns    |
| LVCMOS33   | 0.54                     | 0.54 | ns    |
| LVCMOS25   | 0                        | 0    | ns    |
| LVCMOS18   | 0.83                     | 0.83 | ns    |
| LVCMOS15   | 0.60                     | 0.60 | ns    |
| LVCMOS12   | 0.31                     | 0.31 | ns    |
| PCI33_3  | 0.41                     | 0.41 | ns    |
| PCI66_3  | 0.41                     | 0.41 | ns    |
| HSTL_I   | 0.72                     | 0.72 | ns    |
| HSTL_III   | 0.77                     | 0.77 | ns    |
| HSTL_I_18  | 0.69                     | 0.69 | ns    |
| HSTL_II_18   | 0.69                     | 0.69 | ns    |
| HSTL_III_18  | 0.79                     | 0.79 | ns    |
| SSTL18_I   | 0.71                     | 0.71 | ns    |
| SSTL18_II  | 0.71                     | 0.71 | ns    |
| SSTL2_I  | 0.68                     | 0.68 | ns    |
| SSTL2_II   | 0.68                     | 0.68 | ns    |
| SSTL3_I  | 0.78                     | 0.78 | ns    |
| SSTL3_II   | 0.78                     | 0.78 | ns    |

Table 26: Input Timing Adjustments by IOSTANDARD

| Convert Input Time from LVCMOS25 to the Following Signal Standard (IOSTANDARD) | Add the Adjustment Below |      | Units |
|--|--------------------------|------|-------|
|  | Speed Grade              |      |       |
|  | -5                       | -4   |       |
| <b>Differential Standards</b>  |                          |      |       |
| LVDS_25  | 0.76                     | 0.76 | ns    |
| LVDS_33  | 0.79                     | 0.79 | ns    |
| BLVDS_25   | 0.79                     | 0.79 | ns    |
| MINI_LVDS_25   | 0.78                     | 0.78 | ns    |
| MINI_LVDS_33   | 0.79                     | 0.79 | ns    |
| LVPECL_25  | 0.78                     | 0.78 | ns    |
| LVPECL_33  | 0.79                     | 0.79 | ns    |
| RSDS_25  | 0.79                     | 0.79 | ns    |
| RSDS_33  | 0.77                     | 0.77 | ns    |
| TMDS_33  | 0.79                     | 0.79 | ns    |
| PPDS_25  | 0.79                     | 0.79 | ns    |
| PPDS_33  | 0.79                     | 0.79 | ns    |
| DIFF_HSTL_I_18   | 0.74                     | 0.74 | ns    |
| DIFF_HSTL_II_18  | 0.72                     | 0.72 | ns    |
| DIFF_HSTL_III_18   | 1.05                     | 1.05 | ns    |
| DIFF_HSTL_I  | 0.72                     | 0.72 | ns    |
| DIFF_HSTL_III  | 1.05                     | 1.05 | ns    |
| DIFF_SSTL18_I  | 0.71                     | 0.71 | ns    |
| DIFF_SSTL18_II   | 0.71                     | 0.71 | ns    |
| DIFF_SSTL2_I   | 0.74                     | 0.74 | ns    |
| DIFF_SSTL2_II  | 0.75                     | 0.75 | ns    |
| DIFF_SSTL3_I   | 1.06                     | 1.06 | ns    |
| DIFF_SSTL3_II  | 1.06                     | 1.06 | ns    |

Notes:

1. The numbers in this table are tested using the methodology presented in Table 30 and are based on the operating conditions set forth in Table 10, Table 13, and Table 15.
2. These adjustments are used to convert input path times originally specified for the LVCMOS25 standard to times that correspond to other signal standards.

## Output Propagation Times

Table 27: Timing for the IOB Output Path

| Symbol                       | Description   | Conditions  | Device | Speed Grade |      | Units |
|------------------------------|---|---|--------|-------------|------|-------|
|                              |   |   |        | -5          | -4   |       |
|                              |   |   |        | Max         | Max  |       |
| <b>Clock-to-Output Times</b> |   |   |        |             |      |       |
| $T_{IOCKP}$                  | When reading from the Output Flip-Flop (OFF), the time from the active transition at the OCLK input to data appearing at the Output pin | LVC MOS25 <sup>(2)</sup> , 12 mA output drive, Fast slew rate | All    | 2.87        | 3.13 | ns    |
| <b>Propagation Times</b>     |   |   |        |             |      |       |
| $T_{IOOP}$                   | The time it takes for data to travel from the IOB's O input to the Output pin   | LVC MOS25 <sup>(2)</sup> , 12 mA output drive, Fast slew rate | All    | 2.78        | 2.91 | ns    |
| <b>Set/Reset Times</b>       |   |   |        |             |      |       |
| $T_{IOSRP}$                  | Time from asserting the OFF's SR input to setting/resetting data at the Output pin  | LVC MOS25 <sup>(2)</sup> , 12 mA output drive, Fast slew rate | All    | 3.63        | 3.89 | ns    |
| $T_{IOGSRQ}$                 | Time from asserting the Global Set Reset (GSR) input on the STARTUP_SPARTAN3A primitive to setting/resetting data at the Output pin     |   |        | 8.62        | 9.65 | ns    |

### Notes:

1. The numbers in this table are tested using the methodology presented in [Table 30](#) and are based on the operating conditions set forth in [Table 10](#) and [Table 13](#).
2. This time requires adjustment whenever a signal standard other than LVC MOS25 with 12 mA drive and Fast slew rate is assigned to the data Output. When this is true, *add* the appropriate Output adjustment from [Table 29](#).



### Three-State Output Propagation Times

Table 28: Timing for the IOB Three-State Path

| Symbol  | Description  | Conditions                                    | Device | Speed Grade |       | Units |
|---|--|---|--------|-------------|-------|-------|
|   |  |   |        | -5          | -4    |       |
|   |  |   |        | Max         | Max   |       |
| <b>Synchronous Output Enable/Disable Times</b>  |  |   |        |             |       |       |
| $T_{IOCKHZ}$                                    | Time from the active transition at the OTCLK input of the Three-state Flip-Flop (TFF) to when the Output pin enters the high-impedance state     | LVC MOS25, 12 mA output drive, Fast slew rate | All    | 0.63        | 0.76  | ns    |
| $T_{IOCKON}^{(2)}$                              | Time from the active transition at TFF's OTCLK input to when the Output pin drives valid data  |   | All    | 2.80        | 3.06  | ns    |
| <b>Asynchronous Output Enable/Disable Times</b> |  |   |        |             |       |       |
| $T_{GTS}$                                       | Time from asserting the Global Three State (GTS) input on the STARTUP_SPARTAN3A primitive to when the Output pin enters the high-impedance state | LVC MOS25, 12 mA output drive, Fast slew rate | All    | 9.47        | 10.36 | ns    |
| <b>Set/Reset Times</b>                          |  |   |        |             |       |       |
| $T_{IOSRHZ}$                                    | Time from asserting TFF's SR input to when the Output pin enters a high-impedance state  | LVC MOS25, 12 mA output drive, Fast slew rate | All    | 1.61        | 1.86  | ns    |
| $T_{IOSRON}^{(2)}$                              | Time from asserting TFF's SR input at TFF to when the Output pin drives valid data   |   | All    | 3.57        | 3.82  | ns    |

**Notes:**

1. The numbers in this table are tested using the methodology presented in [Table 30](#) and are based on the operating conditions set forth in [Table 10](#) and [Table 13](#).
2. This time requires adjustment whenever a signal standard other than LVC MOS25 with 12 mA drive and Fast slew rate is assigned to the data Output. When this is true, *add* the appropriate Output adjustment from [Table 29](#).

Output Timing Adjustments

Table 29: Output Timing Adjustments for IOB

| Convert Output Time from LVC MOS25 with 12 mA Drive and Fast Slew Rate to the Following Signal Standard (IOSTANDARD) |         |       | Add the Adjustment Below |                     | Units |
|--|---------|-------|--------------------------|---------------------|-------|
|  |         |       | Speed Grade              |                     |       |
|  |         |       | -5                       | -4                  |       |
| <b>Single-Ended Standards</b>  |         |       |                          |                     |       |
| LVTTTL   | Slow    | 2 mA  | 5.58                     | 5.58                | ns    |
|  |         | 4 mA  | 3.16                     | 3.16                | ns    |
|  |         | 6 mA  | 3.17                     | 3.17                | ns    |
|  |         | 8 mA  | 2.09                     | 2.09                | ns    |
|  |         | 12 mA | 1.62                     | 1.62                | ns    |
|  |         | 16 mA | 1.24                     | 1.24                | ns    |
|  |         | 24 mA | 2.74 <sup>(3)</sup>      | 2.74 <sup>(3)</sup> | ns    |
|  |         | Fast  | 2 mA                     | 3.03                | 3.03  |
|  | 4 mA    |       | 1.71                     | 1.71                | ns    |
|  | 6 mA    |       | 1.71                     | 1.71                | ns    |
|  | 8 mA    |       | 0.53                     | 0.53                | ns    |
|  | 12 mA   |       | 0.53                     | 0.53                | ns    |
|  | 16 mA   |       | 0.59                     | 0.59                | ns    |
|  | 24 mA   |       | 0.60                     | 0.60                | ns    |
|  | QuietIO |       | 2 mA                     | 27.67               | 27.67 |
|  |         | 4 mA  | 27.67                    | 27.67               | ns    |
|  |         | 6 mA  | 27.67                    | 27.67               | ns    |
|  |         | 8 mA  | 16.71                    | 16.71               | ns    |
|  |         | 12 mA | 16.67                    | 16.67               | ns    |
|  |         | 16 mA | 16.22                    | 16.22               | ns    |
|  |         | 24 mA | 12.11                    | 12.11               | ns    |

Table 29: Output Timing Adjustments for IOB (Cont'd)

| Convert Output Time from LVC MOS25 with 12 mA Drive and Fast Slew Rate to the Following Signal Standard (IOSTANDARD) |         |       | Add the Adjustment Below |                     | Units |
|--|---------|-------|--------------------------|---------------------|-------|
|  |         |       | Speed Grade              |                     |       |
|  |         |       | -5                       | -4                  |       |
| LVC MOS33  | Slow    | 2 mA  | 5.58                     | 5.58                | ns    |
|  |         | 4 mA  | 3.17                     | 3.17                | ns    |
|  |         | 6 mA  | 3.17                     | 3.17                | ns    |
|  |         | 8 mA  | 2.09                     | 2.09                | ns    |
|  |         | 12 mA | 1.24                     | 1.24                | ns    |
|  |         | 16 mA | 1.15                     | 1.15                | ns    |
|  |         | 24 mA | 2.55 <sup>(3)</sup>      | 2.55 <sup>(3)</sup> | ns    |
|  |         | Fast  | 2 mA                     | 3.02                | 3.02  |
|  | 4 mA    |       | 1.71                     | 1.71                | ns    |
|  | 6 mA    |       | 1.72                     | 1.72                | ns    |
|  | 8 mA    |       | 0.53                     | 0.53                | ns    |
|  | 12 mA   |       | 0.59                     | 0.59                | ns    |
|  | 16 mA   |       | 0.59                     | 0.59                | ns    |
|  | 24 mA   |       | 0.51                     | 0.51                | ns    |
|  | QuietIO |       | 2 mA                     | 27.67               | 27.67 |
|  |         | 4 mA  | 27.67                    | 27.67               | ns    |
|  |         | 6 mA  | 27.67                    | 27.67               | ns    |
|  |         | 8 mA  | 16.71                    | 16.71               | ns    |
|  |         | 12 mA | 16.29                    | 16.29               | ns    |
|  |         | 16 mA | 16.18                    | 16.18               | ns    |
|  |         | 24 mA | 12.11                    | 12.11               | ns    |

Table 29: Output Timing Adjustments for IOB (Cont'd)

| Convert Output Time from LVC MOS25 with 12 mA Drive and Fast Slew Rate to the Following Signal Standard (IOSTANDARD) |         |       | Add the Adjustment Below |                     | Units |
|--|---------|-------|--------------------------|---------------------|-------|
|  |         |       | Speed Grade              |                     |       |
|  |         |       | -5                       | -4                  |       |
| LVC MOS25  | Slow    | 2 mA  | 5.33                     | 5.33                | ns    |
|  |         | 4 mA  | 2.81                     | 2.81                | ns    |
|  |         | 6 mA  | 2.82                     | 2.82                | ns    |
|  |         | 8 mA  | 1.14                     | 1.14                | ns    |
|  |         | 12 mA | 1.10                     | 1.10                | ns    |
|  |         | 16 mA | 0.83                     | 0.83                | ns    |
|  |         | 24 mA | 2.26 <sup>(3)</sup>      | 2.26 <sup>(3)</sup> | ns    |
|  | Fast    | 2 mA  | 4.36                     | 4.36                | ns    |
|  |         | 4 mA  | 1.76                     | 1.76                | ns    |
|  |         | 6 mA  | 1.25                     | 1.25                | ns    |
|  |         | 8 mA  | 0.38                     | 0.38                | ns    |
|  |         | 12 mA | 0                        | 0                   | ns    |
|  |         | 16 mA | 0.01                     | 0.01                | ns    |
|  |         | 24 mA | 0.01                     | 0.01                | ns    |
|  | QuietIO | 2 mA  | 25.92                    | 25.92               | ns    |
|  |         | 4 mA  | 25.92                    | 25.92               | ns    |
|  |         | 6 mA  | 25.92                    | 25.92               | ns    |
|  |         | 8 mA  | 15.57                    | 15.57               | ns    |
|  |         | 12 mA | 15.59                    | 15.59               | ns    |
|  |         | 16 mA | 14.27                    | 14.27               | ns    |
|  |         | 24 mA | 11.37                    | 11.37               | ns    |

Table 29: Output Timing Adjustments for IOB (Cont'd)

| Convert Output Time from LVC MOS25 with 12 mA Drive and Fast Slew Rate to the Following Signal Standard (IOSTANDARD) |           |       | Add the Adjustment Below |       | Units |    |
|--|-----------|-------|--------------------------|-------|-------|----|
|  |           |       | Speed Grade              |       |       |    |
|  |           |       | -5                       | -4    |       |    |
| LVC MOS18  | Slow      | 2 mA  | 4.48                     | 4.48  | ns    |    |
|  |           | 4 mA  | 3.69                     | 3.69  | ns    |    |
|  |           | 6 mA  | 2.91                     | 2.91  | ns    |    |
|  |           | 8 mA  | 1.99                     | 1.99  | ns    |    |
|  |           | 12 mA | 1.57                     | 1.57  | ns    |    |
|  |           | 16 mA | 1.19                     | 1.19  | ns    |    |
|  |           | Fast  | 2 mA                     | 3.96  | 3.96  | ns |
|  | 4 mA      |       | 2.57                     | 2.57  | ns    |    |
|  | 6 mA      |       | 1.90                     | 1.90  | ns    |    |
|  | 8 mA      |       | 1.06                     | 1.06  | ns    |    |
|  | 12 mA     |       | 0.83                     | 0.83  | ns    |    |
|  | 16 mA     |       | 0.63                     | 0.63  | ns    |    |
|  | QuietIO   | 2 mA  | 24.97                    | 24.97 | ns    |    |
|  |           | 4 mA  | 24.97                    | 24.97 | ns    |    |
|  |           | 6 mA  | 24.08                    | 24.08 | ns    |    |
|  |           | 8 mA  | 16.43                    | 16.43 | ns    |    |
|  |           | 12 mA | 14.52                    | 14.52 | ns    |    |
|  | LVC MOS15 | Slow  | 2 mA                     | 5.82  | 5.82  | ns |
|  |           |       | 4 mA                     | 3.97  | 3.97  | ns |
|  |           |       | 6 mA                     | 3.21  | 3.21  | ns |
|  |           |       | 8 mA                     | 2.53  | 2.53  | ns |
| 12 mA  |           |       | 2.06                     | 2.06  | ns    |    |
| Fast   |           | 2 mA  | 5.23                     | 5.23  | ns    |    |
|  |           | 4 mA  | 3.05                     | 3.05  | ns    |    |
|  |           | 6 mA  | 1.95                     | 1.95  | ns    |    |
|  |           | 8 mA  | 1.60                     | 1.60  | ns    |    |
|  |           | 12 mA | 1.30                     | 1.30  | ns    |    |
| QuietIO  |           | 2 mA  | 34.11                    | 34.11 | ns    |    |
|  |           | 4 mA  | 25.66                    | 25.66 | ns    |    |
|  |           | 6 mA  | 24.64                    | 24.64 | ns    |    |
|  |           | 8 mA  | 22.06                    | 22.06 | ns    |    |
|  |           | 12 mA | 20.64                    | 20.64 | ns    |    |

Table 29: Output Timing Adjustments for IOB (Cont'd)

| Convert Output Time from LVCMOS25 with 12 mA Drive and Fast Slew Rate to the Following Signal Standard (IOSTANDARD) |         |      | Add the Adjustment Below |       | Units |
|---|---------|------|--------------------------|-------|-------|
|   |         |      | Speed Grade              |       |       |
|   |         |      | -5                       | -4    |       |
| LVCMOS12  | Slow    | 2 mA | 7.14                     | 7.14  | ns    |
|   |         | 4 mA | 4.87                     | 4.87  | ns    |
|   |         | 6 mA | 5.67                     | 5.67  | ns    |
|   | Fast    | 2 mA | 6.77                     | 6.77  | ns    |
|   |         | 4 mA | 5.02                     | 5.02  | ns    |
|   |         | 6 mA | 4.09                     | 4.09  | ns    |
|   | QuietIO | 2 mA | 50.76                    | 50.76 | ns    |
|   |         | 4 mA | 43.17                    | 43.17 | ns    |
|   |         | 6 mA | 37.31                    | 37.31 | ns    |
| PCI33_3   |         |      | 0.34                     | 0.34  | ns    |
| PCI66_3   |         |      | 0.34                     | 0.34  | ns    |
| HSTL_I  |         |      | 0.78                     | 0.78  | ns    |
| HSTL_III  |         |      | 1.16                     | 1.16  | ns    |
| HSTL_I_18   |         |      | 0.35                     | 0.35  | ns    |
| HSTL_II_18  |         |      | 0.30                     | 0.30  | ns    |
| HSTL_III_18   |         |      | 0.47                     | 0.47  | ns    |
| SSTL18_I  |         |      | 0.40                     | 0.40  | ns    |
| SSTL18_II   |         |      | 0.30                     | 0.30  | ns    |
| SSTL2_I   |         |      | 0                        | 0     | ns    |
| SSTL2_II  |         |      | -0.05                    | -0.05 | ns    |
| SSTL3_I   |         |      | 0                        | 0     | ns    |
| SSTL3_II  |         |      | 0.17                     | 0.17  | ns    |

Table 29: Output Timing Adjustments for IOB (Cont'd)

| Convert Output Time from LVCMOS25 with 12 mA Drive and Fast Slew Rate to the Following Signal Standard (IOSTANDARD) |  |            | Add the Adjustment Below |    | Units |
|---|--|------------|--------------------------|----|-------|
|   |  |            | Speed Grade              |    |       |
|   |  |            | -5                       | -4 |       |
| <b>Differential Standards</b>   |  |            |                          |    |       |
| LVDS_25   |  | 1.16       | 1.16                     | ns |       |
| LVDS_33   |  | 0.46       | 0.46                     | ns |       |
| BLVDS_25  |  | 0.11       | 0.11                     | ns |       |
| MINI_LVDS_25  |  | 0.75       | 0.75                     | ns |       |
| MINI_LVDS_33  |  | 0.40       | 0.40                     | ns |       |
| LVPECL_25   |  | Input Only |                          |    |       |
| LVPECL_33   |  |            |                          |    |       |
| RSDS_25   |  | 1.42       | 1.42                     | ns |       |
| RSDS_33   |  | 0.58       | 0.58                     | ns |       |
| TMDS_33   |  | 0.46       | 0.46                     | ns |       |
| PPDS_25   |  | 1.07       | 1.07                     | ns |       |
| PPDS_33   |  | 0.63       | 0.63                     | ns |       |
| DIFF_HSTL_I_18  |  | 0.43       | 0.43                     | ns |       |
| DIFF_HSTL_II_18   |  | 0.41       | 0.41                     | ns |       |
| DIFF_HSTL_III_18  |  | 0.36       | 0.36                     | ns |       |
| DIFF_HSTL_I   |  | 1.01       | 1.01                     | ns |       |
| DIFF_HSTL_III   |  | 0.54       | 0.54                     | ns |       |
| DIFF_SSTL18_I   |  | 0.49       | 0.49                     | ns |       |
| DIFF_SSTL18_II  |  | 0.41       | 0.41                     | ns |       |
| DIFF_SSTL2_I  |  | 0.82       | 0.82                     | ns |       |
| DIFF_SSTL2_II   |  | 0.09       | 0.09                     | ns |       |
| DIFF_SSTL3_I  |  | 1.16       | 1.16                     | ns |       |
| DIFF_SSTL3_II   |  | 0.28       | 0.28                     | ns |       |

**Notes:**

1. The numbers in this table are tested using the methodology presented in Table 30 and are based on the operating conditions set forth in Table 10, Table 13, and Table 15.
2. These adjustments are used to convert output- and three-state-path times originally specified for the LVCMOS25 standard with 12 mA drive and Fast slew rate to times that correspond to other signal standards. Do not adjust times that measure when outputs go into a high-impedance state.
3. Note that 16 mA drive is faster than 24 mA drive for the Slow slew rate.

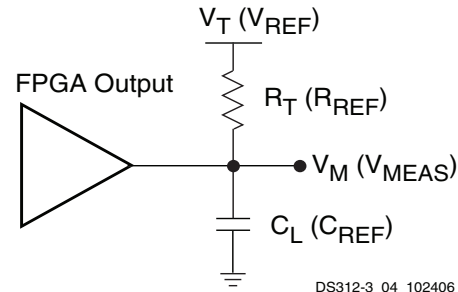
## Timing Measurement Methodology

When measuring timing parameters at the programmable I/Os, different signal standards call for different test conditions. Table 30 lists the conditions to use for each standard.

The method for measuring Input timing is as follows: A signal that swings between a Low logic level of  $V_L$  and a High logic level of  $V_H$  is applied to the Input under test. Some standards also require the application of a bias voltage to the  $V_{REF}$  pins of a given bank to properly set the input-switching threshold. The measurement point of the Input signal ( $V_M$ ) is commonly located halfway between  $V_L$  and  $V_H$ .

The Output test setup is shown in Figure 11. A termination voltage  $V_T$  is applied to the termination resistor  $R_T$ , the other end of which is connected to the Output. For each standard,  $R_T$  and  $V_T$  generally take on the standard values recommended for minimizing signal reflections. If the standard does not ordinarily use terminations (for example,

LVC MOS, LVTTTL), then  $R_T$  is set to  $1M\Omega$  to indicate an open connection, and  $V_T$  is set to zero. The same measurement point ( $V_M$ ) that was used at the Input is also used at the Output.



**Notes:**

1. The names shown in parentheses are used in the IBIS file.

Figure 11: Output Test Setup

Table 30: Test Methods for Timing Measurement at I/Os

| Signal Standard (IOSTANDARD) | Inputs        |                  |                  | Outputs <sup>(2)</sup> |           | Inputs and Outputs |
|------------------------------|---------------|------------------|------------------|------------------------|-----------|--------------------|
|                              | $V_{REF}$ (V) | $V_L$ (V)        | $V_H$ (V)        | $R_T$ ( $\Omega$ )     | $V_T$ (V) | $V_M$ (V)          |
| <b>Single-Ended</b>          |               |                  |                  |                        |           |                    |
| LVTTTL                       | –             | 0                | 3.3              | 1M                     | 0         | 1.4                |
| LVC MOS33                    | –             | 0                | 3.3              | 1M                     | 0         | 1.65               |
| LVC MOS25                    | –             | 0                | 2.5              | 1M                     | 0         | 1.25               |
| LVC MOS18                    | –             | 0                | 1.8              | 1M                     | 0         | 0.9                |
| LVC MOS15                    | –             | 0                | 1.5              | 1M                     | 0         | 0.75               |
| LVC MOS12                    | –             | 0                | 1.2              | 1M                     | 0         | 0.6                |
| PCI33_3                      | Rising        | Note 3           | Note 3           | 25                     | 0         | 0.94               |
|                              | Falling       |                  |                  | 25                     | 3.3       | 2.03               |
| PCI66_3                      | Rising        | Note 3           | Note 3           | 25                     | 0         | 0.94               |
|                              | Falling       |                  |                  | 25                     | 3.3       | 2.03               |
| HSTL_I                       | 0.75          | $V_{REF} - 0.5$  | $V_{REF} + 0.5$  | 50                     | 0.75      | $V_{REF}$          |
| HSTL_III                     | 0.9           | $V_{REF} - 0.5$  | $V_{REF} + 0.5$  | 50                     | 1.5       | $V_{REF}$          |
| HSTL_I_18                    | 0.9           | $V_{REF} - 0.5$  | $V_{REF} + 0.5$  | 50                     | 0.9       | $V_{REF}$          |
| HSTL_II_18                   | 0.9           | $V_{REF} - 0.5$  | $V_{REF} + 0.5$  | 25                     | 0.9       | $V_{REF}$          |
| HSTL_III_18                  | 1.1           | $V_{REF} - 0.5$  | $V_{REF} + 0.5$  | 50                     | 1.8       | $V_{REF}$          |
| SSTL18_I                     | 0.9           | $V_{REF} - 0.5$  | $V_{REF} + 0.5$  | 50                     | 0.9       | $V_{REF}$          |
| SSTL18_II                    | 0.9           | $V_{REF} - 0.5$  | $V_{REF} + 0.5$  | 25                     | 0.9       | $V_{REF}$          |
| SSTL2_I                      | 1.25          | $V_{REF} - 0.75$ | $V_{REF} + 0.75$ | 50                     | 1.25      | $V_{REF}$          |
| SSTL2_II                     | 1.25          | $V_{REF} - 0.75$ | $V_{REF} + 0.75$ | 25                     | 1.25      | $V_{REF}$          |
| SSTL3_I                      | 1.5           | $V_{REF} - 0.75$ | $V_{REF} + 0.75$ | 50                     | 1.5       | $V_{REF}$          |
| SSTL3_II                     | 1.5           | $V_{REF} - 0.75$ | $V_{REF} + 0.75$ | 25                     | 1.5       | $V_{REF}$          |

Table 30: Test Methods for Timing Measurement at I/Os (Cont'd)

| Signal Standard (IOSTANDARD) | Inputs               |                          |                          | Outputs <sup>(2)</sup> |                    | Inputs and Outputs |
|------------------------------|----------------------|--------------------------|--------------------------|------------------------|--------------------|--------------------|
|                              | V <sub>REF</sub> (V) | V <sub>L</sub> (V)       | V <sub>H</sub> (V)       | R <sub>T</sub> (Ω)     | V <sub>T</sub> (V) | V <sub>M</sub> (V) |
| <b>Differential</b>          |                      |                          |                          |                        |                    |                    |
| LVDS_25                      | –                    | V <sub>ICM</sub> – 0.125 | V <sub>ICM</sub> + 0.125 | 50                     | 1.2                | V <sub>ICM</sub>   |
| LVDS_33                      | –                    | V <sub>ICM</sub> – 0.125 | V <sub>ICM</sub> + 0.125 | 50                     | 1.2                | V <sub>ICM</sub>   |
| BLVDS_25                     | –                    | V <sub>ICM</sub> – 0.125 | V <sub>ICM</sub> + 0.125 | 1M                     | 0                  | V <sub>ICM</sub>   |
| MINI_LVDS_25                 | –                    | V <sub>ICM</sub> – 0.125 | V <sub>ICM</sub> + 0.125 | 50                     | 1.2                | V <sub>ICM</sub>   |
| MINI_LVDS_33                 | –                    | V <sub>ICM</sub> – 0.125 | V <sub>ICM</sub> + 0.125 | 50                     | 1.2                | V <sub>ICM</sub>   |
| LVPECL_25                    | –                    | V <sub>ICM</sub> – 0.3   | V <sub>ICM</sub> + 0.3   | N/A                    | N/A                | V <sub>ICM</sub>   |
| LVPECL_33                    | –                    | V <sub>ICM</sub> – 0.3   | V <sub>ICM</sub> + 0.3   | N/A                    | N/A                | V <sub>ICM</sub>   |
| RSDS_25                      | –                    | V <sub>ICM</sub> – 0.1   | V <sub>ICM</sub> + 0.1   | 50                     | 1.2                | V <sub>ICM</sub>   |
| RSDS_33                      | –                    | V <sub>ICM</sub> – 0.1   | V <sub>ICM</sub> + 0.1   | 50                     | 1.2                | V <sub>ICM</sub>   |
| TMDS_33                      | –                    | V <sub>ICM</sub> – 0.1   | V <sub>ICM</sub> + 0.1   | 50                     | 3.3                | V <sub>ICM</sub>   |
| PPDS_25                      | –                    | V <sub>ICM</sub> – 0.1   | V <sub>ICM</sub> + 0.1   | 50                     | 0.8                | V <sub>ICM</sub>   |
| PPDS_33                      | –                    | V <sub>ICM</sub> – 0.1   | V <sub>ICM</sub> + 0.1   | 50                     | 0.8                | V <sub>ICM</sub>   |
| DIFF_HSTL_I                  | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 0.75               | V <sub>ICM</sub>   |
| DIFF_HSTL_III                | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 1.5                | V <sub>ICM</sub>   |
| DIFF_HSTL_I_18               | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 0.9                | V <sub>ICM</sub>   |
| DIFF_HSTL_II_18              | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 0.9                | V <sub>ICM</sub>   |
| DIFF_HSTL_III_18             | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 1.8                | V <sub>ICM</sub>   |
| DIFF_SSTL18_I                | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 0.9                | V <sub>ICM</sub>   |
| DIFF_SSTL18_II               | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 0.9                | V <sub>ICM</sub>   |
| DIFF_SSTL2_I                 | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 1.25               | V <sub>ICM</sub>   |
| DIFF_SSTL2_II                | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 1.25               | V <sub>ICM</sub>   |
| DIFF_SSTL3_I                 | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 1.5                | V <sub>ICM</sub>   |
| DIFF_SSTL3_II                | –                    | V <sub>ICM</sub> – 0.5   | V <sub>ICM</sub> + 0.5   | 50                     | 1.5                | V <sub>ICM</sub>   |

**Notes:**

- Descriptions of the relevant symbols are as follows:  
V<sub>REF</sub> – The reference voltage for setting the input switching threshold  
V<sub>ICM</sub> – The common mode input voltage  
V<sub>M</sub> – Voltage of measurement point on signal transition  
V<sub>L</sub> – Low-level test voltage at Input pin  
V<sub>H</sub> – High-level test voltage at Input pin  
R<sub>T</sub> – Effective termination resistance, which takes on a value of 1 MΩ when no parallel termination is required  
V<sub>T</sub> – Termination voltage
- The load capacitance (C<sub>L</sub>) at the Output pin is 0 pF for all signal standards.
- According to the PCI specification. For information on PCI IP solutions, see [www.xilinx.com/products/design\\_resources/conn\\_central/protocols/pci\\_pcix.htm](http://www.xilinx.com/products/design_resources/conn_central/protocols/pci_pcix.htm). The PCIX IOSTANDARD is available and has equivalent characteristics but no PCI-X IP is supported.

The capacitive load (C<sub>L</sub>) is connected between the output and GND. *The Output timing for all standards, as published in the speed files and the data sheet, is always based on a C<sub>L</sub> value of zero.* High-impedance probes (less than 1 pF) are used for all measurements. Any delay that the test fixture might contribute to test measurements is subtracted from those measurements to produce the final timing numbers as published in the speed files and data sheet.

## Using IBIS Models to Simulate Load Conditions in Application

IBIS models permit the most accurate prediction of timing delays for a given application. The parameters found in the IBIS model ( $V_{REF}$ ,  $R_{REF}$ , and  $V_{MEAS}$ ) correspond directly with the parameters used in Table 30 ( $V_T$ ,  $R_T$ , and  $V_M$ ). Do not confuse  $V_{REF}$  (the termination voltage) from the IBIS model with  $V_{REF}$  (the input-switching threshold) from the table. A fourth parameter,  $C_{REF}$  is always zero. The four parameters describe all relevant output test conditions. IBIS models are found in the Xilinx development software as well as at the following link:

[www.xilinx.com/support/download/index.htm](http://www.xilinx.com/support/download/index.htm)

Delays for a given application are simulated according to its specific load conditions as follows:

1. Simulate the desired signal standard with the output driver connected to the test setup shown in Figure 11. Use parameter values  $V_T$ ,  $R_T$ , and  $V_M$  from Table 30.  $C_{REF}$  is zero.
2. Record the time to  $V_M$ .
3. Simulate the same signal standard with the output driver connected to the PCB trace with load. Use the appropriate IBIS model (including  $V_{REF}$ ,  $R_{REF}$ ,  $C_{REF}$ , and  $V_{MEAS}$  values) or capacitive value to represent the load.
4. Record the time to  $V_{MEAS}$ .
5. Compare the results of steps 2 and 4. Add (or subtract) the increase (or decrease) in delay to (or from) the appropriate Output standard adjustment (Table 29) to yield the worst-case delay of the PCB trace.

## Simultaneously Switching Output Guidelines

This section provides guidelines for the recommended maximum allowable number of Simultaneous Switching Outputs (SSOs). These guidelines describe the maximum number of user I/O pins of a given output signal standard that should simultaneously switch in the same direction, while maintaining a safe level of switching noise. Meeting these guidelines for the stated test conditions ensures that the FPGA operates free from the adverse effects of ground and power bounce.

Ground or power bounce occurs when a large number of outputs simultaneously switch in the same direction. The output drive transistors all conduct current to a common voltage rail. Low-to-High transitions conduct to the  $V_{CCO}$  rail; High-to-Low transitions conduct to the GND rail. The resulting cumulative current transient induces a voltage difference across the inductance that exists between the die pad and the power supply or ground return. The inductance is associated with bonding wires, the package lead frame,

and any other signal routing inside the package. Other variables contribute to SSO noise levels, including stray inductance on the PCB as well as capacitive loading at receivers. Any SSO-induced voltage consequently affects internal switching noise margins and ultimately signal quality.

Table 31 and Table 32 provide the essential SSO guidelines. For each device/package combination, Table 31 provides the number of equivalent  $V_{CCO}/GND$  pairs. The equivalent number of pairs is based on characterization and may not match the physical number of pairs. For each output signal standard and drive strength, Table 32 recommends the maximum number of SSOs, switching in the same direction, allowed per  $V_{CCO}/GND$  pair within an I/O bank. The guidelines in Table 32 are categorized by package style, slew rate, and output drive current. Furthermore, the number of SSOs is specified by I/O bank. Generally, the left and right I/O banks (Banks 1 and 3) support higher output drive current.

Multiply the appropriate numbers from Table 31 and Table 32 to calculate the maximum number of SSOs allowed within an I/O bank. Exceeding these SSO guidelines might result in increased power or ground bounce, degraded signal integrity, or increased system jitter.

$$SSO_{MAX}/IO\ Bank = Table\ 31 \times Table\ 32$$

The recommended maximum SSO values assumes that the FPGA is soldered on the printed circuit board and that the board uses sound design practices. The SSO values do not apply for FPGAs mounted in sockets, due to the lead inductance introduced by the socket.

The number of SSOs allowed for quad-flat packages (TQ) is lower than for ball grid array packages (FG) due to the larger lead inductance of the quad-flat packages. Ball grid array packages are recommended for applications with a large number of simultaneously switching outputs.

Table 31: Equivalent  $V_{CCO}/GND$  Pairs per Bank

| Device     | Package Style |        |        |        |        |
|------------|---------------|--------|--------|--------|--------|
|            | TQG144        | FTG256 | FGG400 | FGG484 | FGG676 |
| XC3S50AN   | 2             | 3      | –      | –      | –      |
| XC3S200AN  | –             | 4      | –      | –      | –      |
| XC3S400AN  | –             | 4      | 5      | –      | –      |
| XC3S700AN  | –             | –      | –      | 5      | –      |
| XC3S1400AN | –             | –      | –      | 6      | 9      |

Table 32: Recommended Number of Simultaneously Switching Outputs per V<sub>CCO</sub>-GND Pair

| Signal Standard (IOSTANDARD)  |         | Package Type          |                       |                                |                       |    |
|-------------------------------|---------|-----------------------|-----------------------|--------------------------------|-----------------------|----|
|                               |         | TQG144                |                       | FTG256, FGG400, FGG484, FGG676 |                       |    |
|                               |         | Top, Bottom Banks 0,2 | Left, Right Banks 1,3 | Top, Bottom Banks 0,2          | Left, Right Banks 1,3 |    |
| <b>Single-Ended Standards</b> |         |                       |                       |                                |                       |    |
| LVTTTL                        | Slow    | 2                     | 20                    | 20                             | 60                    | 60 |
|                               |         | 4                     | 10                    | 10                             | 41                    | 41 |
|                               |         | 6                     | 10                    | 10                             | 29                    | 29 |
|                               |         | 8                     | 6                     | 6                              | 22                    | 22 |
|                               |         | 12                    | 6                     | 6                              | 13                    | 13 |
|                               |         | 16                    | 5                     | 5                              | 11                    | 11 |
|                               |         | 24                    | 4                     | 4                              | 9                     | 9  |
|                               |         | Fast                  | 2                     | 10                             | 10                    | 10 |
|                               | 4       |                       | 6                     | 6                              | 6                     | 6  |
|                               | 6       |                       | 5                     | 5                              | 5                     | 5  |
|                               | 8       |                       | 3                     | 3                              | 3                     | 3  |
|                               | 12      |                       | 3                     | 3                              | 3                     | 3  |
|                               | 16      |                       | 3                     | 3                              | 3                     | 3  |
|                               | 24      |                       | 2                     | 2                              | 2                     | 2  |
|                               | QuietIO |                       | 2                     | 40                             | 40                    | 80 |
|                               |         | 4                     | 24                    | 24                             | 48                    | 48 |
|                               |         | 6                     | 20                    | 20                             | 36                    | 36 |
|                               |         | 8                     | 16                    | 16                             | 27                    | 27 |
|                               |         | 12                    | 12                    | 12                             | 16                    | 16 |
|                               |         | 16                    | 9                     | 9                              | 13                    | 13 |
|                               |         | 24                    | 9                     | 9                              | 12                    | 12 |

Table 32: Recommended Number of Simultaneously Switching Outputs per V<sub>CCO</sub>-GND Pair (Cont'd)

| Signal Standard (IOSTANDARD) |         | Package Type          |                       |                                |                       |    |
|------------------------------|---------|-----------------------|-----------------------|--------------------------------|-----------------------|----|
|                              |         | TQG144                |                       | FTG256, FGG400, FGG484, FGG676 |                       |    |
|                              |         | Top, Bottom Banks 0,2 | Left, Right Banks 1,3 | Top, Bottom Banks 0,2          | Left, Right Banks 1,3 |    |
| LVCMOS33                     | Slow    | 2                     | 24                    | 24                             | 76                    | 76 |
|                              |         | 4                     | 14                    | 14                             | 46                    | 46 |
|                              |         | 6                     | 11                    | 11                             | 27                    | 27 |
|                              |         | 8                     | 10                    | 10                             | 20                    | 20 |
|                              |         | 12                    | 9                     | 9                              | 13                    | 13 |
|                              |         | 16                    | 8                     | 8                              | 10                    | 10 |
|                              |         | 24                    | –                     | 8                              | –                     | 9  |
|                              |         | Fast                  | 2                     | 10                             | 10                    | 10 |
|                              | 4       |                       | 8                     | 8                              | 8                     | 8  |
|                              | 6       |                       | 5                     | 5                              | 5                     | 5  |
|                              | 8       |                       | 4                     | 4                              | 4                     | 4  |
|                              | 12      |                       | 4                     | 4                              | 4                     | 4  |
|                              | 16      |                       | 2                     | 2                              | 2                     | 2  |
|                              | 24      |                       | –                     | 2                              | –                     | 2  |
|                              | QuietIO |                       | 2                     | 36                             | 36                    | 76 |
|                              |         | 4                     | 32                    | 32                             | 46                    | 46 |
|                              |         | 6                     | 24                    | 24                             | 32                    | 32 |
|                              |         | 8                     | 16                    | 16                             | 26                    | 26 |
|                              |         | 12                    | 16                    | 16                             | 18                    | 18 |
|                              |         | 16                    | 12                    | 12                             | 14                    | 14 |
|                              |         | 24                    | –                     | 10                             | –                     | 10 |



Table 32: Recommended Number of Simultaneously Switching Outputs per V<sub>CCO</sub>-GND Pair (Cont'd)

| Signal Standard (IOSTANDARD) |         |    | Package Type          |                       |                                |                       |
|------------------------------|---------|----|-----------------------|-----------------------|--------------------------------|-----------------------|
|                              |         |    | TQG144                |                       | FTG256, FGG400, FGG484, FGG676 |                       |
|                              |         |    | Top, Bottom Banks 0,2 | Left, Right Banks 1,3 | Top, Bottom Banks 0,2          | Left, Right Banks 1,3 |
| LVCMOS25                     | Slow    | 2  | 16                    | 16                    | 76                             | 76                    |
|                              |         | 4  | 10                    | 10                    | 46                             | 46                    |
|                              |         | 6  | 8                     | 8                     | 33                             | 33                    |
|                              |         | 8  | 7                     | 7                     | 24                             | 24                    |
|                              |         | 12 | 6                     | 6                     | 18                             | 18                    |
|                              |         | 16 | –                     | 6                     | –                              | 11                    |
|                              |         | 24 | –                     | 5                     | –                              | 7                     |
|                              | Fast    | 2  | 12                    | 12                    | 18                             | 18                    |
|                              |         | 4  | 10                    | 10                    | 14                             | 14                    |
|                              |         | 6  | 8                     | 8                     | 6                              | 6                     |
|                              |         | 8  | 6                     | 6                     | 6                              | 6                     |
|                              |         | 12 | 3                     | 3                     | 3                              | 3                     |
|                              |         | 16 | –                     | 3                     | –                              | 3                     |
|                              |         | 24 | –                     | 2                     | –                              | 2                     |
|                              | QuietIO | 2  | 36                    | 36                    | 76                             | 76                    |
|                              |         | 4  | 30                    | 30                    | 60                             | 60                    |
|                              |         | 6  | 24                    | 24                    | 48                             | 48                    |
|                              |         | 8  | 20                    | 20                    | 36                             | 36                    |
|                              |         | 12 | 12                    | 12                    | 36                             | 36                    |
|                              |         | 16 | –                     | 12                    | –                              | 36                    |
|                              |         | 24 | –                     | 8                     | –                              | 8                     |

Table 32: Recommended Number of Simultaneously Switching Outputs per V<sub>CCO</sub>-GND Pair (Cont'd)

| Signal Standard (IOSTANDARD) |          |      | Package Type          |                       |                                |                       |    |
|------------------------------|----------|------|-----------------------|-----------------------|--------------------------------|-----------------------|----|
|                              |          |      | TQG144                |                       | FTG256, FGG400, FGG484, FGG676 |                       |    |
|                              |          |      | Top, Bottom Banks 0,2 | Left, Right Banks 1,3 | Top, Bottom Banks 0,2          | Left, Right Banks 1,3 |    |
| LVCMOS18                     | Slow     | 2    | 13                    | 13                    | 64                             | 64                    |    |
|                              |          | 4    | 8                     | 8                     | 34                             | 34                    |    |
|                              |          | 6    | 8                     | 8                     | 22                             | 22                    |    |
|                              |          | 8    | 7                     | 7                     | 18                             | 18                    |    |
|                              |          | 12   | –                     | 5                     | –                              | 13                    |    |
|                              |          | 16   | –                     | 5                     | –                              | 10                    |    |
|                              |          | 24   | –                     | 5                     | –                              | 7                     |    |
|                              | Fast     | 2    | 13                    | 13                    | 18                             | 18                    |    |
|                              |          | 4    | 8                     | 8                     | 9                              | 9                     |    |
|                              |          | 6    | 7                     | 7                     | 7                              | 7                     |    |
|                              |          | 8    | 4                     | 4                     | 4                              | 4                     |    |
|                              |          | 12   | –                     | 4                     | –                              | 4                     |    |
|                              |          | 16   | –                     | 3                     | –                              | 3                     |    |
|                              |          | 24   | –                     | 3                     | –                              | 3                     |    |
|                              | QuietIO  | 2    | 30                    | 30                    | 64                             | 64                    |    |
|                              |          | 4    | 24                    | 24                    | 64                             | 64                    |    |
|                              |          | 6    | 20                    | 20                    | 48                             | 48                    |    |
|                              |          | 8    | 16                    | 16                    | 36                             | 36                    |    |
|                              |          | 12   | –                     | 12                    | –                              | 36                    |    |
|                              |          | 16   | –                     | 12                    | –                              | 24                    |    |
|                              |          | 24   | –                     | 12                    | –                              | 24                    |    |
|                              | LVCMOS15 | Slow | 2                     | 12                    | 12                             | 55                    | 55 |
|                              |          |      | 4                     | 7                     | 7                              | 31                    | 31 |
|                              |          |      | 6                     | 7                     | 7                              | 18                    | 18 |
| 8                            |          |      | –                     | 6                     | –                              | 15                    |    |
| 12                           |          |      | –                     | 5                     | –                              | 10                    |    |
| Fast                         |          | 2    | 10                    | 10                    | 25                             | 25                    |    |
|                              |          | 4    | 7                     | 7                     | 10                             | 10                    |    |
|                              |          | 6    | 6                     | 6                     | 6                              | 6                     |    |
|                              |          | 8    | –                     | 4                     | –                              | 4                     |    |
|                              |          | 12   | –                     | 3                     | –                              | 3                     |    |
| QuietIO                      |          | 2    | 30                    | 30                    | 70                             | 70                    |    |
|                              |          | 4    | 21                    | 21                    | 40                             | 40                    |    |
|                              |          | 6    | 18                    | 18                    | 31                             | 31                    |    |
|                              |          | 8    | –                     | 12                    | –                              | 31                    |    |
|                              |          | 12   | –                     | 12                    | –                              | 20                    |    |

Table 32: Recommended Number of Simultaneously Switching Outputs per V<sub>CCO</sub>-GND Pair (Cont'd)

| Signal Standard (IOSTANDARD)                                    |         |   | Package Type          |                       |                                |                       |
|---|---------|---|-----------------------|-----------------------|--------------------------------|-----------------------|
|   |         |   | TQG144                |                       | FTG256, FGG400, FGG484, FGG676 |                       |
|   |         |   | Top, Bottom Banks 0,2 | Left, Right Banks 1,3 | Top, Bottom Banks 0,2          | Left, Right Banks 1,3 |
| LVCMOS12  | Slow    | 2 | 17                    | 17                    | 40                             | 40                    |
|   |         | 4 | –                     | 13                    | –                              | 25                    |
|   |         | 6 | –                     | 10                    | –                              | 18                    |
|   | Fast    | 2 | 12                    | 9                     | 31                             | 31                    |
|   |         | 4 | –                     | 9                     | –                              | 13                    |
|   |         | 6 | –                     | 9                     | –                              | 9                     |
|   | QuietIO | 2 | 36                    | 36                    | 55                             | 55                    |
|   |         | 4 | –                     | 33                    | –                              | 36                    |
|   |         | 6 | –                     | 27                    | –                              | 36                    |
| PCI33_3   |         |   | 9                     | 9                     | 16                             | 16                    |
| PCI66_3   |         |   | –                     | 9                     | –                              | 13                    |
| HSTL_I  |         |   | –                     | 11                    | –                              | 20                    |
| HSTL_III  |         |   | –                     | 7                     | –                              | 8                     |
| HSTL_I_18   |         |   | 13                    | 13                    | 17                             | 17                    |
| HSTL_II_18  |         |   | –                     | 5                     | –                              | 5                     |
| HSTL_III_18   |         |   | 8                     | 8                     | 10                             | 8                     |
| SSTL18_I  |         |   | 7                     | 13                    | 7                              | 15                    |
| SSTL18_II   |         |   | –                     | 9                     | –                              | 9                     |
| SSTL2_I   |         |   | 10                    | 10                    | 18                             | 18                    |
| SSTL2_II  |         |   | –                     | 6                     | –                              | 9                     |
| SSTL3_I   |         |   | 7                     | 8                     | 8                              | 10                    |
| SSTL3_II  |         |   | 5                     | 6                     | 6                              | 7                     |
| <b>Differential Standards (Number of I/O Pairs or Channels)</b> |         |   |                       |                       |                                |                       |
| LVDS_25   |         |   | 8                     | –                     | 22                             | –                     |
| LVDS_33   |         |   | 8                     | –                     | 27                             | –                     |
| BLVDS_25  |         |   | 1                     | 1                     | 4                              | 4                     |
| MINI_LVDS_25  |         |   | 8                     | –                     | 22                             | –                     |
| MINI_LVDS_33  |         |   | 8                     | –                     | 27                             | –                     |
| LVPECL_25   |         |   | Input Only            |                       |                                |                       |
| LVPECL_33   |         |   | Input Only            |                       |                                |                       |
| RSDS_25   |         |   | 8                     | –                     | 22                             | –                     |
| RSDS_33   |         |   | 8                     | –                     | 27                             | –                     |
| TMDS_33   |         |   | 8                     | –                     | 27                             | –                     |
| PPDS_25   |         |   | 8                     | –                     | 22                             | –                     |

Table 32: Recommended Number of Simultaneously Switching Outputs per V<sub>CCO</sub>-GND Pair (Cont'd)

| Signal Standard (IOSTANDARD) | Package Type          |                       |                                |                       |
|------------------------------|-----------------------|-----------------------|--------------------------------|-----------------------|
|                              | TQG144                |                       | FTG256, FGG400, FGG484, FGG676 |                       |
|                              | Top, Bottom Banks 0,2 | Left, Right Banks 1,3 | Top, Bottom Banks 0,2          | Left, Right Banks 1,3 |
| PPDS_33                      | 8                     | –                     | 27                             | –                     |
| DIFF_HSTL_I                  | –                     | 5                     | –                              | 10                    |
| DIFF_HSTL_III                | –                     | 3                     | –                              | 4                     |
| DIFF_HSTL_I_18               | 6                     | 6                     | 8                              | 8                     |
| DIFF_HSTL_II_18              | –                     | 2                     | –                              | 2                     |
| DIFF_HSTL_III_18             | 4                     | 4                     | 5                              | 4                     |
| DIFF_SSTL18_I                | 3                     | 6                     | 3                              | 7                     |
| DIFF_SSTL18_II               | –                     | 4                     | –                              | 4                     |
| DIFF_SSTL2_I                 | 5                     | 5                     | 9                              | 9                     |
| DIFF_SSTL2_II                | –                     | 3                     | –                              | 4                     |
| DIFF_SSTL3_I                 | 3                     | 4                     | 4                              | 5                     |
| DIFF_SSTL3_II                | 2                     | 3                     | 3                              | 3                     |

**Notes:**

- Not all I/O standards are supported on all I/O banks. The left and right banks (I/O banks 1 and 3) support higher output drive current than the top and bottom banks (I/O banks 0 and 2). Similarly, true differential output standards, such as LVDS, RSDS, PPDS, miniLVDS, and TMDS, are only supported in top or bottom banks (I/O banks 0 and 2). Refer to [UG331: Spartan-3 Generation FPGA User Guide](#) for additional information.
- The numbers in this table are recommendations that assume sound board lay out practice. Test limits are the V<sub>IL</sub>/V<sub>IH</sub> voltage limits for the respective I/O standard.
- If more than one signal standard is assigned to the I/Os of a given bank, refer to [XAPP689: Managing Ground Bounce in Large FPGAs](#) for information on how to perform weighted average SSO calculations.

## Configurable Logic Block (CLB) Timing

Table 33: CLB (SLICEM) Timing

| Symbol                       | Description   | Speed Grade |      |      |      | Units |
|------------------------------|---|-------------|------|------|------|-------|
|                              |   | -5          |      | -4   |      |       |
|                              |   | Min         | Max  | Min  | Max  |       |
| <b>Clock-to-Output Times</b> |   |             |      |      |      |       |
| $T_{CKO}$                    | When reading from the FFX (FFY) Flip-Flop, the time from the active transition at the CLK input to data appearing at the XQ (YQ) output | –           | 0.60 | –    | 0.68 | ns    |
| <b>Setup Times</b>           |   |             |      |      |      |       |
| $T_{AS}$                     | Time from the setup of data at the F or G input to the active transition at the CLK input of the CLB                                    | 0.18        | –    | 0.36 | –    | ns    |
| $T_{DICK}$                   | Time from the setup of data at the BX or BY input to the active transition at the CLK input of the CLB                                  | 1.58        | –    | 1.88 | –    | ns    |
| <b>Hold Times</b>            |   |             |      |      |      |       |
| $T_{AH}$                     | Time from the active transition at the CLK input to the point where data is last held at the F or G input                               | 0           | –    | 0    | –    | ns    |
| $T_{CKDI}$                   | Time from the active transition at the CLK input to the point where data is last held at the BX or BY input                             | 0           | –    | 0    | –    | ns    |
| <b>Clock Timing</b>          |   |             |      |      |      |       |
| $T_{CH}$                     | The High pulse width of the CLB's CLK signal  | 0.63        | –    | 0.75 | –    | ns    |
| $T_{CL}$                     | The Low pulse width of the CLK signal   | 0.63        | –    | 0.75 | –    | ns    |
| $F_{TOG}$                    | Toggle frequency (for export control)   | 0           | 770  | 0    | 667  | MHz   |
| <b>Propagation Times</b>     |   |             |      |      |      |       |
| $T_{ILO}$                    | The time it takes for data to travel from the CLB's F (G) input to the X (Y) output   | –           | 0.62 | –    | 0.71 | ns    |
| <b>Set/Reset Pulse Width</b> |   |             |      |      |      |       |
| $T_{RPW\_CLB}$               | The minimum allowable pulse width, High or Low, to the CLB's SR input   | 1.33        | –    | 1.61 | –    | ns    |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in [Table 10](#).

Table 34: CLB Distributed RAM Switching Characteristics

| Symbol                       | Description   | Speed Grade |      |       |      | Units |
|------------------------------|---|-------------|------|-------|------|-------|
|                              |   | -5          |      | -4    |      |       |
|                              |   | Min         | Max  | Min   | Max  |       |
| <b>Clock-to-Output Times</b> |   |             |      |       |      |       |
| $T_{SHCKO}$                  | Time from the active edge at the CLK input to data appearing on the distributed RAM output  | –           | 1.69 | –     | 2.01 | ns    |
| <b>Setup Times</b>           |   |             |      |       |      |       |
| $T_{DS}$                     | Setup time of data at the BX or BY input before the active transition at the CLK input of the distributed RAM                     | –0.07       | –    | –0.02 | –    | ns    |
| $T_{AS}$                     | Setup time of the F/G address inputs before the active transition at the CLK input of the distributed RAM                         | 0.18        | –    | 0.36  | –    | ns    |
| $T_{WS}$                     | Setup time of the write enable input before the active transition at the CLK input of the distributed RAM                         | 0.30        | –    | 0.59  | –    | ns    |
| <b>Hold Times</b>            |   |             |      |       |      |       |
| $T_{DH}$                     | Hold time of the BX and BY data inputs after the active transition at the CLK input of the distributed RAM                        | 0.13        | –    | 0.13  | –    | ns    |
| $T_{AH}, T_{WH}$             | Hold time of the F/G address inputs or the write enable input after the active transition at the CLK input of the distributed RAM | 0.01        | –    | 0.01  | –    | ns    |
| <b>Clock Pulse Width</b>     |   |             |      |       |      |       |
| $T_{WPH}, T_{WPL}$           | Minimum High or Low pulse width at CLK input  | 0.88        | –    | 1.01  | –    | ns    |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in Table 10.

Table 35: CLB Shift Register Switching Characteristics

| Symbol                       | Description  | Speed Grade |      |      |      | Units |
|------------------------------|--|-------------|------|------|------|-------|
|                              |  | -5          |      | -4   |      |       |
|                              |  | Min         | Max  | Min  | Max  |       |
| <b>Clock-to-Output Times</b> |  |             |      |      |      |       |
| $T_{REG}$                    | Time from the active edge at the CLK input to data appearing on the shift register output                    | –           | 4.11 | –    | 4.82 | ns    |
| <b>Setup Times</b>           |  |             |      |      |      |       |
| $T_{SRLDS}$                  | Setup time of data at the BX or BY input before the active transition at the CLK input of the shift register | 0.13        | –    | 0.18 | –    | ns    |
| <b>Hold Times</b>            |  |             |      |      |      |       |
| $T_{SRLDH}$                  | Hold time of the BX or BY data input after the active transition at the CLK input of the shift register      | 0.16        | –    | 0.16 | –    | ns    |
| <b>Clock Pulse Width</b>     |  |             |      |      |      |       |
| $T_{WPH}, T_{WPL}$           | Minimum High or Low pulse width at CLK input   | 0.90        | –    | 1.01 | –    | ns    |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in Table 10.

## Clock Buffer/Multiplexer Switching Characteristics

Table 36: Clock Distribution Switching Characteristics

| Description   | Symbol     | Minimum | Maximum     |      | Units |
|---|------------|---------|-------------|------|-------|
|   |            |         | Speed Grade |      |       |
|   |            |         | -5          | -4   |       |
| Global clock buffer (BUFG, BUFGMUX, BUFGCE) I input to O-output delay                                       | $T_{GIO}$  | –       | 0.22        | 0.23 | ns    |
| Global clock multiplexer (BUFGMUX) select S-input setup to I0 and I1 inputs. Same as BUFGCE enable CE-input | $T_{GSI}$  | –       | 0.56        | 0.63 | ns    |
| Frequency of signals distributed on global buffers (all sides)  | $F_{BUFG}$ | 0       | 350         | 334  | MHz   |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in [Table 10](#).

## 18 x 18 Embedded Multiplier Timing

Table 37: 18 x 18 Embedded Multiplier Timing

| Symbol                           | Description  | Speed Grade |      |      |      | Units |
|----------------------------------|--|-------------|------|------|------|-------|
|                                  |  | -5          |      | -4   |      |       |
|                                  |  | Min         | Max  | Min  | Max  |       |
| <b>Combinatorial Delay</b>       |  |             |      |      |      |       |
| $T_{MULT}$                       | Combinational multiplier propagation delay from the A and B inputs to the P outputs, assuming 18-bit inputs and a 36-bit product (AREG, BREG, and PREG registers unused) | –           | 4.36 | –    | 4.88 | ns    |
| <b>Clock-to-Output Times</b>     |  |             |      |      |      |       |
| $T_{MSCKP\_P}$                   | Clock-to-output delay from the active transition of the CLK input to valid data appearing on the P outputs when using the PREG register <sup>(2,3)</sup>                 | –           | 0.84 | –    | 1.30 | ns    |
| $T_{MSCKP\_A}$<br>$T_{MSCKP\_B}$ | Clock-to-output delay from the active transition of the CLK input to valid data appearing on the P outputs when using either the AREG or BREG register <sup>(2,4)</sup>  | –           | 4.44 | –    | 4.97 | ns    |
| <b>Setup Times</b>               |  |             |      |      |      |       |
| $T_{MSDCK\_P}$                   | Data setup time at the A or B input before the active transition at the CLK when using only the PREG output register (AREG, BREG registers unused) <sup>(3)</sup>        | 3.56        | –    | 3.98 | –    | ns    |
| $T_{MSDCK\_A}$                   | Data setup time at the A input before the active transition at the CLK when using the AREG input register <sup>(4)</sup>   | 0.00        | –    | 0.00 | –    | ns    |
| $T_{MSDCK\_B}$                   | Data setup time at the B input before the active transition at the CLK when using the BREG input register <sup>(4)</sup>   | 0.00        | –    | 0.00 | –    | ns    |
| <b>Hold Times</b>                |  |             |      |      |      |       |
| $T_{MSCKD\_P}$                   | Data hold time at the A or B input after the active transition at the CLK when using only the PREG output register (AREG, BREG registers unused) <sup>(3)</sup>          | 0.00        | –    | 0.00 | –    | ns    |
| $T_{MSCKD\_A}$                   | Data hold time at the A input after the active transition at the CLK when using the AREG input register <sup>(4)</sup>   | 0.35        | –    | 0.45 | –    | ns    |
| $T_{MSCKD\_B}$                   | Data hold time at the B input after the active transition at the CLK when using the BREG input register <sup>(4)</sup>   | 0.35        | –    | 0.45 | –    | ns    |
| <b>Clock Frequency</b>           |  |             |      |      |      |       |
| $F_{MULT}$                       | Internal operating frequency for a two-stage 18x18 multiplier using the AREG and BREG input registers and the PREG output register <sup>(5)</sup>                        | 0           | 280  | 0    | 250  | MHz   |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in [Table 10](#).
2. The PREG register is typically used in both single-stage and two-stage pipelined multiplier implementations.
3. The PREG register is typically used when inferring a single-stage multiplier.
4. Input registers AREG or BREG are typically used when inferring a two-stage multiplier.
5. Combinational delay is less and pipelined performance is higher when multiplying input data with less than 18 bits.

## Block RAM Timing

Table 38: Block RAM Timing

| Symbol                       | Description   | Speed Grade |      |      |      | Units |
|------------------------------|---|-------------|------|------|------|-------|
|                              |   | -5          |      | -4   |      |       |
|                              |   | Min         | Max  | Min  | Max  |       |
| <b>Clock-to-Output Times</b> |   |             |      |      |      |       |
| $T_{RCKO}$                   | When reading from block RAM, the delay from the active transition at the CLK input to data appearing at the DOUT output | –           | 2.06 | –    | 2.49 | ns    |
| <b>Setup Times</b>           |   |             |      |      |      |       |
| $T_{RCK\_ADDR}$              | Setup time for the ADDR inputs before the active transition at the CLK input of the block RAM                           | 0.32        | –    | 0.36 | –    | ns    |
| $T_{RDCK\_DIB}$              | Setup time for data at the DIN inputs before the active transition at the CLK input of the block RAM                    | 0.28        | –    | 0.31 | –    | ns    |
| $T_{RCK\_ENB}$               | Setup time for the EN input before the active transition at the CLK input of the block RAM                              | 0.69        | –    | 0.77 | –    | ns    |
| $T_{RCK\_WEB}$               | Setup time for the WE input before the active transition at the CLK input of the block RAM                              | 1.12        | –    | 1.26 | –    | ns    |
| <b>Hold Times</b>            |   |             |      |      |      |       |
| $T_{RCKC\_ADDR}$             | Hold time on the ADDR inputs after the active transition at the CLK input   | 0           | –    | 0    | –    | ns    |
| $T_{RCKD\_DIB}$              | Hold time on the DIN inputs after the active transition at the CLK input  | 0           | –    | 0    | –    | ns    |
| $T_{RCKC\_ENB}$              | Hold time on the EN input after the active transition at the CLK input  | 0           | –    | 0    | –    | ns    |
| $T_{RCKC\_WEB}$              | Hold time on the WE input after the active transition at the CLK input  | 0           | –    | 0    | –    | ns    |
| <b>Clock Timing</b>          |   |             |      |      |      |       |
| $T_{BPWH}$                   | High pulse width of the CLK signal  | 1.56        | –    | 1.79 | –    | ns    |
| $T_{BPWL}$                   | Low pulse width of the CLK signal   | 1.56        | –    | 1.79 | –    | ns    |
| <b>Clock Frequency</b>       |   |             |      |      |      |       |
| $F_{BRAM}$                   | Block RAM clock frequency   | 0           | 320  | 0    | 280  | MHz   |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in [Table 10](#).

## Digital Clock Manager (DCM) Timing

For specification purposes, the DCM consists of three key components: the Delay-Locked Loop (DLL), the Digital Frequency Synthesizer (DFS), and the Phase Shifter (PS).

Aspects of DLL operation play a role in all DCM applications. All such applications inevitably use the CLKIN and the CLKFB inputs connected to either the CLK0 or the CLK2X feedback, respectively. Thus, specifications in the DLL tables (Table 39 and Table 40) apply to any application that only employs the DLL component. When the DFS and/or the PS components are used together with the DLL, then the specifications listed in the DFS and PS tables (Table 41 through Table 44) supersede any corresponding ones in the DLL tables. DLL specifications that do not change with the addition of DFS or PS functions are presented in Table 39 and Table 40.

Period jitter and cycle-cycle jitter are two of many different ways of specifying clock jitter. Both specifications describe statistical variation from a mean value.

### Delay-Locked Loop (DLL)

Table 39: Recommended Operating Conditions for the DLL

| Symbol   | Description   | Speed Grade                        |     |                  |                    | Units            |                    |     |
|--|---|------------------------------------|-----|------------------|--------------------|------------------|--------------------|-----|
|  |   | -5                                 |     | -4               |                    |                  |                    |     |
|  |   | Min                                | Max | Min              | Max                |                  |                    |     |
| <b>Input Frequency Ranges</b>  |   |                                    |     |                  |                    |                  |                    |     |
| F <sub>CLKIN</sub>   | CLKIN_FREQ_DLL  | Frequency of the CLKIN clock input |     | 5 <sup>(2)</sup> | 280 <sup>(3)</sup> | 5 <sup>(2)</sup> | 250 <sup>(3)</sup> | MHz |
| <b>Input Pulse Requirements</b>  |   |                                    |     |                  |                    |                  |                    |     |
| CLKIN_PULSE  | CLKIN pulse width as a percentage of the CLKIN period                                 | F <sub>CLKIN</sub> ≤ 150 MHz       | 40% | 60%              | 40%                | 60%              | %                  |     |
|  |   | F <sub>CLKIN</sub> > 150 MHz       | 45% | 55%              | 45%                | 55%              | %                  |     |
| <b>Input Clock Jitter Tolerance and Delay Path Variation<sup>(4)</sup></b> |   |                                    |     |                  |                    |                  |                    |     |
| CLKIN_CYC_JITT_DLL_LF  | Cycle-to-cycle jitter at the CLKIN input  | F <sub>CLKIN</sub> ≤ 150 MHz       | –   | ±300             | –                  | ±300             | ps                 |     |
| CLKIN_CYC_JITT_DLL_HF  |   | F <sub>CLKIN</sub> > 150 MHz       | –   | ±150             | –                  | ±150             | ps                 |     |
| CLKIN_PER_JITT_DLL   | Period jitter at the CLKIN input  |                                    | –   | ±1               | –                  | ±1               | ns                 |     |
| CLKFB_DELAY_VAR_EXT  | Allowable variation of off-chip feedback delay from the DCM output to the CLKFB input |                                    | –   | ±1               | –                  | ±1               | ns                 |     |

**Notes:**

1. DLL specifications apply when any of the DLL outputs (CLK0, CLK90, CLK180, CLK270, CLK2X, CLK2X180, or CLKDV) are in use.
2. The DFS, when operating independently of the DLL, supports lower F<sub>CLKIN</sub> frequencies. See Table 41.
3. The CLKIN\_DIVIDE\_BY\_2 attribute can be used to increase the effective input frequency range up to F<sub>BUFG</sub>. When set to TRUE, CLKIN\_DIVIDE\_BY\_2 divides the incoming clock frequency by two as it enters the DCM.
4. CLKIN input jitter beyond these limits might cause the DCM to lose lock.
5. The DCM specifications are guaranteed when both adjacent DCMs are locked.

Period jitter is the worst-case deviation from the ideal clock period over a collection of millions of samples. In a histogram of period jitter, the mean value is the clock period.

Cycle-cycle jitter is the worst-case difference in clock period between adjacent clock cycles in the collection of clock periods sampled. In a histogram of cycle-cycle jitter, the mean value is zero.

### Spread Spectrum

DCMs accept typical spread spectrum clocks as long as they meet the input requirements. The DLL will track the frequency changes created by the spread spectrum clock to drive the global clocks to the FPGA logic. See XAPP469: *Spread-Spectrum Clocking Reception for Displays* for details.



Table 40: Switching Characteristics for the DLL

| Symbol                                       | Description  | Device  | Speed Grade |                               |                             |                               | Units                       |    |
|--|--|---|-------------|-------------------------------|-----------------------------|-------------------------------|-----------------------------|----|
|  |  |   | -5          |                               | -4                          |                               |                             |    |
|  |  |   | Min         | Max                           | Min                         | Max                           |                             |    |
| <b>Output Frequency Ranges</b>               |  |   |             |                               |                             |                               |                             |    |
| CLKOUT_FREQ_CLK0                             | Frequency for the CLK0 and CLK180 outputs  | All   | 5           | 280                           | 5                           | 250                           | MHz                         |    |
| CLKOUT_FREQ_CLK90                            | Frequency for the CLK90 and CLK270 outputs   |   | 5           | 200                           | 5                           | 200                           | MHz                         |    |
| CLKOUT_FREQ_2X                               | Frequency for the CLK2X and CLK2X180 outputs   |   | 10          | 334                           | 10                          | 334                           | MHz                         |    |
| CLKOUT_FREQ_DV                               | Frequency for the CLKDV output   |   | 0.3125      | 186                           | 0.3125                      | 166                           | MHz                         |    |
| <b>Output Clock Jitter<sup>(2,3,4)</sup></b> |  |   |             |                               |                             |                               |                             |    |
| CLKOUT_PER_JITT_0                            | Period jitter at the CLK0 output   | All   | –           | ±100                          | –                           | ±100                          | ps                          |    |
| CLKOUT_PER_JITT_90                           | Period jitter at the CLK90 output  |   | –           | ±150                          | –                           | ±150                          | ps                          |    |
| CLKOUT_PER_JITT_180                          | Period jitter at the CLK180 output   |   | –           | ±150                          | –                           | ±150                          | ps                          |    |
| CLKOUT_PER_JITT_270                          | Period jitter at the CLK270 output   |   | –           | ±150                          | –                           | ±150                          | ps                          |    |
| CLKOUT_PER_JITT_2X                           | Period jitter at the CLK2X and CLK2X180 outputs  |   | –           | ±[0.5% of CLKIN period + 100] | –                           | ±[0.5% of CLKIN period + 100] | ps                          |    |
| CLKOUT_PER_JITT_DV1                          | Period jitter at the CLKDV output when performing integer division   |   | –           | ±150                          | –                           | ±150                          | ps                          |    |
| CLKOUT_PER_JITT_DV2                          | Period jitter at the CLKDV output when performing non-integer division   |   | –           | ±[0.5% of CLKIN period + 100] | –                           | ±[0.5% of CLKIN period + 100] | ps                          |    |
| <b>Duty Cycle<sup>(4)</sup></b>              |  |   |             |                               |                             |                               |                             |    |
| CLKOUT_DUTY_CYCLE_DLL                        | Duty cycle variation for the CLK0, CLK90, CLK180, CLK270, CLK2X, CLK2X180, and CLKDV outputs, including the BUFGMUX and clock tree duty-cycle distortion                                     | All   | –           | ±[1% of CLKIN period + 350]   | –                           | ±[1% of CLKIN period + 350]   | ps                          |    |
| <b>Phase Alignment<sup>(4)</sup></b>         |  |   |             |                               |                             |                               |                             |    |
| CLKIN_CLKFB_PHASE                            | Phase offset between the CLKIN and CLKFB inputs  |   | All         | –                             | ±150                        | –                             | ±150                        | ps |
| CLKOUT_PHASE_DLL                             | Phase offset between DLL outputs   | CLK0 to CLK2X (not CLK2X180)                              | All         | –                             | ±[1% of CLKIN period + 100] | –                             | ±[1% of CLKIN period + 100] | ps |
|  |  | All others  | All         | –                             | ±[1% of CLKIN period + 150] | –                             | ±[1% of CLKIN period + 150] | ps |
| <b>Lock Time</b>                             |  |   |             |                               |                             |                               |                             |    |
| LOCK_DLL <sup>(3)</sup>                      | When using the DLL alone: The time from deassertion at the DCM's Reset input to the rising transition at its LOCKED output. When the DCM is locked, the CLKIN and CLKFB signals are in phase | $5 \text{ MHz} \leq F_{\text{CLKIN}} \leq 15 \text{ MHz}$ | All         | –                             | 5                           | –                             | 5                           | ms |
|  |  | $F_{\text{CLKIN}} > 15 \text{ MHz}$                       | All         | –                             | 600                         | –                             | 600                         | µs |

Table 40: Switching Characteristics for the DLL (Cont'd)

| Symbol                        | Description                                    | Device | Speed Grade |     |     |     | Units |
|-------------------------------|--|--------|-------------|-----|-----|-----|-------|
|                               |  |        | -5          |     | -4  |     |       |
|                               |  |        | Min         | Max | Min | Max |       |
| <b>Delay Lines</b>            |  |        |             |     |     |     |       |
| DCM_DELAY_STEP <sup>(5)</sup> | Finest delay resolution, average over all taps | All    | 15          | 35  | 15  | 35  | ps    |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in Table 10 and Table 39.
2. Indicates the maximum amount of output jitter that the DCM adds to the jitter on the CLKIN input.
3. For optimal jitter tolerance and faster lock time, use the CLKIN\_PERIOD attribute.
4. Some jitter and duty-cycle specifications include 1% of input clock period or 0.01 UI. For example, the data sheet specifies a maximum jitter of “±[1% of CLKIN period + 150]”. Assume the CLKIN frequency is 100 MHz. The equivalent CLKIN period is 10 ns and 1% of 10 ns is 0.1 ns or 100 ps. According to the data sheet, the maximum jitter is ±[100 ps + 150 ps] = ±250 ps.
5. The typical delay step size is 23 ps.

**Digital Frequency Synthesizer (DFS)**

Table 41: Recommended Operating Conditions for the DFS

| Symbol  | Description   | Device                        | Speed Grade |                    |       |                    | Units |
|---|---|-------------------------------|-------------|--------------------|-------|--------------------|-------|
|   |   |                               | -5          |                    | -4    |                    |       |
|   |   |                               | Min         | Max                | Min   | Max                |       |
| <b>Input Frequency Ranges<sup>(2)</sup></b>       |   |                               |             |                    |       |                    |       |
| F <sub>CLKIN</sub>                                | CLKIN_FREQ_FX   | Frequency for the CLKIN input | 0.200       | 333 <sup>(3)</sup> | 0.200 | 333 <sup>(3)</sup> | MHz   |
| <b>Input Clock Jitter Tolerance<sup>(4)</sup></b> |   |                               |             |                    |       |                    |       |
| CLKIN_CYC_JITT_FX_LF                              | Cycle-to-cycle jitter at the CLKIN input, based on CLKFX output frequency | F <sub>CLKFX</sub> ≤ 150 MHz  | –           | ±300               | –     | ±300               | ps    |
| CLKIN_CYC_JITT_FX_HF                              |   | F <sub>CLKFX</sub> > 150 MHz  | –           | ±150               | –     | ±150               | ps    |
| CLKIN_PER_JITT_FX                                 | Period jitter at the CLKIN input  |                               | –           | ±1                 | –     | ±1                 | ns    |

**Notes:**

1. DFS specifications apply when either of the DFS outputs (CLKFX or CLKFX180) are used.
2. If both DFS and DLL outputs are used on the same DCM, follow the more restrictive CLKIN\_FREQ\_DLL specifications in Table 39.
3. To support double the maximum effective FCLKIN limit, set the CLKIN\_DIVIDE\_BY\_2 attribute to TRUE. This attribute divides the incoming clock frequency by two as it enters the DCM.
4. CLKIN input jitter beyond these limits may cause the DCM to lose lock.

Table 42: Switching Characteristics for the DFS

| Symbol                            | Description   | Device  | Speed Grade |                             |                             |                             | Units                       |    |
|-----------------------------------|---|---|-------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|----|
|                                   |   |   | -5          |                             | -4                          |                             |                             |    |
|                                   |   |   | Min         | Max                         | Min                         | Max                         |                             |    |
| <b>Output Frequency Ranges</b>    |   |   |             |                             |                             |                             |                             |    |
| CLKOUT_FREQ_FX                    | Frequency for the CLKFX and CLKFX180 outputs  | All   | 5           | 350                         | 5                           | 320                         | MHz                         |    |
| <b>Output Clock Jitter (2)(3)</b> |   |   |             |                             |                             |                             |                             |    |
| CLKOUT_PER_JITT_FX                | Period jitter at the CLKFX and CLKFX180 outputs.  | CLKIN ≤ 20 MHz  | All         | Typ                         | Max                         | Typ                         | Max                         | ps |
|                                   |   | Use the Spartan-3A Jitter Calculator:<br><a href="http://www.xilinx.com/support/documentation/data_sheets/s3a_jitter_calc.zip">www.xilinx.com/support/documentation/data_sheets/s3a_jitter_calc.zip</a> |             |                             |                             |                             |                             |    |
|                                   |   | CLKIN > 20 MHz  |             | ±[1% of CLKFX period + 100] | ±[1% of CLKFX period + 200] | ±[1% of CLKFX period + 100] | ±[1% of CLKFX period + 200] | ps |
| <b>Duty Cycle (4)(5)</b>          |   |   |             |                             |                             |                             |                             |    |
| CLKOUT_DUTY_CYCLE_FX              | Duty cycle precision for the CLKFX and CLKFX180 outputs, including the BUFGMUX and clock tree duty-cycle distortion   | All   | –           | ±[1% of CLKFX period + 350] | –                           | ±[1% of CLKFX period + 350] | ps                          |    |
| <b>Phase Alignment (5)</b>        |   |   |             |                             |                             |                             |                             |    |
| CLKOUT_PHASE_FX                   | Phase offset between the DFS CLKFX output and the DLL CLK0 output when both the DFS and DLL are used  | All   | –           | ±200                        | –                           | ±200                        | ps                          |    |
| CLKOUT_PHASE_FX180                | Phase offset between the DFS CLKFX180 output and the DLL CLK0 output when both the DFS and DLL are used   | All   | –           | ±[1% of CLKFX period + 200] | –                           | ±[1% of CLKFX period + 200] | ps                          |    |
| <b>Lock Time</b>                  |   |   |             |                             |                             |                             |                             |    |
| LOCK_FX (2)                       | The time from deassertion at the DCM's Reset input to the rising transition at its LOCKED output. The DFS asserts LOCKED when the CLKFX and CLKFX180 signals are valid. If using both the DLL and the DFS, use the longer locking time. | $5\text{ MHz} \leq F_{\text{CLKIN}} \leq 15\text{ MHz}$   | All         | –                           | 5                           | –                           | 5                           | ms |
|                                   |   | $F_{\text{CLKIN}} > 15\text{ MHz}$  |             | –                           | 450                         | –                           | 450                         | µs |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in Table 10 and Table 41.
2. For optimal jitter tolerance and faster lock time, use the CLKIN\_PERIOD attribute.
3. Maximum output jitter is characterized within a reasonable noise environment (40 SSOs and 25% CLB switching) on an XC3S1400A FPGA. Output jitter strongly depends on the environment, including the number of SSOs, the output drive strength, CLB utilization, CLB switching activities, switching frequency, power supply and PCB design. The actual maximum output jitter depends on the system application.
4. The CLKFX and CLKFX180 outputs always have an approximate 50% duty cycle.
5. Some duty-cycle and alignment specifications include a percentage of the CLKFX output period. For example, the data sheet specifies a maximum CLKFX jitter of “±[1% of CLKFX period + 200]”. Assume the CLKFX output frequency is 100 MHz. The equivalent CLKFX period is 10 ns and 1% of 10 ns is 0.1 ns or 100 ps. According to the data sheet, the maximum jitter is ±[100 ps + 200 ps] = ±300 ps.

## Phase Shifter (PS)

Table 43: Recommended Operating Conditions for the PS in Variable Phase Mode

| Symbol                            | Description   | Speed Grade |     |     |     | Units |
|-----------------------------------|---|-------------|-----|-----|-----|-------|
|                                   |   | -5          |     | -4  |     |       |
|                                   |   | Min         | Max | Min | Max |       |
| <b>Operating Frequency Ranges</b> |   |             |     |     |     |       |
| PSCLK_FREQ (F <sub>PSCLK</sub> )  | Frequency for the PSCLK input                         | 1           | 167 | 1   | 167 | MHz   |
| <b>Input Pulse Requirements</b>   |   |             |     |     |     |       |
| PSCLK_PULSE                       | PSCLK pulse width as a percentage of the PSCLK period | 40%         | 60% | 40% | 60% | %     |

Table 44: Switching Characteristics for the PS in Variable Phase Mode

| Symbol                      | Description  | Phase Shift Amount                | Units  |
|-----------------------------|--|-----------------------------------|--|
| <b>Phase Shifting Range</b> |  |                                   |  |
| MAX_STEPS <sup>(2,3)</sup>  | Maximum allowed number of DCM_DELAY_STEP steps for a given CLKIN clock period, where T = CLKIN clock period in ns. If using CLKIN_DIVIDE_BY_2 = TRUE, double the clock effective clock period. | CLKIN < 60 MHz                    | ±[INTEGER(10 • (T <sub>CLKIN</sub> - 3 ns))] |
|                             |  | CLKIN ≥ 60 MHz                    | ±[INTEGER(15 • (T <sub>CLKIN</sub> - 3 ns))] |
| FINE_SHIFT_RANGE_MIN        | Minimum guaranteed delay for variable phase shifting   | ±[MAX_STEPS • DCM_DELAY_STEP_MIN] | ns   |
| FINE_SHIFT_RANGE_MAX        | Maximum guaranteed delay for variable phase shifting   | ±[MAX_STEPS • DCM_DELAY_STEP_MAX] | ns   |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in Table 10 and Table 43.
2. The maximum variable phase shift range, MAX\_STEPS, is only valid when the DCM is has no initial fixed phase shifting, that is, the PHASE\_SHIFT attribute is set to 0.
3. The DCM\_DELAY\_STEP values are provided at the bottom of Table 40.

## Miscellaneous DCM Timing

Table 45: Miscellaneous DCM Timing

| Symbol                             | Description  | Min | Max | Units        |
|------------------------------------|--|-----|-----|--------------|
| DCM_RST_PW_MIN                     | Minimum duration of a RST pulse width  | 3   | –   | CLKIN cycles |
| DCM_RST_PW_MAX <sup>(2)</sup>      | Maximum duration of a RST pulse width  | N/A | N/A | seconds      |
|                                    |  | N/A | N/A | seconds      |
| DCM_CONFIG_LAG_TIME <sup>(3)</sup> | Maximum duration from V <sub>CCINT</sub> applied to FPGA configuration successfully completed (DONE pin goes High) and clocks applied to DCM DLL | N/A | N/A | minutes      |
|                                    |  | N/A | N/A | minutes      |

**Notes:**

1. This limit only applies to applications that use the DCM DLL outputs (CLK0, CLK90, CLK180, CLK270, CLK2X, CLK2X180, and CLKDV). The DCM DFS outputs (CLKFX, CLKFX180) are unaffected.
2. This specification is equivalent to the Virtex™-4 FPGA DCM\_RESET specification. This specification does not apply for Spartan-3AN FPGAs.
3. This specification is equivalent to the Virtex-4 FPGA T<sub>CONFIG</sub> specification. This specification does not apply for Spartan-3AN FPGAs.

## DNA Port Timing

Table 46: DNA\_PORT Interface Timing

| Symbol               | Description  | Min | Max    | Units |
|----------------------|--|-----|--------|-------|
| T <sub>DNASSU</sub>  | Setup time on SHIFT before the rising edge of CLK      | 1.0 | –      | ns    |
| T <sub>DNASH</sub>   | Hold time on SHIFT after the rising edge of CLK        | 0.5 | –      | ns    |
| T <sub>DNADSU</sub>  | Setup time on DIN before the rising edge of CLK        | 1.0 | –      | ns    |
| T <sub>DNADH</sub>   | Hold time on DIN after the rising edge of CLK          | 0.5 | –      | ns    |
| T <sub>DNARSU</sub>  | Setup time on READ before the rising edge of CLK       | 5.0 | 10,000 | ns    |
| T <sub>DNARH</sub>   | Hold time on READ after the rising edge of CLK         | 0   | –      | ns    |
| T <sub>DNADCKO</sub> | Clock-to-output delay on DOUT after rising edge of CLK | 0.5 | 1.5    | ns    |
| T <sub>DNACLKF</sub> | CLK frequency  | 0   | 100    | MHz   |
| T <sub>DNACLKH</sub> | CLK High time  | 1.0 | ∞      | ns    |
| T <sub>DNACLKL</sub> | CLK Low time   | 1.0 | ∞      | ns    |

**Notes:**

- The minimum READ pulse width is 5 ns, the maximum READ pulse width is 10 μs.

## Internal SPI Access Port Timing

Table 47: SPI\_ACCESS Interface Timing

| Symbol                   | Description  | Speed Grade |      |     |      | Units |
|--------------------------|--|-------------|------|-----|------|-------|
|                          |  | -5          |      | -4  |      |       |
|                          |  | Min         | Max  | Min | Max  |       |
| T <sub>SPICCK_MOSI</sub> | Setup time on MOSI before the active edge of CLK                         | 4.47        | –    | 5.0 | –    | ns    |
| T <sub>SPICKC_MOSI</sub> | Hold time on MOSI after the active edge of CLK                           | 4.03        | –    | 4.5 | –    | ns    |
| T <sub>CSB</sub>         | CSB High time  | 50          | –    | 50  | –    | ns    |
| T <sub>SPICCK_CSB</sub>  | Setup time on CSB before the active edge of CLK                          | 7.15        | –    | 8.0 | –    | ns    |
| T <sub>SPICCK_CSB</sub>  | Hold time on CSB after the active edge of CLK                            | 7.15        | –    | 8.0 | –    | ns    |
| T <sub>SPICKO_MISO</sub> | Clock-to-output delay on MISO after active edge of CLK                   | –           | 14.3 | –   | 16.0 | ns    |
| F <sub>SPICLK</sub>      | CLK frequency  | –           | 50   | –   | 50   | MHz   |
| F <sub>SPICAR1</sub>     | CLK frequency for Continuous Array Read command                          | –           | 50   | –   | 50   | MHz   |
| F <sub>SPICAR1</sub>     | CLK frequency for Continuous Array Read command, reduced initial latency | –           | 33   | –   | 33   | MHz   |
| T <sub>SPICLKL</sub>     | CLK High time  | –           | ∞    | –   | ∞    | ns    |
| T <sub>SPICLKH</sub>     | CLK Low time   | 6.8         | ∞    | 6.8 | ∞    | ns    |

**Notes:**

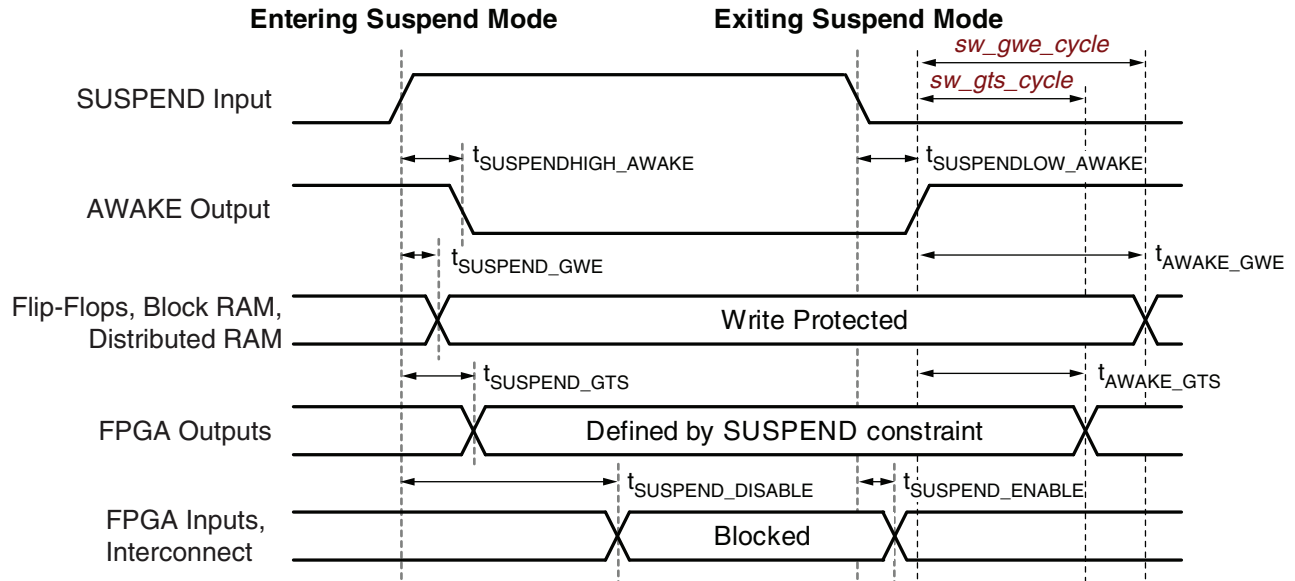
- For details on using SPI\_ACCESS and the In-System Flash memory, see [UG333](#) *Spartan-3AN FPGA In-System Flash User Guide*.

## In-System Flash (ISF) Memory Timing

Table 48: In-System Flash (ISF) Memory Operations

| Symbol     | Description                     | Device  | Typical | Max | Units   |
|------------|---------------------------------|---|---------|-----|---------|
| $T_{XFER}$ | Page to Buffer transfer time    | All   | –       | 400 | $\mu$ s |
| $T_{COMP}$ | Page to Buffer compare time     | All   | –       | 400 | $\mu$ s |
| $T_{PP}$   | Page Programming time           | XC3S50AN<br>XC3S200AN<br>XC3S400AN                | 2       | 4   | ms      |
|            |                                 | XC3S700AN<br>XC3S1400AN                           | 3       | 6   | ms      |
| $T_{PE}$   | Page Erase time                 | XC3S50AN<br>XC3S200AN<br>XC3S400AN                | 13      | 32  | ms      |
|            |                                 | XC3S700AN<br>XC3S1400AN                           | 15      | 35  | ms      |
| $T_{PEP}$  | Page Erase and Programming time | XC3S50AN<br>XC3S200AN<br>XC3S400AN<br>XC3S700AN   | 14      | 35  | ms      |
|            |                                 | XC3S1400AN  | 17      | 40  | ms      |
| $T_{BE}$   | Block Erase time                | XC3S50AN  | 15      | 35  | ms      |
|            |                                 | XC3S200AN<br>XC3S400AN                            | 30      | 75  | ms      |
|            |                                 | XC3S700AN<br>XC3S1400AN                           | 45      | 100 | ms      |
| $T_{SE}$   | Sector Erase time               | XC3S50AN  | 0.8     | 2.5 | s       |
|            |                                 | XC3S200AN<br>XC3S400AN<br>XC3S700AN<br>XC3S1400AN | 1.6     | 5   | s       |

## Suspend Mode Timing



DS610-3\_08\_061207

Figure 12: Suspend Mode Timing

Table 49: Suspend Mode Timing Parameters

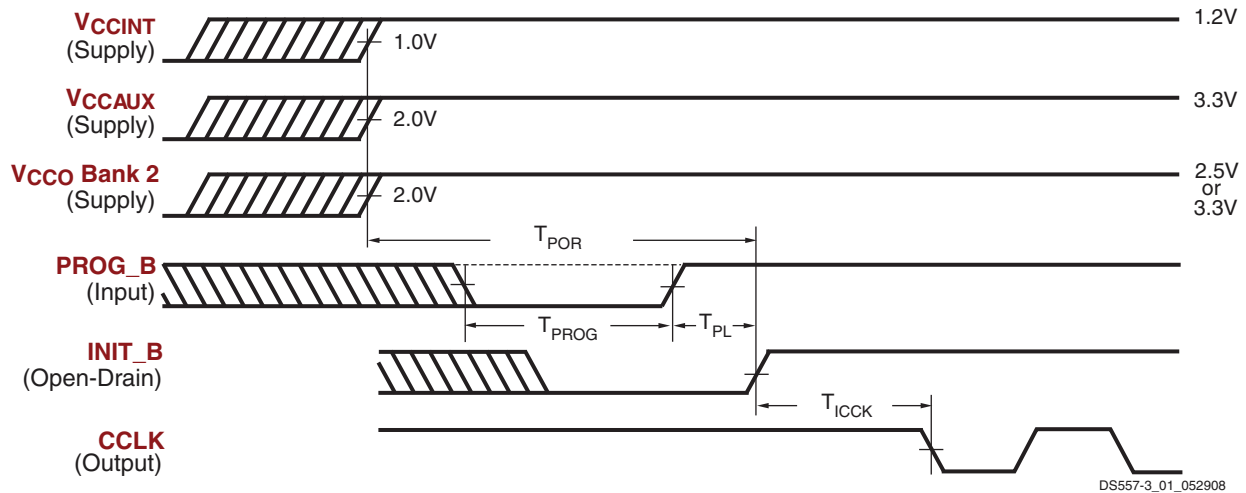
| Symbol                       | Description  | Min  | Typ        | Max  | Units   |
|------------------------------|--|------|------------|------|---------|
| <b>Entering Suspend Mode</b> |  |      |            |      |         |
| $T_{SUSPENDHIGH\_AWAKE}$     | Rising edge of SUSPEND pin to falling edge of AWAKE pin without glitch filter ( <i>suspend_filter:No</i> )   | –    | 7          | –    | ns      |
| $T_{SUSPENDFILTER}$          | Adjustment to SUSPEND pin rising edge parameters when glitch filter enabled ( <i>suspend_filter:Yes</i> )  | +160 | +300       | +600 | ns      |
| $T_{SUSPEND\_GTS}$           | Rising edge of SUSPEND pin until FPGA output pins drive their defined SUSPEND constraint behavior  | –    | 10         | –    | ns      |
| $T_{SUSPEND\_GWE}$           | Rising edge of SUSPEND pin to write-protect lock on all writable clocked elements  | –    | < 5        | –    | ns      |
| $T_{SUSPEND\_DISABLE}$       | Rising edge of the SUSPEND pin to FPGA input pins and interconnect disabled  | –    | 340        | –    | ns      |
| <b>Exiting Suspend Mode</b>  |  |      |            |      |         |
| $T_{SUSPENDLOW\_AWAKE}$      | Falling edge of the SUSPEND pin to rising edge of the AWAKE pin<br>Does not include DCM lock time  | –    | 4 to 108   | –    | $\mu$ s |
| $T_{SUSPEND\_ENABLE}$        | Falling edge of the SUSPEND pin to FPGA input pins and interconnect re-enabled   | –    | 3.7 to 109 | –    | $\mu$ s |
| $T_{AWAKE\_GWE1}$            | Rising edge of the AWAKE pin until write-protect lock released on all writable clocked elements, using <i>sw_clk:InternalClock</i> and <i>sw_gwe_cycle:1</i>       | –    | 67         | –    | ns      |
| $T_{AWAKE\_GWE512}$          | Rising edge of the AWAKE pin until write-protect lock released on all writable clocked elements, using <i>sw_clk:InternalClock</i> and <i>sw_gwe_cycle:512</i>     | –    | 14         | –    | $\mu$ s |
| $T_{AWAKE\_GTS1}$            | Rising edge of the AWAKE pin until outputs return to the behavior described in the FPGA application, using <i>sw_clk:InternalClock</i> and <i>sw_gts_cycle:1</i>   | –    | 57         | –    | ns      |
| $T_{AWAKE\_GTS512}$          | Rising edge of the AWAKE pin until outputs return to the behavior described in the FPGA application, using <i>sw_clk:InternalClock</i> and <i>sw_gts_cycle:512</i> | –    | 14         | –    | $\mu$ s |

**Notes:**

1. These parameters based on characterization.
2. For information on using the Spartan-3AN Suspend feature, see [XAPP480: Using Suspend Mode in Spartan-3 Generation FPGAs](#).

## Configuration and JTAG Timing

### General Configuration Power-On/Reconfigure Timing



**Notes:**

1. When configuring from the In-System Flash,  $V_{CCAUX}$  must be in the recommended operating range; on power-up make sure  $V_{CCAUX}$  reaches at least 3.0V before  $INIT\_B$  goes High to indicate the start of configuration.  $V_{CCINT}$ ,  $V_{CCAUX}$ , and  $V_{CCO}$  supplies to the FPGA can be applied in any order if this requirement is met.
2. The Low-going pulse on  $PROG\_B$  is optional after power-on but necessary for reconfiguration without a power cycle.
3. The rising edge of  $INIT\_B$  samples the voltage levels applied to the mode pins (M0 - M2).

Figure 13: Waveforms for Power-On and the Beginning of Configuration

Table 50: Power-On Timing and the Beginning of Configuration

| Symbol           | Description  | Device     | All Speed Grades |     | Units   |
|------------------|--|------------|------------------|-----|---------|
|                  |  |            | Min              | Max |         |
| $T_{POR}^{(2)}$  | The time from the application of $V_{CCINT}$ , $V_{CCAUX}$ , and $V_{CCO}$ Bank 2 supply voltage ramps (whichever occurs last) to the rising transition of the $INIT\_B$ pin | All        | –                | 18  | ms      |
| $T_{PROG}$       | The width of the low-going pulse on the $PROG\_B$ pin  | All        | 0.5              | –   | $\mu$ s |
| $T_{PL}^{(2)}$   | The time from the rising edge of the $PROG\_B$ pin to the rising transition on the $INIT\_B$ pin   | XC3S50AN   | –                | 0.5 | ms      |
|                  |  | XC3S200AN  | –                | 0.5 | ms      |
|                  |  | XC3S400AN  | –                | 1   | ms      |
|                  |  | XC3S700AN  | –                | 2   | ms      |
|                  |  | XC3S1400AN | –                | 2   | ms      |
| $T_{INIT}$       | Minimum Low pulse width on $INIT\_B$ output  | All        | 250              | –   | ns      |
| $T_{ICCK}^{(3)}$ | The time from the rising edge of the $INIT\_B$ pin to the generation of the configuration clock signal at the $CCLK$ output pin  | All        | 0.5              | 4   | $\mu$ s |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in Table 10. This means power must be applied to all  $V_{CCINT}$ ,  $V_{CCO}$ , and  $V_{CCAUX}$  lines.
2. Power-on reset and the clearing of configuration memory occurs during this period.
3. This specification applies only to the Master Serial, SPI, and BPI modes.
4. For details on configuration, see UG332 *Spartan-3 Generation Configuration User Guide*.



**Configuration Clock (CCLK) Characteristics**

 Table 51: Master Mode CCLK Output Period by *ConfigRate* Option Setting

| Symbol               | Description                                    | <i>ConfigRate</i> Setting <sup>(1)</sup> | Temperature Range | Minimum | Maximum | Units |
|----------------------|--|--|-------------------|---------|---------|-------|
| T <sub>CCLK1</sub>   | CCLK clock period by <i>ConfigRate</i> setting | 1<br>(power-on value)                    | Commercial        | 1,254   | 2,500   | ns    |
|                      |  |  | Industrial        | 1,180   |         | ns    |
| T <sub>CCLK3</sub>   |  | 3  | Commercial        | 413     | 833     | ns    |
|                      |  |  | Industrial        | 390     |         | ns    |
| T <sub>CCLK6</sub>   |  | 6<br>(default)                           | Commercial        | 207     | 417     | ns    |
|                      |  |  | Industrial        | 195     |         | ns    |
| T <sub>CCLK7</sub>   |  | 7  | Commercial        | 178     | 357     | ns    |
|                      |  |  | Industrial        | 168     |         | ns    |
| T <sub>CCLK8</sub>   |  | 8  | Commercial        | 156     | 313     | ns    |
|                      |  |  | Industrial        | 147     |         | ns    |
| T <sub>CCLK10</sub>  |  | 10                                       | Commercial        | 123     | 250     | ns    |
|                      |  |  | Industrial        | 116     |         | ns    |
| T <sub>CCLK12</sub>  |  | 12                                       | Commercial        | 103     | 208     | ns    |
|                      |  |  | Industrial        | 97      |         | ns    |
| T <sub>CCLK13</sub>  |  | 13                                       | Commercial        | 93      | 192     | ns    |
|                      |  |  | Industrial        | 88      |         | ns    |
| T <sub>CCLK17</sub>  |  | 17                                       | Commercial        | 72      | 147     | ns    |
|                      |  |  | Industrial        | 68      |         | ns    |
| T <sub>CCLK22</sub>  |  | 22                                       | Commercial        | 54      | 114     | ns    |
|                      |  |  | Industrial        | 51      |         | ns    |
| T <sub>CCLK25</sub>  | 25   | Commercial                               | 47                | 100     | ns      |       |
|                      |  | Industrial                               | 45                |         | ns      |       |
| T <sub>CCLK27</sub>  | 27   | Commercial                               | 44                | 93      | ns      |       |
|                      |  | Industrial                               | 42                |         | ns      |       |
| T <sub>CCLK33</sub>  | 33   | Commercial                               | 36                | 76      | ns      |       |
|                      |  | Industrial                               | 34                |         | ns      |       |
| T <sub>CCLK44</sub>  | 44   | Commercial                               | 26                | 57      | ns      |       |
|                      |  | Industrial                               | 25                |         | ns      |       |
| T <sub>CCLK50</sub>  | 50   | Commercial                               | 22                | 50      | ns      |       |
|                      |  | Industrial                               | 21                |         | ns      |       |
| T <sub>CCLK100</sub> | 100  | Commercial                               | 11.2              | 25      | ns      |       |
|                      |  | Industrial                               | 10.6              |         | ns      |       |

**Notes:**

1. Set the *ConfigRate* option value when generating a configuration bitstream.

Table 52: Master Mode CCLK Output Frequency by ConfigRate Option Setting

| Symbol               | Description  | ConfigRate Setting    | Temperature Range | Minimum | Maximum | Units |
|----------------------|--|-----------------------|-------------------|---------|---------|-------|
| F <sub>CCLK1</sub>   | Equivalent CCLK clock frequency by <b>ConfigRate</b> setting | 1<br>(power-on value) | Commercial        | 0.400   | 0.797   | MHz   |
|                      |  |                       | Industrial        |         | 0.847   | MHz   |
| F <sub>CCLK3</sub>   |  | 3                     | Commercial        | 1.20    | 2.42    | MHz   |
|                      |  |                       | Industrial        |         | 2.57    | MHz   |
| F <sub>CCLK6</sub>   |  | 6<br>(default)        | Commercial        | 2.40    | 4.83    | MHz   |
|                      |  |                       | Industrial        |         | 5.13    | MHz   |
| F <sub>CCLK7</sub>   |  | 7                     | Commercial        | 2.80    | 5.61    | MHz   |
|                      |  |                       | Industrial        |         | 5.96    | MHz   |
| F <sub>CCLK8</sub>   |  | 8                     | Commercial        | 3.20    | 6.41    | MHz   |
|                      |  |                       | Industrial        |         | 6.81    | MHz   |
| F <sub>CCLK10</sub>  |  | 10                    | Commercial        | 4.00    | 8.12    | MHz   |
|                      |  |                       | Industrial        |         | 8.63    | MHz   |
| F <sub>CCLK12</sub>  |  | 12                    | Commercial        | 4.80    | 9.70    | MHz   |
|                      |  |                       | Industrial        |         | 10.31   | MHz   |
| F <sub>CCLK13</sub>  |  | 13                    | Commercial        | 5.20    | 10.69   | MHz   |
|                      |  |                       | Industrial        |         | 11.37   | MHz   |
| F <sub>CCLK17</sub>  |  | 17                    | Commercial        | 6.80    | 13.74   | MHz   |
|                      |  |                       | Industrial        |         | 14.61   | MHz   |
| F <sub>CCLK22</sub>  |  | 22                    | Commercial        | 8.80    | 18.44   | MHz   |
|                      |  |                       | Industrial        |         | 19.61   | MHz   |
| F <sub>CCLK25</sub>  | 25   | Commercial            | 10.00             | 20.90   | MHz     |       |
|                      |  | Industrial            |                   | 22.23   | MHz     |       |
| F <sub>CCLK27</sub>  | 27   | Commercial            | 10.80             | 22.39   | MHz     |       |
|                      |  | Industrial            |                   | 23.81   | MHz     |       |
| F <sub>CCLK33</sub>  | 33   | Commercial            | 13.20             | 27.48   | MHz     |       |
|                      |  | Industrial            |                   | 29.23   | MHz     |       |
| F <sub>CCLK44</sub>  | 44   | Commercial            | 17.60             | 37.60   | MHz     |       |
|                      |  | Industrial            |                   | 40.00   | MHz     |       |
| F <sub>CCLK50</sub>  | 50   | Commercial            | 20.00             | 44.80   | MHz     |       |
|                      |  | Industrial            |                   | 47.66   | MHz     |       |
| F <sub>CCLK100</sub> | 100  | Commercial            | 40.00             | 88.68   | MHz     |       |
|                      |  | Industrial            |                   | 94.34   | MHz     |       |

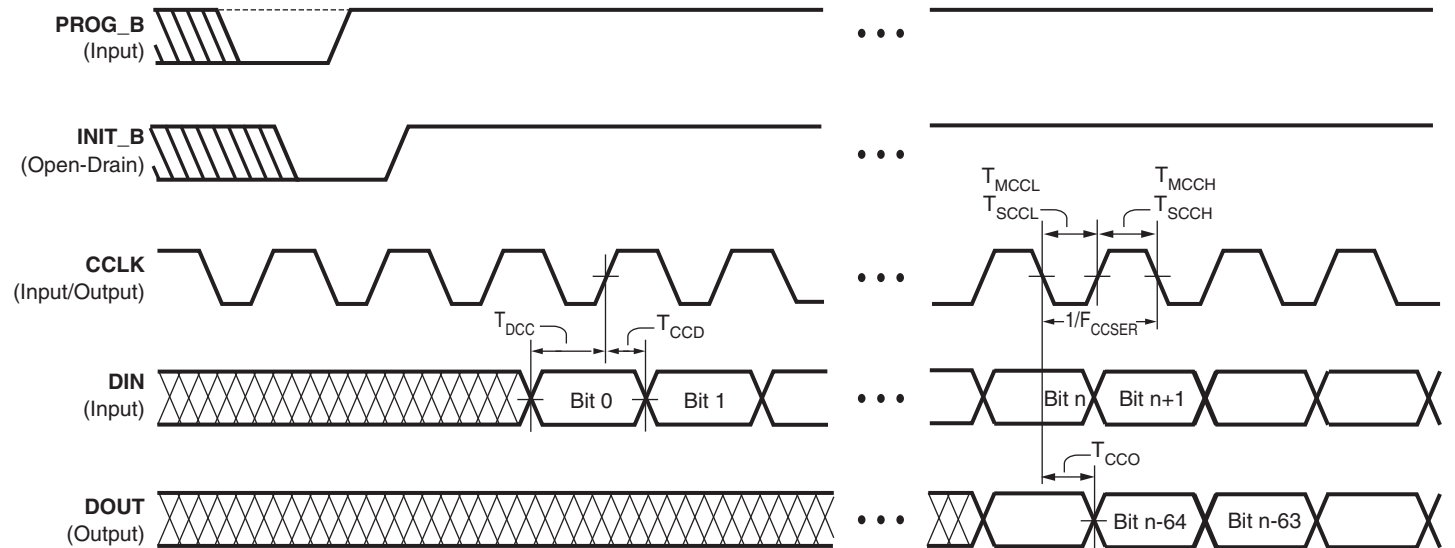
Table 53: Master Mode CCLK Output Minimum Low and High Time

| Symbol                                   | Description                                |            | ConfigRate Setting |     |      |      |      |      |      |      |      |      |      |      |      |      |      |     | Units |
|--|--|------------|--------------------|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-------|
|  |  |            | 1                  | 3   | 6    | 7    | 8    | 10   | 12   | 13   | 17   | 22   | 25   | 27   | 33   | 44   | 50   | 100 |       |
| T <sub>MCCL</sub> ,<br>T <sub>MCCH</sub> | Master Mode CCLK Minimum Low and High Time | Commercial | 595                | 196 | 98.3 | 84.5 | 74.1 | 58.4 | 48.9 | 44.1 | 34.2 | 25.6 | 22.3 | 20.9 | 17.1 | 12.3 | 10.4 | 5.3 | ns    |
|  |  | Industrial | 560                | 185 | 92.6 | 79.8 | 69.8 | 55.0 | 46.0 | 41.8 | 32.3 | 24.2 | 21.4 | 20.0 | 16.2 | 11.9 | 10.0 | 5.0 | ns    |

Table 54: Slave Mode CCLK Input Low and High Time

| Symbol                     | Description            | Min | Max      | Units |
|----------------------------|------------------------|-----|----------|-------|
| $T_{SCCL}$ ,<br>$T_{SCCH}$ | CCLK Low and High time | 5   | $\infty$ | ns    |

Master Serial and Slave Serial Mode Timing



DS312-3\_05\_103105

Figure 14: Waveforms for Master Serial and Slave Serial Configuration

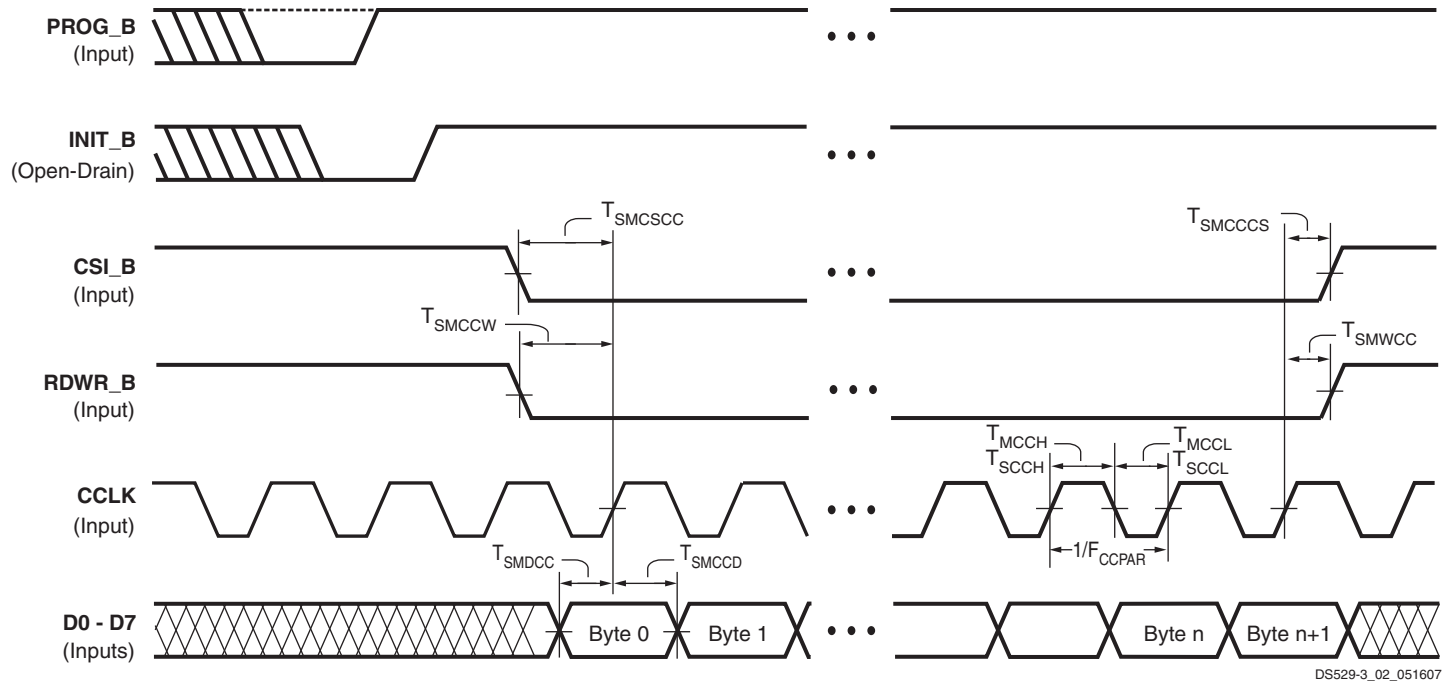
Table 55: Timing for the Master Serial and Slave Serial Configuration Modes

| Symbol                       | Description  | Slave/<br>Master | All Speed Grades           |     | Units |     |
|------------------------------|--|------------------|----------------------------|-----|-------|-----|
|                              |  |                  | Min                        | Max |       |     |
| <b>Clock-to-Output Times</b> |  |                  |                            |     |       |     |
| $T_{CCO}$                    | The time from the falling transition on the CCLK pin to data appearing at the DOUT pin                 | Both             | 1.5                        | 10  | ns    |     |
| <b>Setup Times</b>           |  |                  |                            |     |       |     |
| $T_{DCC}$                    | The time from the setup of data at the DIN pin to the rising transition at the CCLK pin                | Both             | 7                          | –   | ns    |     |
| <b>Hold Times</b>            |  |                  |                            |     |       |     |
| $T_{CCD}$                    | The time from the rising transition at the CCLK pin to the point when data is last held at the DIN pin | Master           | 0                          | –   | ns    |     |
|                              |  | Slave            | 1.0                        |     |       |     |
| <b>Clock Timing</b>          |  |                  |                            |     |       |     |
| $T_{CCH}$                    | High pulse width at the CCLK input pin   | Master           | See Table 53               |     |       |     |
|                              |  | Slave            | See Table 54               |     |       |     |
| $T_{CCL}$                    | Low pulse width at the CCLK input pin  | Master           | See Table 53               |     |       |     |
|                              |  | Slave            | See Table 54               |     |       |     |
| $F_{CCSER}$                  | Frequency of the clock signal at the CCLK input pin <sup>(2)</sup>                                     | Slave            | No bitstream compression   | 0   | 100   | MHz |
|                              |  |                  | With bitstream compression | 0   | 100   | MHz |

Notes:

1. The numbers in this table are based on the operating conditions set forth in Table 10.
2. For serial configuration with a daisy-chain of multiple FPGAs, the maximum limit is 25 MHz.

Slave Parallel Mode Timing



Notes:

1. It is possible to abort configuration by pulling CSI\_B Low in a given CCLK cycle, then switching RDWR\_B Low or High in any subsequent cycle for which CSI\_B remains Low. The RDWR\_B pin asynchronously controls the driver impedance of the D0–D7 bus. When RDWR\_B switches High, be careful to avoid contention on the D0–D7 bus.
2. To pause configuration, pause CCLK instead of de-asserting CSI\_B. See [UG332](#), Chapter 7, section “Non-Continuous SelectMAP Data Loading” for more details.

Figure 15: Waveforms for Slave Parallel Configuration

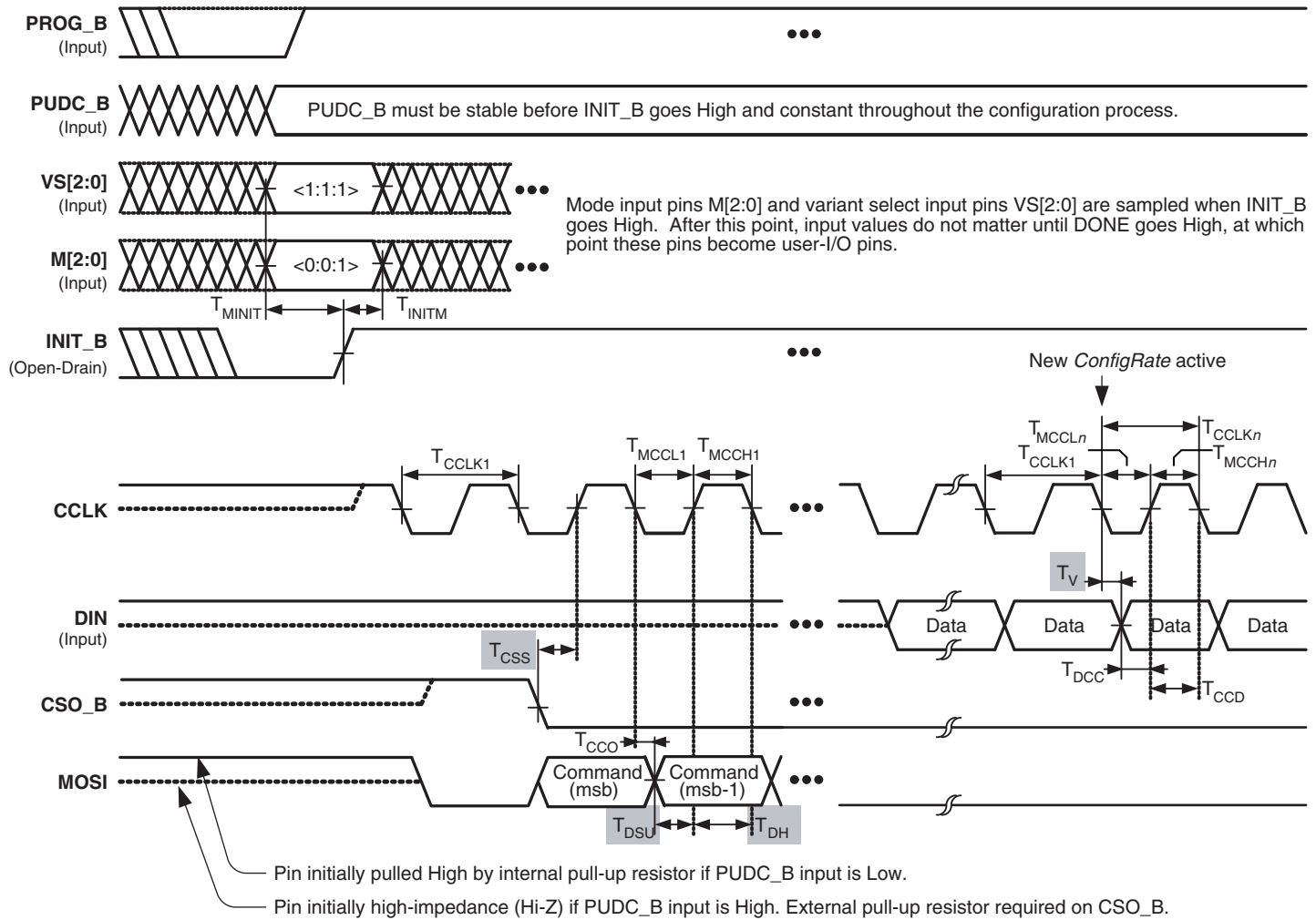
Table 56: Timing for the Slave Parallel Configuration Mode

| Symbol              | Description  | All Speed Grades           |     | Units |     |
|---------------------|--|----------------------------|-----|-------|-----|
|                     |  | Min                        | Max |       |     |
| <b>Setup Times</b>  |  |                            |     |       |     |
| $T_{SMDCC}$         | The time from the setup of data at the D0-D7 pins to the rising transition at the CCLK pin                         | 7                          | –   | ns    |     |
| $T_{SMCSCC}$        | Setup time on the CSI_B pin before the rising transition at the CCLK pin   | 7                          | –   | ns    |     |
| $T_{SMCCW}^{(2)}$   | Setup time on the RDWR_B pin before the rising transition at the CCLK pin  | 15                         | –   | ns    |     |
| <b>Hold Times</b>   |  |                            |     |       |     |
| $T_{SMCCD}$         | The time from the rising transition at the CCLK pin to the point when data is last held at the D0-D7 pins          | 1.0                        | –   | ns    |     |
| $T_{SMCCCS}$        | The time from the rising transition at the CCLK pin to the point when a logic level is last held at the CSO_B pin  | 0                          | –   | ns    |     |
| $T_{SMWCC}$         | The time from the rising transition at the CCLK pin to the point when a logic level is last held at the RDWR_B pin | 0                          | –   | ns    |     |
| <b>Clock Timing</b> |  |                            |     |       |     |
| $T_{CCH}$           | The High pulse width at the CCLK input pin   | 5                          | –   | ns    |     |
| $T_{CCL}$           | The Low pulse width at the CCLK input pin  | 5                          | –   | ns    |     |
| $F_{CCPAR}$         | Frequency of the clock signal at the CCLK input pin  | No bitstream compression   | 0   | 80    | MHz |
|                     |  | With bitstream compression | 0   | 80    | MHz |

Notes:

1. The numbers in this table are based on the operating conditions set forth in [Table 10](#).
2. Some Xilinx documents refer to Parallel modes as SelectMAP modes.

External Serial Peripheral Interface (SPI) Configuration Timing



Shaded values indicate specifications on attached SPI Flash PROM.

DS529-3\_06\_102506

Figure 16: Waveforms for External Serial Peripheral Interface (SPI) Configuration

Table 57: Timing for External Serial Peripheral Interface (SPI) Configuration Mode

| Symbol      | Description   | Minimum      | Maximum | Units |
|-------------|---|--------------|---------|-------|
| $T_{CCLK1}$ | Initial CCLK clock period   | See Table 51 |         |       |
| $T_{CCLKn}$ | CCLK clock period after FPGA loads <b>ConfigRate</b> bitstream option setting                   | See Table 51 |         |       |
| $T_{MINIT}$ | Setup time on VS[2:0] variant-select pins and M[2:0] mode pins before the rising edge of INIT_B | 50           | –       | ns    |
| $T_{INITM}$ | Hold time on VS[2:0] variant-select pins and M[2:0] mode pins after the rising edge of INIT_B   | 0            | –       | ns    |
| $T_{CCO}$   | MOSI output valid delay after CCLK falling clock edge   | See Table 55 |         |       |
| $T_{DCC}$   | Setup time on the DIN data input before CCLK rising clock edge                                  | See Table 55 |         |       |
| $T_{CCD}$   | Hold time on the DIN data input after CCLK rising clock edge                                    | See Table 55 |         |       |

Table 58: Configuration Timing Requirements for Attached SPI Serial Flash

| Symbol         | Description  | Requirement                         | Units |
|----------------|--|-------------------------------------|-------|
| $T_{CCS}$      | SPI serial Flash PROM chip-select time   | $T_{CCS} \leq T_{MCCL1} - T_{CCO}$  | ns    |
| $T_{DSU}$      | SPI serial Flash PROM data input setup time  | $T_{DSU} \leq T_{MCCL1} - T_{CCO}$  | ns    |
| $T_{DH}$       | SPI serial Flash PROM data input hold time   | $T_{DH} \leq T_{MCCH1}$             | ns    |
| $T_V$          | SPI serial Flash PROM data clock-to-output time  | $T_V \leq T_{MCCLn} - T_{DCC}$      | ns    |
| $f_C$ or $f_R$ | Maximum SPI serial Flash PROM clock frequency (also depends on specific read command used) | $f_C \geq \frac{1}{T_{CCLKn(min)}}$ | MHz   |

**Notes:**

1. These requirements are for successful FPGA configuration in SPI mode, where the FPGA generates the CCLK signal. The post-configuration timing can be different to support the specific needs of the application loaded into the FPGA.
2. Subtract additional printed circuit board routing delay as required by the application.

**Byte Peripheral Interface (BPI) Configuration Timing**

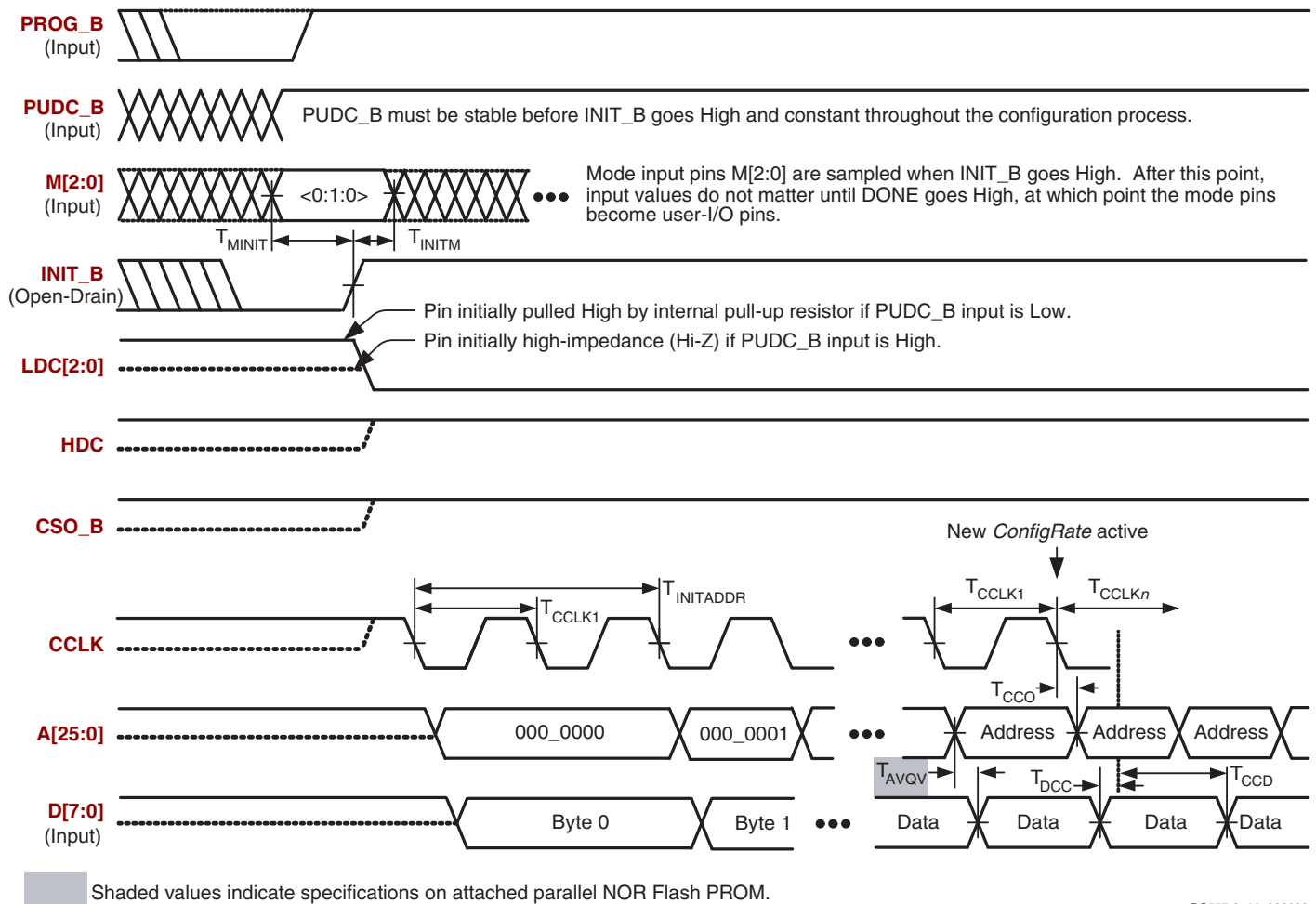


Figure 17: Waveforms for Byte-wide Peripheral Interface (BPI) Configuration

Table 59: Timing for Byte-wide Peripheral Interface (BPI) Configuration Mode

| Symbol         | Description  | Minimum                     | Maximum | Units              |
|----------------|--|-----------------------------|---------|--------------------|
| $T_{CCLK1}$    | Initial CCLK clock period  | See Table 51                |         |                    |
| $T_{CCLKn}$    | CCLK clock period after FPGA loads ConfigRate setting                                    | See Table 51                |         |                    |
| $T_{MINIT}$    | Setup time on M[2:0] mode pins before the rising edge of INIT_B                          | 50                          | –       | ns                 |
| $T_{INITM}$    | Hold time on M[2:0] mode pins after the rising edge of INIT_B                            | 0                           | –       | ns                 |
| $T_{INITADDR}$ | Minimum period of initial A[25:0] address cycle; LDC[2:0] and HDC are asserted and valid | 5                           | 5       | $T_{CCLK1}$ cycles |
| $T_{CCO}$      | Address A[25:0] outputs valid after CCLK falling edge                                    | See Table 55                |         |                    |
| $T_{DCC}$      | Setup time on D[7:0] data inputs before CCLK rising edge                                 | See $T_{SMDCC}$ in Table 56 |         |                    |
| $T_{CCD}$      | Hold time on D[7:0] data inputs after CCLK rising edge                                   | 0                           | –       | ns                 |

Table 60: Configuration Timing Requirements for Attached Parallel NOR Flash

| Symbol                                 | Description  | Requirement  | Units |
|--|--|--|-------|
| $T_{CE}$<br>( $t_{ELQV}$ )             | Parallel NOR Flash PROM chip-select time                         | $T_{CE} \leq T_{INITADDR}$                                 | ns    |
| $T_{OE}$<br>( $t_{GLQV}$ )             | Parallel NOR Flash PROM output-enable time                       | $T_{OE} \leq T_{INITADDR}$                                 | ns    |
| $T_{ACC}$<br>( $t_{AVQV}$ )            | Parallel NOR Flash PROM read access time                         | $T_{ACC} \leq 0.5T_{CCLKn(min)} - T_{CCO} - T_{DCC} - PCB$ | ns    |
| $T_{BYTE}$<br>( $t_{FLQV}, t_{FHQV}$ ) | For x8/x16 PROMs only: BYTE# to output valid time <sup>(3)</sup> | $T_{BYTE} \leq T_{INITADDR}$                               | ns    |

**Notes:**

1. These requirements are for successful FPGA configuration in BPI mode, where the FPGA generates the CCLK signal. The post-configuration timing can be different to support the specific needs of the application loaded into the FPGA.
2. Subtract additional printed circuit board routing delay as required by the application.
3. The initial BYTE# timing can be extended using an external, appropriately sized pull-down resistor on the FPGA's LDC2 pin. The resistor value also depends on whether the FPGA's PUDC\_B pin is High or Low.

**IEEE 1149.1/1532 JTAG Test Access Port Timing**

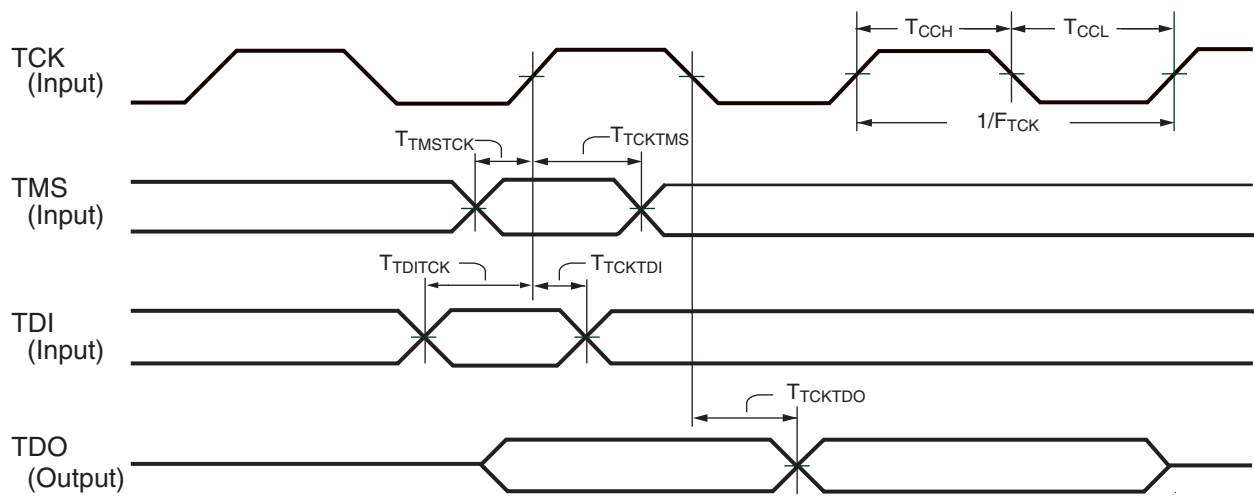


Figure 18: JTAG Waveforms

Table 61: Timing for the JTAG<sup>(2)</sup> Test Access Port

| Symbol                       | Description  | All Speed Grades   |      | Units  |     |
|------------------------------|--|--|------|--------|-----|
|                              |  | Min  | Max  |        |     |
| <b>Clock-to-Output Times</b> |  |  |      |        |     |
| T <sub>TCKTDO</sub>          | The time from the falling transition on the TCK pin to data appearing at the TDO pin                           | 1.0  | 11.0 | ns     |     |
| <b>Setup Times</b>           |  |  |      |        |     |
| T <sub>TDITCK</sub>          | The time from the setup of data at the TDI pin to the rising transition at the TCK pin                         | All devices and functions except those shown below   | 7.0  | –      | ns  |
|                              |  | Boundary-Scan commands (INTEST, EXTEST, SAMPLE) on XC3S700AN and XC3S1400AN FPGAs                            | 11.0 |        |     |
| T <sub>TMSTCK</sub>          | The time from the setup of a logic level at the TMS pin to the rising transition at the TCK pin                | 7.0  | –    | ns     |     |
| <b>Hold Times</b>            |  |  |      |        |     |
| T <sub>TCKTDI</sub>          | The time from the rising transition at the TCK pin to the point when data is last held at the TDI pin          | All functions except those shown below   | 0    | –      | ns  |
|                              |  | Configuration commands (CFG_IN, ISC_PROGRAM)   | 2.0  |        |     |
| T <sub>TCKTMS</sub>          | The time from the rising transition at the TCK pin to the point when a logic level is last held at the TMS pin | 0  | –    | ns     |     |
| <b>Clock Timing</b>          |  |  |      |        |     |
| T <sub>CCH</sub>             | The High pulse width at the TCK pin  | All functions except ISC_DNA command   | 5    | –      | ns  |
| T <sub>CCL</sub>             | The Low pulse width at the TCK pin   |  | 5    | –      | ns  |
| T <sub>CCHDNA</sub>          | The High pulse width at the TCK pin  | During ISC_DNA command   | 10   | 10,000 | ns  |
| T <sub>CCLDNA</sub>          | The Low pulse width at the TCK pin   |  | 10   | 10,000 | ns  |
| F <sub>TCK</sub>             | Frequency of the TCK signal  | All operations on XC3S50AN, XC3S200AN, and XC3S400AN FPGAs and for BYPASS or HIGHZ instructions on all FPGAs | 0    | 33     | MHz |
|                              |  | All operations on XC3S700AN and XC3S1400AN FPGAs, except for BYPASS or HIGHZ instructions                    |      | 20     |     |

**Notes:**

1. The numbers in this table are based on the operating conditions set forth in [Table 10](#).
2. For details on JTAG, see Chapter 9, “JTAG Configuration Mode and Boundary-Scan” in [UG332 Spartan-3 Generation Configuration User Guide](#).



## Revision History

The following table shows the revision history for this document.

| Date     | Version | Revision   |
|----------|---------|--|
| 02/26/07 | 1.0     | Initial release.   |
| 08/16/07 | 2.0     | Updated for Production release of initial device (XC3S200AN). Timing specifications updated for v1.38 speed files. DC specifications updated with production values. Other changes throughout.   |
| 08/31/07 | 2.0.1   | Updated for Production release of XC3S1400AN. Improved $t_{PEP}$ for XC3S700AN in <a href="#">Table 48</a> .   |
| 09/12/07 | 2.0.2   | Updated for Production release of XC3S700AN.   |
| 09/24/07 | 2.1     | Updated for Production release of XC3S400AN. Updated <a href="#">Software Version Requirements</a> to note that Production speed files are available as of Service Pack 3. Removed PCIX IOSTANDARD due to limited PCIX interface support. Added note that SPI_ACCESS (In-System Flash) is not currently supported in simulation.   |
| 12/12/07 | 3.0     | Updated to Production status with Production release of final family member, XC3S50AN. Noted that SPI_ACCESS simulation is supported in ISE 10.1 software. Removed DNA_RETENTION limit of 10 years in <a href="#">Table 17</a> since number of Read cycles is the only unique limit. Updated Setup, Hold, and Propagation Times for the IOB Input Path to show values by device in <a href="#">Table 23</a> and <a href="#">Table 25</a> . Increased SSO recommendation for SSTL18_II in <a href="#">Table 32</a> . Updated <a href="#">Figure 17</a> and <a href="#">Table 59</a> to show BPI data synchronous to CCLK rising edge. Updated links.  |
| 06/02/08 | 3.1     | Improved $V_{CCAUXT}$ and $V_{CCO2T}$ POR minimum in <a href="#">Table 7</a> and updated $V_{CCO}$ POR levels in <a href="#">Figure 13</a> . Clarified power sequencing in Note 1 of <a href="#">Table 7</a> , <a href="#">Table 8</a> , and <a href="#">Figure 13</a> . Added $V_{IN}$ to Recommended Operating Conditions in <a href="#">Table 10</a> and added reference to <a href="#">XAPP459</a> , "Eliminating I/O Coupling Effects when Interfacing Large-Swing Single-Ended Signals to User I/O Pins." Reduced typical $I_{CCINTQ}$ and $I_{CCAUXQ}$ quiescent current values by 12%-58% in <a href="#">Table 12</a> . Noted latest speed file v1.39 in ISE 10.1 software in <a href="#">Table 19</a> . Added reference to Sample Window in <a href="#">Table 24</a> . Changed Internal SPI interface max frequency to 50 MHz and updated other Internal SPI timing parameters to match names and values from speed file in <a href="#">Table 47</a> . Restored Units column to <a href="#">Table 49</a> . Updated CCLK output maximum period in <a href="#">Table 51</a> to match minimum frequency in <a href="#">Table 52</a> . Added references to User Guides. |
| 11/19/09 | 3.2     | Updated selected I/O standard DC characteristics. Changed typical quiescent current temperature from ambient to junction. Removed references to older software versions. Updated column 3 header of <a href="#">Table 17</a> and <a href="#">Table 18</a> . Added table note to <a href="#">Table 18</a> . Added $T_{IOPI}$ and $T_{IOPID}$ propagation times in <a href="#">Table 25</a> . Updated $T_{IOCKHZ}$ and $T_{IOCKON}$ synchronous output enable/disable times in <a href="#">Table 28</a> . Removed $V_{REF}$ requirements for differential HSTL and differential SSTL in <a href="#">Table 30</a> . Improved DIFF_SSTL18_II SSO limits in <a href="#">Table 32</a> . Updated table note 3 in <a href="#">Table 39</a> . Removed references to old software versions from <a href="#">Table 47</a> and <a href="#">Table 48</a> . Added description of spread spectrum in <a href="#">Spread Spectrum</a> section. Updated BPI configuration waveforms in <a href="#">Figure 17</a> . Updated $T_{ACC}$ equation in <a href="#">Table 60</a> .   |
| 12/02/10 | 4.0     | Added $I_{IK}$ to <a href="#">Table 6</a> . Updated $V_{IN}$ in <a href="#">Table 10</a> and added a footnote to $I_L$ in <a href="#">Table 11</a> to note potential leakage between pins of a differential pair. Added note 6 to <a href="#">Table 13</a> . Corrected CLK High and Low Time symbol in <a href="#">Table 46</a> . Corrected symbols for $T_{SUSPEND\_GTS}$ and $T_{SUSPEND\_GWE}$ in <a href="#">Table 49</a> . Updated link to sign up for Alerts and updated <a href="#">Notice of Disclaimer</a> .  |
| 04/01/11 | 4.1     | In <a href="#">Table 31</a> , added the equivalent pairs per bank for the XC3S50AN and XC3S400AN in the FT(G)256 package and the XC3S1400AN in the FG(G)484 package.   |

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## Introduction

This section describes how the various pins on a Spartan®-3AN FPGA connect within the supported component packages, and provides device-specific thermal characteristics. For general information on the pin functions and the package characteristics, see the Packaging section of UG331:

- UG331: Spartan-3 Generation FPGA User Guide**  
[http://www.xilinx.com/support/documentation/user\\_guides/ug331.pdf](http://www.xilinx.com/support/documentation/user_guides/ug331.pdf)

Spartan-3AN FPGAs are available in Pb-free, RoHS packages, indicated by a “G” in the middle of the package code. Leaded (Pb) packages are available for selected devices, with the same pinout and without the “G” in the ordering code (see [Table 5, page 7](#)). The Pb-free package code can be selected in the software for the Pb packages since the pinouts are identical. References to the Pb-free package code in this document apply also to the Pb package.

## Pin Types

Most pins on a Spartan-3AN FPGA are general-purpose, user-defined I/O pins. There are, however, up to 12 different functional types of pins on Spartan-3AN FPGA packages, as outlined in [Table 62](#). In the package footprint drawings that follow, the individual pins are color-coded according to pin type as in the table.

Table 62: Types of Pins on Spartan-3AN FPGAs

| Type with Color Code | Description  | Pin Name(s) in Type <sup>(1)</sup>   |
|----------------------|--|--|
| I/O                  | Unrestricted, general-purpose user-I/O pin. Most pins can be paired together to form differential I/Os.  | IO_#<br>IO_Lxxy_#  |
| INPUT                | Unrestricted, general-purpose input-only pin. This pin does not have an output structure, differential termination resistor, or PCI™ clamp diode.  | IP_#<br>IP_Lxxy_#  |
| DUAL                 | Dual-purpose pin used in some configuration modes during the configuration process and then usually available as a user I/O after configuration. If the pin is not used during configuration, this pin behaves as an I/O-type pin. See <a href="#">UG332: Spartan-3 Generation Configuration User Guide</a> for additional information on these signals.   | M[2:0]<br>PUDC_B<br>CCLK<br>MOSI/CSI_B<br>D[7:1]<br>D0/DIN<br>DOUT<br>CSO_B<br>RDWR_B<br>INIT_B<br>A[25:0]<br>VS[2:0]<br>LDC[2:0]<br>HDC |
| VREF                 | Dual-purpose pin that is either a user-I/O pin or Input-only pin, or, along with all other VREF pins in the same bank, provides a reference voltage input for certain I/O standards. If used for a reference voltage within a bank, all VREF pins within the bank must be connected.   | IP/VREF_#<br>IP_Lxx_#/VREF_#<br>IO/VREF_#<br>IO_Lxx_#/VREF_#   |
| CLK                  | Either a user-I/O pin or an input to a specific clock buffer driver. Most packages have 16 global clock inputs that optionally clock the entire device. The exceptions are all devices in the TQG144 package and the XC3S50AN in the FTG256 package. The RHCLK inputs optionally clock the right half of the device. The LHCLK inputs optionally clock the left half of the device. See the Using Global Clock Resources chapter in <a href="#">UG331: Spartan-3 Generation FPGA User Guide</a> for additional information on these signals. | IO_Lxx_#/GCLK[15:0],<br>IO_Lxx_#/LHCLK[7:0],<br>IO_Lxx_#/RHCLK[7:0]  |

Table 62: Types of Pins on Spartan-3AN FPGAs (Cont'd)

| Type with Color Code | Description   | Pin Name(s) in Type <sup>(1)</sup> |
|----------------------|---|------------------------------------|
| CONFIG               | Dedicated configuration pin, two per device. Not available as a user-I/O pin. Every package has two dedicated configuration pins. These pins are powered by VCCAUX. See <a href="#">UG332: Spartan-3 Generation Configuration User Guide</a> for additional information on the DONE and PROG_B signals. | DONE, PROG_B                       |
| PWR MGMT             | Control and status pins for the power-saving Suspend mode. SUSPEND is a dedicated pin and is powered by VCCAUX. AWAKE is a dual-purpose pin. Unless Suspend mode is enabled in the application, AWAKE is available as a user-I/O pin.   | SUSPEND, AWAKE                     |
| JTAG                 | Dedicated JTAG pin - 4 per device. Not available as a user-I/O pin. Every package has four dedicated JTAG pins. These pins are powered by VCCAUX.   | TDI, TMS, TCK, TDO                 |
| GND                  | Dedicated ground pin. The number of GND pins depends on the package used. All must be connected.  | GND                                |
| VCCAUX               | Dedicated auxiliary power supply pin. The number of VCCAUX pins depends on the package used. The In-System Flash memory is powered by VCCAUX. All must be connected to +3.3V.   | VCCAUX                             |
| VCCINT               | Dedicated internal core logic power supply pin. The number of VCCINT pins depends on the package used. All must be connected to +1.2V.  | VCCINT                             |
| VCCO                 | Along with all the other VCCO pins in the same bank, this pin supplies power to the output buffers within the I/O bank and sets the input threshold voltage for some I/O standards. All must be connected.  | VCCO_#                             |
| N.C.                 | This package pin is not connected in this specific device/package combination.  | N.C.                               |

**Notes:**

- # = I/O bank number, an integer between 0 and 3.

### Package Pins by Type

Each package has three separate voltage supply inputs—VCCINT, VCCAUX, and VCCO—and a common ground return, GND. The numbers of pins dedicated to these functions vary by package, as shown in [Table 63](#).

Table 63: Power and Ground Supply Pins by Package

| Package | VCCINT | VCCAUX | VCCO | GND |
|---------|--------|--------|------|-----|
| TQG144  | 4      | 4      | 8    | 13  |
| FTG256  | 6      | 4      | 16   | 28  |
| FGG400  | 9      | 8      | 22   | 43  |
| FGG484  | 15     | 10     | 24   | 53  |
| FGG676  | 23     | 14     | 36   | 77  |

A majority of package pins are user-defined I/O or input pins. However, the numbers and characteristics of these I/Os depend on the device type and the package in which it is available, as shown in [Table 64](#). The table shows the maximum number of single-ended I/O pins available, assuming that all I/O-, INPUT-, DUAL-, VREF-, and CLK-type pins are used as general-purpose I/O. AWAKE is counted here as a dual-purpose I/O pin. Likewise, the table shows the maximum number of differential pin-pairs available on the package. Finally, the table shows how the total maximum user-I/Os are distributed by pin type, including the number of unconnected—N.C.—pins on the device.

Not all I/O standards are supported on all I/O banks. The left and right banks (I/O banks 1 and 3) support higher output drive current than the top and bottom banks (I/O banks 0 and 2). Similarly, true differential output standards, such as LVDS, RSDS, PPDS, miniLVDS, and TMS, are only supported in the top or bottom banks (I/O banks 0 and 2). Inputs are unrestricted. For more details, see the “Using I/O Resources” chapter in [UG331](#).

Table 64: Maximum User I/O by Package

| Device     | Package | Maximum User I/Os and Input-Only | Maximum Input-Only | Maximum Differential Pairs | All Possible I/Os by Type |       |      |          |     |      |
|------------|---------|----------------------------------|--------------------|----------------------------|---------------------------|-------|------|----------|-----|------|
|            |         |                                  |                    |                            | I/O                       | INPUT | DUAL | VREF (1) | CLK | N.C. |
| XC3S50AN   | TQG144  | 108                              | 7                  | 50                         | 42                        | 2     | 26   | 8        | 30  | 0    |
|            | FTG256  | 144                              | 32                 | 64                         | 53                        | 20    | 26   | 15       | 30  | 51   |
| XC3S200AN  | FTG256  | 195                              | 35                 | 90                         | 69                        | 21    | 52   | 21       | 32  | 0    |
| XC3S400AN  | FTG256  | 195                              | 35                 | 90                         | 69                        | 21    | 52   | 21       | 32  | 0    |
|            | FGG400  | 311                              | 63                 | 142                        | 155                       | 46    | 52   | 26       | 32  | 0    |
| XC3S700AN  | FGG484  | 372                              | 84                 | 165                        | 194                       | 61    | 52   | 33       | 32  | 3    |
| XC3S1400AN | FGG484  | 375                              | 87                 | 165                        | 195                       | 62    | 52   | 34       | 32  | 0    |
|            | FGG676  | 502                              | 94                 | 227                        | 313                       | 67    | 52   | 38       | 32  | 17   |

**Notes:**

1. Some VREFs are on INPUT pins. See pinout tables for details.

Electronic versions of the package pinout tables and foot-prints are available for download from the Xilinx website at:

[http://www.xilinx.com/support/documentation/data\\_sheets/s3a\\_pin.zip](http://www.xilinx.com/support/documentation/data_sheets/s3a_pin.zip)

Using a spreadsheet program, the data can be sorted and reformatted according to any specific needs. Similarly, the ASCII-text file is easily parsed by most scripting programs.

## Package Overview

Table 65 shows the five low-cost, space-saving production package styles for the Spartan-3AN family.

Table 65: Spartan-3AN Family Package Options

| Package      | Leads | Type                                   | Maximum I/Os | Lead Pitch (mm) | Body Area (mm) | Height (mm) |
|--------------|-------|--|--------------|-----------------|----------------|-------------|
| TQ144/TQG144 | 144   | Thin Quad Flat Pack (TQFP)             | 108          | 0.5             | 20 x 20        | 1.60        |
| FT256/FTG256 | 256   | Fine-pitch Thin Ball Grid Array (FBGA) | 195          | 1.0             | 17 x 17        | 1.55        |
| FG400/FGG400 | 400   | Fine-pitch Ball Grid Array (FBGA)      | 311          | 1.0             | 21 x 21        | 2.43        |
| FG484/FGG484 | 484   | Fine-pitch Ball Grid Array (FBGA)      | 375          | 1.0             | 23 x 23        | 2.60        |
| FG676/FGG676 | 676   | Fine-pitch Ball Grid Array (FBGA)      | 502          | 1.0             | 27 x 27        | 2.60        |

**Notes:**

1. For mass, refer to the MDDS files (see Table 66).

Each package style is available in an environmentally friendly lead-free (Pb-free) option. The Pb-free packages include an extra “G” in the package style name. For example, the standard “CS484” package becomes “CSG484” when ordered as the Pb-free option. Leaded (Pb) packages are available for selected devices, with the same pinout and without the “G” in the ordering code; See Table 5, page 7 for more information. The mechanical dimensions of the Pb and Pb-free packages are similar, as shown in the mechanical drawings provided in Table 66.

For additional package information, see [UG112: Device Package User Guide](#).

## Mechanical Drawings

Detailed mechanical drawings for each package type are available from the Xilinx website at the specified location in [Table 66](#).

Material Declaration Data Sheets (MDDS) are also available on the [Xilinx website](#) for each package.

Table 66: Xilinx Package Documentation

| Package | Drawing                         | MDDS                         |
|---------|---------------------------------|------------------------------|
| TQ144   | <a href="#">Package Drawing</a> | <a href="#">PK169_TQ144</a>  |
| TQG144  |                                 | <a href="#">PK461_TQG144</a> |
| FT256   | <a href="#">Package Drawing</a> | <a href="#">PK158_FT256</a>  |
| FTG256  |                                 | <a href="#">PK424_FTG256</a> |
| FG400   | <a href="#">Package Drawing</a> | <a href="#">PK182_FG400</a>  |
| FGG400  |                                 | <a href="#">PK108_FGG400</a> |
| FG484   | <a href="#">Package Drawing</a> | <a href="#">PK183_FG484</a>  |
| FGG484  |                                 | <a href="#">PK110_FGG484</a> |
| FG676   | <a href="#">Package Drawing</a> | <a href="#">PK155_FG676</a>  |
| FGG676  |                                 | <a href="#">PK394_FGG676</a> |

## Package Thermal Characteristics

The power dissipated by an FPGA application has implications on package selection and system design. The power consumed by a Spartan-3AN FPGA is reported using either the [XPower Power Estimator](#) or the [XPower Analyzer](#) calculator integrated in the Xilinx® ISE® development software. [Table 67](#) provides the thermal characteristics for the various Spartan-3AN FPGA packages. This information is also available using the Thermal Query tool at <http://www.xilinx.com/cgi-bin/thermal/thermal.pl>.

The junction-to-case thermal resistance ( $\theta_{JC}$ ) indicates the difference between the temperature measured on the package body (case) and the junction temperature per watt of power consumption. The junction-to-board ( $\theta_{JB}$ ) value similarly reports the difference between the board and junction temperature. The junction-to-ambient ( $\theta_{JA}$ ) value reports the temperature difference between the ambient environment and the junction temperature. The  $\theta_{JA}$  value is reported at different air velocities, measured in linear feet per minute (LFM). The “Still Air (0 LFM)” column shows the  $\theta_{JA}$  value in a system without a fan. The thermal resistance drops with increasing air flow.

Table 67: Spartan-3AN FPGA Package Thermal Characteristics

| Device     | Package <sup>(1)</sup> | Junction-to-Case ( $\theta_{JC}$ ) | Junction-to-Board ( $\theta_{JB}$ ) | Junction-to-Ambient ( $\theta_{JA}$ ) at Different Air Flows |         |         |         | Units   |
|------------|------------------------|------------------------------------|-------------------------------------|--|---------|---------|---------|---------|
|            |                        |                                    |                                     | Still Air (0 LFM)  | 250 LFM | 500 LFM | 750 LFM |         |
| XC3S50AN   | TQG144                 | 13.4                               | 32.8                                | 38.9   | 32.8    | 32.5    | 31.7    | °C/Watt |
|            | FTG256                 |                                    |                                     |  |         |         |         | °C/Watt |
| XC3S200AN  | FTG256                 | 7.4                                | 23.3                                | 29.0   | 23.8    | 23.0    | 22.3    | °C/Watt |
| XC3S400AN  | FTG256                 |                                    |                                     |  |         |         |         | °C/Watt |
|            | FGG400                 | 6.2                                | 12.9                                | 22.5   | 16.7    | 15.6    | 15.0    | °C/Watt |
| XC3S700AN  | FGG484                 | 5.3                                | 11.5                                | 19.4   | 15.0    | 13.9    | 13.4    | °C/Watt |
| XC3S1400AN | FGG484                 |                                    |                                     |  |         |         |         | °C/Watt |
|            | FGG676                 | 4.3                                | 10.9                                | 17.7   | 13.7    | 12.6    | 12.1    | °C/Watt |

**Notes:**

1. Thermal characteristics are similar for leaded (non-Pb-free) packages.
2. Use the Thermal Query tool at <http://www.xilinx.com/cgi-bin/thermal/thermal.pl> for specific device information.

## TQG144: 144-lead Thin Quad Flat Package

The XC3S50AN is available in the 144-lead thin quad flat package, TQG144.

Table 68 lists all the package pins. They are sorted by bank number and then by pin name. Pins that form a differential I/O pair appear together in the table. The table also shows the pin number for each pin and the pin type (as defined in Table 62). The XC3S50AN does not support the address output pins for the Byte-wide Peripheral Interface (BPI) configuration mode.

An electronic version of this package pinout table and footprint diagram is available for download from the Xilinx website at: [www.xilinx.com/support/documentation/data\\_sheets/s3a\\_pin.zip](http://www.xilinx.com/support/documentation/data_sheets/s3a_pin.zip).

### Pinout Table

Table 68: Spartan-3AN TQG144 Pinout

| Bank | Pin Name         | Pin  | Type  |
|------|------------------|------|-------|
| 0    | IO_0             | P142 | I/O   |
| 0    | IO_L01N_0        | P111 | I/O   |
| 0    | IO_L01P_0        | P110 | I/O   |
| 0    | IO_L02N_0        | P113 | I/O   |
| 0    | IO_L02P_0/VREF_0 | P112 | VREF  |
| 0    | IO_L03N_0        | P117 | I/O   |
| 0    | IO_L03P_0        | P115 | I/O   |
| 0    | IO_L04N_0        | P116 | I/O   |
| 0    | IO_L04P_0        | P114 | I/O   |
| 0    | IO_L05N_0        | P121 | I/O   |
| 0    | IO_L05P_0        | P120 | I/O   |
| 0    | IO_L06N_0/GCLK5  | P126 | GCLK  |
| 0    | IO_L06P_0/GCLK4  | P124 | GCLK  |
| 0    | IO_L07N_0/GCLK7  | P127 | GCLK  |
| 0    | IO_L07P_0/GCLK6  | P125 | GCLK  |
| 0    | IO_L08N_0/GCLK9  | P131 | GCLK  |
| 0    | IO_L08P_0/GCLK8  | P129 | GCLK  |
| 0    | IO_L09N_0/GCLK11 | P132 | GCLK  |
| 0    | IO_L09P_0/GCLK10 | P130 | GCLK  |
| 0    | IO_L10N_0        | P135 | I/O   |
| 0    | IO_L10P_0        | P134 | I/O   |
| 0    | IO_L11N_0        | P139 | I/O   |
| 0    | IO_L11P_0        | P138 | I/O   |
| 0    | IO_L12N_0/PUDC_B | P143 | DUAL  |
| 0    | IO_L12P_0/VREF_0 | P141 | VREF  |
| 0    | IP_0             | P140 | INPUT |
| 0    | IP_0/VREF_0      | P123 | VREF  |
| 0    | VCCO_0           | P119 | VCCO  |
| 0    | VCCO_0           | P136 | VCCO  |
| 1    | IO_1             | P79  | I/O   |
| 1    | IO_L01N_1/LDC2   | P78  | DUAL  |
| 1    | IO_L01P_1/HDC    | P76  | DUAL  |
| 1    | IO_L02N_1/LDC0   | P77  | DUAL  |

Table 68: Spartan-3AN TQG144 Pinout (Cont'd)

| Bank | Pin Name               | Pin  | Type  |
|------|------------------------|------|-------|
| 1    | IO_L02P_1/LDC1         | P75  | DUAL  |
| 1    | IO_L03N_1              | P84  | I/O   |
| 1    | IO_L03P_1              | P82  | I/O   |
| 1    | IO_L04N_1/RHCLK1       | P85  | RHCLK |
| 1    | IO_L04P_1/RHCLK0       | P83  | RHCLK |
| 1    | IO_L05N_1/TRDY1/RHCLK3 | P88  | RHCLK |
| 1    | IO_L05P_1/RHCLK2       | P87  | RHCLK |
| 1    | IO_L06N_1/RHCLK5       | P92  | RHCLK |
| 1    | IO_L06P_1/RHCLK4       | P90  | RHCLK |
| 1    | IO_L07N_1/RHCLK7       | P93  | RHCLK |
| 1    | IO_L07P_1/IRDY1/RHCLK6 | P91  | RHCLK |
| 1    | IO_L08N_1              | P98  | I/O   |
| 1    | IO_L08P_1              | P96  | I/O   |
| 1    | IO_L09N_1              | P101 | I/O   |
| 1    | IO_L09P_1              | P99  | I/O   |
| 1    | IO_L10N_1              | P104 | I/O   |
| 1    | IO_L10P_1              | P102 | I/O   |
| 1    | IO_L11N_1              | P105 | I/O   |
| 1    | IO_L11P_1              | P103 | I/O   |
| 1    | IP_1/VREF_1            | P80  | VREF  |
| 1    | IP_1/VREF_1            | P97  | VREF  |
| 1    | VCCO_1                 | P86  | VCCO  |
| 1    | VCCO_1                 | P95  | VCCO  |
| 2    | IO_2/MOSI/CSI_B        | P62  | DUAL  |
| 2    | IO_L01N_2/M0           | P38  | DUAL  |
| 2    | IO_L01P_2/M1           | P37  | DUAL  |
| 2    | IO_L02N_2/CSO_B        | P41  | DUAL  |
| 2    | IO_L02P_2/M2           | P39  | DUAL  |
| 2    | IO_L03N_2/VS1          | P44  | DUAL  |
| 2    | IO_L03P_2/RDWR_B       | P42  | DUAL  |
| 2    | IO_L04N_2/VS0          | P45  | DUAL  |
| 2    | IO_L04P_2/VS2          | P43  | DUAL  |
| 2    | IO_L05N_2/D7           | P48  | DUAL  |



**Table 68: Spartan-3AN TQG144 Pinout (Cont'd)**

| Bank | Pin Name               | Pin | Type     |
|------|------------------------|-----|----------|
| 2    | IO_L05P_2              | P46 | I/O      |
| 2    | IO_L06N_2/D6           | P49 | DUAL     |
| 2    | IO_L06P_2              | P47 | I/O      |
| 2    | IO_L07N_2/D4           | P51 | DUAL     |
| 2    | IO_L07P_2/D5           | P50 | DUAL     |
| 2    | IO_L08N_2/GCLK15       | P55 | GCLK     |
| 2    | IO_L08P_2/GCLK14       | P54 | GCLK     |
| 2    | IO_L09N_2/GCLK1        | P59 | GCLK     |
| 2    | IO_L09P_2/GCLK0        | P57 | GCLK     |
| 2    | IO_L10N_2/GCLK3        | P60 | GCLK     |
| 2    | IO_L10P_2/GCLK2        | P58 | GCLK     |
| 2    | IO_L11N_2/DOOUT        | P64 | DUAL     |
| 2    | IO_L11P_2/AWAKE        | P63 | PWR MGMT |
| 2    | IO_L12N_2/D3           | P68 | DUAL     |
| 2    | IO_L12P_2/INIT_B       | P67 | DUAL     |
| 2    | IO_L13N_2/D0/DIN/MISO  | P71 | DUAL     |
| 2    | IO_L13P_2/D2           | P69 | DUAL     |
| 2    | IO_L14N_2/CCLK         | P72 | DUAL     |
| 2    | IO_L14P_2/D1           | P70 | DUAL     |
| 2    | IP_2/VREF_2            | P53 | VREF     |
| 2    | VCCO_2                 | P40 | VCCO     |
| 2    | VCCO_2                 | P61 | VCCO     |
| 3    | IO_L01N_3              | P6  | I/O      |
| 3    | IO_L01P_3              | P4  | I/O      |
| 3    | IO_L02N_3              | P5  | I/O      |
| 3    | IO_L02P_3              | P3  | I/O      |
| 3    | IO_L03N_3              | P8  | I/O      |
| 3    | IO_L03P_3              | P7  | I/O      |
| 3    | IO_L04N_3/VREF_3       | P11 | VREF     |
| 3    | IO_L04P_3              | P10 | I/O      |
| 3    | IO_L05N_3/LHCLK1       | P13 | LHCLK    |
| 3    | IO_L05P_3/LHCLK0       | P12 | LHCLK    |
| 3    | IO_L06N_3/IRDY2/LHCLK3 | P16 | LHCLK    |
| 3    | IO_L06P_3/LHCLK2       | P15 | LHCLK    |
| 3    | IO_L07N_3/LHCLK5       | P20 | LHCLK    |
| 3    | IO_L07P_3/LHCLK4       | P18 | LHCLK    |
| 3    | IO_L08N_3/LHCLK7       | P21 | LHCLK    |
| 3    | IO_L08P_3/TRDY2/LHCLK6 | P19 | LHCLK    |
| 3    | IO_L09N_3              | P25 | I/O      |
| 3    | IO_L09P_3              | P24 | I/O      |
| 3    | IO_L10N_3              | P29 | I/O      |
| 3    | IO_L10P_3              | P27 | I/O      |

**Table 68: Spartan-3AN TQG144 Pinout (Cont'd)**

| Bank   | Pin Name         | Pin  | Type     |
|--------|------------------|------|----------|
| 3      | IO_L11N_3        | P30  | I/O      |
| 3      | IO_L11P_3        | P28  | I/O      |
| 3      | IO_L12N_3        | P32  | I/O      |
| 3      | IO_L12P_3        | P31  | I/O      |
| 3      | IP_L13N_3/VREF_3 | P35  | VREF     |
| 3      | IP_L13P_3        | P33  | INPUT    |
| 3      | VCCO_3           | P14  | VCCO     |
| 3      | VCCO_3           | P23  | VCCO     |
| GND    | GND              | P9   | GND      |
| GND    | GND              | P17  | GND      |
| GND    | GND              | P26  | GND      |
| GND    | GND              | P34  | GND      |
| GND    | GND              | P56  | GND      |
| GND    | GND              | P65  | GND      |
| GND    | GND              | P81  | GND      |
| GND    | GND              | P89  | GND      |
| GND    | GND              | P100 | GND      |
| GND    | GND              | P106 | GND      |
| GND    | GND              | P118 | GND      |
| GND    | GND              | P128 | GND      |
| GND    | GND              | P137 | GND      |
| VCCAUX | SUSPEND          | P74  | PWR MGMT |
| VCCAUX | DONE             | P73  | CONFIG   |
| VCCAUX | PROG_B           | P144 | CONFIG   |
| VCCAUX | TCK              | P109 | JTAG     |
| VCCAUX | TDI              | P2   | JTAG     |
| VCCAUX | TDO              | P107 | JTAG     |
| VCCAUX | TMS              | P1   | JTAG     |
| VCCAUX | VCCAUX           | P36  | VCCAUX   |
| VCCAUX | VCCAUX           | P66  | VCCAUX   |
| VCCAUX | VCCAUX           | P108 | VCCAUX   |
| VCCAUX | VCCAUX           | P133 | VCCAUX   |
| VCCINT | VCCINT           | P22  | VCCINT   |
| VCCINT | VCCINT           | P52  | VCCINT   |
| VCCINT | VCCINT           | P94  | VCCINT   |
| VCCINT | VCCINT           | P122 | VCCINT   |



## User I/Os by Bank

Table 69 indicates how the 108 available user-I/O pins are distributed between the four I/O banks on the TQG144 package. The AWAKE pin is counted as a dual-purpose I/O.

Table 69: User I/Os Per Bank for the XC3S50AN in the TQG144 Package

| Package Edge | I/O Bank | Maximum I/Os | All Possible I/O Pins by Type |          |           |          |           |
|--------------|----------|--------------|-------------------------------|----------|-----------|----------|-----------|
|              |          |              | I/O                           | INPUT    | DUAL      | VREF     | CLK       |
| Top          | 0        | 27           | 14                            | 1        | 1         | 3        | 8         |
| Right        | 1        | 25           | 11                            | 0        | 4         | 2        | 8         |
| Bottom       | 2        | 30           | 2                             | 0        | 21        | 1        | 6         |
| Left         | 3        | 26           | 15                            | 1        | 0         | 2        | 8         |
| <b>Total</b> |          | <b>108</b>   | <b>42</b>                     | <b>2</b> | <b>26</b> | <b>8</b> | <b>30</b> |

## Footprint Migration Differences

The XC3S50AN FPGA is the only Spartan-3AN device offered in the TQG144 package. The XC3S50AN FPGA is pin compatible with the Spartan-3A XC3S50A FPGA in the TQ(G)144 package, although the Spartan-3A FPGA requires an external configuration source.

### TQG144 Footprint

**Note:** Pin 1 indicator in top-left corner and logo orientation.

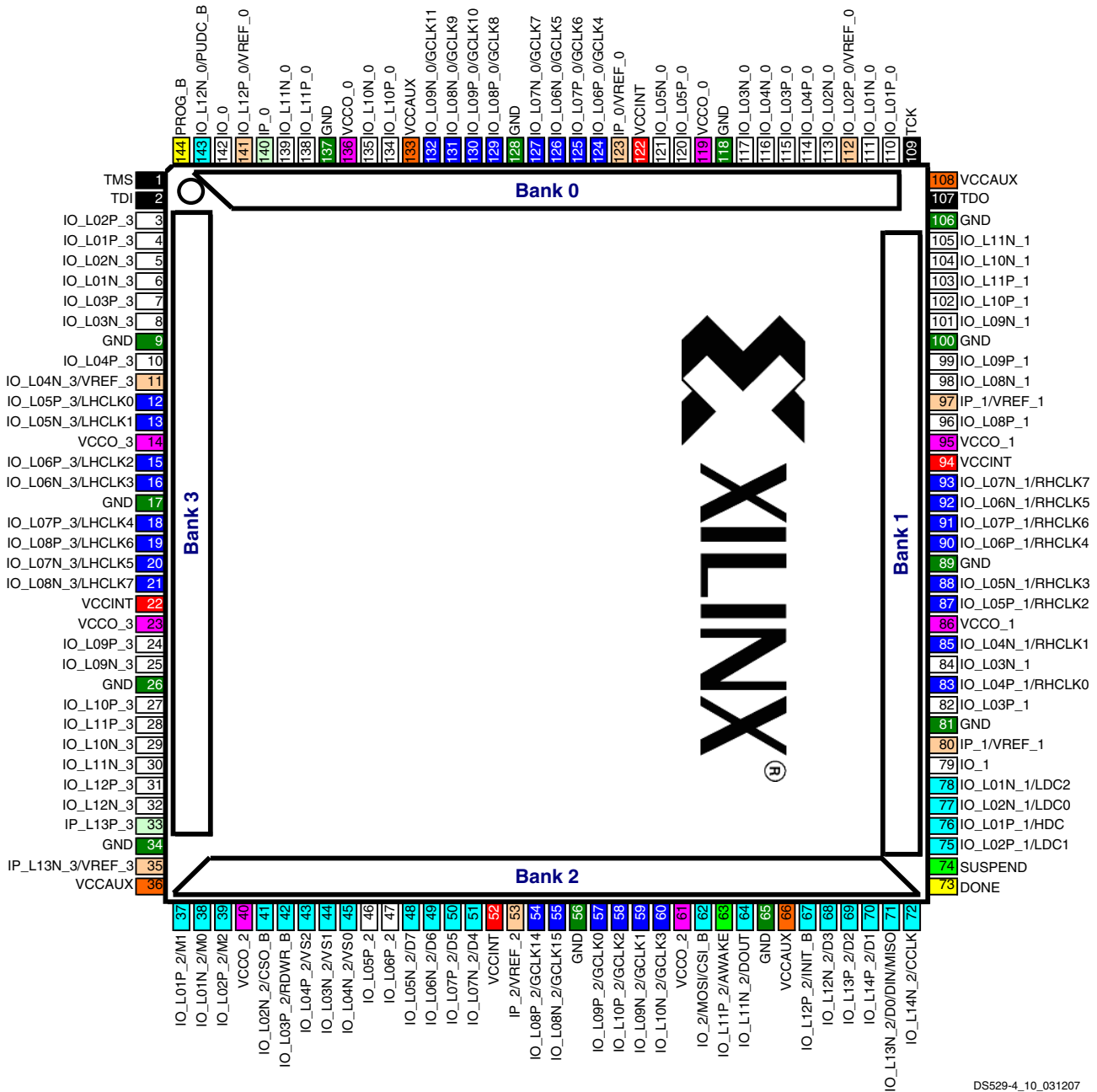


Figure 19: XC3S50AN FPGA in TQG144 Package Footprint (Top View)

|    |  |    |   |   |   |
|----|--|----|---|---|---|
| 42 | <b>IO:</b> Unrestricted, general-purpose user I/O                              | 25 | <b>DUAL:</b> Configuration pins, then possible user I/O | 8 | <b>VREF:</b> User I/O or input voltage reference for bank |
| 2  | <b>INPUT:</b> Unrestricted, general-purpose input pin                          | 30 | <b>CLK:</b> User I/O, input, or global buffer input     | 8 | <b>VCCO:</b> Output voltage supply for bank               |
| 2  | <b>CONFIG:</b> Dedicated configuration pins                                    | 4  | <b>JTAG:</b> Dedicated JTAG port pins                   | 4 | <b>VCCINT:</b> Internal core supply voltage (+1.2V)       |
| 0  | <b>N.C.:</b> Not connected   | 13 | <b>GND:</b> Ground                                      | 4 | <b>VCCAUX:</b> Auxiliary supply voltage                   |
| 2  | <b>SUSPEND:</b> Dedicated SUSPEND and dual-purpose AWAKE Power Management pins |    |   |   |   |

## FTG256: 256-Ball Fine-Pitch, Thin Ball Grid Array

The 256-ball fine-pitch, thin ball grid array package, FTG256, supports the XC3S50AN, XC3S200AN, and XC3S400AN devices. Table 70 lists all the package pins for these devices. They are sorted by bank number and then by the pin name of the largest device. Pins that form a differential I/O pair appear together in the table. The differential I/O pairs that have different assignments between the XC3S50AN and the XC3S200AN or XC3S400AN are highlighted in light blue in Table 70. See Footprint Migration Differences, page 87 for additional information. The table also shows the pin number for each pin and the pin type (as defined in Table 62).

The footprints for the XC3S200AN and XC3S400AN in the FTG256 are identical. Figure 21 shows the common footprint for the XC3S200AN and XC3S400AN. The XC3S50AN footprint is compatible with the XC3S200AN and XC3S400AN, however, there are 51 unconnected balls (indicated as N.C. in Table 70).

Table 73 summarizes the XC3S50AN FPGA footprint migration differences for the FTG256 package.

The XC3S50AN does not support the address output pins for the byte-wide peripheral interface (BPI) configuration mode.

An electronic version of this package pinout table and footprint diagram is available for download from the Xilinx website at: [www.xilinx.com/support/documentation/data\\_sheets/s3a\\_pin.zip](http://www.xilinx.com/support/documentation/data_sheets/s3a_pin.zip).

### Pinout Table

Table 70: Spartan-3AN FTG256 Pinout (XC3S50AN, XC3S200AN, XC3S400AN)

| Bank | XC3S50AN Pin Name | XC3S200AN/XC3S400AN Pin Name | FTG256 Ball | Type |
|------|-------------------|------------------------------|-------------|------|
| 0    | IO_L01N_0         | IO_L01N_0                    | C13         | I/O  |
| 0    | IO_L01P_0         | IO_L01P_0                    | D13         | I/O  |
| 0    | IO_L02N_0         | IO_L02N_0                    | B14         | I/O  |
| 0    | IO_L02P_0/VREF_0  | IO_L02P_0/VREF_0             | B15         | VREF |
| 0    | IO_L03N_0         | IO_L03N_0                    | D11         | I/O  |
| 0    | IO_L03P_0         | IO_L03P_0                    | C12         | I/O  |
| 0    | IO_L04N_0         | IO_L04N_0                    | A13         | I/O  |
| 0    | IO_L04P_0         | IO_L04P_0                    | A14         | I/O  |
| 0    | N.C.              | IO_L05N_0                    | A12         | I/O  |
| 0    | IP_0              | IO_L05P_0                    | B12         | I/O  |
| 0    | N.C.              | IO_L06N_0/VREF_0             | E10         | VREF |
| 0    | N.C.              | IO_L06P_0                    | D10         | I/O  |
| 0    | IO_L07N_0         | IO_L07N_0                    | A11         | I/O  |
| 0    | IO_L07P_0         | IO_L07P_0                    | C11         | I/O  |
| 0    | IO_L08N_0         | IO_L08N_0                    | A10         | I/O  |
| 0    | IO_L08P_0         | IO_L08P_0                    | B10         | I/O  |
| 0    | IO_L09N_0/GCLK5   | IO_L09N_0/GCLK5              | D9          | GCLK |
| 0    | IO_L09P_0/GCLK4   | IO_L09P_0/GCLK4              | C10         | GCLK |
| 0    | IO_L10N_0/GCLK7   | IO_L10N_0/GCLK7              | A9          | GCLK |
| 0    | IO_L10P_0/GCLK6   | IO_L10P_0/GCLK6              | C9          | GCLK |
| 0    | IO_L11N_0/GCLK9   | IO_L11N_0/GCLK9              | D8          | GCLK |
| 0    | IO_L11P_0/GCLK8   | IO_L11P_0/GCLK8              | C8          | GCLK |
| 0    | IO_L12N_0/GCLK11  | IO_L12N_0/GCLK11             | B8          | GCLK |
| 0    | IO_L12P_0/GCLK10  | IO_L12P_0/GCLK10             | A8          | GCLK |
| 0    | N.C.              | IO_L13N_0                    | C7          | I/O  |
| 0    | N.C.              | IO_L13P_0                    | A7          | I/O  |

Table 70: Spartan-3AN FTG256 Pinout (XC3S50AN, XC3S200AN, XC3S400AN) (Cont'd)

| Bank | XC3S50AN Pin Name | XC3S200AN/XC3S400AN Pin Name | FTG256 Ball | Type  |
|------|-------------------|------------------------------|-------------|-------|
| 0    | N.C.              | IO_L14N_0/VREF_0             | E7          | VREF  |
| 0    | N.C.              | IO_L14P_0                    | F8          | I/O   |
| 0    | IO_L15N_0         | IO_L15N_0                    | B6          | I/O   |
| 0    | IO_L15P_0         | IO_L15P_0                    | A6          | I/O   |
| 0    | IO_L16N_0         | IO_L16N_0                    | C6          | I/O   |
| 0    | IO_L16P_0         | IO_L16P_0                    | D7          | I/O   |
| 0    | IO_L17N_0         | IO_L17N_0                    | C5          | I/O   |
| 0    | IO_L17P_0         | IO_L17P_0                    | A5          | I/O   |
| 0    | IO_L18N_0         | IO_L18N_0                    | B4          | I/O   |
| 0    | IO_L18P_0         | IO_L18P_0                    | A4          | I/O   |
| 0    | IO_L19N_0         | IO_L19N_0                    | B3          | I/O   |
| 0    | IO_L19P_0         | IO_L19P_0                    | A3          | I/O   |
| 0    | IO_L20N_0/PUDC_B  | IO_L20N_0/PUDC_B             | D5          | DUAL  |
| 0    | IO_L20P_0/VREF_0  | IO_L20P_0/VREF_0             | C4          | VREF  |
| 0    | IP_0              | IP_0                         | D6          | INPUT |
| 0    | IP_0              | IP_0                         | D12         | INPUT |
| 0    | IP_0              | IP_0                         | E6          | INPUT |
| 0    | IP_0              | IP_0                         | F7          | INPUT |
| 0    | IP_0              | IP_0                         | F9          | INPUT |
| 0    | IP_0              | IP_0                         | F10         | INPUT |
| 0    | IP_0/VREF_0       | IP_0/VREF_0                  | E9          | VREF  |
| 0    | VCCO_0            | VCCO_0                       | B5          | VCCO  |
| 0    | VCCO_0            | VCCO_0                       | B9          | VCCO  |
| 0    | VCCO_0            | VCCO_0                       | B13         | VCCO  |
| 0    | VCCO_0            | VCCO_0                       | E8          | VCCO  |
| 1    | IO_L01N_1/LDC2    | IO_L01N_1/LDC2               | N14         | DUAL  |
| 1    | IO_L01P_1/HDC     | IO_L01P_1/HDC                | N13         | DUAL  |
| 1    | IO_L02N_1/LDC0    | IO_L02N_1/LDC0               | P15         | DUAL  |
| 1    | IO_L02P_1/LDC1    | IO_L02P_1/LDC1               | R15         | DUAL  |
| 1    | IO_L03N_1         | IO_L03N_1/A1                 | N16         | DUAL  |
| 1    | IO_L03P_1         | IO_L03P_1/A0                 | P16         | DUAL  |
| 1    | N.C.              | IO_L05N_1/VREF_1             | M14         | VREF  |
| 1    | N.C.              | IO_L05P_1                    | M13         | I/O   |
| 1    | N.C.              | IO_L06N_1/A3                 | K13         | DUAL  |
| 1    | N.C.              | IO_L06P_1/A2                 | L13         | DUAL  |
| 1    | N.C.              | IO_L07N_1/A5                 | M16         | DUAL  |
| 1    | N.C.              | IO_L07P_1/A4                 | M15         | DUAL  |
| 1    | N.C.              | IO_L08N_1/A7                 | L16         | DUAL  |
| 1    | N.C.              | IO_L08P_1/A6                 | L14         | DUAL  |
| 1    | IO_L10N_1         | IO_L10N_1/A9                 | J13         | DUAL  |

Table 70: Spartan-3AN FTG256 Pinout (XC3S50AN, XC3S200AN, XC3S400AN) (Cont'd)

| Bank | XC3S50AN Pin Name      | XC3S200AN/XC3S400AN Pin Name | FTG256 Ball | Type  |
|------|------------------------|------------------------------|-------------|-------|
| 1    | IO_L10P_1              | IO_L10P_1/A8                 | J12         | DUAL  |
| 1    | IO_L11N_1/RHCLK1       | IO_L11N_1/RHCLK1             | K14         | RHCLK |
| 1    | IO_L11P_1/RHCLK0       | IO_L11P_1/RHCLK0             | K15         | RHCLK |
| 1    | IO_L12N_1/TRDY1/RHCLK3 | IO_L12N_1/TRDY1/RHCLK3       | J16         | RHCLK |
| 1    | IO_L12P_1/RHCLK2       | IO_L12P_1/RHCLK2             | K16         | RHCLK |
| 1    | IO_L14N_1/RHCLK5       | IO_L14N_1/RHCLK5             | H14         | RHCLK |
| 1    | IO_L14P_1/RHCLK4       | IO_L14P_1/RHCLK4             | J14         | RHCLK |
| 1    | IO_L15N_1/RHCLK7       | IO_L15N_1/RHCLK7             | H16         | RHCLK |
| 1    | IO_L15P_1/IRDY1/RHCLK6 | IO_L15P_1/IRDY1/RHCLK6       | H15         | RHCLK |
| 1    | N.C.                   | IO_L16N_1/A11                | F16         | DUAL  |
| 1    | N.C.                   | IO_L16P_1/A10                | G16         | DUAL  |
| 1    | N.C.                   | IO_L17N_1/A13                | G14         | DUAL  |
| 1    | N.C.                   | IO_L17P_1/A12                | H13         | DUAL  |
| 1    | N.C.                   | IO_L18N_1/A15                | F15         | DUAL  |
| 1    | N.C.                   | IO_L18P_1/A14                | E16         | DUAL  |
| 1    | N.C.                   | IO_L19N_1/A17                | F14         | DUAL  |
| 1    | N.C.                   | IO_L19P_1/A16                | G13         | DUAL  |
| 1    | IO_L20N_1              | IO_L20N_1/A19                | F13         | DUAL  |
| 1    | IO_L20P_1              | IO_L20P_1/A18                | E14         | DUAL  |
| 1    | IO_L22N_1              | IO_L22N_1/A21                | D15         | DUAL  |
| 1    | IO_L22P_1              | IO_L22P_1/A20                | D16         | DUAL  |
| 1    | IO_L23N_1              | IO_L23N_1/A23                | D14         | DUAL  |
| 1    | IO_L23P_1              | IO_L23P_1/A22                | E13         | DUAL  |
| 1    | IO_L24N_1              | IO_L24N_1/A25                | C15         | DUAL  |
| 1    | IO_L24P_1              | IO_L24P_1/A24                | C16         | DUAL  |
| 1    | IP_L04N_1/VREF_1       | IP_L04N_1/VREF_1             | K12         | VREF  |
| 1    | IP_L04P_1              | IP_L04P_1                    | K11         | INPUT |
| 1    | N.C.                   | IP_L09N_1                    | J11         | INPUT |
| 1    | N.C.                   | IP_L09P_1/VREF_1             | J10         | VREF  |
| 1    | IP_L13N_1              | IP_L13N_1                    | H11         | INPUT |
| 1    | IP_L13P_1              | IP_L13P_1                    | H10         | INPUT |
| 1    | IP_L21N_1              | IP_L21N_1                    | G11         | INPUT |
| 1    | IP_L21P_1/VREF_1       | IP_L21P_1/VREF_1             | G12         | VREF  |
| 1    | IP_L25N_1              | IP_L25N_1                    | F11         | INPUT |
| 1    | IP_L25P_1/VREF_1       | IP_L25P_1/VREF_1             | F12         | VREF  |
| 1    | VCCO_1                 | VCCO_1                       | E15         | VCCO  |
| 1    | VCCO_1                 | VCCO_1                       | H12         | VCCO  |
| 1    | VCCO_1                 | VCCO_1                       | J15         | VCCO  |
| 1    | VCCO_1                 | VCCO_1                       | N15         | VCCO  |

Table 70: Spartan-3AN FTG256 Pinout (XC3S50AN, XC3S200AN, XC3S400AN) (Cont'd)

| Bank | XC3S50AN Pin Name     | XC3S200AN/XC3S400AN Pin Name | FTG256 Ball | Type     |
|------|-----------------------|------------------------------|-------------|----------|
| 2    | IO_L01N_2/M0          | IO_L01N_2/M0                 | P4          | DUAL     |
| 2    | IO_L01P_2/M1          | IO_L01P_2/M1                 | N4          | DUAL     |
| 2    | IO_L02N_2/CSO_B       | IO_L02N_2/CSO_B              | T2          | DUAL     |
| 2    | IO_L02P_2/M2          | IO_L02P_2/M2                 | R2          | DUAL     |
| 2    | IO_L04P_2/VS2         | IO_L03N_2/VS2                | T3          | DUAL     |
| 2    | IO_L03P_2/RDWR_B      | IO_L03P_2/RDWR_B             | R3          | DUAL     |
| 2    | IO_L04N_2/VS0         | IO_L04N_2/VS0                | P5          | DUAL     |
| 2    | IO_L03N_2/VS1         | IO_L04P_2/VS1                | N6          | DUAL     |
| 2    | IO_L06P_2             | IO_L05N_2                    | R5          | I/O      |
| 2    | IO_L05P_2             | IO_L05P_2                    | T4          | I/O      |
| 2    | IO_L06N_2/D6          | IO_L06N_2/D6                 | T6          | DUAL     |
| 2    | IO_L05N_2/D7          | IO_L06P_2/D7                 | T5          | DUAL     |
| 2    | N.C.                  | IO_L07N_2                    | P6          | I/O      |
| 2    | N.C.                  | IO_L07P_2                    | N7          | I/O      |
| 2    | IO_L08N_2/D4          | IO_L08N_2/D4                 | N8          | DUAL     |
| 2    | IO_L08P_2/D5          | IO_L08P_2/D5                 | P7          | DUAL     |
| 2    | N.C.                  | IO_L09N_2/GCLK13             | T7          | GCLK     |
| 2    | N.C.                  | IO_L09P_2/GCLK12             | R7          | GCLK     |
| 2    | IO_L10N_2/GCLK15      | IO_L10N_2/GCLK15             | T8          | GCLK     |
| 2    | IO_L10P_2/GCLK14      | IO_L10P_2/GCLK14             | P8          | GCLK     |
| 2    | IO_L11N_2/GCLK1       | IO_L11N_2/GCLK1              | P9          | GCLK     |
| 2    | IO_L11P_2/GCLK0       | IO_L11P_2/GCLK0              | N9          | GCLK     |
| 2    | IO_L12N_2/GCLK3       | IO_L12N_2/GCLK3              | T9          | GCLK     |
| 2    | IO_L12P_2/GCLK2       | IO_L12P_2/GCLK2              | R9          | GCLK     |
| 2    | N.C.                  | IO_L13N_2                    | M10         | I/O      |
| 2    | N.C.                  | IO_L13P_2                    | N10         | I/O      |
| 2    | IO_L14P_2/MOSI/CSI_B  | IO_L14N_2/MOSI/CSI_B         | P10         | DUAL     |
| 2    | IO_L14N_2             | IO_L14P_2                    | T10         | I/O      |
| 2    | IO_L15N_2/DOUT        | IO_L15N_2/DOUT               | R11         | DUAL     |
| 2    | IO_L15P_2/AWAKE       | IO_L15P_2/AWAKE              | T11         | PWR MGMT |
| 2    | IO_L16N_2             | IO_L16N_2                    | N11         | I/O      |
| 2    | IO_L16P_2             | IO_L16P_2                    | P11         | I/O      |
| 2    | IO_L17N_2/D3          | IO_L17N_2/D3                 | P12         | DUAL     |
| 2    | IO_L17P_2/INIT_B      | IO_L17P_2/INIT_B             | T12         | DUAL     |
| 2    | IO_L20P_2/D1          | IO_L18N_2/D1                 | R13         | DUAL     |
| 2    | IO_L18P_2/D2          | IO_L18P_2/D2                 | T13         | DUAL     |
| 2    | N.C.                  | IO_L19N_2                    | P13         | I/O      |
| 2    | N.C.                  | IO_L19P_2                    | N12         | I/O      |
| 2    | IO_L20N_2/CCLK        | IO_L20N_2/CCLK               | R14         | DUAL     |
| 2    | IO_L18N_2/D0/DIN/MISO | IO_L20P_2/D0/DIN/MISO        | T14         | DUAL     |

Table 70: Spartan-3AN FTG256 Pinout (XC3S50AN, XC3S200AN, XC3S400AN) (Cont'd)

| Bank | XC3S50AN Pin Name      | XC3S200AN/XC3S400AN Pin Name | FTG256 Ball | Type  |
|------|------------------------|------------------------------|-------------|-------|
| 2    | IP_2                   | IP_2                         | L7          | INPUT |
| 2    | IP_2                   | IP_2                         | L8          | INPUT |
| 2    | IP_2/VREF_2            | IP_2/VREF_2                  | L9          | VREF  |
| 2    | IP_2/VREF_2            | IP_2/VREF_2                  | L10         | VREF  |
| 2    | IP_2/VREF_2            | IP_2/VREF_2                  | M7          | VREF  |
| 2    | IP_2/VREF_2            | IP_2/VREF_2                  | M8          | VREF  |
| 2    | IP_2/VREF_2            | IP_2/VREF_2                  | M11         | VREF  |
| 2    | IP_2/VREF_2            | IP_2/VREF_2                  | N5          | VREF  |
| 2    | VCCO_2                 | VCCO_2                       | M9          | VCCO  |
| 2    | VCCO_2                 | VCCO_2                       | R4          | VCCO  |
| 2    | VCCO_2                 | VCCO_2                       | R8          | VCCO  |
| 2    | VCCO_2                 | VCCO_2                       | R12         | VCCO  |
| 3    | IO_L01N_3              | IO_L01N_3                    | C1          | I/O   |
| 3    | IO_L01P_3              | IO_L01P_3                    | C2          | I/O   |
| 3    | IO_L02N_3              | IO_L02N_3                    | D3          | I/O   |
| 3    | IO_L02P_3              | IO_L02P_3                    | D4          | I/O   |
| 3    | IO_L03N_3              | IO_L03N_3                    | E1          | I/O   |
| 3    | IO_L03P_3              | IO_L03P_3                    | D1          | I/O   |
| 3    | N.C.                   | IO_L05N_3                    | E2          | I/O   |
| 3    | N.C.                   | IO_L05P_3                    | E3          | I/O   |
| 3    | N.C.                   | IO_L07N_3                    | G4          | I/O   |
| 3    | N.C.                   | IO_L07P_3                    | F3          | I/O   |
| 3    | IO_L08N_3/VREF_3       | IO_L08N_3/VREF_3             | G1          | VREF  |
| 3    | IO_L08P_3              | IO_L08P_3                    | F1          | I/O   |
| 3    | N.C.                   | IO_L09N_3                    | H4          | I/O   |
| 3    | N.C.                   | IO_L09P_3                    | G3          | I/O   |
| 3    | N.C.                   | IO_L10N_3                    | H5          | I/O   |
| 3    | N.C.                   | IO_L10P_3                    | H6          | I/O   |
| 3    | IO_L11N_3/LHCLK1       | IO_L11N_3/LHCLK1             | H1          | LHCLK |
| 3    | IO_L11P_3/LHCLK0       | IO_L11P_3/LHCLK0             | G2          | LHCLK |
| 3    | IO_L12N_3/IRDY2/LHCLK3 | IO_L12N_3/IRDY2/LHCLK3       | J3          | LHCLK |
| 3    | IO_L12P_3/LHCLK2       | IO_L12P_3/LHCLK2             | H3          | LHCLK |
| 3    | IO_L14N_3/LHCLK5       | IO_L14N_3/LHCLK5             | J1          | LHCLK |
| 3    | IO_L14P_3/LHCLK4       | IO_L14P_3/LHCLK4             | J2          | LHCLK |
| 3    | IO_L15N_3/LHCLK7       | IO_L15N_3/LHCLK7             | K1          | LHCLK |
| 3    | IO_L15P_3/TRDY2/LHCLK6 | IO_L15P_3/TRDY2/LHCLK6       | K3          | LHCLK |
| 3    | N.C.                   | IO_L16N_3                    | L2          | I/O   |
| 3    | N.C.                   | IO_L16P_3/VREF_3             | L1          | VREF  |
| 3    | N.C.                   | IO_L17N_3                    | J6          | I/O   |
| 3    | N.C.                   | IO_L17P_3                    | J4          | I/O   |

Table 70: Spartan-3AN FTG256 Pinout (XC3S50AN, XC3S200AN, XC3S400AN) (Cont'd)

| Bank | XC3S50AN Pin Name | XC3S200AN/XC3S400AN Pin Name | FTG256 Ball | Type  |
|------|-------------------|------------------------------|-------------|-------|
| 3    | N.C.              | IO_L18N_3                    | L3          | I/O   |
| 3    | N.C.              | IO_L18P_3                    | K4          | I/O   |
| 3    | N.C.              | IO_L19N_3                    | L4          | I/O   |
| 3    | N.C.              | IO_L19P_3                    | M3          | I/O   |
| 3    | IO_L20N_3         | IO_L20N_3                    | N1          | I/O   |
| 3    | IO_L20P_3         | IO_L20P_3                    | M1          | I/O   |
| 3    | IO_L22N_3         | IO_L22N_3                    | P1          | I/O   |
| 3    | IO_L22P_3         | IO_L22P_3                    | N2          | I/O   |
| 3    | IO_L23N_3         | IO_L23N_3                    | P2          | I/O   |
| 3    | IO_L23P_3         | IO_L23P_3                    | R1          | I/O   |
| 3    | IO_L24N_3         | IO_L24N_3                    | M4          | I/O   |
| 3    | IO_L24P_3         | IO_L24P_3                    | N3          | I/O   |
| 3    | IP_L04N_3/VREF_3  | IP_L04N_3/VREF_3             | F4          | VREF  |
| 3    | IP_L04P_3         | IP_L04P_3                    | E4          | INPUT |
| 3    | N.C.              | IP_L06N_3/VREF_3             | G5          | VREF  |
| 3    | N.C.              | IP_L06P_3                    | G6          | INPUT |
| 3    | IP_L13N_3         | IP_L13N_3                    | J7          | INPUT |
| 3    | IP_L13P_3         | IP_L13P_3                    | H7          | INPUT |
| 3    | IP_L21N_3         | IP_L21N_3                    | K6          | INPUT |
| 3    | IP_L21P_3         | IP_L21P_3                    | K5          | INPUT |
| 3    | IP_L25N_3/VREF_3  | IP_L25N_3/VREF_3             | L6          | VREF  |
| 3    | IP_L25P_3         | IP_L25P_3                    | L5          | INPUT |
| 3    | VCCO_3            | VCCO_3                       | D2          | VCCO  |
| 3    | VCCO_3            | VCCO_3                       | H2          | VCCO  |
| 3    | VCCO_3            | VCCO_3                       | J5          | VCCO  |
| 3    | VCCO_3            | VCCO_3                       | M2          | VCCO  |
| GND  | GND               | GND                          | A1          | GND   |
| GND  | GND               | GND                          | A16         | GND   |
| GND  | GND               | GND                          | B7          | GND   |
| GND  | GND               | GND                          | B11         | GND   |
| GND  | GND               | GND                          | C3          | GND   |
| GND  | GND               | GND                          | C14         | GND   |
| GND  | GND               | GND                          | E5          | GND   |
| GND  | GND               | GND                          | E12         | GND   |
| GND  | GND               | GND                          | F2          | GND   |
| GND  | GND               | GND                          | F6          | GND   |
| GND  | GND               | GND                          | G8          | GND   |
| GND  | GND               | GND                          | G10         | GND   |
| GND  | GND               | GND                          | G15         | GND   |
| GND  | GND               | GND                          | H9          | GND   |



**Table 70: Spartan-3AN FTG256 Pinout (XC3S50AN, XC3S200AN, XC3S400AN) (Cont'd)**

| Bank   | XC3S50AN Pin Name | XC3S200AN/XC3S400AN Pin Name | FTG256 Ball | Type     |
|--------|-------------------|------------------------------|-------------|----------|
| GND    | GND               | GND                          | J8          | GND      |
| GND    | GND               | GND                          | K2          | GND      |
| GND    | GND               | GND                          | K7          | GND      |
| GND    | GND               | GND                          | K9          | GND      |
| GND    | GND               | GND                          | L11         | GND      |
| GND    | GND               | GND                          | L15         | GND      |
| GND    | GND               | GND                          | M5          | GND      |
| GND    | GND               | GND                          | M12         | GND      |
| GND    | GND               | GND                          | P3          | GND      |
| GND    | GND               | GND                          | P14         | GND      |
| GND    | GND               | GND                          | R6          | GND      |
| GND    | GND               | GND                          | R10         | GND      |
| GND    | GND               | GND                          | T1          | GND      |
| GND    | GND               | GND                          | T16         | GND      |
| VCCAUX | SUSPEND           | SUSPEND                      | R16         | PWR MGMT |
| VCCAUX | DONE              | DONE                         | T15         | CONFIG   |
| VCCAUX | PROG_B            | PROG_B                       | A2          | CONFIG   |
| VCCAUX | TCK               | TCK                          | A15         | JTAG     |
| VCCAUX | TDI               | TDI                          | B1          | JTAG     |
| VCCAUX | TDO               | TDO                          | B16         | JTAG     |
| VCCAUX | TMS               | TMS                          | B2          | JTAG     |
| VCCAUX | VCCAUX            | VCCAUX                       | E11         | VCCAUX   |
| VCCAUX | VCCAUX            | VCCAUX                       | F5          | VCCAUX   |
| VCCAUX | VCCAUX            | VCCAUX                       | L12         | VCCAUX   |
| VCCAUX | VCCAUX            | VCCAUX                       | M6          | VCCAUX   |
| VCCINT | VCCINT            | VCCINT                       | G7          | VCCINT   |
| VCCINT | VCCINT            | VCCINT                       | G9          | VCCINT   |
| VCCINT | VCCINT            | VCCINT                       | H8          | VCCINT   |
| VCCINT | VCCINT            | VCCINT                       | J9          | VCCINT   |
| VCCINT | VCCINT            | VCCINT                       | K8          | VCCINT   |
| VCCINT | VCCINT            | VCCINT                       | K10         | VCCINT   |

## User I/Os by Bank

Table 71 and Table 72 indicate how the available user-I/O pins are distributed between the four I/O banks on the FTG256 package. The AWAKE pin is counted as a dual-purpose I/O. The XC3S50AN FPGA in the FTG256 package has 51 unconnected balls, labeled with an N.C. type. These pins are also indicated in Figure 20.

Table 71: User I/Os Per Bank on XC3S50AN in the FTG256 Package

| Package Edge | I/O Bank | Maximum I/Os | All Possible I/O Pins by Type |           |           |           |           |
|--------------|----------|--------------|-------------------------------|-----------|-----------|-----------|-----------|
|              |          |              | I/O                           | INPUT     | DUAL      | VREF      | CLK       |
| Top          | 0        | 40           | 21                            | 7         | 1         | 3         | 8         |
| Right        | 1        | 32           | 12                            | 5         | 4         | 3         | 8         |
| Bottom       | 2        | 40           | 5                             | 2         | 21        | 6         | 6         |
| Left         | 3        | 32           | 15                            | 6         | 0         | 3         | 8         |
| <b>Total</b> |          | <b>144</b>   | <b>53</b>                     | <b>20</b> | <b>26</b> | <b>15</b> | <b>30</b> |

Table 72: User I/Os Per Bank on XC3S200AN and XC3S400AN in the FTG256 Package

| Package Edge | I/O Bank | Maximum I/Os | All Possible I/O Pins by Type |           |           |           |           |
|--------------|----------|--------------|-------------------------------|-----------|-----------|-----------|-----------|
|              |          |              | I/O                           | INPUT     | DUAL      | VREF      | CLK       |
| Top          | 0        | 47           | 27                            | 6         | 1         | 5         | 8         |
| Right        | 1        | 50           | 1                             | 6         | 30        | 5         | 8         |
| Bottom       | 2        | 48           | 11                            | 2         | 21        | 6         | 8         |
| Left         | 3        | 50           | 30                            | 7         | 0         | 5         | 8         |
| <b>Total</b> |          | <b>195</b>   | <b>69</b>                     | <b>21</b> | <b>52</b> | <b>21</b> | <b>32</b> |

## Footprint Migration Differences

### Unconnected Balls on XC3S50AN

Table 73 summarizes any footprint and functionality differences between the XC3S50AN and the XC3S200AN or XC3S400AN devices for migration between these devices in the FTG256 package. The XC3S200AN and XC3S400AN have identical pinouts. The XC3S50AN pinout is compatible with the XC3S200AN and XC3S400AN, however, there are 51 unconnected balls and one functionally different ball. Generally, designs migrate upward from the XC3S50AN to either the XC3S200AN or XC3S400AN. If using differential I/O, see Table 74. If using the BPI configuration mode (parallel Flash), see Table 75.

In Table 73, the arrow (→) indicates that this pin can unconditionally migrate from the device on the left to the device on the right. Migration in the other direction is possible depending on how the pin is configured for the device on the right.

Table 73: FTG256 XC3S50AN Footprint Migration/Differences

| FTG256 Ball | Bank | XC3S50AN | Migration | XC3S200AN or XC3S400AN |
|-------------|------|----------|-----------|------------------------|
| A7          | 0    | N.C.     | →         | I/O                    |
| A12         | 0    | N.C.     | →         | I/O                    |
| B12         | 0    | INPUT    | →         | I/O                    |
| C7          | 0    | N.C.     | →         | I/O                    |
| D10         | 0    | N.C.     | →         | I/O                    |
| E2          | 3    | N.C.     | →         | I/O                    |
| E3          | 3    | N.C.     | →         | I/O                    |
| E7          | 0    | N.C.     | →         | I/O/VREF               |
| E10         | 0    | N.C.     | →         | I/O/VREF               |
| E16         | 1    | N.C.     | →         | I/O                    |
| F3          | 3    | N.C.     | →         | I/O                    |
| F8          | 0    | N.C.     | →         | I/O                    |
| F14         | 1    | N.C.     | →         | I/O                    |
| F15         | 1    | N.C.     | →         | I/O                    |
| F16         | 1    | N.C.     | →         | I/O                    |
| G3          | 3    | N.C.     | →         | I/O                    |
| G4          | 3    | N.C.     | →         | I/O                    |
| G5          | 3    | N.C.     | →         | INPUT/VREF             |
| G6          | 3    | N.C.     | →         | INPUT                  |
| G13         | 1    | N.C.     | →         | I/O                    |
| G14         | 1    | N.C.     | →         | I/O                    |
| G16         | 1    | N.C.     | →         | I/O                    |
| H4          | 3    | N.C.     | →         | I/O                    |
| H5          | 3    | N.C.     | →         | I/O                    |
| H6          | 3    | N.C.     | →         | I/O                    |
| H13         | 1    | N.C.     | →         | I/O                    |
| J4          | 3    | N.C.     | →         | I/O                    |
| J6          | 3    | N.C.     | →         | I/O                    |
| J10         | 1    | N.C.     | →         | INPUT/VREF             |
| J11         | 1    | N.C.     | →         | INPUT                  |
| K4          | 3    | N.C.     | →         | I/O                    |

Table 73: FTG256 XC3S50AN Footprint Migration/Differences (Cont'd)

| FTG256 Ball                   | Bank | XC3S50AN | Migration | XC3S200AN or XC3S400AN |
|-------------------------------|------|----------|-----------|------------------------|
| K13                           | 1    | N.C.     | →         | I/O                    |
| L1                            | 3    | N.C.     | →         | I/O/VREF               |
| L2                            | 3    | N.C.     | →         | I/O                    |
| L3                            | 3    | N.C.     | →         | I/O                    |
| L4                            | 3    | N.C.     | →         | I/O                    |
| L13                           | 1    | N.C.     | →         | I/O                    |
| L14                           | 1    | N.C.     | →         | I/O                    |
| L16                           | 1    | N.C.     | →         | I/O                    |
| M3                            | 3    | N.C.     | →         | I/O                    |
| M10                           | 2    | N.C.     | →         | I/O                    |
| M13                           | 1    | N.C.     | →         | I/O                    |
| M14                           | 1    | N.C.     | →         | I/O/VREF               |
| M15                           | 1    | N.C.     | →         | I/O                    |
| M16                           | 1    | N.C.     | →         | I/O                    |
| N7                            | 2    | N.C.     | →         | I/O                    |
| N10                           | 2    | N.C.     | →         | I/O                    |
| N12                           | 2    | N.C.     | →         | I/O                    |
| P6                            | 2    | N.C.     | →         | I/O                    |
| P13                           | 2    | N.C.     | →         | I/O                    |
| R7                            | 2    | N.C.     | →         | I/O                    |
| T7                            | 2    | N.C.     | →         | I/O                    |
| <b>Number of Differences:</b> |      |          | 52        |                        |

### XC3S50AN Differential I/O Alignment Differences

Also, some differential I/O pairs on the XC3S50AN FPGA are aligned differently than the corresponding pairs on the XC3S200AN or XC3S400AN FPGAs, as shown in [Table 74](#). All the mismatched pairs are in I/O Bank 2. The N side of each pair is shaded.

Table 74: Differential I/O Differences in FTG256

| FTG256 Ball | Bank | XC3S50AN             | XC3S200AN or XC3S400AN |
|-------------|------|----------------------|------------------------|
| T3          | 2    | IO_L04P_2/VS2        | IO_L03N_2/VS2          |
| N6          |      | IO_L03N_2/VS1        | IO_L04P_2/VS1          |
| R5          |      | IO_L06P_2            | IO_L05N_2              |
| T5          |      | IO_L05N_2/D7         | IO_L06P_2/D7           |
| P10         |      | IO_L14P_2/MOSI/CSI_B | IO_L14N_2/MOSI/CSI_B   |
| T10         |      | IO_L14N_2            | IO_L14P_2              |
| R13         |      | IO_L20P_2            | IO_L18N_2              |
| T14         |      | IO_L18N_2            | IO_L20P_2              |

### XC3S50AN Does Not Have BPI Mode Address Outputs

The XC3S50AN FPGA does not generate the BPI-mode address pins during configuration. [Table 75](#) summarizes these differences.

Table 75: XC3S50AN BPI Functional Differences

| FTG256 Ball | Bank | XC3S50AN  | XC3S200AN or XC3S400AN |
|-------------|------|-----------|------------------------|
| N16         | 1    | IO_L03N_1 | IO_L03N_1/A1           |
| P16         |      | IO_L03P_1 | IO_L03P_1/A0           |
| J13         |      | IO_L10N_1 | IO_L10N_1/A9           |
| J12         |      | IO_L10P_1 | IO_L10P_1/A8           |
| F13         |      | IO_L20N_1 | IO_L20N_1/A19          |
| E14         |      | IO_L20P_1 | IO_L20P_1/A18          |
| D15         |      | IO_L22N_1 | IO_L22N_1/A21          |
| D16         |      | IO_L22P_1 | IO_L22P_1/A20          |
| D14         |      | IO_L23N_1 | IO_L23N_1/A23          |
| E13         |      | IO_L23P_1 | IO_L23P_1/A22          |
| C15         |      | IO_L24N_1 | IO_L24N_1/A25          |
| C16         |      | IO_L24P_1 | IO_L24P_1/A24          |

The Spartan-3AN FPGAs are pin compatible with the same density Spartan-3A FPGAs in the FT(G)256 package, although the Spartan-3A FPGAs require an external configuration source.

FTG256 Footprint (XC3S50AN)

|                     |   | (Differential Outputs) |                        |                         |                     | Bank 0              |                |               |                   | (Differential Outputs) |                        |                  |                     |                |                        |                         |                         |
|---------------------|---|------------------------|------------------------|-------------------------|---------------------|---------------------|----------------|---------------|-------------------|------------------------|------------------------|------------------|---------------------|----------------|------------------------|-------------------------|-------------------------|
|                     |   | 1                      | 2                      | 3                       | 4                   | 5                   | 6              | 7             | 8                 | 9                      | 10                     | 11               | 12                  | 13             | 14                     | 15                      | 16                      |
| (High Output Drive) | A | GND                    | PROG_B                 | I/O L19P_0              | I/O L18P_0          | I/O L17P_0          | I/O L15P_0     | N.C.          | I/O L12P_0 GCLK10 | I/O L10N_0 GCLK7       | I/O L08N_0             | I/O L07N_0       | N.C.                | I/O L04N_0     | I/O L04P_0             | TCK                     | GND                     |
|                     | B | TDI                    | TMS                    | I/O L19N_0              | I/O L18N_0          | VCCO_0              | I/O L15N_0     | GND           | I/O L12N_0 GCLK11 | VCCO_0                 | I/O L08P_0             | GND              | INPUT               | VCCO_0         | I/O L02N_0             | I/O L02P_0 VREF_0       | TDO                     |
|                     | C | I/O L01N_3             | I/O L01P_3             | GND                     | I/O L20P_0 VREF_0   | I/O L17N_0          | I/O L16N_0     | N.C.          | I/O L11P_0 GCLK8  | I/O L10P_0 GCLK6       | I/O L09P_0 GCLK4       | I/O L07P_0       | I/O L03P_0          | I/O L01N_0     | GND                    | I/O L24N_1              | I/O L24P_1              |
|                     | D | I/O L03P_3             | VCCO_3                 | I/O L02N_3              | I/O L02P_3          | I/O L20N_0 PUDC_B   | INPUT          | I/O L16P_0    | I/O L11N_0 GCLK9  | I/O L09N_0 GCLK5       | N.C.                   | I/O L03N_0       | INPUT               | I/O L01P_0     | I/O L23N_1             | I/O L22N_1              | I/O L22P_1              |
|                     | E | I/O L03N_3             | N.C.                   | N.C.                    | INPUT L04P_3        | GND                 | INPUT          | N.C.          | VCCO_0            | INPUT VREF_0           | N.C.                   | VCCAUX           | GND                 | I/O L23P_1     | I/O L20P_1             | VCCO_1                  | N.C.                    |
|                     | F | I/O L08P_3             | GND                    | N.C.                    | INPUT L04N_3 VREF_3 | VCCAUX              | GND            | INPUT         | N.C.              | INPUT                  | INPUT                  | INPUT L25N_1     | INPUT L25P_1 VREF_1 | I/O L20N_1     | N.C.                   | N.C.                    | N.C.                    |
|                     | G | I/O L08N_3 VREF_3      | I/O L11P_3 LHCLK0      | N.C.                    | N.C.                | N.C.                | N.C.           | VCCINT        | GND               | VCCINT                 | GND                    | INPUT L21N_1     | INPUT L21P_1 VREF_1 | N.C.           | N.C.                   | GND                     | N.C.                    |
|                     | H | I/O L11N_3 LHCLK1      | VCCO_3                 | I/O L12P_3 LHCLK2       | N.C.                | N.C.                | N.C.           | INPUT L13P_3  | VCCINT            | GND                    | INPUT L13P_1           | INPUT L13N_1     | VCCO_1              | N.C.           | I/O L14N_1 RHCLK5      | I/O L15P_1 IRDY1 RHCLK6 | I/O L15N_1 RHCLK7       |
|                     | J | I/O L14N_3 LHCLK5      | I/O L14P_3 LHCLK4      | I/O L12N_3 IRDY2 LHCLK3 | N.C.                | VCCO_3              | N.C.           | INPUT L13N_3  | GND               | VCCINT                 | N.C.                   | N.C.             | I/O L10P_1          | I/O L10N_1     | I/O L14P_1 RHCLK4      | VCCO_1                  | I/O L12N_1 TRDY1 RHCLK3 |
|                     | K | I/O L15N_3 LHCLK7      | GND                    | I/O L15P_3 TRDY2 LHCLK6 | N.C.                | INPUT L21P_3        | INPUT L21N_3   | GND           | VCCINT            | GND                    | VCCINT                 | INPUT L04P_1     | INPUT L04N_1 VREF_1 | N.C.           | I/O L11N_1 RHCLK1      | I/O L11P_1 RHCLK0       | I/O L12P_1 RHCLK2       |
| (High Output Drive) | L | N.C.                   | N.C.                   | N.C.                    | N.C.                | INPUT L25P_3 VREF_3 | INPUT          | INPUT         | INPUT VREF_2      | INPUT VREF_2           | GND                    | VCCAUX           | N.C.                | N.C.           | GND                    | N.C.                    |                         |
|                     | M | I/O L20P_3             | VCCO_3                 | N.C.                    | I/O L24N_3          | GND                 | VCCAUX         | INPUT VREF_2  | INPUT VREF_2      | VCCO_2                 | N.C.                   | INPUT VREF_2     | GND                 | N.C.           | N.C.                   | N.C.                    | N.C.                    |
|                     | N | I/O L20N_3             | I/O L22P_3             | I/O L24P_3              | I/O L01P_2 M1       | INPUT VREF_2        | I/O L03N_2 VS1 | N.C.          | I/O L08N_2 D4     | I/O L11P_2 GCLK0       | N.C.                   | I/O L16N_2       | N.C.                | I/O L01P_1 HDC | I/O L01N_1 LDC2        | VCCO_1                  | I/O L03N_1              |
|                     | P | I/O L22N_3             | I/O L23N_3             | GND                     | I/O L01N_2 M0       | I/O L04N_2 VS0      | N.C.           | I/O L08P_2 D5 | I/O L10P_2 GCLK14 | I/O L11N_2 GCLK1       | I/O L14P_2 MOSI CSI_B  | I/O L16P_2       | I/O L17N_2 D3       | N.C.           | GND                    | I/O L02N_1 LDC0         | I/O L03P_1              |
|                     | R | I/O L23P_3             | I/O L02P_2 M2          | I/O L03P_2 RDWR_B       | VCCO_2              | I/O L06P_2          | GND            | N.C.          | VCCO_2            | I/O L12P_2 GCLK2       | GND                    | I/O L15N_2 DOUT  | VCCO_2              | I/O L20P_2 D1  | I/O L20N_2 CCLK        | I/O L02P_1 LDC1         | SUSPEND                 |
|                     | T | GND                    | I/O L02N_2 CSO_B       | I/O L04P_2 VS2          | I/O L05P_2          | I/O L05N_2 D7       | I/O L06N_2 D6  | N.C.          | I/O L10N_2 GCLK15 | I/O L12N_2 GCLK3       | I/O L14N_2             | I/O L15P_2 AWAKE | I/O L17P_2 INIT_B   | I/O L18P_2 D2  | I/O L18N_2 D0 DIN/MISO | DONE                    | GND                     |
|                     |   |                        | (Differential Outputs) |                         |                     |                     | Bank 2         |               |                   |                        | (Differential Outputs) |                  |                     |                |                        |                         |                         |

Figure 20: XC3S50AN FTG256 Package Footprint (Top View)

- 53** I/O: Unrestricted, general-purpose user I/O
- 25** DUAL: Configuration pins, then possible user I/O
- 15** VREF: User I/O or input voltage reference for bank
- 2** SUSPEND: Dedicated SUSPEND and dual-purpose AWAKE Power Management pins
- 20** INPUT: Unrestricted, general-purpose input pin
- 30** CLK: User I/O, input, or global buffer input
- 16** VCCO: Output voltage supply for bank
- 2** CONFIG: Dedicated configuration pins
- 4** JTAG: Dedicated JTAG port pins
- 6** VCCINT: Internal core supply voltage (+1.2V)
- 51** N.C.: Not connected (XC3S50AN only)
- 28** GND: Ground
- 4** VCCAUX: Auxiliary supply voltage

FTG256 Footprint (XC3S200AN, XC3S400AN)

|        |   | Bank 0            |                   |                         |                     |                     |                     |                   |                   |                  |                       |                  |                     |                |                        |                         |                         |  |
|--------|---|-------------------|-------------------|-------------------------|---------------------|---------------------|---------------------|-------------------|-------------------|------------------|-----------------------|------------------|---------------------|----------------|------------------------|-------------------------|-------------------------|--|
|        |   | 1                 | 2                 | 3                       | 4                   | 5                   | 6                   | 7                 | 8                 | 9                | 10                    | 11               | 12                  | 13             | 14                     | 15                      | 16                      |  |
| Bank 3 | A | GND               | PROG_B            | I/O L19P_0              | I/O L18P_0          | I/O L17P_0          | I/O L15P_0          | I/O L13P_0        | I/O L12P_0 GCLK10 | I/O L10N_0 GCLK7 | I/O L08N_0            | I/O L07N_0       | I/O L05N_0          | I/O L04N_0     | I/O L04P_0             | TCK                     | GND                     |  |
|        | B | TDI               | TMS               | I/O L19N_0              | I/O L18N_0          | VCCO_0              | I/O L15N_0          | GND               | I/O L12N_0 GCLK11 | VCCO_0           | I/O L08P_0            | GND              | I/O L05P_0          | VCCO_0         | I/O L02N_0             | I/O L02P_0 VREF_0       | TDO                     |  |
|        | C | I/O L01N_3        | I/O L01P_3        | GND                     | I/O L20P_0 VREF_0   | I/O L17N_0          | I/O L16N_0          | I/O L13N_0        | I/O L11P_0 GCLK8  | I/O L10P_0 GCLK6 | I/O L09P_0 GCLK4      | I/O L07P_0       | I/O L03P_0          | I/O L01N_0     | GND                    | I/O L24N_1 A25          | I/O L24P_1 A24          |  |
|        | D | I/O L03P_3        | VCCO_3            | I/O L02N_3              | I/O L02P_3          | I/O L20N_0 PUDC_B   | INPUT               | I/O L16P_0        | I/O L11N_0 GCLK9  | I/O L09N_0 GCLK5 | I/O L06P_0            | I/O L03N_0       | INPUT               | I/O L01P_0     | I/O L23N_1 A23         | I/O L22N_1 A21          | I/O L22P_1 A20          |  |
|        | E | I/O L03N_3        | I/O L05N_3        | I/O L05P_3              | INPUT L04P_3        | GND                 | INPUT               | I/O L14N_0 VREF_0 | VCCO_0            | INPUT VREF_0     | I/O L06N_0 VREF_0     | VCCAUX           | GND                 | I/O L23P_1 A22 | I/O L20P_1 A18         | VCCO_1                  | I/O L18P_1 A14          |  |
|        | F | I/O L08P_3        | GND               | I/O L07P_3              | INPUT L04N_3 VREF_3 | VCCAUX              | GND                 | INPUT             | I/O L14P_0        | INPUT            | INPUT                 | INPUT L25N_1     | INPUT L25P_1 VREF_1 | I/O L20N_1 A19 | I/O L19N_1 A17         | I/O L18N_1 A15          | I/O L16N_1 A11          |  |
|        | G | I/O L08N_3 VREF_3 | I/O L11P_3 LHCLK0 | I/O L09P_3              | I/O L07N_3          | INPUT L06N_3 VREF_3 | INPUT L06P_3        | VCCINT            | GND               | VCCINT           | GND                   | INPUT L21N_1     | INPUT L21P_1 VREF_1 | I/O L19P_1 A16 | I/O L17N_1 A13         | GND                     | I/O L16P_1 A10          |  |
|        | H | I/O L11N_3 LHCLK1 | VCCO_3            | I/O L12P_3 LHCLK2       | I/O L09N_3          | I/O L10N_3          | I/O L10P_3          | INPUT L13P_3      | VCCINT            | GND              | INPUT L13P_1          | INPUT L13N_1     | VCCO_1              | I/O L17P_1 A12 | I/O L14N_1 RHCLK5      | I/O L15P_1 IRDY1 RHCLK6 | I/O L15N_1 RHCLK7       |  |
|        | J | I/O L14N_3 LHCLK5 | I/O L14P_3 LHCLK4 | I/O L12N_3 IRDY2 LHCLK3 | I/O L17P_3          | VCCO_3              | I/O L17N_3          | INPUT L13N_3      | GND               | VCCINT           | INPUT L09P_1 VREF_1   | INPUT L09N_1     | I/O L10P_1 A8       | I/O L10N_1 A9  | I/O L14P_1 RHCLK4      | VCCO_1                  | I/O L12N_1 TRDY1 RHCLK3 |  |
|        | K | I/O L15N_3 LHCLK7 | GND               | I/O L15P_3 TRDY2 LHCLK6 | I/O L18P_3          | INPUT L21P_3        | INPUT L21N_3        | GND               | VCCINT            | GND              | VCCINT                | INPUT L04P_1     | INPUT L04N_1 VREF_1 | I/O L06N_1 A3  | I/O L11N_1 RHCLK1      | I/O L11P_1 RHCLK0       | I/O L12P_1 RHCLK2       |  |
|        | L | I/O L16P_3 VREF_3 | I/O L16N_3        | I/O L18N_3              | I/O L19N_3          | INPUT L25P_3        | INPUT L25N_3 VREF_3 | INPUT             | INPUT             | INPUT VREF_2     | INPUT VREF_2          | GND              | VCCAUX              | I/O L06P_1 A2  | I/O L08P_1 A6          | GND                     | I/O L08N_1 A7           |  |
|        | M | I/O L20P_3        | VCCO_3            | I/O L19P_3              | I/O L24N_3          | GND                 | VCCAUX              | INPUT VREF_2      | INPUT VREF_2      | VCCO_2           | I/O L13N_2            | INPUT VREF_2     | GND                 | I/O L05P_1     | I/O L05N_1 VREF_1      | I/O L07P_1 A4           | I/O L07N_1 A5           |  |
|        | N | I/O L20N_3        | I/O L22P_3        | I/O L24P_3              | I/O L01P_2 M1       | INPUT VREF_2        | I/O L04P_2 VS1      | I/O L07P_2        | I/O L08N_2 D4     | I/O L11P_2 GCLK0 | I/O L13P_2            | I/O L16N_2       | I/O L19P_2          | I/O L01P_1 HDC | I/O L01N_1 LDC2        | VCCO_1                  | I/O L03N_1 A1           |  |
|        | P | I/O L22N_3        | I/O L23N_3        | GND                     | I/O L01N_2 M0       | I/O L04N_2 VS0      | I/O L07N_2          | I/O L08P_2 D5     | I/O L10P_2 GCLK14 | I/O L11N_2 GCLK1 | I/O L14N_2 MOSI CSI_B | I/O L16P_2       | I/O L17N_2 D3       | I/O L19N_2     | GND                    | I/O L02N_1 LDC0         | I/O L03P_1 A0           |  |
|        | R | I/O L23P_3        | I/O L02P_2 M2     | I/O L03P_2 RDWR_B       | VCCO_2              | I/O L05N_2          | GND                 | I/O L09P_2 GCLK12 | VCCO_2            | I/O L12P_2 GCLK2 | GND                   | I/O L15N_2 DOUT  | VCCO_2              | I/O L18N_2 D1  | I/O L20N_2 CCLK        | I/O L02P_1 LDC1         | SUSPEND                 |  |
|        | T | GND               | I/O L02N_2 CSO_B  | I/O L03N_2 VS2          | I/O L05P_2          | I/O L06P_2 D7       | I/O L06N_2 D6       | I/O L09N_2 GCLK13 | I/O L10N_2 GCLK15 | I/O L12N_2 GCLK3 | I/O L14P_2            | I/O L15P_2 AWAKE | I/O L17P_2 INIT_B   | I/O L18P_2 D2  | I/O L20P_2 D0 DIN/MISO | DONE                    | GND                     |  |
|        |   |                   | Bank 2            |                         |                     |                     |                     |                   |                   |                  |                       |                  |                     |                |                        |                         |                         |  |

Figure 21: XC3S200AN and XC3S400AN FPGA in FTG256 Package Footprint (Top View)

|    |  |    |  |    |  |   |   |
|----|--|----|--|----|--|---|---|
| 69 | I/O: Unrestricted, general-purpose user I/O    | 51 | DUAL: Configuration pins, then possible user I/O | 21 | VREF: User I/O or input voltage reference for bank | 2 | SUSPEND: Dedicated SUSPEND and dual-purpose AWAKE Power Management pins |
| 21 | INPUT: Unrestricted, general-purpose input pin | 32 | CLK: User I/O, input, or global buffer input     | 16 | VCCO: Output voltage supply for bank               |   |   |
| 2  | CONFIG: Dedicated configuration pins           | 4  | JTAG: Dedicated JTAG port pins                   | 6  | VCCINT: Internal core supply voltage (+1.2V)       |   |   |
| 0  | N.C.: Not connected                            | 28 | GND: Ground                                      | 4  | VCCAUX: Auxiliary supply voltage                   |   |   |

## FGG400: 400-Ball Fine-Pitch Ball Grid Array

The 400-ball fine-pitch ball grid array, FGG400, supports the XC3S400AN FPGA as shown in [Table 76](#) and [Figure 22](#).

[Table 76](#) lists all the FGG400 package pins. They are sorted by bank number and then by pin name. Pins that form a differential I/O pair appear together in the table. The table also shows the pin number for each pin and the pin type (as defined in [Table 62](#)).

An electronic version of this package pinout table and footprint diagram is available for download from the Xilinx website at: [www.xilinx.com/support/documentation/data\\_sheets/s3a\\_pin.zip](http://www.xilinx.com/support/documentation/data_sheets/s3a_pin.zip).

### Pinout Table

Table 76: Spartan-3AN FGG400 Pinout

| Bank | Pin Name         | FGG400 Ball | Type |
|------|------------------|-------------|------|
| 0    | IO_L01N_0        | A18         | I/O  |
| 0    | IO_L01P_0        | B18         | I/O  |
| 0    | IO_L02N_0        | C17         | I/O  |
| 0    | IO_L02P_0/VREF_0 | D17         | VREF |
| 0    | IO_L03N_0        | E15         | I/O  |
| 0    | IO_L03P_0        | D16         | I/O  |
| 0    | IO_L04N_0        | A17         | I/O  |
| 0    | IO_L04P_0/VREF_0 | B17         | VREF |
| 0    | IO_L05N_0        | A16         | I/O  |
| 0    | IO_L05P_0        | C16         | I/O  |
| 0    | IO_L06N_0        | C15         | I/O  |
| 0    | IO_L06P_0        | D15         | I/O  |
| 0    | IO_L07N_0        | A14         | I/O  |
| 0    | IO_L07P_0        | C14         | I/O  |
| 0    | IO_L08N_0        | A15         | I/O  |
| 0    | IO_L08P_0        | B15         | I/O  |
| 0    | IO_L09N_0        | F13         | I/O  |
| 0    | IO_L09P_0        | E13         | I/O  |
| 0    | IO_L10N_0/VREF_0 | C13         | VREF |
| 0    | IO_L10P_0        | D14         | I/O  |
| 0    | IO_L11N_0        | C12         | I/O  |
| 0    | IO_L11P_0        | B13         | I/O  |
| 0    | IO_L12N_0        | F12         | I/O  |
| 0    | IO_L12P_0        | D12         | I/O  |
| 0    | IO_L13N_0        | A12         | I/O  |
| 0    | IO_L13P_0        | B12         | I/O  |
| 0    | IO_L14N_0        | C11         | I/O  |
| 0    | IO_L14P_0        | B11         | I/O  |
| 0    | IO_L15N_0/GCLK5  | E11         | GCLK |
| 0    | IO_L15P_0/GCLK4  | D11         | GCLK |
| 0    | IO_L16N_0/GCLK7  | C10         | GCLK |

Table 76: Spartan-3AN FGG400 Pinout (Cont'd)

| Bank | Pin Name         | FGG400 Ball | Type |
|------|------------------|-------------|------|
| 0    | IO_L16P_0/GCLK6  | A10         | GCLK |
| 0    | IO_L17N_0/GCLK9  | E10         | GCLK |
| 0    | IO_L17P_0/GCLK8  | D10         | GCLK |
| 0    | IO_L18N_0/GCLK11 | A8          | GCLK |
| 0    | IO_L18P_0/GCLK10 | A9          | GCLK |
| 0    | IO_L19N_0        | C9          | I/O  |
| 0    | IO_L19P_0        | B9          | I/O  |
| 0    | IO_L20N_0        | C8          | I/O  |
| 0    | IO_L20P_0        | B8          | I/O  |
| 0    | IO_L21N_0        | D8          | I/O  |
| 0    | IO_L21P_0        | C7          | I/O  |
| 0    | IO_L22N_0/VREF_0 | F9          | VREF |
| 0    | IO_L22P_0        | E9          | I/O  |
| 0    | IO_L23N_0        | F8          | I/O  |
| 0    | IO_L23P_0        | E8          | I/O  |
| 0    | IO_L24N_0        | A7          | I/O  |
| 0    | IO_L24P_0        | B7          | I/O  |
| 0    | IO_L25N_0        | C6          | I/O  |
| 0    | IO_L25P_0        | A6          | I/O  |
| 0    | IO_L26N_0        | B5          | I/O  |
| 0    | IO_L26P_0        | A5          | I/O  |
| 0    | IO_L27N_0        | F7          | I/O  |
| 0    | IO_L27P_0        | E7          | I/O  |
| 0    | IO_L28N_0        | D6          | I/O  |
| 0    | IO_L28P_0        | C5          | I/O  |
| 0    | IO_L29N_0        | C4          | I/O  |
| 0    | IO_L29P_0        | A4          | I/O  |
| 0    | IO_L30N_0        | B3          | I/O  |
| 0    | IO_L30P_0        | A3          | I/O  |
| 0    | IO_L31N_0        | F6          | I/O  |
| 0    | IO_L31P_0        | E6          | I/O  |



Table 76: Spartan-3AN FGG400 Pinout (Cont'd)

| Bank | Pin Name         | FGG400 Ball | Type  |
|------|------------------|-------------|-------|
| 0    | IO_L32N_0/PUDC_B | B2          | DUAL  |
| 0    | IO_L32P_0/VREF_0 | A2          | VREF  |
| 0    | IP_0             | E14         | INPUT |
| 0    | IP_0             | F11         | INPUT |
| 0    | IP_0             | F14         | INPUT |
| 0    | IP_0             | G8          | INPUT |
| 0    | IP_0             | G9          | INPUT |
| 0    | IP_0             | G10         | INPUT |
| 0    | IP_0             | G12         | INPUT |
| 0    | IP_0             | G13         | INPUT |
| 0    | IP_0             | H9          | INPUT |
| 0    | IP_0             | H10         | INPUT |
| 0    | IP_0             | H11         | INPUT |
| 0    | IP_0             | H12         | INPUT |
| 0    | IP_0/VREF_0      | G11         | VREF  |
| 0    | VCCO_0           | B4          | VCCO  |
| 0    | VCCO_0           | B10         | VCCO  |
| 0    | VCCO_0           | B16         | VCCO  |
| 0    | VCCO_0           | D7          | VCCO  |
| 0    | VCCO_0           | D13         | VCCO  |
| 0    | VCCO_0           | F10         | VCCO  |
| 1    | IO_L01N_1/LDC2   | V20         | DUAL  |
| 1    | IO_L01P_1/HDC    | W20         | DUAL  |
| 1    | IO_L02N_1/LDC0   | U18         | DUAL  |
| 1    | IO_L02P_1/LDC1   | V19         | DUAL  |
| 1    | IO_L03N_1/A1     | R16         | DUAL  |
| 1    | IO_L03P_1/A0     | T17         | DUAL  |
| 1    | IO_L05N_1        | T20         | I/O   |
| 1    | IO_L05P_1        | T18         | I/O   |
| 1    | IO_L06N_1        | U20         | I/O   |
| 1    | IO_L06P_1        | U19         | I/O   |
| 1    | IO_L07N_1        | P17         | I/O   |
| 1    | IO_L07P_1        | P16         | I/O   |
| 1    | IO_L08N_1        | R17         | I/O   |
| 1    | IO_L08P_1        | R18         | I/O   |
| 1    | IO_L09N_1        | R20         | I/O   |
| 1    | IO_L09P_1        | R19         | I/O   |
| 1    | IO_L10N_1/VREF_1 | P20         | VREF  |
| 1    | IO_L10P_1        | P18         | I/O   |
| 1    | IO_L12N_1/A3     | N17         | DUAL  |

Table 76: Spartan-3AN FGG400 Pinout (Cont'd)

| Bank | Pin Name               | FGG400 Ball | Type  |
|------|------------------------|-------------|-------|
| 1    | IO_L12P_1/A2           | N15         | DUAL  |
| 1    | IO_L13N_1/A5           | N19         | DUAL  |
| 1    | IO_L13P_1/A4           | N18         | DUAL  |
| 1    | IO_L14N_1/A7           | M18         | DUAL  |
| 1    | IO_L14P_1/A6           | M17         | DUAL  |
| 1    | IO_L16N_1/A9           | L16         | DUAL  |
| 1    | IO_L16P_1/A8           | L15         | DUAL  |
| 1    | IO_L17N_1/RHCLK1       | M20         | RHCLK |
| 1    | IO_L17P_1/RHCLK0       | M19         | RHCLK |
| 1    | IO_L18N_1/TRDY1/RHCLK3 | L18         | RHCLK |
| 1    | IO_L18P_1/RHCLK2       | L19         | RHCLK |
| 1    | IO_L20N_1/RHCLK5       | L17         | RHCLK |
| 1    | IO_L20P_1/RHCLK4       | K18         | RHCLK |
| 1    | IO_L21N_1/RHCLK7       | J20         | RHCLK |
| 1    | IO_L21P_1/IRDY1/RHCLK6 | K20         | RHCLK |
| 1    | IO_L22N_1/A11          | J18         | DUAL  |
| 1    | IO_L22P_1/A10          | J19         | DUAL  |
| 1    | IO_L24N_1              | K16         | I/O   |
| 1    | IO_L24P_1              | J17         | I/O   |
| 1    | IO_L25N_1/A13          | H18         | DUAL  |
| 1    | IO_L25P_1/A12          | H19         | DUAL  |
| 1    | IO_L26N_1/A15          | G20         | DUAL  |
| 1    | IO_L26P_1/A14          | H20         | DUAL  |
| 1    | IO_L28N_1              | H17         | I/O   |
| 1    | IO_L28P_1              | G18         | I/O   |
| 1    | IO_L29N_1/A17          | F19         | DUAL  |
| 1    | IO_L29P_1/A16          | F20         | DUAL  |
| 1    | IO_L30N_1/A19          | F18         | DUAL  |
| 1    | IO_L30P_1/A18          | G17         | DUAL  |
| 1    | IO_L32N_1              | E19         | I/O   |
| 1    | IO_L32P_1              | E20         | I/O   |
| 1    | IO_L33N_1              | F17         | I/O   |
| 1    | IO_L33P_1              | E18         | I/O   |
| 1    | IO_L34N_1              | D18         | I/O   |
| 1    | IO_L34P_1              | D20         | I/O   |
| 1    | IO_L36N_1/A21          | F16         | DUAL  |
| 1    | IO_L36P_1/A20          | G16         | DUAL  |
| 1    | IO_L37N_1/A23          | C19         | DUAL  |
| 1    | IO_L37P_1/A22          | C20         | DUAL  |
| 1    | IO_L38N_1/A25          | B19         | DUAL  |

Table 76: Spartan-3AN FGG400 Pinout (Cont'd)

| Bank | Pin Name         | FGG400 Ball | Type  |
|------|------------------|-------------|-------|
| 1    | IO_L38P_1/A24    | B20         | DUAL  |
| 1    | IP_1/VREF_1      | N14         | VREF  |
| 1    | IP_L04N_1/VREF_1 | P15         | VREF  |
| 1    | IP_L04P_1        | P14         | INPUT |
| 1    | IP_L11N_1/VREF_1 | M15         | VREF  |
| 1    | IP_L11P_1        | M16         | INPUT |
| 1    | IP_L15N_1        | M13         | INPUT |
| 1    | IP_L15P_1/VREF_1 | M14         | VREF  |
| 1    | IP_L19N_1        | L13         | INPUT |
| 1    | IP_L19P_1        | L14         | INPUT |
| 1    | IP_L23N_1        | K14         | INPUT |
| 1    | IP_L23P_1/VREF_1 | K15         | VREF  |
| 1    | IP_L27N_1        | J15         | INPUT |
| 1    | IP_L27P_1        | J16         | INPUT |
| 1    | IP_L31N_1        | J13         | INPUT |
| 1    | IP_L31P_1/VREF_1 | J14         | VREF  |
| 1    | IP_L35N_1        | H14         | INPUT |
| 1    | IP_L35P_1        | H15         | INPUT |
| 1    | IP_L39N_1        | G14         | INPUT |
| 1    | IP_L39P_1/VREF_1 | G15         | VREF  |
| 1    | VCCO_1           | D19         | VCCO  |
| 1    | VCCO_1           | H16         | VCCO  |
| 1    | VCCO_1           | K19         | VCCO  |
| 1    | VCCO_1           | N16         | VCCO  |
| 1    | VCCO_1           | T19         | VCCO  |
| 2    | IO_L01N_2/M0     | V4          | DUAL  |
| 2    | IO_L01P_2/M1     | U4          | DUAL  |
| 2    | IO_L02N_2/CSO_B  | Y2          | DUAL  |
| 2    | IO_L02P_2/M2     | W3          | DUAL  |
| 2    | IO_L03N_2        | W4          | I/O   |
| 2    | IO_L03P_2        | Y3          | I/O   |
| 2    | IO_L04N_2        | R7          | I/O   |
| 2    | IO_L04P_2        | T6          | I/O   |
| 2    | IO_L05N_2        | U5          | I/O   |
| 2    | IO_L05P_2        | V5          | I/O   |
| 2    | IO_L06N_2        | U6          | I/O   |
| 2    | IO_L06P_2        | T7          | I/O   |
| 2    | IO_L07N_2/VS2    | U7          | DUAL  |
| 2    | IO_L07P_2/RDWR_B | T8          | DUAL  |
| 2    | IO_L08N_2        | Y5          | I/O   |

Table 76: Spartan-3AN FGG400 Pinout (Cont'd)

| Bank | Pin Name             | FGG400 Ball | Type     |
|------|----------------------|-------------|----------|
| 2    | IO_L08P_2            | Y4          | I/O      |
| 2    | IO_L09N_2/VS0        | W6          | DUAL     |
| 2    | IO_L09P_2/VS1        | V6          | DUAL     |
| 2    | IO_L10N_2            | Y7          | I/O      |
| 2    | IO_L10P_2            | Y6          | I/O      |
| 2    | IO_L11N_2            | U9          | I/O      |
| 2    | IO_L11P_2            | T9          | I/O      |
| 2    | IO_L12N_2/D6         | W8          | DUAL     |
| 2    | IO_L12P_2/D7         | V7          | DUAL     |
| 2    | IO_L13N_2            | V9          | I/O      |
| 2    | IO_L13P_2            | V8          | I/O      |
| 2    | IO_L14N_2/D4         | T10         | DUAL     |
| 2    | IO_L14P_2/D5         | U10         | DUAL     |
| 2    | IO_L15N_2/GCLK13     | Y9          | GCLK     |
| 2    | IO_L15P_2/GCLK12     | W9          | GCLK     |
| 2    | IO_L16N_2/GCLK15     | W10         | GCLK     |
| 2    | IO_L16P_2/GCLK14     | V10         | GCLK     |
| 2    | IO_L17N_2/GCLK1      | V11         | GCLK     |
| 2    | IO_L17P_2/GCLK0      | Y11         | GCLK     |
| 2    | IO_L18N_2/GCLK3      | V12         | GCLK     |
| 2    | IO_L18P_2/GCLK2      | U11         | GCLK     |
| 2    | IO_L19N_2            | R12         | I/O      |
| 2    | IO_L19P_2            | T12         | I/O      |
| 2    | IO_L20N_2/MOSI/CSI_B | W12         | DUAL     |
| 2    | IO_L20P_2            | Y12         | I/O      |
| 2    | IO_L21N_2            | W13         | I/O      |
| 2    | IO_L21P_2            | Y13         | I/O      |
| 2    | IO_L22N_2/DOOUT      | V13         | DUAL     |
| 2    | IO_L22P_2/AWAKE      | U13         | PWR MGMT |
| 2    | IO_L23N_2            | R13         | I/O      |
| 2    | IO_L23P_2            | T13         | I/O      |
| 2    | IO_L24N_2/D3         | W14         | DUAL     |
| 2    | IO_L24P_2/INIT_B     | Y14         | DUAL     |
| 2    | IO_L25N_2            | T14         | I/O      |
| 2    | IO_L25P_2            | V14         | I/O      |
| 2    | IO_L26N_2/D1         | V15         | DUAL     |
| 2    | IO_L26P_2/D2         | Y15         | DUAL     |
| 2    | IO_L27N_2            | T15         | I/O      |
| 2    | IO_L27P_2            | U15         | I/O      |
| 2    | IO_L28N_2            | W16         | I/O      |

**Table 76: Spartan-3AN FGG400 Pinout (Cont'd)**

| Bank | Pin Name              | FGG400 Ball | Type  |
|------|-----------------------|-------------|-------|
| 2    | IO_L28P_2             | Y16         | I/O   |
| 2    | IO_L29N_2             | U16         | I/O   |
| 2    | IO_L29P_2             | V16         | I/O   |
| 2    | IO_L30N_2             | Y18         | I/O   |
| 2    | IO_L30P_2             | Y17         | I/O   |
| 2    | IO_L31N_2             | U17         | I/O   |
| 2    | IO_L31P_2             | V17         | I/O   |
| 2    | IO_L32N_2/CCLK        | Y19         | DUAL  |
| 2    | IO_L32P_2/D0/DIN/MISO | W18         | DUAL  |
| 2    | IP_2                  | P9          | INPUT |
| 2    | IP_2                  | P12         | INPUT |
| 2    | IP_2                  | P13         | INPUT |
| 2    | IP_2                  | R8          | INPUT |
| 2    | IP_2                  | R10         | INPUT |
| 2    | IP_2                  | T11         | INPUT |
| 2    | IP_2/VREF_2           | N9          | VREF  |
| 2    | IP_2/VREF_2           | N12         | VREF  |
| 2    | IP_2/VREF_2           | P8          | VREF  |
| 2    | IP_2/VREF_2           | P10         | VREF  |
| 2    | IP_2/VREF_2           | P11         | VREF  |
| 2    | IP_2/VREF_2           | R14         | VREF  |
| 2    | VCCO_2                | R11         | VCCO  |
| 2    | VCCO_2                | U8          | VCCO  |
| 2    | VCCO_2                | U14         | VCCO  |
| 2    | VCCO_2                | W5          | VCCO  |
| 2    | VCCO_2                | W11         | VCCO  |
| 2    | VCCO_2                | W17         | VCCO  |
| 3    | IO_L01N_3             | D3          | I/O   |
| 3    | IO_L01P_3             | D4          | I/O   |
| 3    | IO_L02N_3             | C2          | I/O   |
| 3    | IO_L02P_3             | B1          | I/O   |
| 3    | IO_L03N_3             | D2          | I/O   |
| 3    | IO_L03P_3             | C1          | I/O   |
| 3    | IO_L05N_3             | E1          | I/O   |
| 3    | IO_L05P_3             | D1          | I/O   |
| 3    | IO_L06N_3             | G5          | I/O   |
| 3    | IO_L06P_3             | F4          | I/O   |
| 3    | IO_L07N_3             | J5          | I/O   |
| 3    | IO_L07P_3             | J6          | I/O   |
| 3    | IO_L08N_3             | H4          | I/O   |

**Table 76: Spartan-3AN FGG400 Pinout (Cont'd)**

| Bank | Pin Name               | FGG400 Ball | Type  |
|------|------------------------|-------------|-------|
| 3    | IO_L08P_3              | H6          | I/O   |
| 3    | IO_L09N_3              | G4          | I/O   |
| 3    | IO_L09P_3              | F3          | I/O   |
| 3    | IO_L10N_3              | F2          | I/O   |
| 3    | IO_L10P_3              | E3          | I/O   |
| 3    | IO_L12N_3              | H2          | I/O   |
| 3    | IO_L12P_3              | G3          | I/O   |
| 3    | IO_L13N_3/VREF_3       | G1          | VREF  |
| 3    | IO_L13P_3              | F1          | I/O   |
| 3    | IO_L14N_3              | H3          | I/O   |
| 3    | IO_L14P_3              | J4          | I/O   |
| 3    | IO_L16N_3              | J2          | I/O   |
| 3    | IO_L16P_3              | J3          | I/O   |
| 3    | IO_L17N_3/LHCLK1       | K2          | LHCLK |
| 3    | IO_L17P_3/LHCLK0       | J1          | LHCLK |
| 3    | IO_L18N_3/IRDY2/LHCLK3 | L3          | LHCLK |
| 3    | IO_L18P_3/LHCLK2       | K3          | LHCLK |
| 3    | IO_L20N_3/LHCLK5       | L5          | LHCLK |
| 3    | IO_L20P_3/LHCLK4       | K4          | LHCLK |
| 3    | IO_L21N_3/LHCLK7       | M1          | LHCLK |
| 3    | IO_L21P_3/TRDY2/LHCLK6 | L1          | LHCLK |
| 3    | IO_L22N_3              | M3          | I/O   |
| 3    | IO_L22P_3/VREF_3       | M2          | VREF  |
| 3    | IO_L24N_3              | M5          | I/O   |
| 3    | IO_L24P_3              | M4          | I/O   |
| 3    | IO_L25N_3              | N2          | I/O   |
| 3    | IO_L25P_3              | N1          | I/O   |
| 3    | IO_L26N_3              | N4          | I/O   |
| 3    | IO_L26P_3              | N3          | I/O   |
| 3    | IO_L28N_3              | R1          | I/O   |
| 3    | IO_L28P_3              | P1          | I/O   |
| 3    | IO_L29N_3              | P4          | I/O   |
| 3    | IO_L29P_3              | P3          | I/O   |
| 3    | IO_L30N_3              | R3          | I/O   |
| 3    | IO_L30P_3              | R2          | I/O   |
| 3    | IO_L32N_3              | T2          | I/O   |
| 3    | IO_L32P_3/VREF_3       | T1          | VREF  |
| 3    | IO_L33N_3              | R4          | I/O   |
| 3    | IO_L33P_3              | T3          | I/O   |
| 3    | IO_L34N_3              | U3          | I/O   |

Table 76: Spartan-3AN FGG400 Pinout (Cont'd)

| Bank | Pin Name         | FGG400 Ball | Type  |
|------|------------------|-------------|-------|
| 3    | IO_L34P_3        | U1          | I/O   |
| 3    | IO_L36N_3        | T4          | I/O   |
| 3    | IO_L36P_3        | R5          | I/O   |
| 3    | IO_L37N_3        | V2          | I/O   |
| 3    | IO_L37P_3        | V1          | I/O   |
| 3    | IO_L38N_3        | W2          | I/O   |
| 3    | IO_L38P_3        | W1          | I/O   |
| 3    | IP_3             | H7          | INPUT |
| 3    | IP_L04N_3/VREF_3 | G6          | VREF  |
| 3    | IP_L04P_3        | G7          | INPUT |
| 3    | IP_L11N_3/VREF_3 | J7          | VREF  |
| 3    | IP_L11P_3        | J8          | INPUT |
| 3    | IP_L15N_3        | K7          | INPUT |
| 3    | IP_L15P_3        | K8          | INPUT |
| 3    | IP_L19N_3        | K5          | INPUT |
| 3    | IP_L19P_3        | K6          | INPUT |
| 3    | IP_L23N_3        | L6          | INPUT |
| 3    | IP_L23P_3        | L7          | INPUT |
| 3    | IP_L27N_3        | M7          | INPUT |
| 3    | IP_L27P_3        | M8          | INPUT |
| 3    | IP_L31N_3        | N7          | INPUT |
| 3    | IP_L31P_3        | M6          | INPUT |
| 3    | IP_L35N_3        | N6          | INPUT |
| 3    | IP_L35P_3        | P5          | INPUT |
| 3    | IP_L39N_3/VREF_3 | P7          | VREF  |
| 3    | IP_L39P_3        | P6          | INPUT |
| 3    | VCCO_3           | E2          | VCCO  |
| 3    | VCCO_3           | H5          | VCCO  |
| 3    | VCCO_3           | L2          | VCCO  |
| 3    | VCCO_3           | N5          | VCCO  |
| 3    | VCCO_3           | U2          | VCCO  |
| GND  | GND              | A1          | GND   |
| GND  | GND              | A11         | GND   |
| GND  | GND              | A20         | GND   |
| GND  | GND              | B6          | GND   |
| GND  | GND              | B14         | GND   |
| GND  | GND              | C3          | GND   |
| GND  | GND              | C18         | GND   |
| GND  | GND              | D9          | GND   |
| GND  | GND              | E5          | GND   |

Table 76: Spartan-3AN FGG400 Pinout (Cont'd)

| Bank   | Pin Name | FGG400 Ball | Type     |
|--------|----------|-------------|----------|
| GND    | GND      | E12         | GND      |
| GND    | GND      | F15         | GND      |
| GND    | GND      | G2          | GND      |
| GND    | GND      | G19         | GND      |
| GND    | GND      | H8          | GND      |
| GND    | GND      | H13         | GND      |
| GND    | GND      | J9          | GND      |
| GND    | GND      | J11         | GND      |
| GND    | GND      | K1          | GND      |
| GND    | GND      | K10         | GND      |
| GND    | GND      | K12         | GND      |
| GND    | GND      | K17         | GND      |
| GND    | GND      | L4          | GND      |
| GND    | GND      | L9          | GND      |
| GND    | GND      | L11         | GND      |
| GND    | GND      | L20         | GND      |
| GND    | GND      | M10         | GND      |
| GND    | GND      | M12         | GND      |
| GND    | GND      | N8          | GND      |
| GND    | GND      | N11         | GND      |
| GND    | GND      | N13         | GND      |
| GND    | GND      | P2          | GND      |
| GND    | GND      | P19         | GND      |
| GND    | GND      | R6          | GND      |
| GND    | GND      | R9          | GND      |
| GND    | GND      | T16         | GND      |
| GND    | GND      | U12         | GND      |
| GND    | GND      | V3          | GND      |
| GND    | GND      | V18         | GND      |
| GND    | GND      | W7          | GND      |
| GND    | GND      | W15         | GND      |
| GND    | GND      | Y1          | GND      |
| GND    | GND      | Y10         | GND      |
| GND    | GND      | Y20         | GND      |
| VCCAUX | SUSPEND  | R15         | PWR MGMT |
| VCCAUX | DONE     | W19         | CONFIG   |
| VCCAUX | PROG_B   | D5          | CONFIG   |
| VCCAUX | TCK      | A19         | JTAG     |
| VCCAUX | TDI      | F5          | JTAG     |
| VCCAUX | TDO      | E17         | JTAG     |

Table 76: Spartan-3AN FGG400 Pinout (Cont'd)

| Bank   | Pin Name | FGG400 Ball | Type   |
|--------|----------|-------------|--------|
| VCCAUX | TMS      | E4          | JTAG   |
| VCCAUX | VCCAUX   | A13         | VCCAUX |
| VCCAUX | VCCAUX   | E16         | VCCAUX |
| VCCAUX | VCCAUX   | H1          | VCCAUX |
| VCCAUX | VCCAUX   | K13         | VCCAUX |
| VCCAUX | VCCAUX   | L8          | VCCAUX |
| VCCAUX | VCCAUX   | N20         | VCCAUX |
| VCCAUX | VCCAUX   | T5          | VCCAUX |
| VCCAUX | VCCAUX   | Y8          | VCCAUX |
| VCCINT | VCCINT   | J10         | VCCINT |
| VCCINT | VCCINT   | J12         | VCCINT |
| VCCINT | VCCINT   | K9          | VCCINT |
| VCCINT | VCCINT   | K11         | VCCINT |
| VCCINT | VCCINT   | L10         | VCCINT |
| VCCINT | VCCINT   | L12         | VCCINT |
| VCCINT | VCCINT   | M9          | VCCINT |
| VCCINT | VCCINT   | M11         | VCCINT |
| VCCINT | VCCINT   | N10         | VCCINT |

## User I/Os by Bank

Table 77 indicates how the 311 available user-I/O pins are distributed between the four I/O banks on the FGG400 package. The AWAKE pin is counted as a dual-purpose I/O.

Table 77: User I/Os Per Bank for the XC3S400AN in the FGG400 Package

| Package Edge | I/O Bank | Maximum I/Os | All Possible I/O Pins by Type |           |           |           |           |
|--------------|----------|--------------|-------------------------------|-----------|-----------|-----------|-----------|
|              |          |              | I/O                           | INPUT     | DUAL      | VREF      | CLK       |
| Top          | 0        | 77           | 50                            | 12        | 1         | 6         | 8         |
| Right        | 1        | 79           | 21                            | 12        | 30        | 8         | 8         |
| Bottom       | 2        | 76           | 35                            | 6         | 21        | 6         | 8         |
| Left         | 3        | 79           | 49                            | 16        | 0         | 6         | 8         |
| <b>Total</b> |          | <b>311</b>   | <b>155</b>                    | <b>46</b> | <b>52</b> | <b>26</b> | <b>32</b> |

## Footprint Migration Differences

The XC3S400AN is the only Spartan-3AN FPGA offered in the FGG400 package.

The XC3S400AN FPGA is pin compatible with the Spartan-3A XC3S400A FPGA in the FG(G)400 package, although the Spartan-3A FPGA requires an external configuration source.

### FGG400 Footprint

#### Left Half of FGG400 Package (Top View)

- 155 **I/O:** Unrestricted, general-purpose user I/O
- 46 **INPUT:** Unrestricted, general-purpose input pin
- 51 **DUAL:** Configuration pins, then possible user I/O
- 26 **VREF:** User I/O or input voltage reference for bank
- 32 **CLK:** User I/O, input, or clock buffer input
- 2 **CONFIG:** Dedicated configuration pins
- 4 **JTAG:** Dedicated JTAG port pins
- 2 **SUSPEND:** Dedicated SUSPEND and dual-purpose AWAKE Power Management pins
- 43 **GND:** Ground
- 22 **VCCO:** Output voltage supply for bank
- 9 **VCCINT:** Internal core supply voltage (+1.2V)
- 8 **VCCAUX:** Auxiliary supply voltage

|        |               | Bank 0                           |                         |                                  |                         |                         |                           |                           |                         |                         |                        |
|--------|---------------|----------------------------------|-------------------------|----------------------------------|-------------------------|-------------------------|---------------------------|---------------------------|-------------------------|-------------------------|------------------------|
|        |               | 1                                | 2                       | 3                                | 4                       | 5                       | 6                         | 7                         | 8                       | 9                       | 10                     |
| Bank 3 | A             | GND                              | I/O<br>L32P_0<br>VREF_0 | I/O<br>L30P_0                    | I/O<br>L29P_0           | I/O<br>L26P_0           | I/O<br>L25P_0             | I/O<br>L24N_0             | I/O<br>L18N_0<br>GCLK11 | I/O<br>L18P_0<br>GCLK10 | I/O<br>L16P_0<br>GCLK6 |
|        | B             | I/O<br>L02P_3                    | I/O<br>L32N_0<br>PUDC_B | I/O<br>L30N_0                    | VCCO_0                  | I/O<br>L26N_0           | GND                       | I/O<br>L24P_0             | I/O<br>L20P_0           | I/O<br>L19P_0           | VCCO_0                 |
|        | C             | I/O<br>L03P_3                    | I/O<br>L02N_3           | GND                              | I/O<br>L29N_0           | I/O<br>L28P_0           | I/O<br>L25N_0             | I/O<br>L21P_0             | I/O<br>L20N_0           | I/O<br>L19N_0           | I/O<br>L16N_0<br>GCLK7 |
|        | D             | I/O<br>L05P_3                    | I/O<br>L03N_3           | I/O<br>L01N_3                    | I/O<br>L01P_3           | PROG_B                  | I/O<br>L28N_0             | VCCO_0                    | I/O<br>L21N_0           | GND                     | I/O<br>L17P_0<br>GCLK8 |
|        | E             | I/O<br>L05N_3                    | VCCO_3                  | I/O<br>L10P_3                    | TMS                     | GND                     | I/O<br>L31P_0             | I/O<br>L27P_0             | I/O<br>L23P_0           | I/O<br>L22P_0           | I/O<br>L17N_0<br>GCLK9 |
|        | F             | I/O<br>L13P_3                    | I/O<br>L10N_3           | I/O<br>L09P_3                    | I/O<br>L06P_3           | TDI                     | I/O<br>L31N_0             | I/O<br>L27N_0             | I/O<br>L23N_0           | I/O<br>L22N_0<br>VREF_0 | VCCO_0                 |
|        | G             | I/O<br>L13N_3<br>VREF_3          | GND                     | I/O<br>L12P_3                    | I/O<br>L09N_3           | I/O<br>L06N_3           | INPUT<br>L04N_3<br>VREF_3 | INPUT<br>L04P_3           | INPUT                   | INPUT                   | INPUT                  |
|        | H             | VCCAUX                           | I/O<br>L12N_3           | I/O<br>L14N_3                    | I/O<br>L08N_3           | VCCO_3                  | I/O<br>L08P_3             | INPUT                     | GND                     | INPUT                   | INPUT                  |
|        | J             | I/O<br>L17P_3<br>LHCLK0          | I/O<br>L16N_3           | I/O<br>L16P_3                    | I/O<br>L14P_3           | I/O<br>L07N_3           | I/O<br>L07P_3             | INPUT<br>L11N_3<br>VREF_3 | INPUT<br>L11P_3         | GND                     | VCCINT                 |
|        | K             | GND                              | I/O<br>L17N_3<br>LHCLK1 | I/O<br>L18P_3<br>LHCLK2          | I/O<br>L20P_3<br>LHCLK4 | INPUT<br>L19N_3         | INPUT<br>L19P_3           | INPUT<br>L15N_3           | INPUT<br>L15P_3         | VCCINT                  | GND                    |
|        | L             | I/O<br>L21P_3<br>TRDY2<br>LHCLK6 | VCCO_3                  | I/O<br>L18N_3<br>IRDY2<br>LHCLK3 | GND                     | I/O<br>L20N_3<br>LHCLK5 | INPUT<br>L23N_3           | INPUT<br>L23P_3           | VCCAUX                  | GND                     | VCCINT                 |
|        | M             | I/O<br>L21N_3<br>LHCLK7          | I/O<br>L22P_3<br>VREF_3 | I/O<br>L22N_3                    | I/O<br>L24P_3           | I/O<br>L24N_3           | INPUT<br>L31P_3           | INPUT<br>L27N_3           | INPUT<br>L27P_3         | VCCINT                  | GND                    |
|        | N             | I/O<br>L25P_3                    | I/O<br>L25N_3           | I/O<br>L26P_3                    | I/O<br>L26N_3           | VCCO_3                  | INPUT<br>L35N_3           | INPUT<br>L31N_3           | GND                     | INPUT<br>VREF_2         | VCCINT                 |
|        | P             | I/O<br>L28P_3                    | GND                     | I/O<br>L29P_3                    | I/O<br>L29N_3           | INPUT<br>L35P_3         | INPUT<br>L39P_3           | INPUT<br>L39N_3<br>VREF_3 | INPUT<br>VREF_2         | INPUT                   | INPUT<br>VREF_2        |
|        | R             | I/O<br>L28N_3                    | I/O<br>L30P_3           | I/O<br>L30N_3                    | I/O<br>L33N_3           | I/O<br>L36P_3           | GND                       | I/O<br>L04N_2             | INPUT                   | GND                     | INPUT                  |
|        | T             | I/O<br>L32P_3<br>VREF_3          | I/O<br>L32N_3           | I/O<br>L33P_3                    | I/O<br>L36N_3           | VCCAUX                  | I/O<br>L04P_2             | I/O<br>L06P_2             | I/O<br>L07P_2<br>RDWR_B | I/O<br>L11P_2           | I/O<br>L14N_2<br>D4    |
| U      | I/O<br>L34P_3 | VCCO_3                           | I/O<br>L34N_3           | I/O<br>L01P_2<br>M1              | I/O<br>L05N_2           | I/O<br>L06N_2           | I/O<br>L07N_2<br>VS2      | VCCO_2                    | I/O<br>L11N_2           | I/O<br>L14P_2<br>D5     |                        |
| V      | I/O<br>L37P_3 | I/O<br>L37N_3                    | GND                     | I/O<br>L01N_2<br>M0              | I/O<br>L05P_2           | I/O<br>L09P_2<br>VS1    | I/O<br>L12P_2<br>D7       | I/O<br>L13P_2             | I/O<br>L13N_2           | I/O<br>L16P_2<br>GCLK14 |                        |
| W      | I/O<br>L38P_3 | I/O<br>L38N_3                    | I/O<br>L02P_2<br>M2     | I/O<br>L03N_2                    | VCCO_2                  | I/O<br>L09N_2<br>VS0    | GND                       | I/O<br>L12N_2<br>D6       | I/O<br>L15P_2<br>GCLK12 | I/O<br>L16N_2<br>GCLK15 |                        |
| Y      | GND           | I/O<br>L02N_2<br>CSO_B           | I/O<br>L03P_2           | I/O<br>L08P_2                    | I/O<br>L08N_2           | I/O<br>L10P_2           | I/O<br>L10N_2             | VCCAUX                    | I/O<br>L15N_2<br>GCLK13 | GND                     |                        |
|        |               | Bank 2                           |                         |                                  |                         |                         |                           |                           |                         |                         |                        |

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Figure 22: FGG400 Package Footprint (Top View)

| Bank 0                 |                                |                         |                           |                           |                      |                         |                                  |                         |                                  | Right Half of FGG400 Package (Top View) |
|------------------------|--------------------------------|-------------------------|---------------------------|---------------------------|----------------------|-------------------------|----------------------------------|-------------------------|----------------------------------|---|
| 11                     | 12                             | 13                      | 14                        | 15                        | 16                   | 17                      | 18                               | 19                      | 20                               |   |
| GND                    | I/O<br>L13N_0                  | VCCAUX                  | I/O<br>L07N_0             | I/O<br>L08N_0             | I/O<br>L05N_0        | I/O<br>L04N_0           | I/O<br>L01N_0                    | TCK                     | GND                              | A                                       |
| I/O<br>L14P_0          | I/O<br>L13P_0                  | I/O<br>L11P_0           | GND                       | I/O<br>L08P_0             | VCCO_0               | I/O<br>L04P_0<br>VREF_0 | I/O<br>L01P_0                    | I/O<br>L38N_1<br>A25    | I/O<br>L38P_1<br>A24             | B                                       |
| I/O<br>L14N_0          | I/O<br>L11N_0                  | I/O<br>L10N_0<br>VREF_0 | I/O<br>L07P_0             | I/O<br>L06N_0             | I/O<br>L05P_0        | I/O<br>L02N_0           | GND                              | I/O<br>L37N_1<br>A23    | I/O<br>L37P_1<br>A22             | C                                       |
| I/O<br>L15P_0<br>GCLK4 | I/O<br>L12P_0                  | VCCO_0                  | I/O<br>L10P_0             | I/O<br>L06P_0             | I/O<br>L03P_0        | I/O<br>L02P_0<br>VREF_0 | I/O<br>L34N_1                    | VCCO_1                  | I/O<br>L34P_1                    | D                                       |
| I/O<br>L15N_0<br>GCLK5 | GND                            | I/O<br>L09P_0           | INPUT                     | I/O<br>L03N_0             | VCCAUX               | TDO                     | I/O<br>L33P_1                    | I/O<br>L32N_1           | I/O<br>L32P_1                    | E                                       |
| INPUT                  | I/O<br>L12N_0                  | I/O<br>L09N_0           | INPUT                     | GND                       | I/O<br>L36N_1<br>A21 | I/O<br>L33N_1           | I/O<br>L30N_1<br>A19             | I/O<br>L29N_1<br>A17    | I/O<br>L29P_1<br>A16             | F                                       |
| INPUT<br>VREF_0        | INPUT                          | INPUT                   | INPUT<br>L39N_1           | INPUT<br>L36P_1<br>VREF_1 | I/O<br>L36P_1<br>A20 | I/O<br>L30P_1<br>A18    | I/O<br>L28P_1                    | GND                     | I/O<br>L26N_1<br>A15             | G                                       |
| INPUT                  | INPUT                          | GND                     | INPUT<br>L35N_1           | INPUT<br>L35P_1           | VCCO_1               | I/O<br>L28N_1           | I/O<br>L25N_1<br>A13             | I/O<br>L25P_1<br>A12    | I/O<br>L26P_1<br>A14             | H                                       |
| GND                    | VCCINT                         | INPUT<br>L31N_1         | INPUT<br>L31P_1<br>VREF_1 | INPUT<br>L27N_1           | INPUT<br>L27P_1      | I/O<br>L24P_1           | I/O<br>L22N_1<br>A11             | I/O<br>L22P_1<br>A10    | I/O<br>L21N_1<br>RHCLK7          | J                                       |
| VCCINT                 | GND                            | VCCAUX                  | INPUT<br>L23N_1           | INPUT<br>L23P_1<br>VREF_1 | I/O<br>L24N_1        | GND                     | I/O<br>L20P_1<br>RHCLK4          | VCCO_1                  | I/O<br>L21P_1<br>IRDY1<br>RHCLK6 | K                                       |
| GND                    | VCCINT                         | INPUT<br>L19N_1         | INPUT<br>L19P_1           | I/O<br>L16P_1<br>A8       | I/O<br>L16N_1<br>A9  | I/O<br>L20N_1<br>RHCLK5 | I/O<br>L18N_1<br>TRDY1<br>RHCLK3 | I/O<br>L18P_1<br>RHCLK2 | GND                              | L                                       |
| VCCINT                 | GND                            | INPUT<br>L15N_1         | INPUT<br>L15P_1<br>VREF_1 | INPUT<br>L11N_1<br>VREF_1 | INPUT<br>L11P_1      | I/O<br>L14P_1<br>A6     | I/O<br>L14N_1<br>A7              | I/O<br>L17P_1<br>RHCLK0 | I/O<br>L17N_1<br>RHCLK1          | M                                       |
| GND                    | INPUT<br>VREF_2                | GND                     | INPUT<br>VREF_1           | I/O<br>L12P_1<br>A2       | VCCO_1               | I/O<br>L12N_1<br>A3     | I/O<br>L13P_1<br>A4              | I/O<br>L13N_1<br>A5     | VCCAUX                           | N                                       |
| INPUT<br>VREF_2        | INPUT                          | INPUT                   | INPUT<br>L04P_1           | INPUT<br>L04N_1<br>VREF_1 | I/O<br>L07P_1        | I/O<br>L07N_1           | I/O<br>L10P_1                    | GND                     | I/O<br>L10N_1<br>VREF_1          | P                                       |
| VCCO_2                 | I/O<br>L19N_2                  | I/O<br>L23N_2           | INPUT<br>VREF_2           | SUSPEND                   | I/O<br>L03N_1<br>A1  | I/O<br>L08N_1           | I/O<br>L08P_1                    | I/O<br>L09P_1           | I/O<br>L09N_1                    | R                                       |
| INPUT                  | I/O<br>L19P_2                  | I/O<br>L23P_2           | I/O<br>L25N_2             | I/O<br>L27N_2             | GND                  | I/O<br>L03P_1<br>A0     | I/O<br>L05P_1                    | VCCO_1                  | I/O<br>L05N_1                    | T                                       |
| I/O<br>L18P_2<br>GCLK2 | GND                            | I/O<br>L22P_2<br>AWAKE  | VCCO_2                    | I/O<br>L27P_2             | I/O<br>L29N_2        | I/O<br>L31N_2           | I/O<br>L02N_1<br>LDC0            | I/O<br>L06P_1           | I/O<br>L06N_1                    | U                                       |
| I/O<br>L17N_2<br>GCLK1 | I/O<br>L18N_2<br>GCLK3         | I/O<br>L22N_2<br>DOUT   | I/O<br>L25P_2             | I/O<br>L26N_2<br>D1       | I/O<br>L29P_2        | I/O<br>L31P_2           | GND                              | I/O<br>L02P_1<br>LDC1   | I/O<br>L01N_1<br>LDC2            | V                                       |
| VCCO_2                 | I/O<br>L20N_2<br>MOSI<br>CSL_B | I/O<br>L21N_2           | I/O<br>L24N_2<br>D3       | GND                       | I/O<br>L28N_2        | VCCO_2                  | I/O<br>L32P_2<br>D0<br>DIN/MISO  | DONE                    | I/O<br>L01P_1<br>HDC             | W                                       |
| I/O<br>L17P_2<br>GCLK0 | I/O<br>L20P_2                  | I/O<br>L21P_2           | I/O<br>L24P_2<br>INIT_B   | I/O<br>L26P_2<br>D2       | I/O<br>L28P_2        | I/O<br>L30P_2           | I/O<br>L30N_2                    | I/O<br>L32N_2<br>CCLK   | GND                              | Y                                       |
| Bank 2                 |                                |                         |                           |                           |                      |                         |                                  |                         |                                  |   |

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Figure 22: FGG400 Package Footprint (Top View)

## FGG484: 484-Ball Fine-Pitch Ball Grid Array

The 484-ball fine-pitch ball grid array, FGG484, supports both the XC3S700AN and the XC3S1400AN FPGAs. There are three pinout differences, as described in [Table 81](#).

[Table 78](#) lists all the FGG484 package pins. They are sorted by bank number and then by pin name. Pins that form a differential I/O pair appear together in the table. The table also shows the pin number for each pin and the pin type (as defined in [Table 62](#)).

The shaded rows indicate pinout differences between the XC3S700AN and the XC3S1400AN FPGAs. The XC3S700AN has three unconnected balls, indicated as N.C. and with a black diamond (◆) in [Table 78](#) and [Figure 23](#).

An electronic version of this package pinout table and footprint diagram is available for download from the Xilinx website at: [www.xilinx.com/support/documentation/data\\_sheets/s3a\\_pin.zip](http://www.xilinx.com/support/documentation/data_sheets/s3a_pin.zip).

### Pinout Table

Table 78: Spartan-3AN FGG484 Pinout

| Bank | Pin Name         | FGG484 Ball | Type |
|------|------------------|-------------|------|
| 0    | IO_L01N_0        | D18         | I/O  |
| 0    | IO_L01P_0        | E17         | I/O  |
| 0    | IO_L02N_0        | C19         | I/O  |
| 0    | IO_L02P_0/VREF_0 | D19         | VREF |
| 0    | IO_L03N_0        | A20         | I/O  |
| 0    | IO_L03P_0        | B20         | I/O  |
| 0    | IO_L04N_0        | F15         | I/O  |
| 0    | IO_L04P_0        | E15         | I/O  |
| 0    | IO_L05N_0        | A18         | I/O  |
| 0    | IO_L05P_0        | C18         | I/O  |
| 0    | IO_L06N_0        | A19         | I/O  |
| 0    | IO_L06P_0/VREF_0 | B19         | VREF |
| 0    | IO_L07N_0        | C17         | I/O  |
| 0    | IO_L07P_0        | D17         | I/O  |
| 0    | IO_L08N_0        | C16         | I/O  |
| 0    | IO_L08P_0        | D16         | I/O  |
| 0    | IO_L09N_0        | E14         | I/O  |
| 0    | IO_L09P_0        | C14         | I/O  |
| 0    | IO_L10N_0        | A17         | I/O  |
| 0    | IO_L10P_0        | B17         | I/O  |
| 0    | IO_L11N_0        | C15         | I/O  |
| 0    | IO_L11P_0        | D15         | I/O  |
| 0    | IO_L12N_0/VREF_0 | A15         | VREF |
| 0    | IO_L12P_0        | A16         | I/O  |
| 0    | IO_L13N_0        | A14         | I/O  |
| 0    | IO_L13P_0        | B15         | I/O  |
| 0    | IO_L14N_0        | E13         | I/O  |
| 0    | IO_L14P_0        | F13         | I/O  |

Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank | Pin Name         | FGG484 Ball | Type |
|------|------------------|-------------|------|
| 0    | IO_L15N_0        | C13         | I/O  |
| 0    | IO_L15P_0        | D13         | I/O  |
| 0    | IO_L16N_0        | A13         | I/O  |
| 0    | IO_L16P_0        | B13         | I/O  |
| 0    | IO_L17N_0/GCLK5  | E12         | GCLK |
| 0    | IO_L17P_0/GCLK4  | C12         | GCLK |
| 0    | IO_L18N_0/GCLK7  | A11         | GCLK |
| 0    | IO_L18P_0/GCLK6  | A12         | GCLK |
| 0    | IO_L19N_0/GCLK9  | C11         | GCLK |
| 0    | IO_L19P_0/GCLK8  | B11         | GCLK |
| 0    | IO_L20N_0/GCLK11 | E11         | GCLK |
| 0    | IO_L20P_0/GCLK10 | D11         | GCLK |
| 0    | IO_L21N_0        | C10         | I/O  |
| 0    | IO_L21P_0        | A10         | I/O  |
| 0    | IO_L22N_0        | A8          | I/O  |
| 0    | IO_L22P_0        | A9          | I/O  |
| 0    | IO_L23N_0        | E10         | I/O  |
| 0    | IO_L23P_0        | D10         | I/O  |
| 0    | IO_L24N_0/VREF_0 | C9          | VREF |
| 0    | IO_L24P_0        | B9          | I/O  |
| 0    | IO_L25N_0        | C8          | I/O  |
| 0    | IO_L25P_0        | B8          | I/O  |
| 0    | IO_L26N_0        | A6          | I/O  |
| 0    | IO_L26P_0        | A7          | I/O  |
| 0    | IO_L27N_0        | C7          | I/O  |
| 0    | IO_L27P_0        | D7          | I/O  |
| 0    | IO_L28N_0        | A5          | I/O  |
| 0    | IO_L28P_0        | B6          | I/O  |



Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank | Pin Name         | FGG484 Ball | Type  |
|------|------------------|-------------|-------|
| 0    | IO_L29N_0        | D6          | I/O   |
| 0    | IO_L29P_0        | C6          | I/O   |
| 0    | IO_L30N_0        | D8          | I/O   |
| 0    | IO_L30P_0        | E9          | I/O   |
| 0    | IO_L31N_0        | B4          | I/O   |
| 0    | IO_L31P_0        | A4          | I/O   |
| 0    | IO_L32N_0        | D5          | I/O   |
| 0    | IO_L32P_0        | C5          | I/O   |
| 0    | IO_L33N_0        | B3          | I/O   |
| 0    | IO_L33P_0        | A3          | I/O   |
| 0    | IO_L34N_0        | F8          | I/O   |
| 0    | IO_L34P_0        | E7          | I/O   |
| 0    | IO_L35N_0        | E6          | I/O   |
| 0    | IO_L35P_0        | F7          | I/O   |
| 0    | IO_L36N_0/PUDC_B | A2          | DUAL  |
| 0    | IO_L36P_0/VREF_0 | B2          | VREF  |
| 0    | IP_0             | E16         | INPUT |
| 0    | IP_0             | E8          | INPUT |
| 0    | IP_0             | F10         | INPUT |
| 0    | IP_0             | F12         | INPUT |
| 0    | IP_0             | F16         | INPUT |
| 0    | IP_0             | G10         | INPUT |
| 0    | IP_0             | G11         | INPUT |
| 0    | IP_0             | G12         | INPUT |
| 0    | IP_0             | G13         | INPUT |
| 0    | IP_0             | G14         | INPUT |
| 0    | IP_0             | G15         | INPUT |
| 0    | IP_0             | G16         | INPUT |
| 0    | IP_0             | G7          | INPUT |
| 0    | IP_0             | G9          | INPUT |
| 0    | IP_0             | H10         | INPUT |
| 0    | IP_0             | H13         | INPUT |
| 0    | IP_0             | H14         | INPUT |
| 0    | IP_0/VREF_0      | G8          | VREF  |
| 0    | IP_0/VREF_0      | H12         | VREF  |
| 0    | IP_0/VREF_0      | H9          | VREF  |
| 0    | VCCO_0           | B10         | VCCO  |
| 0    | VCCO_0           | B14         | VCCO  |
| 0    | VCCO_0           | B18         | VCCO  |
| 0    | VCCO_0           | B5          | VCCO  |

Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank | Pin Name               | FGG484 Ball | Type  |
|------|------------------------|-------------|-------|
| 0    | VCCO_0                 | F14         | VCCO  |
| 0    | VCCO_0                 | F9          | VCCO  |
| 1    | IO_L01N_1/LDC2         | Y21         | DUAL  |
| 1    | IO_L01P_1/HDC          | AA22        | DUAL  |
| 1    | IO_L02N_1/LDC0         | W20         | DUAL  |
| 1    | IO_L02P_1/LDC1         | W19         | DUAL  |
| 1    | IO_L03N_1/A1           | T18         | DUAL  |
| 1    | IO_L03P_1/A0           | T17         | DUAL  |
| 1    | IO_L05N_1              | W21         | I/O   |
| 1    | IO_L05P_1              | Y22         | I/O   |
| 1    | IO_L06N_1              | V20         | I/O   |
| 1    | IO_L06P_1              | V19         | I/O   |
| 1    | IO_L07N_1              | V22         | I/O   |
| 1    | IO_L07P_1              | W22         | I/O   |
| 1    | IO_L09N_1              | U21         | I/O   |
| 1    | IO_L09P_1              | U22         | I/O   |
| 1    | IO_L10N_1              | U19         | I/O   |
| 1    | IO_L10P_1              | U20         | I/O   |
| 1    | IO_L11N_1              | T22         | I/O   |
| 1    | IO_L11P_1              | T20         | I/O   |
| 1    | IO_L13N_1              | T19         | I/O   |
| 1    | IO_L13P_1              | R20         | I/O   |
| 1    | IO_L14N_1              | R22         | I/O   |
| 1    | IO_L14P_1              | R21         | I/O   |
| 1    | IO_L15N_1/VREF_1       | P22         | VREF  |
| 1    | IO_L15P_1              | P20         | I/O   |
| 1    | IO_L17N_1/A3           | P18         | DUAL  |
| 1    | IO_L17P_1/A2           | R19         | DUAL  |
| 1    | IO_L18N_1/A5           | N21         | DUAL  |
| 1    | IO_L18P_1/A4           | N22         | DUAL  |
| 1    | IO_L19N_1/A7           | N19         | DUAL  |
| 1    | IO_L19P_1/A6           | N20         | DUAL  |
| 1    | IO_L20N_1/A9           | N17         | DUAL  |
| 1    | IO_L20P_1/A8           | N18         | DUAL  |
| 1    | IO_L21N_1/RHCLK1       | L22         | RHCLK |
| 1    | IO_L21P_1/RHCLK0       | M22         | RHCLK |
| 1    | IO_L22N_1/TRDY1/RHCLK3 | L20         | RHCLK |
| 1    | IO_L22P_1/RHCLK2       | L21         | RHCLK |
| 1    | IO_L24N_1/RHCLK5       | M20         | RHCLK |
| 1    | IO_L24P_1/RHCLK4       | M18         | RHCLK |

**Table 78: Spartan-3AN FGG484 Pinout (Cont'd)**

| Bank | Pin Name               | FGG484 Ball | Type  |
|------|------------------------|-------------|-------|
| 1    | IO_L25N_1/RHCLK7       | K19         | RHCLK |
| 1    | IO_L25P_1/IRDY1/RHCLK6 | K20         | RHCLK |
| 1    | IO_L26N_1/A11          | J22         | DUAL  |
| 1    | IO_L26P_1/A10          | K22         | DUAL  |
| 1    | IO_L28N_1              | L19         | I/O   |
| 1    | IO_L28P_1              | L18         | I/O   |
| 1    | IO_L29N_1/A13          | J20         | DUAL  |
| 1    | IO_L29P_1/A12          | J21         | DUAL  |
| 1    | IO_L30N_1/A15          | G22         | DUAL  |
| 1    | IO_L30P_1/A14          | H22         | DUAL  |
| 1    | IO_L32N_1              | K18         | I/O   |
| 1    | IO_L32P_1              | K17         | I/O   |
| 1    | IO_L33N_1/A17          | H20         | DUAL  |
| 1    | IO_L33P_1/A16          | H21         | DUAL  |
| 1    | IO_L34N_1/A19          | F21         | DUAL  |
| 1    | IO_L34P_1/A18          | F22         | DUAL  |
| 1    | IO_L36N_1              | G20         | I/O   |
| 1    | IO_L36P_1              | G19         | I/O   |
| 1    | IO_L37N_1              | H19         | I/O   |
| 1    | IO_L37P_1              | J18         | I/O   |
| 1    | IO_L38N_1              | F20         | I/O   |
| 1    | IO_L38P_1              | E20         | I/O   |
| 1    | IO_L40N_1              | F18         | I/O   |
| 1    | IO_L40P_1              | F19         | I/O   |
| 1    | IO_L41N_1              | D22         | I/O   |
| 1    | IO_L41P_1              | E22         | I/O   |
| 1    | IO_L42N_1              | D20         | I/O   |
| 1    | IO_L42P_1              | D21         | I/O   |
| 1    | IO_L44N_1/A21          | C21         | DUAL  |
| 1    | IO_L44P_1/A20          | C22         | DUAL  |
| 1    | IO_L45N_1/A23          | B21         | DUAL  |
| 1    | IO_L45P_1/A22          | B22         | DUAL  |
| 1    | IO_L46N_1/A25          | G17         | DUAL  |
| 1    | IO_L46P_1/A24          | G18         | DUAL  |
| 1    | IP_L04N_1/VREF_1       | R16         | VREF  |
| 1    | IP_L04P_1              | R15         | INPUT |
| 1    | IP_L08N_1              | P16         | INPUT |
| 1    | IP_L08P_1              | P15         | INPUT |
| 1    | IP_L12N_1/VREF_1       | R18         | VREF  |
| 1    | IP_L12P_1              | R17         | INPUT |

**Table 78: Spartan-3AN FGG484 Pinout (Cont'd)**

| Bank | Pin Name         | FGG484 Ball | Type  |
|------|------------------|-------------|-------|
| 1    | IP_L16N_1/VREF_1 | N16         | VREF  |
| 1    | IP_L16P_1        | N15         | INPUT |
| 1    | IP_L23N_1        | M16         | INPUT |
| 1    | IP_L23P_1        | M17         | INPUT |
| 1    | IP_L27N_1        | L16         | INPUT |
| 1    | IP_L27P_1/VREF_1 | M15         | VREF  |
| 1    | IP_L31N_1        | K16         | INPUT |
| 1    | IP_L31P_1        | L15         | INPUT |
| 1    | IP_L35N_1        | K15         | INPUT |
| 1    | IP_L35P_1/VREF_1 | K14         | VREF  |
| 1    | IP_L39N_1        | H18         | INPUT |
| 1    | IP_L39P_1        | H17         | INPUT |
| 1    | IP_L43N_1/VREF_1 | J15         | VREF  |
| 1    | IP_L43P_1        | J16         | INPUT |
| 1    | IP_L47N_1        | H15         | INPUT |
| 1    | IP_L47P_1/VREF_1 | H16         | VREF  |
| 1    | VCCO_1           | E21         | VCCO  |
| 1    | VCCO_1           | J17         | VCCO  |
| 1    | VCCO_1           | K21         | VCCO  |
| 1    | VCCO_1           | P17         | VCCO  |
| 1    | VCCO_1           | P21         | VCCO  |
| 1    | VCCO_1           | V21         | VCCO  |
| 2    | IO_L01N_2/M0     | W5          | DUAL  |
| 2    | IO_L01P_2/M1     | V6          | DUAL  |
| 2    | IO_L02N_2/CSO_B  | Y4          | DUAL  |
| 2    | IO_L02P_2/M2     | W4          | DUAL  |
| 2    | IO_L03N_2        | AA3         | I/O   |
| 2    | IO_L03P_2        | AB2         | I/O   |
| 2    | IO_L04N_2        | AA4         | I/O   |
| 2    | IO_L04P_2        | AB3         | I/O   |
| 2    | IO_L05N_2        | Y5          | I/O   |
| 2    | IO_L05P_2        | W6          | I/O   |
| 2    | IO_L06N_2        | AB5         | I/O   |
| 2    | IO_L06P_2        | AB4         | I/O   |
| 2    | IO_L07N_2        | Y6          | I/O   |
| 2    | IO_L07P_2        | W7          | I/O   |
| 2    | IO_L08N_2        | AB6         | I/O   |
| 2    | IO_L08P_2        | AA6         | I/O   |
| 2    | IO_L09N_2/VS2    | W9          | DUAL  |
| 2    | IO_L09P_2/RDWR_B | V9          | DUAL  |

Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank | Pin Name             | FGG484 Ball | Type     |
|------|----------------------|-------------|----------|
| 2    | IO_L10N_2            | AB7         | I/O      |
| 2    | IO_L10P_2            | Y7          | I/O      |
| 2    | IO_L11N_2/VS0        | Y8          | DUAL     |
| 2    | IO_L11P_2/VS1        | W8          | DUAL     |
| 2    | IO_L12N_2            | AB8         | I/O      |
| 2    | IO_L12P_2            | AA8         | I/O      |
| 2    | IO_L13N_2            | Y10         | I/O      |
| 2    | IO_L13P_2            | V10         | I/O      |
| 2    | IO_L14N_2/D6         | AB9         | DUAL     |
| 2    | IO_L14P_2/D7         | Y9          | DUAL     |
| 2    | IO_L15N_2            | AB10        | I/O      |
| 2    | IO_L15P_2            | AA10        | I/O      |
| 2    | IO_L16N_2/D4         | AB11        | DUAL     |
| 2    | IO_L16P_2/D5         | Y11         | DUAL     |
| 2    | IO_L17N_2/GCLK13     | V11         | GCLK     |
| 2    | IO_L17P_2/GCLK12     | U11         | GCLK     |
| 2    | IO_L18N_2/GCLK15     | Y12         | GCLK     |
| 2    | IO_L18P_2/GCLK14     | W12         | GCLK     |
| 2    | IO_L19N_2/GCLK1      | AB12        | GCLK     |
| 2    | IO_L19P_2/GCLK0      | AA12        | GCLK     |
| 2    | IO_L20N_2/GCLK3      | U12         | GCLK     |
| 2    | IO_L20P_2/GCLK2      | V12         | GCLK     |
| 2    | IO_L21N_2            | Y13         | I/O      |
| 2    | IO_L21P_2            | AB13        | I/O      |
| 2    | IO_L22N_2/MOSI/CSI_B | AB14        | DUAL     |
| 2    | IO_L22P_2            | AA14        | I/O      |
| 2    | IO_L23N_2            | Y14         | I/O      |
| 2    | IO_L23P_2            | W13         | I/O      |
| 2    | IO_L24N_2/DOOUT      | AA15        | DUAL     |
| 2    | IO_L24P_2/AWAKE      | AB15        | PWR MGMT |
| 2    | IO_L25N_2            | Y15         | I/O      |
| 2    | IO_L25P_2            | W15         | I/O      |
| 2    | IO_L26N_2/D3         | U13         | DUAL     |
| 2    | IO_L26P_2/INIT_B     | V13         | DUAL     |
| 2    | IO_L27N_2            | Y16         | I/O      |
| 2    | IO_L27P_2            | AB16        | I/O      |
| 2    | IO_L28N_2/D1         | Y17         | DUAL     |
| 2    | IO_L28P_2/D2         | AA17        | DUAL     |
| 2    | IO_L29N_2            | AB18        | I/O      |
| 2    | IO_L29P_2            | AB17        | I/O      |

Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank | Pin Name                                     | FGG484 Ball | Type  |
|------|--|-------------|-------|
| 2    | IO_L30N_2                                    | V15         | I/O   |
| 2    | IO_L30P_2                                    | V14         | I/O   |
| 2    | IO_L31N_2                                    | V16         | I/O   |
| 2    | IO_L31P_2                                    | W16         | I/O   |
| 2    | IO_L32N_2                                    | AA19        | I/O   |
| 2    | IO_L32P_2                                    | AB19        | I/O   |
| 2    | IO_L33N_2                                    | V17         | I/O   |
| 2    | IO_L33P_2                                    | W18         | I/O   |
| 2    | IO_L34N_2                                    | W17         | I/O   |
| 2    | IO_L34P_2                                    | Y18         | I/O   |
| 2    | IO_L35N_2                                    | AA21        | I/O   |
| 2    | IO_L35P_2                                    | AB21        | I/O   |
| 2    | IO_L36N_2/CCLK                               | AA20        | DUAL  |
| 2    | IO_L36P_2/D0/DIN/MISO                        | AB20        | DUAL  |
| 2    | IP_2   | P12         | INPUT |
| 2    | IP_2   | R10         | INPUT |
| 2    | IP_2   | R11         | INPUT |
| 2    | IP_2   | R9          | INPUT |
| 2    | IP_2   | T13         | INPUT |
| 2    | IP_2   | T14         | INPUT |
| 2    | IP_2   | T9          | INPUT |
| 2    | IP_2   | U10         | INPUT |
| 2    | IP_2   | U15         | INPUT |
| 2    | XC3S1400AN: IP_2<br>XC3S700AN: N.C. ♦        | U16         | INPUT |
| 2    | XC3S1400AN: IP_2<br>XC3S700AN: N.C. ♦        | U7          | INPUT |
| 2    | IP_2   | U8          | INPUT |
| 2    | IP_2   | V7          | INPUT |
| 2    | IP_2/VREF_2                                  | R12         | VREF  |
| 2    | IP_2/VREF_2                                  | R13         | VREF  |
| 2    | IP_2/VREF_2                                  | R14         | VREF  |
| 2    | IP_2/VREF_2                                  | T10         | VREF  |
| 2    | IP_2/VREF_2                                  | T11         | VREF  |
| 2    | IP_2/VREF_2                                  | T15         | VREF  |
| 2    | IP_2/VREF_2                                  | T16         | VREF  |
| 2    | IP_2/VREF_2                                  | T7          | VREF  |
| 2    | XC3S1400AN: IP_2/VREF_2<br>XC3S700AN: N.C. ♦ | T8          | VREF  |
| 2    | IP_2/VREF_2                                  | V8          | VREF  |

Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank | Pin Name         | FGG484 Ball | Type  |
|------|------------------|-------------|-------|
| 2    | VCCO_2           | AA13        | VCCO  |
| 2    | VCCO_2           | AA18        | VCCO  |
| 2    | VCCO_2           | AA5         | VCCO  |
| 2    | VCCO_2           | AA9         | VCCO  |
| 2    | VCCO_2           | U14         | VCCO  |
| 2    | VCCO_2           | U9          | VCCO  |
| 3    | IO_L01N_3        | D2          | I/O   |
| 3    | IO_L01P_3        | C1          | I/O   |
| 3    | IO_L02N_3        | C2          | I/O   |
| 3    | IO_L02P_3        | B1          | I/O   |
| 3    | IO_L03N_3        | E4          | I/O   |
| 3    | IO_L03P_3        | D3          | I/O   |
| 3    | IO_L05N_3        | G5          | I/O   |
| 3    | IO_L05P_3        | G6          | I/O   |
| 3    | IO_L06N_3        | E1          | I/O   |
| 3    | IO_L06P_3        | D1          | I/O   |
| 3    | IO_L07N_3        | E3          | I/O   |
| 3    | IO_L07P_3        | F4          | I/O   |
| 3    | IO_L08N_3        | G4          | I/O   |
| 3    | IO_L08P_3        | F3          | I/O   |
| 3    | IO_L09N_3        | H6          | I/O   |
| 3    | IO_L09P_3        | H5          | I/O   |
| 3    | IO_L10N_3        | J5          | I/O   |
| 3    | IO_L10P_3        | K6          | I/O   |
| 3    | IO_L12N_3        | F1          | I/O   |
| 3    | IO_L12P_3        | F2          | I/O   |
| 3    | IO_L13N_3        | G1          | I/O   |
| 3    | IO_L13P_3        | G3          | I/O   |
| 3    | IO_L14N_3        | H3          | I/O   |
| 3    | IO_L14P_3        | H4          | I/O   |
| 3    | IO_L16N_3        | H1          | I/O   |
| 3    | IO_L16P_3        | H2          | I/O   |
| 3    | IO_L17N_3/VREF_3 | J1          | VREF  |
| 3    | IO_L17P_3        | J3          | I/O   |
| 3    | IO_L18N_3        | K4          | I/O   |
| 3    | IO_L18P_3        | K5          | I/O   |
| 3    | IO_L20N_3        | K2          | I/O   |
| 3    | IO_L20P_3        | K3          | I/O   |
| 3    | IO_L21N_3/LHCLK1 | L3          | LHCLK |
| 3    | IO_L21P_3/LHCLK0 | L5          | LHCLK |

Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank | Pin Name               | FGG484 Ball | Type  |
|------|------------------------|-------------|-------|
| 3    | IO_L22N_3/IRDY2/LHCLK3 | L1          | LHCLK |
| 3    | IO_L22P_3/LHCLK2       | K1          | LHCLK |
| 3    | IO_L24N_3/LHCLK5       | M2          | LHCLK |
| 3    | IO_L24P_3/LHCLK4       | M1          | LHCLK |
| 3    | IO_L25N_3/LHCLK7       | M4          | LHCLK |
| 3    | IO_L25P_3/TRDY2/LHCLK6 | M3          | LHCLK |
| 3    | IO_L26N_3              | N3          | I/O   |
| 3    | IO_L26P_3/VREF_3       | N1          | VREF  |
| 3    | IO_L28N_3              | P2          | I/O   |
| 3    | IO_L28P_3              | P1          | I/O   |
| 3    | IO_L29N_3              | P5          | I/O   |
| 3    | IO_L29P_3              | P3          | I/O   |
| 3    | IO_L30N_3              | N4          | I/O   |
| 3    | IO_L30P_3              | M5          | I/O   |
| 3    | IO_L32N_3              | R2          | I/O   |
| 3    | IO_L32P_3              | R1          | I/O   |
| 3    | IO_L33N_3              | R4          | I/O   |
| 3    | IO_L33P_3              | R3          | I/O   |
| 3    | IO_L34N_3              | T4          | I/O   |
| 3    | IO_L34P_3              | R5          | I/O   |
| 3    | IO_L36N_3              | T3          | I/O   |
| 3    | IO_L36P_3/VREF_3       | T1          | VREF  |
| 3    | IO_L37N_3              | U2          | I/O   |
| 3    | IO_L37P_3              | U1          | I/O   |
| 3    | IO_L38N_3              | V3          | I/O   |
| 3    | IO_L38P_3              | V1          | I/O   |
| 3    | IO_L40N_3              | U5          | I/O   |
| 3    | IO_L40P_3              | T5          | I/O   |
| 3    | IO_L41N_3              | U4          | I/O   |
| 3    | IO_L41P_3              | U3          | I/O   |
| 3    | IO_L42N_3              | W2          | I/O   |
| 3    | IO_L42P_3              | W1          | I/O   |
| 3    | IO_L43N_3              | W3          | I/O   |
| 3    | IO_L43P_3              | V4          | I/O   |
| 3    | IO_L44N_3              | Y2          | I/O   |
| 3    | IO_L44P_3              | Y1          | I/O   |
| 3    | IO_L45N_3              | AA2         | I/O   |
| 3    | IO_L45P_3              | AA1         | I/O   |
| 3    | IP_3/VREF_3            | J8          | VREF  |
| 3    | IP_3/VREF_3            | R6          | VREF  |

Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank | Pin Name         | FGG484 Ball | Type  |
|------|------------------|-------------|-------|
| 3    | IP_L04N_3/VREF_3 | H7          | VREF  |
| 3    | IP_L04P_3        | H8          | INPUT |
| 3    | IP_L11N_3        | K8          | INPUT |
| 3    | IP_L11P_3        | J7          | INPUT |
| 3    | IP_L15N_3/VREF_3 | L8          | VREF  |
| 3    | IP_L15P_3        | K7          | INPUT |
| 3    | IP_L19N_3        | M8          | INPUT |
| 3    | IP_L19P_3        | L7          | INPUT |
| 3    | IP_L23N_3        | M6          | INPUT |
| 3    | IP_L23P_3        | M7          | INPUT |
| 3    | IP_L27N_3        | N9          | INPUT |
| 3    | IP_L27P_3        | N8          | INPUT |
| 3    | IP_L31N_3        | N5          | INPUT |
| 3    | IP_L31P_3        | N6          | INPUT |
| 3    | IP_L35N_3        | P8          | INPUT |
| 3    | IP_L35P_3        | N7          | INPUT |
| 3    | IP_L39N_3        | R8          | INPUT |
| 3    | IP_L39P_3        | P7          | INPUT |
| 3    | IP_L46N_3/VREF_3 | T6          | VREF  |
| 3    | IP_L46P_3        | R7          | INPUT |
| 3    | VCCO_3           | E2          | VCCO  |
| 3    | VCCO_3           | J2          | VCCO  |
| 3    | VCCO_3           | J6          | VCCO  |
| 3    | VCCO_3           | N2          | VCCO  |
| 3    | VCCO_3           | P6          | VCCO  |
| 3    | VCCO_3           | V2          | VCCO  |
| GND  | GND              | A1          | GND   |
| GND  | GND              | A22         | GND   |
| GND  | GND              | AA11        | GND   |
| GND  | GND              | AA16        | GND   |
| GND  | GND              | AA7         | GND   |
| GND  | GND              | AB1         | GND   |
| GND  | GND              | AB22        | GND   |
| GND  | GND              | B12         | GND   |
| GND  | GND              | B16         | GND   |
| GND  | GND              | B7          | GND   |
| GND  | GND              | C20         | GND   |
| GND  | GND              | C3          | GND   |
| GND  | GND              | D14         | GND   |
| GND  | GND              | D9          | GND   |

Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank   | Pin Name | FGG484 Ball | Type     |
|--------|----------|-------------|----------|
| GND    | GND      | F11         | GND      |
| GND    | GND      | F17         | GND      |
| GND    | GND      | F6          | GND      |
| GND    | GND      | G2          | GND      |
| GND    | GND      | G21         | GND      |
| GND    | GND      | J11         | GND      |
| GND    | GND      | J13         | GND      |
| GND    | GND      | J14         | GND      |
| GND    | GND      | J19         | GND      |
| GND    | GND      | J4          | GND      |
| GND    | GND      | J9          | GND      |
| GND    | GND      | K10         | GND      |
| GND    | GND      | K12         | GND      |
| GND    | GND      | L11         | GND      |
| GND    | GND      | L13         | GND      |
| GND    | GND      | L17         | GND      |
| GND    | GND      | L2          | GND      |
| GND    | GND      | L6          | GND      |
| GND    | GND      | L9          | GND      |
| GND    | GND      | M10         | GND      |
| GND    | GND      | M12         | GND      |
| GND    | GND      | M14         | GND      |
| GND    | GND      | M21         | GND      |
| GND    | GND      | N11         | GND      |
| GND    | GND      | N13         | GND      |
| GND    | GND      | P10         | GND      |
| GND    | GND      | P14         | GND      |
| GND    | GND      | P19         | GND      |
| GND    | GND      | P4          | GND      |
| GND    | GND      | P9          | GND      |
| GND    | GND      | T12         | GND      |
| GND    | GND      | T2          | GND      |
| GND    | GND      | T21         | GND      |
| GND    | GND      | U17         | GND      |
| GND    | GND      | U6          | GND      |
| GND    | GND      | W10         | GND      |
| GND    | GND      | W14         | GND      |
| GND    | GND      | Y20         | GND      |
| GND    | GND      | Y3          | GND      |
| VCCAUX | SUSPEND  | U18         | PWR MGMT |

Table 78: Spartan-3AN FGG484 Pinout (Cont'd)

| Bank   | Pin Name | FGG484 Ball | Type   |
|--------|----------|-------------|--------|
| VCCAUX | DONE     | Y19         | CONFIG |
| VCCAUX | PROG_B   | C4          | CONFIG |
| VCCAUX | TCK      | A21         | JTAG   |
| VCCAUX | TDI      | F5          | JTAG   |
| VCCAUX | TDO      | E19         | JTAG   |
| VCCAUX | TMS      | D4          | JTAG   |
| VCCAUX | VCCAUX   | D12         | VCCAUX |
| VCCAUX | VCCAUX   | E18         | VCCAUX |
| VCCAUX | VCCAUX   | E5          | VCCAUX |
| VCCAUX | VCCAUX   | H11         | VCCAUX |
| VCCAUX | VCCAUX   | L4          | VCCAUX |
| VCCAUX | VCCAUX   | M19         | VCCAUX |
| VCCAUX | VCCAUX   | P11         | VCCAUX |
| VCCAUX | VCCAUX   | V18         | VCCAUX |
| VCCAUX | VCCAUX   | V5          | VCCAUX |
| VCCAUX | VCCAUX   | W11         | VCCAUX |
| VCCINT | VCCINT   | J10         | VCCINT |
| VCCINT | VCCINT   | J12         | VCCINT |
| VCCINT | VCCINT   | K11         | VCCINT |
| VCCINT | VCCINT   | K13         | VCCINT |
| VCCINT | VCCINT   | K9          | VCCINT |
| VCCINT | VCCINT   | L10         | VCCINT |
| VCCINT | VCCINT   | L12         | VCCINT |
| VCCINT | VCCINT   | L14         | VCCINT |
| VCCINT | VCCINT   | M11         | VCCINT |
| VCCINT | VCCINT   | M13         | VCCINT |
| VCCINT | VCCINT   | M9          | VCCINT |
| VCCINT | VCCINT   | N10         | VCCINT |
| VCCINT | VCCINT   | N12         | VCCINT |
| VCCINT | VCCINT   | N14         | VCCINT |
| VCCINT | VCCINT   | P13         | VCCINT |

## User I/Os by Bank

Table 79 and Table 80 indicate how the user-I/O pins are distributed between the four I/O banks on the FGG484 package. The AWAKE pin is counted as a dual-purpose I/O.

Table 79: User I/Os Per Bank for the XC3S700AN in the FGG484 Package

| Package Edge | I/O Bank | Maximum I/Os | All Possible I/O Pins by Type |           |           |           |           |
|--------------|----------|--------------|-------------------------------|-----------|-----------|-----------|-----------|
|              |          |              | I/O                           | INPUT     | DUAL      | VREF      | CLK       |
| Top          | 0        | 92           | 58                            | 17        | 1         | 8         | 8         |
| Right        | 1        | 94           | 33                            | 15        | 30        | 8         | 8         |
| Bottom       | 2        | 92           | 43                            | 11        | 21        | 9         | 8         |
| Left         | 3        | 94           | 61                            | 17        | 0         | 8         | 8         |
| <b>Total</b> |          | <b>372</b>   | <b>195</b>                    | <b>60</b> | <b>52</b> | <b>33</b> | <b>32</b> |

Table 80: User I/Os Per Bank for the XC3S1400AN in the FGG484 Package

| Package Edge | I/O Bank | Maximum I/Os | All Possible I/O Pins by Type |           |           |           |           |
|--------------|----------|--------------|-------------------------------|-----------|-----------|-----------|-----------|
|              |          |              | I/O                           | INPUT     | DUAL      | VREF      | CLK       |
| Top          | 0        | 92           | 58                            | 17        | 1         | 8         | 8         |
| Right        | 1        | 94           | 33                            | 15        | 30        | 8         | 8         |
| Bottom       | 2        | 95           | 43                            | 13        | 21        | 10        | 8         |
| Left         | 3        | 94           | 61                            | 17        | 0         | 8         | 8         |
| <b>Total</b> |          | <b>375</b>   | <b>195</b>                    | <b>62</b> | <b>52</b> | <b>34</b> | <b>32</b> |

## Footprint Migration Differences

Table 81 summarizes the three footprint and functionality differences between the XC3S700AN and the XC3S1400AN FPGAs that can affect migration between devices available in the FGG484 package. All other pins unconditionally migrate between the Spartan-3AN devices available in the FGG484 package.

Spartan-3AN FPGAs are pin compatible with the same density Spartan-3A FPGAs in the FG(G)484 package, although the Spartan-3A FPGAs require an external configuration source.

In Table 81, the arrow (→) indicates that this pin can unconditionally migrate from the device on the left to the device on the right. Migration in the other direction is possible depending on how the pin is configured for the device on the right.

Table 81: FGG484 XC3S700AN to XC3S1400AN Footprint Migration/Differences

| FGG484 Ball                   | Bank | XC3S700AN | Migration | XC3S1400AN |
|-------------------------------|------|-----------|-----------|------------|
| T8                            | 2    | N.C.      | →         | INPUT/VREF |
| U7                            | 2    | N.C.      | →         | INPUT      |
| U16                           | 2    | N.C.      | →         | INPUT      |
| <b>Number of Differences:</b> |      |           | <b>3</b>  |            |

### FGG484 Footprint

#### Left Half of FGG484 Package (Top View)

- 195 **I/O:** Unrestricted, general-purpose user I/O
- 60-62 **INPUT:** Unrestricted, general-purpose input pin
- 51 **DUAL:** Configuration pins, then possible user I/O
- 33-34 **VREF:** User I/O or input voltage reference for bank
- 32 **CLK:** User I/O, input, or clock buffer input
- 2 **SUSPEND:** Dedicated SUSPEND and dual-purpose AWAKE Power Management pins
- 2 **CONFIG:** Dedicated configuration pins
- 4 **JTAG:** Dedicated JTAG port pins
- 53 **GND:** Ground
- 24 **VCCO:** Output voltage supply for bank
- 15 **VCCINT:** Internal core supply voltage (+1.2V)
- 10 **VCCAUX:** Auxiliary supply voltage (+3.3V)
- 3 **N.C.:** Not connected (XC3S700AN only)

|        |               | Bank 0                           |                         |                                  |                         |                         |                           |                           |                           |                         |                     |                         |
|--------|---------------|----------------------------------|-------------------------|----------------------------------|-------------------------|-------------------------|---------------------------|---------------------------|---------------------------|-------------------------|---------------------|-------------------------|
|        |               | 1                                | 2                       | 3                                | 4                       | 5                       | 6                         | 7                         | 8                         | 9                       | 10                  | 11                      |
| Bank 3 | A             | GND                              | I/O<br>L36N_0<br>PUDC_B | I/O<br>L33P_0                    | I/O<br>L31P_0           | I/O<br>L28N_0           | I/O<br>L26N_0             | I/O<br>L26P_0             | I/O<br>L22N_0             | I/O<br>L22P_0           | I/O<br>L21P_0       | I/O<br>L18N_0<br>GCLK7  |
|        | B             | I/O<br>L02P_3                    | I/O<br>L36P_0<br>VREF_0 | I/O<br>L33N_0                    | I/O<br>L31N_0           | VCCO_0                  | I/O<br>L28P_0             | GND                       | I/O<br>L25P_0             | I/O<br>L24P_0           | VCCO_0              | I/O<br>L19P_0<br>GCLK8  |
|        | C             | I/O<br>L01P_3                    | I/O<br>L02N_3           | GND                              | PROG_B                  | I/O<br>L32P_0           | I/O<br>L29P_0             | I/O<br>L27N_0             | I/O<br>L25N_0             | I/O<br>L24N_0<br>VREF_0 | I/O<br>L21N_0       | I/O<br>L19N_0<br>GCLK9  |
|        | D             | I/O<br>L06P_3                    | I/O<br>L01N_3           | I/O<br>L03P_3                    | TMS                     | I/O<br>L32N_0           | I/O<br>L29N_0             | I/O<br>L27P_0             | I/O<br>L30N_0             | GND                     | I/O<br>L23P_0       | I/O<br>L20P_0<br>GCLK10 |
|        | E             | I/O<br>L06N_3                    | VCCO_3                  | I/O<br>L07N_3                    | I/O<br>L03N_3           | VCCAUX                  | I/O<br>L35N_0             | I/O<br>L34P_0             | INPUT                     | I/O<br>L30P_0           | I/O<br>L23N_0       | I/O<br>L20N_0<br>GCLK11 |
|        | F             | I/O<br>L12N_3                    | I/O<br>L12P_3           | I/O<br>L08P_3                    | I/O<br>L07P_3           | TDI                     | GND                       | I/O<br>L35P_0             | I/O<br>L34N_0             | VCCO_0                  | INPUT               | GND                     |
|        | G             | I/O<br>L13N_3                    | GND                     | I/O<br>L13P_3                    | I/O<br>L08N_3           | I/O<br>L05N_3           | I/O<br>L05P_3             | INPUT                     | INPUT<br>VREF_0           | INPUT                   | INPUT               | INPUT                   |
|        | H             | I/O<br>L16N_3                    | I/O<br>L16P_3           | I/O<br>L14N_3                    | I/O<br>L14P_3           | I/O<br>L09P_3           | I/O<br>L09N_3             | INPUT<br>L04N_3<br>VREF_3 | INPUT<br>L04P_3           | INPUT<br>VREF_0         | INPUT               | VCCAUX                  |
|        | J             | I/O<br>L17N_3<br>VREF_3          | VCCO_3                  | I/O<br>L17P_3                    | GND                     | I/O<br>L10N_3           | VCCO_3                    | INPUT<br>L11P_3           | INPUT<br>VREF_3           | GND                     | VCCINT              | GND                     |
|        | K             | I/O<br>L22P_3<br>LHCLK2          | I/O<br>L20N_3           | I/O<br>L20P_3                    | I/O<br>L18N_3           | I/O<br>L18P_3           | I/O<br>L10P_3             | INPUT<br>L15P_3           | INPUT<br>L11N_3           | VCCINT                  | GND                 | VCCINT                  |
|        | L             | I/O<br>L22N_3<br>IRDY2<br>LHCLK3 | GND                     | I/O<br>L21N_3<br>LHCLK1          | VCCAUX                  | I/O<br>L21P_3<br>LHCLK0 | GND                       | INPUT<br>L19P_3           | INPUT<br>L15N_3<br>VREF_3 | GND                     | VCCINT              | GND                     |
|        | M             | I/O<br>L24P_3<br>LHCLK4          | I/O<br>L24N_3<br>LHCLK5 | I/O<br>L25P_3<br>TRDY2<br>LHCLK6 | I/O<br>L25N_3<br>LHCLK7 | I/O<br>L30P_3           | INPUT<br>L23N_3           | INPUT<br>L23P_3           | INPUT<br>L19N_3           | VCCINT                  | GND                 | VCCINT                  |
|        | N             | I/O<br>L26P_3<br>VREF_3          | VCCO_3                  | I/O<br>L26N_3                    | I/O<br>L30N_3           | INPUT<br>L31N_3         | INPUT<br>L31P_3           | INPUT<br>L35P_3           | INPUT<br>L27P_3           | INPUT<br>L27N_3         | VCCINT              | GND                     |
|        | P             | I/O<br>L28P_3                    | I/O<br>L28N_3           | I/O<br>L29P_3                    | GND                     | I/O<br>L29N_3           | VCCO_3                    | INPUT<br>L39P_3           | INPUT<br>L35N_3           | GND                     | GND                 | VCCAUX                  |
|        | R             | I/O<br>L32P_3                    | I/O<br>L32N_3           | I/O<br>L33P_3                    | I/O<br>L33N_3           | I/O<br>L34P_3           | INPUT<br>VREF_3           | INPUT<br>L46P_3           | INPUT<br>L39N_3           | INPUT                   | INPUT               | INPUT                   |
|        | T             | I/O<br>L36P_3<br>VREF_3          | GND                     | I/O<br>L36N_3                    | I/O<br>L34N_3           | I/O<br>L40P_3           | INPUT<br>L46N_3<br>VREF_3 | INPUT<br>VREF_0           | INPUT<br>VREF_2           | INPUT                   | INPUT<br>VREF_2     | INPUT<br>VREF_2         |
|        | U             | I/O<br>L37P_3                    | I/O<br>L37N_3           | I/O<br>L41P_3                    | I/O<br>L41N_3           | I/O<br>L40N_3           | GND                       | INPUT                     | INPUT                     | VCCO_2                  | INPUT               | I/O<br>L17P_2<br>GCLK12 |
|        | V             | I/O<br>L38P_3                    | VCCO_3                  | I/O<br>L38N_3                    | I/O<br>L43P_3           | VCCAUX                  | I/O<br>L01P_2<br>M1       | INPUT                     | INPUT<br>VREF_2           | I/O<br>L09P_2<br>RDWR_B | I/O<br>L13P_2       | I/O<br>L17N_2<br>GCLK13 |
|        | W             | I/O<br>L42P_3                    | I/O<br>L42N_3           | I/O<br>L43N_3                    | I/O<br>L02P_2<br>M2     | I/O<br>L01N_2<br>M0     | I/O<br>L05P_2             | I/O<br>L07P_2             | I/O<br>L11P_2<br>VS1      | I/O<br>L09N_2<br>VS2    | GND                 | VCCAUX                  |
| Y      | I/O<br>L44P_3 | I/O<br>L44N_3                    | GND                     | I/O<br>L02N_2<br>CSO_B           | I/O<br>L05N_2           | I/O<br>L07N_2           | I/O<br>L10P_2             | I/O<br>L11N_2<br>VS0      | I/O<br>L14P_2<br>D7       | I/O<br>L13N_2           | I/O<br>L16P_2<br>D5 |                         |
| A      | I/O<br>L45P_3 | I/O<br>L45N_3                    | I/O<br>L03N_2           | I/O<br>L04N_2                    | VCCO_2                  | I/O<br>L08P_2           | GND                       | I/O<br>L12P_2             | VCCO_2                    | I/O<br>L15P_2           | GND                 |                         |
| A      | GND           | I/O<br>L03P_2                    | I/O<br>L04P_2           | I/O<br>L06P_2                    | I/O<br>L06N_2           | I/O<br>L08N_2           | I/O<br>L10N_2             | I/O<br>L12N_2             | I/O<br>L14N_2<br>D6       | I/O<br>L15N_2           | I/O<br>L16N_2<br>D4 |                         |
|        |               | Bank 2                           |                         |                                  |                         |                         |                           |                           |                           |                         |                     |                         |

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Figure 23: FGG484 Package Footprint (Top View)



| Bank 0                  |                         |                                |                           |                           |                       |                           |                         |                                  |                         |                         | Bank 1 |  |
|-------------------------|-------------------------|--------------------------------|---------------------------|---------------------------|-----------------------|---------------------------|-------------------------|----------------------------------|-------------------------|-------------------------|--------|--|
| 12                      | 13                      | 14                             | 15                        | 16                        | 17                    | 18                        | 19                      | 20                               | 21                      | 22                      |        |  |
| I/O<br>L18P_0<br>GCLK6  | I/O<br>L16N_0           | I/O<br>L13N_0                  | I/O<br>L12N_0<br>VREF_0   | I/O<br>L12P_0             | I/O<br>L10N_0         | I/O<br>L05N_0             | I/O<br>L06N_0           | I/O<br>L03N_0                    | TCK                     | GND                     | A      |  |
| GND                     | I/O<br>L16P_0           | VCCO_0                         | I/O<br>L13P_0             | GND                       | I/O<br>L10P_0         | VCCO_0                    | I/O<br>L06P_0<br>VREF_0 | I/O<br>L03P_0                    | I/O<br>L45N_1<br>A23    | I/O<br>L45P_1<br>A22    | B      |  |
| I/O<br>L17P_0<br>GCLK4  | I/O<br>L15N_0           | I/O<br>L09P_0                  | I/O<br>L11N_0             | I/O<br>L08N_0             | I/O<br>L07N_0         | I/O<br>L05P_0             | I/O<br>L02N_0           | GND                              | I/O<br>L44N_1<br>A21    | I/O<br>L44P_1<br>A20    | C      |  |
| VCCAUX                  | I/O<br>L15P_0           | GND                            | I/O<br>L11P_0             | I/O<br>L08P_0             | I/O<br>L07P_0         | I/O<br>L01N_0             | I/O<br>L02P_0<br>VREF_0 | I/O<br>L42N_1                    | I/O<br>L42P_1           | I/O<br>L41N_1           | D      |  |
| I/O<br>L17N_0<br>GCLK5  | I/O<br>L14N_0           | I/O<br>L09N_0                  | I/O<br>L04P_0             | INPUT                     | I/O<br>L01P_0         | VCCAUX                    | TDO                     | I/O<br>L38P_1                    | VCCO_1                  | I/O<br>L41P_1           | E      |  |
| INPUT                   | I/O<br>L14P_0           | VCCO_0                         | I/O<br>L04N_0             | INPUT                     | GND                   | I/O<br>L40N_1             | I/O<br>L40P_1           | I/O<br>L38N_1                    | I/O<br>L34N_1<br>A19    | I/O<br>L34P_1<br>A18    | F      |  |
| INPUT                   | INPUT                   | INPUT                          | INPUT                     | INPUT                     | I/O<br>L46N_1<br>A25  | I/O<br>L46P_1<br>A24      | I/O<br>L36P_1           | I/O<br>L36N_1                    | GND                     | I/O<br>L30N_1<br>A15    | G      |  |
| INPUT<br>VREF_0         | INPUT                   | INPUT                          | INPUT<br>L47N_1           | INPUT<br>L47P_1<br>VREF_1 | INPUT<br>L39P_1       | INPUT<br>L39N_1           | I/O<br>L37N_1           | I/O<br>L33N_1<br>A17             | I/O<br>L33P_1<br>A16    | I/O<br>L30P_1<br>A14    | H      |  |
| VCCINT                  | GND                     | GND                            | INPUT<br>L43N_1<br>VREF_1 | INPUT<br>L43P_1           | VCCO_1                | I/O<br>L37P_1             | GND                     | I/O<br>L29N_1<br>A13             | I/O<br>L29P_1<br>A12    | I/O<br>L26N_1<br>A11    | J      |  |
| GND                     | VCCINT                  | INPUT<br>L35P_1<br>VREF_1      | INPUT<br>L35N_1           | INPUT<br>L31N_1           | I/O<br>L32P_1         | I/O<br>L32N_1             | I/O<br>L25N_1<br>RHCLK7 | I/O<br>L25P_1<br>IRDY1<br>RHCLK6 | VCCO_1                  | I/O<br>L26P_1<br>A10    | K      |  |
| VCCINT                  | GND                     | VCCINT                         | INPUT<br>L31P_1           | INPUT<br>L27N_1           | GND                   | I/O<br>L28P_1             | I/O<br>L28N_1           | I/O<br>L22N_1<br>TRDY1<br>RHCLK3 | I/O<br>L22P_1<br>RHCLK2 | I/O<br>L21N_1<br>RHCLK1 | L      |  |
| GND                     | VCCINT                  | GND                            | INPUT<br>L27P_1<br>VREF_1 | INPUT<br>L23N_1           | INPUT<br>L23P_1       | I/O<br>L24P_1<br>RHCLK4   | VCCAUX                  | I/O<br>L24N_1<br>RHCLK5          | GND                     | I/O<br>L21P_1<br>RHCLK0 | M      |  |
| VCCINT                  | GND                     | VCCINT                         | INPUT<br>L16P_1           | INPUT<br>L16N_1<br>VREF_1 | INPUT<br>L20N_1<br>A9 | I/O<br>L20P_1<br>A8       | I/O<br>L19N_1<br>A7     | I/O<br>L19P_1<br>A6              | I/O<br>L18N_1<br>A5     | I/O<br>L18P_1<br>A4     | N      |  |
| INPUT                   | VCCINT                  | GND                            | INPUT<br>L08P_1           | INPUT<br>L08N_1           | VCCO_1                | I/O<br>L17N_1<br>A3       | GND                     | I/O<br>L15P_1                    | VCCO_1                  | I/O<br>L15N_1<br>VREF_1 | P      |  |
| INPUT<br>VREF_2         | INPUT<br>VREF_2         | INPUT<br>VREF_2                | INPUT<br>L04P_1           | INPUT<br>L04N_1<br>VREF_1 | INPUT<br>L12P_1       | INPUT<br>L12N_1<br>VREF_1 | I/O<br>L17P_1<br>A2     | I/O<br>L13P_1                    | I/O<br>L14P_1           | I/O<br>L14N_1           | R      |  |
| GND                     | INPUT                   | INPUT                          | INPUT<br>VREF_2           | INPUT<br>VREF_2           | I/O<br>L03P_1<br>A0   | I/O<br>L03N_1<br>A1       | I/O<br>L13N_1           | I/O<br>L11P_1                    | GND                     | I/O<br>L11N_1           | T      |  |
| I/O<br>L20N_2<br>GCLK3  | I/O<br>L26N_2<br>D3     | VCCO_2                         | INPUT                     | INPUT<br>◆                | GND                   | SUSPEND                   | I/O<br>L10N_1           | I/O<br>L10P_1                    | I/O<br>L09N_1           | I/O<br>L09P_1           | U      |  |
| I/O<br>L20P_2<br>GCLK2  | I/O<br>L26P_2<br>INIT_B | I/O<br>L30P_2                  | I/O<br>L30N_2             | I/O<br>L31N_2             | I/O<br>L33N_2         | VCCAUX                    | I/O<br>L06P_1           | I/O<br>L06N_1                    | VCCO_1                  | I/O<br>L07N_1           | V      |  |
| I/O<br>L18P_2<br>GCLK14 | I/O<br>L23P_2           | GND                            | I/O<br>L25P_2             | I/O<br>L31P_2             | I/O<br>L34N_2         | I/O<br>L33P_2             | I/O<br>L02P_1<br>LDC1   | I/O<br>L02N_1<br>LDC0            | I/O<br>L05N_1           | I/O<br>L07P_1           | W      |  |
| I/O<br>L18N_2<br>GCLK15 | I/O<br>L21N_2           | I/O<br>L23N_2                  | I/O<br>L25N_2             | I/O<br>L27N_2             | I/O<br>L28N_2<br>D1   | I/O<br>L34P_2             | DONE                    | GND                              | I/O<br>L01N_1<br>LDC2   | I/O<br>L05P_1           | Y      |  |
| I/O<br>L19P_2<br>GCLK0  | VCCO_2                  | I/O<br>L22P_2                  | I/O<br>L24N_2<br>DOUT     | GND                       | I/O<br>L28P_2<br>D2   | VCCO_2                    | I/O<br>L32N_2           | I/O<br>L36N_2<br>CCLK            | I/O<br>L35N_2           | I/O<br>L01P_1<br>HDC    | A<br>A |  |
| I/O<br>L19N_2<br>GCLK1  | I/O<br>L21P_2           | I/O<br>L22N_2<br>MOSI<br>CSI_B | I/O<br>L24P_2<br>AWAKE    | I/O<br>L27P_2             | I/O<br>L29P_2         | I/O<br>L29N_2             | I/O<br>L32P_2           | I/O<br>L36P_2<br>D0<br>DIN/MISO  | I/O<br>L35P_2           | GND                     | A<br>B |  |

Right Half of FGG484 Package (Top View)

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Figure 23: FGG484 Package Footprint (Top View)

## FGG676: 676-Ball Fine-Pitch Ball Grid Array

The 676-ball fine-pitch ball grid array, FGG676, supports the XC3S1400AN FPGA.

Table 82 lists all the FGG676 package pins. They are sorted by bank number and then by pin name. Pins that form a differential I/O pair appear together in the table. The table also shows the pin number for each pin and the pin type (as defined in Table 62).

The XC3S1400AN has 17 unconnected balls, indicated as N.C. in Table 82 and Figure 24.

An electronic version of this package pinout table and footprint diagram is available for download from the Xilinx website at: [www.xilinx.com/support/documentation/data\\_sheets/s3a\\_pin.zip](http://www.xilinx.com/support/documentation/data_sheets/s3a_pin.zip).

### Pinout Table

Table 82: Spartan-3AN FGG676 Pinout

| Bank | Pin Name         | FGG676 Ball | Type |
|------|------------------|-------------|------|
| 0    | IO_L01N_0        | F20         | I/O  |
| 0    | IO_L01P_0        | G20         | I/O  |
| 0    | IO_L02N_0        | F19         | I/O  |
| 0    | IO_L02P_0/VREF_0 | G19         | VREF |
| 0    | IO_L05N_0        | C22         | I/O  |
| 0    | IO_L05P_0        | D22         | I/O  |
| 0    | IO_L06N_0        | C23         | I/O  |
| 0    | IO_L06P_0        | D23         | I/O  |
| 0    | IO_L07N_0        | A22         | I/O  |
| 0    | IO_L07P_0        | B23         | I/O  |
| 0    | IO_L08N_0        | G17         | I/O  |
| 0    | IO_L08P_0        | H17         | I/O  |
| 0    | IO_L09N_0        | B21         | I/O  |
| 0    | IO_L09P_0        | C21         | I/O  |
| 0    | IO_L10N_0        | D21         | I/O  |
| 0    | IO_L10P_0        | E21         | I/O  |
| 0    | IO_L11N_0        | C20         | I/O  |
| 0    | IO_L11P_0        | D20         | I/O  |
| 0    | IO_L12N_0        | K16         | I/O  |
| 0    | IO_L12P_0        | J16         | I/O  |
| 0    | IO_L13N_0        | E17         | I/O  |
| 0    | IO_L13P_0        | F17         | I/O  |
| 0    | IO_L14N_0        | A20         | I/O  |
| 0    | IO_L14P_0/VREF_0 | B20         | VREF |
| 0    | IO_L15N_0        | A19         | I/O  |
| 0    | IO_L15P_0        | B19         | I/O  |
| 0    | IO_L16N_0        | H15         | I/O  |
| 0    | IO_L16P_0        | G15         | I/O  |
| 0    | IO_L17N_0        | C18         | I/O  |
| 0    | IO_L17P_0        | D18         | I/O  |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name         | FGG676 Ball | Type |
|------|------------------|-------------|------|
| 0    | IO_L18N_0        | A18         | I/O  |
| 0    | IO_L18P_0        | B18         | I/O  |
| 0    | IO_L19N_0        | B17         | I/O  |
| 0    | IO_L19P_0        | C17         | I/O  |
| 0    | IO_L20N_0/VREF_0 | E15         | VREF |
| 0    | IO_L20P_0        | F15         | I/O  |
| 0    | IO_L21N_0        | C16         | I/O  |
| 0    | IO_L21P_0        | D17         | I/O  |
| 0    | IO_L22N_0        | C15         | I/O  |
| 0    | IO_L22P_0        | D16         | I/O  |
| 0    | IO_L23N_0        | A15         | I/O  |
| 0    | IO_L23P_0        | B15         | I/O  |
| 0    | IO_L24N_0        | F14         | I/O  |
| 0    | IO_L24P_0        | E14         | I/O  |
| 0    | IO_L25N_0/GCLK5  | J14         | GCLK |
| 0    | IO_L25P_0/GCLK4  | K14         | GCLK |
| 0    | IO_L26N_0/GCLK7  | A14         | GCLK |
| 0    | IO_L26P_0/GCLK6  | B14         | GCLK |
| 0    | IO_L27N_0/GCLK9  | G13         | GCLK |
| 0    | IO_L27P_0/GCLK8  | F13         | GCLK |
| 0    | IO_L28N_0/GCLK11 | C13         | GCLK |
| 0    | IO_L28P_0/GCLK10 | B13         | GCLK |
| 0    | IO_L29N_0        | B12         | I/O  |
| 0    | IO_L29P_0        | A12         | I/O  |
| 0    | IO_L30N_0        | C12         | I/O  |
| 0    | IO_L30P_0        | D13         | I/O  |
| 0    | IO_L31N_0        | F12         | I/O  |
| 0    | IO_L31P_0        | E12         | I/O  |
| 0    | IO_L32N_0/VREF_0 | D11         | VREF |
| 0    | IO_L32P_0        | C11         | I/O  |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name         | FGG676 Ball | Type  |
|------|------------------|-------------|-------|
| 0    | IO_L33N_0        | B10         | I/O   |
| 0    | IO_L33P_0        | A10         | I/O   |
| 0    | IO_L34N_0        | D10         | I/O   |
| 0    | IO_L34P_0        | C10         | I/O   |
| 0    | IO_L35N_0        | H12         | I/O   |
| 0    | IO_L35P_0        | G12         | I/O   |
| 0    | IO_L36N_0        | B9          | I/O   |
| 0    | IO_L36P_0        | A9          | I/O   |
| 0    | IO_L37N_0        | D9          | I/O   |
| 0    | IO_L37P_0        | E10         | I/O   |
| 0    | IO_L38N_0        | B8          | I/O   |
| 0    | IO_L38P_0        | A8          | I/O   |
| 0    | IO_L39N_0        | K12         | I/O   |
| 0    | IO_L39P_0        | J12         | I/O   |
| 0    | IO_L40N_0        | D8          | I/O   |
| 0    | IO_L40P_0        | C8          | I/O   |
| 0    | IO_L41N_0        | C6          | I/O   |
| 0    | IO_L41P_0        | B6          | I/O   |
| 0    | IO_L42N_0        | C7          | I/O   |
| 0    | IO_L42P_0        | B7          | I/O   |
| 0    | IO_L43N_0        | K11         | I/O   |
| 0    | IO_L43P_0        | J11         | I/O   |
| 0    | IO_L44N_0        | D6          | I/O   |
| 0    | IO_L44P_0        | C5          | I/O   |
| 0    | IO_L45N_0        | B4          | I/O   |
| 0    | IO_L45P_0        | A4          | I/O   |
| 0    | IO_L46N_0        | H10         | I/O   |
| 0    | IO_L46P_0        | G10         | I/O   |
| 0    | IO_L47N_0        | H9          | I/O   |
| 0    | IO_L47P_0        | G9          | I/O   |
| 0    | IO_L48N_0        | E7          | I/O   |
| 0    | IO_L48P_0        | F7          | I/O   |
| 0    | IO_L51N_0        | B3          | I/O   |
| 0    | IO_L51P_0        | A3          | I/O   |
| 0    | IO_L52N_0/PUDC_B | G8          | DUAL  |
| 0    | IO_L52P_0/VREF_0 | F8          | VREF  |
| 0    | IP_0             | A5          | INPUT |
| 0    | IP_0             | A7          | INPUT |
| 0    | IP_0             | A13         | INPUT |
| 0    | IP_0             | A17         | INPUT |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name       | FGG676 Ball | Type  |
|------|----------------|-------------|-------|
| 0    | IP_0           | A23         | INPUT |
| 0    | IP_0           | C4          | INPUT |
| 0    | IP_0           | D12         | INPUT |
| 0    | IP_0           | D15         | INPUT |
| 0    | IP_0           | D19         | INPUT |
| 0    | IP_0           | E11         | INPUT |
| 0    | IP_0           | E18         | INPUT |
| 0    | IP_0           | E20         | INPUT |
| 0    | IP_0           | F10         | INPUT |
| 0    | IP_0           | G14         | INPUT |
| 0    | IP_0           | G16         | INPUT |
| 0    | IP_0           | H13         | INPUT |
| 0    | IP_0           | H18         | INPUT |
| 0    | IP_0           | J10         | INPUT |
| 0    | IP_0           | J13         | INPUT |
| 0    | IP_0           | J15         | INPUT |
| 0    | IP_0/VREF_0    | D7          | VREF  |
| 0    | IP_0/VREF_0    | D14         | VREF  |
| 0    | IP_0/VREF_0    | G11         | VREF  |
| 0    | IP_0/VREF_0    | J17         | VREF  |
| 0    | N.C.           | A24         | N.C.  |
| 0    | N.C.           | B24         | N.C.  |
| 0    | N.C.           | D5          | N.C.  |
| 0    | N.C.           | E9          | N.C.  |
| 0    | N.C.           | F18         | N.C.  |
| 0    | N.C.           | E6          | N.C.  |
| 0    | N.C.           | F9          | N.C.  |
| 0    | N.C.           | G18         | N.C.  |
| 0    | VCCO_0         | B5          | VCCO  |
| 0    | VCCO_0         | B11         | VCCO  |
| 0    | VCCO_0         | B16         | VCCO  |
| 0    | VCCO_0         | B22         | VCCO  |
| 0    | VCCO_0         | E8          | VCCO  |
| 0    | VCCO_0         | E13         | VCCO  |
| 0    | VCCO_0         | E19         | VCCO  |
| 0    | VCCO_0         | H11         | VCCO  |
| 0    | VCCO_0         | H16         | VCCO  |
| 1    | IO_L01N_1/LDC2 | Y21         | DUAL  |
| 1    | IO_L01P_1/HDC  | Y20         | DUAL  |
| 1    | IO_L02N_1/LDC0 | AD25        | DUAL  |

**Table 82: Spartan-3AN FGG676 Pinout (Cont'd)**

| Bank | Pin Name         | FGG676 Ball | Type |
|------|------------------|-------------|------|
| 1    | IO_L02P_1/LDC1   | AE26        | DUAL |
| 1    | IO_L03N_1/A1     | AC24        | DUAL |
| 1    | IO_L03P_1/A0     | AC23        | DUAL |
| 1    | IO_L04N_1        | W21         | I/O  |
| 1    | IO_L04P_1        | W20         | I/O  |
| 1    | IO_L05N_1        | AC25        | I/O  |
| 1    | IO_L05P_1        | AD26        | I/O  |
| 1    | IO_L06N_1        | AB26        | I/O  |
| 1    | IO_L06P_1        | AC26        | I/O  |
| 1    | IO_L07N_1/VREF_1 | AB24        | VREF |
| 1    | IO_L07P_1        | AB23        | I/O  |
| 1    | IO_L08N_1        | V19         | I/O  |
| 1    | IO_L08P_1        | V18         | I/O  |
| 1    | IO_L09N_1        | AA23        | I/O  |
| 1    | IO_L09P_1        | AA22        | I/O  |
| 1    | IO_L10N_1        | U20         | I/O  |
| 1    | IO_L10P_1        | V21         | I/O  |
| 1    | IO_L11N_1        | AA25        | I/O  |
| 1    | IO_L11P_1        | AA24        | I/O  |
| 1    | IO_L12N_1        | U18         | I/O  |
| 1    | IO_L12P_1        | U19         | I/O  |
| 1    | IO_L13N_1        | Y23         | I/O  |
| 1    | IO_L13P_1        | Y22         | I/O  |
| 1    | IO_L14N_1        | T20         | I/O  |
| 1    | IO_L14P_1        | U21         | I/O  |
| 1    | IO_L15N_1        | Y25         | I/O  |
| 1    | IO_L15P_1        | Y24         | I/O  |
| 1    | IO_L17N_1        | T17         | I/O  |
| 1    | IO_L17P_1        | T18         | I/O  |
| 1    | IO_L18N_1        | V22         | I/O  |
| 1    | IO_L18P_1        | W23         | I/O  |
| 1    | IO_L19N_1        | V25         | I/O  |
| 1    | IO_L19P_1        | V24         | I/O  |
| 1    | IO_L21N_1        | U22         | I/O  |
| 1    | IO_L21P_1        | V23         | I/O  |
| 1    | IO_L22N_1        | R20         | I/O  |
| 1    | IO_L22P_1        | R19         | I/O  |
| 1    | IO_L23N_1/VREF_1 | U24         | VREF |
| 1    | IO_L23P_1        | U23         | I/O  |
| 1    | IO_L25N_1/A3     | R22         | DUAL |

**Table 82: Spartan-3AN FGG676 Pinout (Cont'd)**

| Bank | Pin Name               | FGG676 Ball | Type  |
|------|------------------------|-------------|-------|
| 1    | IO_L25P_1/A2           | R21         | DUAL  |
| 1    | IO_L26N_1/A5           | T24         | DUAL  |
| 1    | IO_L26P_1/A4           | T23         | DUAL  |
| 1    | IO_L27N_1/A7           | R17         | DUAL  |
| 1    | IO_L27P_1/A6           | R18         | DUAL  |
| 1    | IO_L29N_1/A9           | R26         | DUAL  |
| 1    | IO_L29P_1/A8           | R25         | DUAL  |
| 1    | IO_L30N_1/RHCLK1       | P20         | RHCLK |
| 1    | IO_L30P_1/RHCLK0       | P21         | RHCLK |
| 1    | IO_L31N_1/TRDY1/RHCLK3 | P25         | RHCLK |
| 1    | IO_L31P_1/RHCLK2       | P26         | RHCLK |
| 1    | IO_L33N_1/RHCLK5       | N24         | RHCLK |
| 1    | IO_L33P_1/RHCLK4       | P23         | RHCLK |
| 1    | IO_L34N_1/RHCLK7       | N19         | RHCLK |
| 1    | IO_L34P_1/IRDY1/RHCLK6 | P18         | RHCLK |
| 1    | IO_L35N_1/A11          | M25         | DUAL  |
| 1    | IO_L35P_1/A10          | M26         | DUAL  |
| 1    | IO_L37N_1              | N21         | I/O   |
| 1    | IO_L37P_1              | P22         | I/O   |
| 1    | IO_L38N_1/A13          | M23         | DUAL  |
| 1    | IO_L38P_1/A12          | L24         | DUAL  |
| 1    | IO_L39N_1/A15          | N17         | DUAL  |
| 1    | IO_L39P_1/A14          | N18         | DUAL  |
| 1    | IO_L41N_1              | K26         | I/O   |
| 1    | IO_L41P_1              | K25         | I/O   |
| 1    | IO_L42N_1/A17          | M20         | DUAL  |
| 1    | IO_L42P_1/A16          | N20         | DUAL  |
| 1    | IO_L43N_1/A19          | J25         | DUAL  |
| 1    | IO_L43P_1/A18          | J26         | DUAL  |
| 1    | IO_L45N_1              | M22         | I/O   |
| 1    | IO_L45P_1              | M21         | I/O   |
| 1    | IO_L46N_1              | K22         | I/O   |
| 1    | IO_L46P_1              | K23         | I/O   |
| 1    | IO_L47N_1              | M18         | I/O   |
| 1    | IO_L47P_1              | M19         | I/O   |
| 1    | IO_L49N_1              | J22         | I/O   |
| 1    | IO_L49P_1              | J23         | I/O   |
| 1    | IO_L50N_1              | K21         | I/O   |
| 1    | IO_L50P_1              | L22         | I/O   |
| 1    | IO_L51N_1              | G24         | I/O   |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name         | FGG676 Ball | Type  |
|------|------------------|-------------|-------|
| 1    | IO_L51P_1        | G23         | I/O   |
| 1    | IO_L53N_1        | K20         | I/O   |
| 1    | IO_L53P_1        | L20         | I/O   |
| 1    | IO_L54N_1        | F24         | I/O   |
| 1    | IO_L54P_1        | F25         | I/O   |
| 1    | IO_L55N_1        | L17         | I/O   |
| 1    | IO_L55P_1        | L18         | I/O   |
| 1    | IO_L56N_1        | F23         | I/O   |
| 1    | IO_L56P_1        | E24         | I/O   |
| 1    | IO_L57N_1        | K18         | I/O   |
| 1    | IO_L57P_1        | K19         | I/O   |
| 1    | IO_L58N_1        | G22         | I/O   |
| 1    | IO_L58P_1/VREF_1 | F22         | VREF  |
| 1    | IO_L59N_1        | J20         | I/O   |
| 1    | IO_L59P_1        | J19         | I/O   |
| 1    | IO_L60N_1        | D26         | I/O   |
| 1    | IO_L60P_1        | E26         | I/O   |
| 1    | IO_L61N_1        | D24         | I/O   |
| 1    | IO_L61P_1        | D25         | I/O   |
| 1    | IO_L62N_1/A21    | H21         | DUAL  |
| 1    | IO_L62P_1/A20    | J21         | DUAL  |
| 1    | IO_L63N_1/A23    | C25         | DUAL  |
| 1    | IO_L63P_1/A22    | C26         | DUAL  |
| 1    | IO_L64N_1/A25    | G21         | DUAL  |
| 1    | IO_L64P_1/A24    | H20         | DUAL  |
| 1    | IP_L16N_1        | Y26         | INPUT |
| 1    | IP_L16P_1        | W25         | INPUT |
| 1    | IP_L20N_1/VREF_1 | V26         | VREF  |
| 1    | IP_L20P_1        | W26         | INPUT |
| 1    | IP_L24N_1/VREF_1 | U26         | VREF  |
| 1    | IP_L24P_1        | U25         | INPUT |
| 1    | IP_L28N_1        | R24         | INPUT |
| 1    | IP_L28P_1/VREF_1 | R23         | VREF  |
| 1    | IP_L32N_1        | N25         | INPUT |
| 1    | IP_L32P_1        | N26         | INPUT |
| 1    | IP_L36N_1        | N23         | INPUT |
| 1    | IP_L36P_1/VREF_1 | M24         | VREF  |
| 1    | IP_L40N_1        | L23         | INPUT |
| 1    | IP_L40P_1        | K24         | INPUT |
| 1    | IP_L44N_1        | H25         | INPUT |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name         | FGG676 Ball | Type  |
|------|------------------|-------------|-------|
| 1    | IP_L44P_1/VREF_1 | H26         | VREF  |
| 1    | IP_L48N_1        | H24         | INPUT |
| 1    | IP_L48P_1        | H23         | INPUT |
| 1    | IP_L52N_1/VREF_1 | G25         | VREF  |
| 1    | IP_L52P_1        | G26         | INPUT |
| 1    | IP_L65N_1        | B25         | INPUT |
| 1    | IP_L65P_1/VREF_1 | B26         | VREF  |
| 1    | VCCO_1           | AB25        | VCCO  |
| 1    | VCCO_1           | E25         | VCCO  |
| 1    | VCCO_1           | H22         | VCCO  |
| 1    | VCCO_1           | L19         | VCCO  |
| 1    | VCCO_1           | L25         | VCCO  |
| 1    | VCCO_1           | N22         | VCCO  |
| 1    | VCCO_1           | T19         | VCCO  |
| 1    | VCCO_1           | T25         | VCCO  |
| 1    | VCCO_1           | W22         | VCCO  |
| 2    | IO_L01N_2/M0     | AD4         | DUAL  |
| 2    | IO_L01P_2/M1     | AC4         | DUAL  |
| 2    | IO_L02N_2/CSO_B  | AA7         | DUAL  |
| 2    | IO_L02P_2/M2     | Y7          | DUAL  |
| 2    | IO_L05N_2        | Y9          | I/O   |
| 2    | IO_L05P_2        | W9          | I/O   |
| 2    | IO_L06N_2        | AF3         | I/O   |
| 2    | IO_L06P_2        | AE3         | I/O   |
| 2    | IO_L07N_2        | AF4         | I/O   |
| 2    | IO_L07P_2        | AE4         | I/O   |
| 2    | IO_L08N_2        | AD6         | I/O   |
| 2    | IO_L08P_2        | AC6         | I/O   |
| 2    | IO_L09N_2        | W10         | I/O   |
| 2    | IO_L09P_2        | V10         | I/O   |
| 2    | IO_L10N_2        | AE6         | I/O   |
| 2    | IO_L10P_2        | AF5         | I/O   |
| 2    | IO_L11N_2        | AE7         | I/O   |
| 2    | IO_L11P_2        | AD7         | I/O   |
| 2    | IO_L12N_2        | AA10        | I/O   |
| 2    | IO_L12P_2        | Y10         | I/O   |
| 2    | IO_L13N_2        | U11         | I/O   |
| 2    | IO_L13P_2        | V11         | I/O   |
| 2    | IO_L14N_2        | AB7         | I/O   |
| 2    | IO_L14P_2        | AC8         | I/O   |

**Table 82: Spartan-3AN FGG676 Pinout (Cont'd)**

| Bank | Pin Name             | FGG676 Ball | Type     |
|------|----------------------|-------------|----------|
| 2    | IO_L15N_2            | AC9         | I/O      |
| 2    | IO_L15P_2            | AB9         | I/O      |
| 2    | IO_L16N_2            | W12         | I/O      |
| 2    | IO_L16P_2            | V12         | I/O      |
| 2    | IO_L17N_2/VS2        | AA12        | DUAL     |
| 2    | IO_L17P_2/RDWR_B     | Y12         | DUAL     |
| 2    | IO_L18N_2            | AF8         | I/O      |
| 2    | IO_L18P_2            | AE8         | I/O      |
| 2    | IO_L19N_2/VS0        | AF9         | DUAL     |
| 2    | IO_L19P_2/VS1        | AE9         | DUAL     |
| 2    | IO_L20N_2            | W13         | I/O      |
| 2    | IO_L20P_2            | V13         | I/O      |
| 2    | IO_L21N_2            | AC12        | I/O      |
| 2    | IO_L21P_2            | AB12        | I/O      |
| 2    | IO_L22N_2/D6         | AF10        | DUAL     |
| 2    | IO_L22P_2/D7         | AE10        | DUAL     |
| 2    | IO_L23N_2            | AC11        | I/O      |
| 2    | IO_L23P_2            | AD11        | I/O      |
| 2    | IO_L24N_2/D4         | AE12        | DUAL     |
| 2    | IO_L24P_2/D5         | AF12        | DUAL     |
| 2    | IO_L25N_2/GCLK13     | Y13         | GCLK     |
| 2    | IO_L25P_2/GCLK12     | AA13        | GCLK     |
| 2    | IO_L26N_2/GCLK15     | AE13        | GCLK     |
| 2    | IO_L26P_2/GCLK14     | AF13        | GCLK     |
| 2    | IO_L27N_2/GCLK1      | AA14        | GCLK     |
| 2    | IO_L27P_2/GCLK0      | Y14         | GCLK     |
| 2    | IO_L28N_2/GCLK3      | AE14        | GCLK     |
| 2    | IO_L28P_2/GCLK2      | AF14        | GCLK     |
| 2    | IO_L29N_2            | AC14        | I/O      |
| 2    | IO_L29P_2            | AD14        | I/O      |
| 2    | IO_L30N_2/MOSI/CSI_B | AB15        | DUAL     |
| 2    | IO_L30P_2            | AC15        | I/O      |
| 2    | IO_L31N_2            | W15         | I/O      |
| 2    | IO_L31P_2            | V14         | I/O      |
| 2    | IO_L32N_2/DOUT       | AE15        | DUAL     |
| 2    | IO_L32P_2/AWAKE      | AD15        | PWR MGMT |
| 2    | IO_L33N_2            | AD17        | I/O      |
| 2    | IO_L33P_2            | AE17        | I/O      |
| 2    | IO_L34N_2/D3         | Y15         | DUAL     |
| 2    | IO_L34P_2/INIT_B     | AA15        | DUAL     |

**Table 82: Spartan-3AN FGG676 Pinout (Cont'd)**

| Bank | Pin Name              | FGG676 Ball | Type  |
|------|-----------------------|-------------|-------|
| 2    | IO_L35N_2             | U15         | I/O   |
| 2    | IO_L35P_2             | V15         | I/O   |
| 2    | IO_L36N_2/D1          | AE18        | DUAL  |
| 2    | IO_L36P_2/D2          | AF18        | DUAL  |
| 2    | IO_L37N_2             | AE19        | I/O   |
| 2    | IO_L37P_2             | AF19        | I/O   |
| 2    | IO_L38N_2             | AB16        | I/O   |
| 2    | IO_L38P_2             | AC16        | I/O   |
| 2    | IO_L39N_2             | AE20        | I/O   |
| 2    | IO_L39P_2             | AF20        | I/O   |
| 2    | IO_L40N_2             | AC19        | I/O   |
| 2    | IO_L40P_2             | AD19        | I/O   |
| 2    | IO_L41N_2             | AC20        | I/O   |
| 2    | IO_L41P_2             | AD20        | I/O   |
| 2    | IO_L42N_2             | U16         | I/O   |
| 2    | IO_L42P_2             | V16         | I/O   |
| 2    | IO_L43N_2             | Y17         | I/O   |
| 2    | IO_L43P_2             | AA17        | I/O   |
| 2    | IO_L44N_2             | AD21        | I/O   |
| 2    | IO_L44P_2             | AE21        | I/O   |
| 2    | IO_L45N_2             | AC21        | I/O   |
| 2    | IO_L45P_2             | AD22        | I/O   |
| 2    | IO_L46N_2             | V17         | I/O   |
| 2    | IO_L46P_2             | W17         | I/O   |
| 2    | IO_L47N_2             | AA18        | I/O   |
| 2    | IO_L47P_2             | AB18        | I/O   |
| 2    | IO_L48N_2             | AE23        | I/O   |
| 2    | IO_L48P_2             | AF23        | I/O   |
| 2    | IO_L51N_2             | AE25        | I/O   |
| 2    | IO_L51P_2             | AF25        | I/O   |
| 2    | IO_L52N_2/CCLK        | AE24        | DUAL  |
| 2    | IO_L52P_2/D0/DIN/MISO | AF24        | DUAL  |
| 2    | IP_2                  | AA19        | INPUT |
| 2    | IP_2                  | AB13        | INPUT |
| 2    | IP_2                  | AB17        | INPUT |
| 2    | IP_2                  | AB20        | INPUT |
| 2    | IP_2                  | AC7         | INPUT |
| 2    | IP_2                  | AC13        | INPUT |
| 2    | IP_2                  | AC17        | INPUT |
| 2    | IP_2                  | AC18        | INPUT |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name    | FGG676 Ball | Type  |
|------|-------------|-------------|-------|
| 2    | IP_2        | AD9         | INPUT |
| 2    | IP_2        | AD10        | INPUT |
| 2    | IP_2        | AD16        | INPUT |
| 2    | IP_2        | AF2         | INPUT |
| 2    | IP_2        | AF7         | INPUT |
| 2    | IP_2        | Y11         | INPUT |
| 2    | IP_2/VREF_2 | AA9         | VREF  |
| 2    | IP_2/VREF_2 | AA20        | VREF  |
| 2    | IP_2/VREF_2 | AB6         | VREF  |
| 2    | IP_2/VREF_2 | AB10        | VREF  |
| 2    | IP_2/VREF_2 | AC10        | VREF  |
| 2    | IP_2/VREF_2 | AD12        | VREF  |
| 2    | IP_2/VREF_2 | AF15        | VREF  |
| 2    | IP_2/VREF_2 | AF17        | VREF  |
| 2    | IP_2/VREF_2 | AF22        | VREF  |
| 2    | IP_2/VREF_2 | Y16         | VREF  |
| 2    | N.C.        | AA8         | N.C.  |
| 2    | N.C.        | AC5         | N.C.  |
| 2    | N.C.        | AC22        | N.C.  |
| 2    | N.C.        | AD5         | N.C.  |
| 2    | N.C.        | Y18         | N.C.  |
| 2    | N.C.        | Y19         | N.C.  |
| 2    | N.C.        | AD23        | N.C.  |
| 2    | N.C.        | W18         | N.C.  |
| 2    | N.C.        | Y8          | N.C.  |
| 2    | VCCO_2      | AB8         | VCCO  |
| 2    | VCCO_2      | AB14        | VCCO  |
| 2    | VCCO_2      | AB19        | VCCO  |
| 2    | VCCO_2      | AE5         | VCCO  |
| 2    | VCCO_2      | AE11        | VCCO  |
| 2    | VCCO_2      | AE16        | VCCO  |
| 2    | VCCO_2      | AE22        | VCCO  |
| 2    | VCCO_2      | W11         | VCCO  |
| 2    | VCCO_2      | W16         | VCCO  |
| 3    | IO_L01N_3   | J9          | I/O   |
| 3    | IO_L01P_3   | J8          | I/O   |
| 3    | IO_L02N_3   | B1          | I/O   |
| 3    | IO_L02P_3   | B2          | I/O   |
| 3    | IO_L03N_3   | H7          | I/O   |
| 3    | IO_L03P_3   | G6          | I/O   |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name         | FGG676 Ball | Type |
|------|------------------|-------------|------|
| 3    | IO_L05N_3        | K8          | I/O  |
| 3    | IO_L05P_3        | K9          | I/O  |
| 3    | IO_L06N_3        | E4          | I/O  |
| 3    | IO_L06P_3        | D3          | I/O  |
| 3    | IO_L07N_3        | F4          | I/O  |
| 3    | IO_L07P_3        | E3          | I/O  |
| 3    | IO_L09N_3        | G4          | I/O  |
| 3    | IO_L09P_3        | F5          | I/O  |
| 3    | IO_L10N_3        | H6          | I/O  |
| 3    | IO_L10P_3        | J7          | I/O  |
| 3    | IO_L11N_3        | F2          | I/O  |
| 3    | IO_L11P_3        | E1          | I/O  |
| 3    | IO_L13N_3        | J6          | I/O  |
| 3    | IO_L13P_3        | K7          | I/O  |
| 3    | IO_L14N_3        | F3          | I/O  |
| 3    | IO_L14P_3        | G3          | I/O  |
| 3    | IO_L15N_3        | L9          | I/O  |
| 3    | IO_L15P_3        | L10         | I/O  |
| 3    | IO_L17N_3        | H1          | I/O  |
| 3    | IO_L17P_3        | H2          | I/O  |
| 3    | IO_L18N_3        | L7          | I/O  |
| 3    | IO_L18P_3        | K6          | I/O  |
| 3    | IO_L19N_3        | J4          | I/O  |
| 3    | IO_L19P_3        | J5          | I/O  |
| 3    | IO_L21N_3        | M9          | I/O  |
| 3    | IO_L21P_3        | M10         | I/O  |
| 3    | IO_L22N_3        | K4          | I/O  |
| 3    | IO_L22P_3        | K5          | I/O  |
| 3    | IO_L23N_3        | K2          | I/O  |
| 3    | IO_L23P_3        | K3          | I/O  |
| 3    | IO_L25N_3        | L3          | I/O  |
| 3    | IO_L25P_3        | L4          | I/O  |
| 3    | IO_L26N_3        | M7          | I/O  |
| 3    | IO_L26P_3        | M8          | I/O  |
| 3    | IO_L27N_3        | M3          | I/O  |
| 3    | IO_L27P_3        | M4          | I/O  |
| 3    | IO_L28N_3        | M6          | I/O  |
| 3    | IO_L28P_3        | M5          | I/O  |
| 3    | IO_L29N_3/VREF_3 | M1          | VREF |
| 3    | IO_L29P_3        | M2          | I/O  |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name               | FGG676 Ball | Type  |
|------|------------------------|-------------|-------|
| 3    | IO_L30N_3              | N4          | I/O   |
| 3    | IO_L30P_3              | N5          | I/O   |
| 3    | IO_L31N_3              | N2          | I/O   |
| 3    | IO_L31P_3              | N1          | I/O   |
| 3    | IO_L32N_3/LHCLK1       | N7          | LHCLK |
| 3    | IO_L32P_3/LHCLK0       | N6          | LHCLK |
| 3    | IO_L33N_3/IRDY2/LHCLK3 | P2          | LHCLK |
| 3    | IO_L33P_3/LHCLK2       | P1          | LHCLK |
| 3    | IO_L34N_3/LHCLK5       | P3          | LHCLK |
| 3    | IO_L34P_3/LHCLK4       | P4          | LHCLK |
| 3    | IO_L35N_3/LHCLK7       | P10         | LHCLK |
| 3    | IO_L35P_3/TRDY2/LHCLK6 | N9          | LHCLK |
| 3    | IO_L36N_3              | R2          | I/O   |
| 3    | IO_L36P_3/VREF_3       | R1          | VREF  |
| 3    | IO_L37N_3              | R4          | I/O   |
| 3    | IO_L37P_3              | R3          | I/O   |
| 3    | IO_L38N_3              | T4          | I/O   |
| 3    | IO_L38P_3              | T3          | I/O   |
| 3    | IO_L39N_3              | P6          | I/O   |
| 3    | IO_L39P_3              | P7          | I/O   |
| 3    | IO_L40N_3              | R6          | I/O   |
| 3    | IO_L40P_3              | R5          | I/O   |
| 3    | IO_L41N_3              | P9          | I/O   |
| 3    | IO_L41P_3              | P8          | I/O   |
| 3    | IO_L42N_3              | U4          | I/O   |
| 3    | IO_L42P_3              | T5          | I/O   |
| 3    | IO_L43N_3              | R9          | I/O   |
| 3    | IO_L43P_3/VREF_3       | R10         | VREF  |
| 3    | IO_L44N_3              | U2          | I/O   |
| 3    | IO_L44P_3              | U1          | I/O   |
| 3    | IO_L45N_3              | R7          | I/O   |
| 3    | IO_L45P_3              | R8          | I/O   |
| 3    | IO_L47N_3              | V2          | I/O   |
| 3    | IO_L47P_3              | V1          | I/O   |
| 3    | IO_L48N_3              | T9          | I/O   |
| 3    | IO_L48P_3              | T10         | I/O   |
| 3    | IO_L49N_3              | V5          | I/O   |
| 3    | IO_L49P_3              | U5          | I/O   |
| 3    | IO_L51N_3              | U6          | I/O   |
| 3    | IO_L51P_3              | T7          | I/O   |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name         | FGG676 Ball | Type  |
|------|------------------|-------------|-------|
| 3    | IO_L52N_3        | W4          | I/O   |
| 3    | IO_L52P_3        | W3          | I/O   |
| 3    | IO_L53N_3        | Y2          | I/O   |
| 3    | IO_L53P_3        | Y1          | I/O   |
| 3    | IO_L55N_3        | AA3         | I/O   |
| 3    | IO_L55P_3        | AA2         | I/O   |
| 3    | IO_L56N_3        | U8          | I/O   |
| 3    | IO_L56P_3        | U7          | I/O   |
| 3    | IO_L57N_3        | Y6          | I/O   |
| 3    | IO_L57P_3        | Y5          | I/O   |
| 3    | IO_L59N_3        | V6          | I/O   |
| 3    | IO_L59P_3        | V7          | I/O   |
| 3    | IO_L60N_3        | AC1         | I/O   |
| 3    | IO_L60P_3        | AB1         | I/O   |
| 3    | IO_L61N_3        | V8          | I/O   |
| 3    | IO_L61P_3        | U9          | I/O   |
| 3    | IO_L63N_3        | W6          | I/O   |
| 3    | IO_L63P_3        | W7          | I/O   |
| 3    | IO_L64N_3        | AC3         | I/O   |
| 3    | IO_L64P_3        | AC2         | I/O   |
| 3    | IO_L65N_3        | AD2         | I/O   |
| 3    | IO_L65P_3        | AD1         | I/O   |
| 3    | IP_L04N_3/VREF_3 | C1          | VREF  |
| 3    | IP_L04P_3        | C2          | INPUT |
| 3    | IP_L08N_3        | D1          | INPUT |
| 3    | IP_L08P_3        | D2          | INPUT |
| 3    | IP_L12N_3/VREF_3 | H4          | VREF  |
| 3    | IP_L12P_3        | G5          | INPUT |
| 3    | IP_L16N_3        | G1          | INPUT |
| 3    | IP_L16P_3        | G2          | INPUT |
| 3    | IP_L20N_3/VREF_3 | J2          | VREF  |
| 3    | IP_L20P_3        | J3          | INPUT |
| 3    | IP_L24N_3        | K1          | INPUT |
| 3    | IP_L24P_3        | J1          | INPUT |
| 3    | IP_L46N_3        | V4          | INPUT |
| 3    | IP_L46P_3        | U3          | INPUT |
| 3    | IP_L50N_3/VREF_3 | W2          | VREF  |
| 3    | IP_L50P_3        | W1          | INPUT |
| 3    | IP_L54N_3        | Y4          | INPUT |
| 3    | IP_L54P_3        | Y3          | INPUT |



Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name         | FGG676 Ball | Type  |
|------|------------------|-------------|-------|
| 3    | IP_L58N_3/VREF_3 | AA5         | VREF  |
| 3    | IP_L58P_3        | AA4         | INPUT |
| 3    | IP_L62N_3        | AB4         | INPUT |
| 3    | IP_L62P_3        | AB3         | INPUT |
| 3    | IP_L66N_3/VREF_3 | AE2         | VREF  |
| 3    | IP_L66P_3        | AE1         | INPUT |
| 3    | VCCO_3           | AB2         | VCCO  |
| 3    | VCCO_3           | E2          | VCCO  |
| 3    | VCCO_3           | H5          | VCCO  |
| 3    | VCCO_3           | L2          | VCCO  |
| 3    | VCCO_3           | L8          | VCCO  |
| 3    | VCCO_3           | P5          | VCCO  |
| 3    | VCCO_3           | T2          | VCCO  |
| 3    | VCCO_3           | T8          | VCCO  |
| 3    | VCCO_3           | W5          | VCCO  |
| GND  | GND              | A1          | GND   |
| GND  | GND              | A6          | GND   |
| GND  | GND              | A11         | GND   |
| GND  | GND              | A16         | GND   |
| GND  | GND              | A21         | GND   |
| GND  | GND              | A26         | GND   |
| GND  | GND              | AA1         | GND   |
| GND  | GND              | AA6         | GND   |
| GND  | GND              | AA11        | GND   |
| GND  | GND              | AA16        | GND   |
| GND  | GND              | AA21        | GND   |
| GND  | GND              | AA26        | GND   |
| GND  | GND              | AD3         | GND   |
| GND  | GND              | AD8         | GND   |
| GND  | GND              | AD13        | GND   |
| GND  | GND              | AD18        | GND   |
| GND  | GND              | AD24        | GND   |
| GND  | GND              | AF1         | GND   |
| GND  | GND              | AF6         | GND   |
| GND  | GND              | AF11        | GND   |
| GND  | GND              | AF16        | GND   |
| GND  | GND              | AF21        | GND   |
| GND  | GND              | AF26        | GND   |
| GND  | GND              | C3          | GND   |
| GND  | GND              | C9          | GND   |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank | Pin Name | FGG676 Ball | Type |
|------|----------|-------------|------|
| GND  | GND      | C14         | GND  |
| GND  | GND      | C19         | GND  |
| GND  | GND      | C24         | GND  |
| GND  | GND      | F1          | GND  |
| GND  | GND      | F6          | GND  |
| GND  | GND      | F11         | GND  |
| GND  | GND      | F16         | GND  |
| GND  | GND      | F21         | GND  |
| GND  | GND      | F26         | GND  |
| GND  | GND      | H3          | GND  |
| GND  | GND      | H8          | GND  |
| GND  | GND      | H14         | GND  |
| GND  | GND      | H19         | GND  |
| GND  | GND      | J24         | GND  |
| GND  | GND      | K10         | GND  |
| GND  | GND      | K17         | GND  |
| GND  | GND      | L1          | GND  |
| GND  | GND      | L6          | GND  |
| GND  | GND      | L11         | GND  |
| GND  | GND      | L13         | GND  |
| GND  | GND      | L15         | GND  |
| GND  | GND      | L21         | GND  |
| GND  | GND      | L26         | GND  |
| GND  | GND      | M12         | GND  |
| GND  | GND      | M14         | GND  |
| GND  | GND      | M16         | GND  |
| GND  | GND      | N3          | GND  |
| GND  | GND      | N8          | GND  |
| GND  | GND      | N11         | GND  |
| GND  | GND      | N15         | GND  |
| GND  | GND      | P12         | GND  |
| GND  | GND      | P16         | GND  |
| GND  | GND      | P19         | GND  |
| GND  | GND      | P24         | GND  |
| GND  | GND      | R11         | GND  |
| GND  | GND      | R13         | GND  |
| GND  | GND      | R15         | GND  |
| GND  | GND      | T1          | GND  |
| GND  | GND      | T6          | GND  |
| GND  | GND      | T12         | GND  |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank   | Pin Name | FGG676 Ball | Type     |
|--------|----------|-------------|----------|
| GND    | GND      | T14         | GND      |
| GND    | GND      | T16         | GND      |
| GND    | GND      | T21         | GND      |
| GND    | GND      | T26         | GND      |
| GND    | GND      | U10         | GND      |
| GND    | GND      | U13         | GND      |
| GND    | GND      | U17         | GND      |
| GND    | GND      | V3          | GND      |
| GND    | GND      | W8          | GND      |
| GND    | GND      | W14         | GND      |
| GND    | GND      | W19         | GND      |
| GND    | GND      | W24         | GND      |
| VCCAUX | SUSPEND  | V20         | PWR MGMT |
| VCCAUX | DONE     | AB21        | CONFIG   |
| VCCAUX | PROG_B   | A2          | CONFIG   |
| VCCAUX | TCK      | A25         | JTAG     |
| VCCAUX | TDI      | G7          | JTAG     |
| VCCAUX | TDO      | E23         | JTAG     |
| VCCAUX | TMS      | D4          | JTAG     |
| VCCAUX | VCCAUX   | AB5         | VCCAUX   |
| VCCAUX | VCCAUX   | AB11        | VCCAUX   |
| VCCAUX | VCCAUX   | AB22        | VCCAUX   |
| VCCAUX | VCCAUX   | E5          | VCCAUX   |
| VCCAUX | VCCAUX   | E16         | VCCAUX   |
| VCCAUX | VCCAUX   | E22         | VCCAUX   |
| VCCAUX | VCCAUX   | J18         | VCCAUX   |
| VCCAUX | VCCAUX   | K13         | VCCAUX   |
| VCCAUX | VCCAUX   | L5          | VCCAUX   |
| VCCAUX | VCCAUX   | N10         | VCCAUX   |
| VCCAUX | VCCAUX   | P17         | VCCAUX   |
| VCCAUX | VCCAUX   | T22         | VCCAUX   |
| VCCAUX | VCCAUX   | U14         | VCCAUX   |
| VCCAUX | VCCAUX   | V9          | VCCAUX   |
| VCCINT | VCCINT   | K15         | VCCINT   |
| VCCINT | VCCINT   | L12         | VCCINT   |
| VCCINT | VCCINT   | L14         | VCCINT   |
| VCCINT | VCCINT   | L16         | VCCINT   |
| VCCINT | VCCINT   | M11         | VCCINT   |
| VCCINT | VCCINT   | M13         | VCCINT   |
| VCCINT | VCCINT   | M15         | VCCINT   |

Table 82: Spartan-3AN FGG676 Pinout (Cont'd)

| Bank   | Pin Name | FGG676 Ball | Type   |
|--------|----------|-------------|--------|
| VCCINT | VCCINT   | M17         | VCCINT |
| VCCINT | VCCINT   | N12         | VCCINT |
| VCCINT | VCCINT   | N13         | VCCINT |
| VCCINT | VCCINT   | N14         | VCCINT |
| VCCINT | VCCINT   | N16         | VCCINT |
| VCCINT | VCCINT   | P11         | VCCINT |
| VCCINT | VCCINT   | P13         | VCCINT |
| VCCINT | VCCINT   | P14         | VCCINT |
| VCCINT | VCCINT   | P15         | VCCINT |
| VCCINT | VCCINT   | R12         | VCCINT |
| VCCINT | VCCINT   | R14         | VCCINT |
| VCCINT | VCCINT   | R16         | VCCINT |
| VCCINT | VCCINT   | T11         | VCCINT |
| VCCINT | VCCINT   | T13         | VCCINT |
| VCCINT | VCCINT   | T15         | VCCINT |
| VCCINT | VCCINT   | U12         | VCCINT |

## User I/Os by Bank

Table 83 indicates how the 502 available user-I/O pins are distributed between the four I/O banks on the FGG676 package. The AWAKE pin is counted as a dual-purpose I/O.

Table 83: User I/Os Per Bank for the XC3S1400AN in the FGG676 Package

| Package Edge | I/O Bank | Maximum I/Os | All Possible I/O Pins by Type |           |           |           |           |
|--------------|----------|--------------|-------------------------------|-----------|-----------|-----------|-----------|
|              |          |              | I/O                           | INPUT     | DUAL      | VREF      | CLK       |
| Top          | 0        | 120          | 82                            | 20        | 1         | 9         | 8         |
| Right        | 1        | 130          | 67                            | 15        | 30        | 10        | 8         |
| Bottom       | 2        | 120          | 67                            | 14        | 21        | 10        | 8         |
| Left         | 3        | 132          | 97                            | 18        | 0         | 9         | 8         |
| <b>Total</b> |          | <b>502</b>   | <b>313</b>                    | <b>67</b> | <b>52</b> | <b>38</b> | <b>32</b> |

## Footprint Migration Differences

The XC3S1400AN is the only Spartan-3AN FPGA offered in the FGG676 package. The XC3S1400AN FPGA is pin compatible with the Spartan-3A XC3S1400A FPGA in the FG(G)676 package, although the Spartan-3A FPGA requires an external configuration source.

### FGG676 Footprint

#### Left Half of FGG676 Package (Top View)

313 I/O: Unrestricted, general-purpose user I/O

67 INPUT: Unrestricted, general-purpose input pin

51 DUAL: Configuration pins, then possible user I/O

2 SUSPEND: Dedicated SUSPEND and dual-purpose AWAKE Power Management pins

38 VREF: User I/O or input voltage reference for bank

32 CLK: User I/O, input, or clock buffer input

2 CONFIG: Dedicated configuration pins

4 JTAG: Dedicated JTAG port pins

77 GND: Ground

36 VCCO: Output voltage supply for bank

23 VCCINT: Internal core supply voltage (+1.2V)

14 VCCAUX: Auxiliary supply voltage

17 N.C.: Not connected

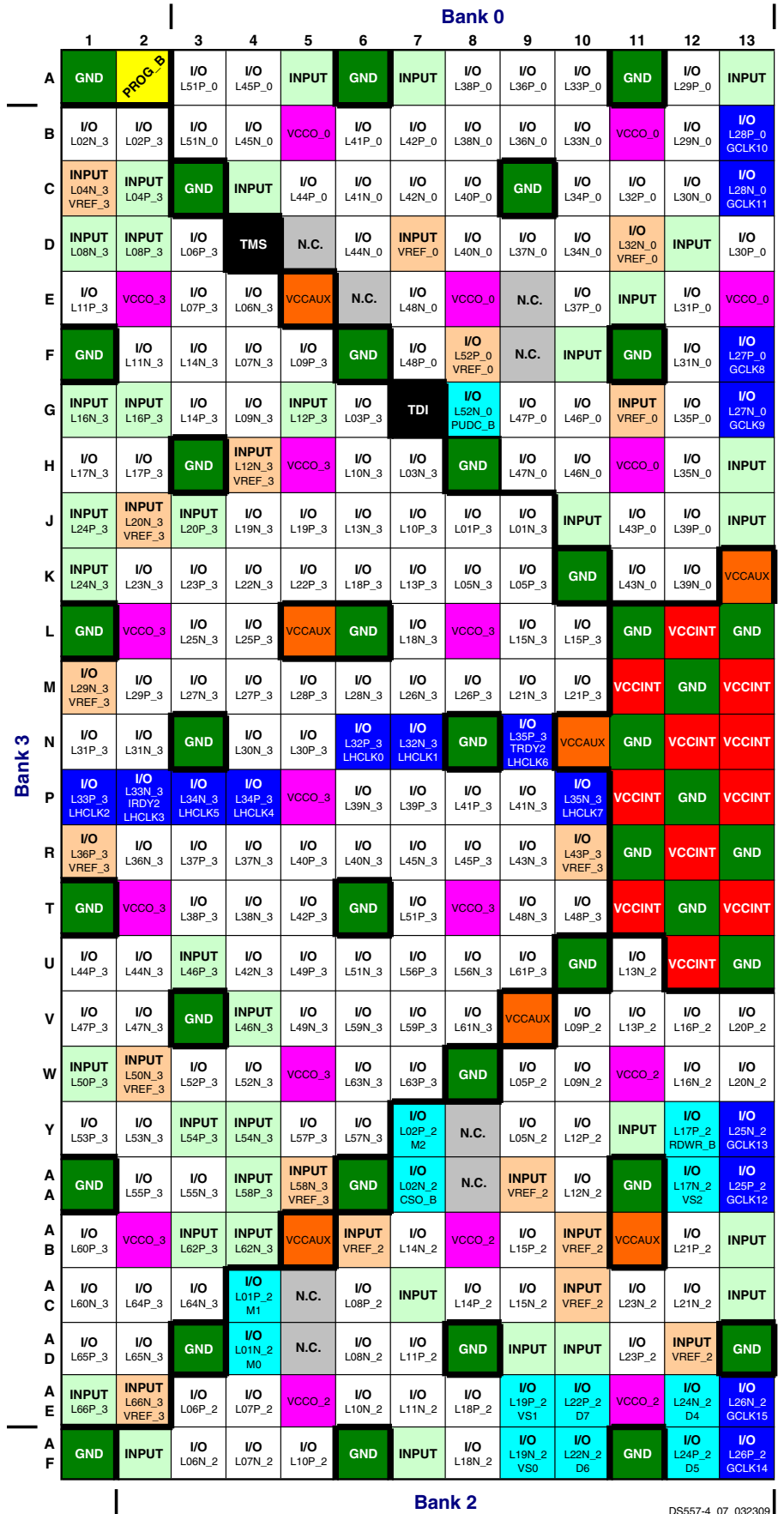


Figure 24: FGG676 Package Footprint (Top View)

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| Bank 0              |                             |              |                   |                               |                      |                      |                      |                  |                        |                              |                               |                        |   | Bank 1              |                             |              |                   |                               |                      |                      |                      |                      |                        |                              |                               |                        |        |            |   |
|---------------------|-----------------------------|--------------|-------------------|-------------------------------|----------------------|----------------------|----------------------|------------------|------------------------|------------------------------|-------------------------------|------------------------|---|---------------------|-----------------------------|--------------|-------------------|-------------------------------|----------------------|----------------------|----------------------|----------------------|------------------------|------------------------------|-------------------------------|------------------------|--------|------------|---|
| 14                  | 15                          | 16           | 17                | 18                            | 19                   | 20                   | 21                   | 22               | 23                     | 24                           | 25                            | 26                     |   | 14                  | 15                          | 16           | 17                | 18                            | 19                   | 20                   | 21                   | 22                   | 23                     | 24                           | 25                            | 26                     |        |            |   |
| I/O L26N_0<br>GCLK7 | I/O L23N_0                  | GND          | INPUT             | I/O L18N_0                    | I/O L15N_0           | I/O L14N_0           | GND                  | I/O L07N_0       | INPUT                  | N.C.                         | TCK                           | GND                    | A | I/O L25N_0<br>GCLK5 | INPUT                       | I/O L12P_0   | INPUT VREF_0      | VCCAUX                        | I/O L13N_0           | INPUT                | VCCO_0               | INPUT                | I/O L10P_0             | VCCAUX                       | TDO                           | I/O L56P_1             | VCCO_1 | I/O L60P_1 | E |
| I/O L26P_0<br>GCLK6 | I/O L23P_0                  | VCCO_0       | I/O L19N_0        | I/O L18P_0                    | I/O L15P_0           | I/O L14P_0<br>VREF_0 | I/O L09N_0           | VCCO_0           | I/O L07P_0             | N.C.                         | INPUT L65N_1                  | INPUT L65P_1<br>VREF_1 | B | I/O L24P_0          | I/O L20N_0<br>VREF_0        | VCCAUX       | I/O L13N_0        | INPUT                         | VCCO_0               | INPUT                | I/O L10P_0           | VCCAUX               | TDO                    | I/O L56P_1                   | VCCO_1                        | I/O L60P_1             | E      |            |   |
| GND                 | I/O L22N_0                  | I/O L21N_0   | I/O L21P_0        | I/O L17N_0                    | GND                  | I/O L11N_0           | I/O L09P_0           | I/O L05N_0       | I/O L06N_0             | GND                          | I/O L63N_1<br>A23             | I/O L63P_1<br>A22      | C | I/O L24N_0          | I/O L20P_0                  | GND          | I/O L13P_0        | N.C.                          | I/O L02N_0           | I/O L01N_0           | GND                  | I/O L58P_1<br>VREF_1 | I/O L56N_1             | I/O L54N_1                   | I/O L54P_1                    | GND                    | F      |            |   |
| INPUT VREF_0        | INPUT                       | I/O L22P_0   | I/O L21P_0        | I/O L17P_0                    | INPUT                | I/O L11P_0           | I/O L10N_0           | I/O L05P_0       | I/O L06P_0             | I/O L61N_1                   | I/O L61P_1                    | I/O L60N_1             | D | I/O L24N_0          | I/O L20P_0                  | GND          | I/O L13P_0        | N.C.                          | I/O L02N_0           | I/O L01N_0           | GND                  | I/O L58P_1<br>VREF_1 | I/O L56N_1             | I/O L54N_1                   | I/O L54P_1                    | GND                    | F      |            |   |
| I/O L24P_0          | I/O L20N_0<br>VREF_0        | VCCAUX       | I/O L13N_0        | INPUT                         | VCCO_0               | INPUT                | I/O L10P_0           | VCCAUX           | TDO                    | I/O L56P_1                   | VCCO_1                        | I/O L60P_1             | E | I/O L24N_0          | I/O L20P_0                  | GND          | I/O L13P_0        | N.C.                          | I/O L02P_0<br>VREF_0 | I/O L01P_0           | I/O L64N_1<br>A25    | I/O L58N_1           | I/O L51P_1             | I/O L51N_1                   | INPUT L52N_1<br>VREF_1        | INPUT L52P_1           | G      |            |   |
| I/O L25N_0<br>GCLK5 | INPUT                       | I/O L12P_0   | INPUT VREF_0      | VCCAUX                        | I/O L15N_1           | I/O L15N_1           | I/O L62P_1<br>A20    | I/O L49N_1       | I/O L49P_1             | GND                          | I/O L43N_1<br>A19             | I/O L43P_1<br>A18      | J | I/O L25P_0<br>GCLK4 | VCCINT                      | I/O L12N_0   | GND               | I/O L15N_1                    | I/O L15P_1           | I/O L53N_1           | I/O L50N_1           | I/O L46N_1           | I/O L46P_1             | INPUT L40P_1                 | I/O L41P_1                    | I/O L41N_1             | K      |            |   |
| VCCINT              | GND                         | VCCINT       | I/O L55N_1        | I/O L55P_1                    | VCCO_1               | I/O L53P_1           | GND                  | I/O L50P_1       | INPUT L40N_1           | I/O L38P_1<br>A12            | VCCO_1                        | GND                    | L | VCCINT              | GND                         | VCCINT       | I/O L55N_1        | I/O L55P_1                    | VCCO_1               | I/O L53P_1           | GND                  | I/O L50P_1           | INPUT L40N_1           | I/O L38P_1<br>A12            | VCCO_1                        | GND                    | L      |            |   |
| GND                 | VCCINT                      | GND          | VCCINT            | I/O L47N_1                    | I/O L47P_1           | I/O L42N_1<br>A17    | I/O L45P_1           | I/O L45N_1       | I/O L38N_1<br>A13      | INPUT L36P_1<br>VREF_1       | I/O L35N_1                    | I/O L35P_1<br>A10      | M | GND                 | VCCINT                      | GND          | VCCINT            | I/O L47N_1                    | I/O L47P_1           | I/O L42N_1<br>A17    | I/O L45P_1           | I/O L45N_1           | I/O L38N_1<br>A13      | INPUT L36P_1<br>VREF_1       | I/O L35N_1                    | I/O L35P_1<br>A10      | M      |            |   |
| VCCINT              | GND                         | VCCINT       | I/O L39N_1<br>A15 | I/O L39P_1<br>A14             | I/O L34N_1<br>RHCLK7 | I/O L42P_1<br>A16    | I/O L37N_1           | VCCO_1           | INPUT L36N_1           | I/O L33N_1<br>RHCLK5         | INPUT L32N_1                  | INPUT L32P_1           | N | VCCINT              | GND                         | VCCINT       | I/O L39N_1<br>A15 | I/O L39P_1<br>A14             | I/O L34N_1<br>RHCLK7 | I/O L42P_1<br>A16    | I/O L37N_1           | VCCO_1               | INPUT L36N_1           | I/O L33N_1<br>RHCLK5         | INPUT L32N_1                  | INPUT L32P_1           | N      |            |   |
| VCCINT              | VCCINT                      | GND          | VCCAUX            | I/O L34P_1<br>IRDY1<br>RHCLK6 | GND                  | I/O L30N_1<br>RHCLK1 | I/O L30P_1<br>RHCLK0 | I/O L37P_1       | I/O L33P_1<br>RHCLK4   | GND                          | I/O L31N_1<br>TRDY1<br>RHCLK3 | I/O L31P_1<br>RHCLK2   | P | VCCINT              | VCCINT                      | GND          | VCCAUX            | I/O L34P_1<br>IRDY1<br>RHCLK6 | GND                  | I/O L30N_1<br>RHCLK1 | I/O L30P_1<br>RHCLK0 | I/O L37P_1           | I/O L33P_1<br>RHCLK4   | GND                          | I/O L31N_1<br>TRDY1<br>RHCLK3 | I/O L31P_1<br>RHCLK2   | P      |            |   |
| VCCINT              | GND                         | VCCINT       | I/O L27N_1<br>A7  | I/O L27P_1<br>A6              | I/O L22P_1           | I/O L22N_1           | I/O L25P_1<br>A2     | I/O L25N_1<br>A3 | INPUT L28P_1<br>VREF_1 | INPUT L28N_1                 | I/O L29P_1<br>A8              | I/O L29N_1<br>A9       | R | VCCINT              | GND                         | VCCINT       | I/O L27N_1<br>A7  | I/O L27P_1<br>A6              | I/O L22P_1           | I/O L22N_1           | I/O L25P_1<br>A2     | I/O L25N_1<br>A3     | INPUT L28P_1<br>VREF_1 | INPUT L28N_1                 | I/O L29P_1<br>A8              | I/O L29N_1<br>A9       | R      |            |   |
| GND                 | VCCINT                      | GND          | I/O L17N_1        | I/O L17P_1                    | VCCO_1               | I/O L14N_1           | GND                  | VCCAUX           | I/O L26P_1<br>A4       | I/O L26N_1<br>A5             | VCCO_1                        | GND                    | T | GND                 | VCCINT                      | GND          | I/O L17N_1        | I/O L17P_1                    | VCCO_1               | I/O L14N_1           | GND                  | VCCAUX               | I/O L26P_1<br>A4       | I/O L26N_1<br>A5             | VCCO_1                        | GND                    | T      |            |   |
| VCCAUX              | I/O L35N_2                  | I/O L42N_2   | GND               | I/O L12N_1                    | I/O L12P_1           | I/O L10N_1           | I/O L14P_1           | I/O L21N_1       | I/O L23P_1             | I/O L23N_1<br>VREF_1         | INPUT L24P_1                  | INPUT L24N_1<br>VREF_1 | U | VCCAUX              | I/O L35N_2                  | I/O L42N_2   | GND               | I/O L12N_1                    | I/O L12P_1           | I/O L10N_1           | I/O L14P_1           | I/O L21N_1           | I/O L23P_1             | I/O L23N_1<br>VREF_1         | INPUT L24P_1                  | INPUT L24N_1<br>VREF_1 | U      |            |   |
| I/O L31P_2          | I/O L35P_2                  | I/O L42P_2   | I/O L46N_2        | I/O L08P_1                    | I/O L08N_1           | SUSPEND              | I/O L10P_1           | I/O L18N_1       | I/O L21P_1             | I/O L19P_1                   | I/O L19N_1                    | INPUT L20N_1<br>VREF_1 | V | I/O L31P_2          | I/O L35P_2                  | I/O L42P_2   | I/O L46N_2        | I/O L08P_1                    | I/O L08N_1           | SUSPEND              | I/O L10P_1           | I/O L18N_1           | I/O L21P_1             | I/O L19P_1                   | I/O L19N_1                    | INPUT L20N_1<br>VREF_1 | V      |            |   |
| GND                 | I/O L31N_2                  | VCCO_2       | I/O L46P_2        | N.C.                          | GND                  | I/O L04P_1           | I/O L04N_1           | VCCO_1           | I/O L18P_1             | GND                          | INPUT L16P_1                  | INPUT L20P_1           | W | GND                 | I/O L31N_2                  | VCCO_2       | I/O L46P_2        | N.C.                          | GND                  | I/O L04P_1           | I/O L04N_1           | VCCO_1               | I/O L18P_1             | GND                          | INPUT L16P_1                  | INPUT L20P_1           | W      |            |   |
| I/O L27P_2<br>GCLK0 | I/O L34N_2<br>D3            | INPUT VREF_2 | I/O L43N_2        | N.C.                          | N.C.                 | I/O L01P_1<br>HDC    | I/O L01N_1<br>LDC2   | I/O L13P_1       | I/O L13N_1             | I/O L15P_1                   | I/O L15N_1                    | INPUT L16N_1           | Y | I/O L27P_2<br>GCLK0 | I/O L34N_2<br>D3            | INPUT VREF_2 | I/O L43N_2        | N.C.                          | N.C.                 | I/O L01P_1<br>HDC    | I/O L01N_1<br>LDC2   | I/O L13P_1           | I/O L13N_1             | I/O L15P_1                   | I/O L15N_1                    | INPUT L16N_1           | Y      |            |   |
| I/O L27N_2<br>GCLK1 | I/O L34P_2<br>INIT_B        | GND          | I/O L43P_2        | I/O L47N_2                    | INPUT                | INPUT VREF_2         | GND                  | I/O L09P_1       | I/O L09N_1             | I/O L11P_1                   | I/O L11N_1                    | GND                    | A | I/O L27N_2<br>GCLK1 | I/O L34P_2<br>INIT_B        | GND          | I/O L43P_2        | I/O L47N_2                    | INPUT                | INPUT VREF_2         | GND                  | I/O L09P_1           | I/O L09N_1             | I/O L11P_1                   | I/O L11N_1                    | GND                    | A      |            |   |
| VCCO_2              | I/O L30N_2<br>MOSI<br>CSL_B | I/O L38N_2   | INPUT             | I/O L47P_2                    | VCCO_2               | INPUT                | DONE                 | VCCAUX           | I/O L07P_1             | I/O L07N_1<br>VREF_1         | VCCO_1                        | I/O L06N_1             | A | VCCO_2              | I/O L30N_2<br>MOSI<br>CSL_B | I/O L38N_2   | INPUT             | I/O L47P_2                    | VCCO_2               | INPUT                | DONE                 | VCCAUX               | I/O L07P_1             | I/O L07N_1<br>VREF_1         | VCCO_1                        | I/O L06N_1             | A      |            |   |
| I/O L29N_2          | I/O L30P_2                  | I/O L38P_2   | INPUT             | INPUT                         | I/O L40N_2           | I/O L41N_2           | I/O L45N_2           | N.C.             | I/O L03P_1<br>A0       | I/O L03N_1<br>A1             | I/O L05N_1                    | I/O L06P_1             | C | I/O L29N_2          | I/O L30P_2                  | I/O L38P_2   | INPUT             | INPUT                         | I/O L40N_2           | I/O L41N_2           | I/O L45N_2           | N.C.                 | I/O L03P_1<br>A0       | I/O L03N_1<br>A1             | I/O L05N_1                    | I/O L06P_1             | C      |            |   |
| I/O L29P_2          | I/O L32P_2<br>AWAKE         | INPUT        | I/O L33N_2        | GND                           | I/O L40P_2           | I/O L41P_2           | I/O L44N_2           | I/O L45P_2       | N.C.                   | GND                          | I/O L02N_1<br>LDC0            | I/O L05P_1             | D | I/O L29P_2          | I/O L32P_2<br>AWAKE         | INPUT        | I/O L33N_2        | GND                           | I/O L40P_2           | I/O L41P_2           | I/O L44N_2           | I/O L45P_2           | N.C.                   | GND                          | I/O L02N_1<br>LDC0            | I/O L05P_1             | D      |            |   |
| I/O L28N_2<br>GCLK3 | I/O L32N_2<br>DOUT          | VCCO_2       | I/O L33P_2        | I/O L36N_2<br>D1              | I/O L37N_2           | I/O L39N_2           | I/O L44P_2           | VCCO_2           | I/O L48N_2             | I/O L52N_2<br>CCLK           | I/O L51N_2                    | I/O L02P_1<br>LDC1     | E | I/O L28N_2<br>GCLK3 | I/O L32N_2<br>DOUT          | VCCO_2       | I/O L33P_2        | I/O L36N_2<br>D1              | I/O L37N_2           | I/O L39N_2           | I/O L44P_2           | VCCO_2               | I/O L48N_2             | I/O L52N_2<br>CCLK           | I/O L51N_2                    | I/O L02P_1<br>LDC1     | E      |            |   |
| I/O L28P_2<br>GCLK2 | INPUT VREF_2                | GND          | INPUT VREF_2      | I/O L36P_2<br>D2              | I/O L37P_2           | I/O L39P_2           | GND                  | INPUT VREF_2     | I/O L48P_2             | I/O L52P_2<br>D0<br>DIN/MISO | I/O L51P_2                    | GND                    | F | I/O L28P_2<br>GCLK2 | INPUT VREF_2                | GND          | INPUT VREF_2      | I/O L36P_2<br>D2              | I/O L37P_2           | I/O L39P_2           | GND                  | INPUT VREF_2         | I/O L48P_2             | I/O L52P_2<br>D0<br>DIN/MISO | I/O L51P_2                    | GND                    | F      |            |   |

Right Half of FGG676 Package (Top View)

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Figure 24: FGG676 Package Footprint (Top View)

## Revision History

The following table shows the revision history for this document.

| Date     | Version | Revision  |
|----------|---------|---|
| 02/26/07 | 1.0     | Initial release.  |
| 08/16/07 | 2.0     | Updated for Production release of initial device. Noted that family is available in Pb-free packages only.  |
| 09/12/07 | 2.0.1   | Minor updates to text.  |
| 09/24/07 | 2.1     | Update thermal characteristics in <a href="#">Table 67</a> .  |
| 12/12/07 | 3.0     | Updated to Production status with Production release of final family member, XC3S50AN. Noted that non-Pb-free packages may be available for selected devices. Updated thermal characteristics in <a href="#">Table 67</a> . Updated links.  |
| 06/02/08 | 3.1     | Add <a href="#">Package Overview</a> section. Removed VREF and INPUT designations and diamond symbols on unconnected N.C. pins for XC3S700AN FGG484 in <a href="#">Table 78</a> and <a href="#">Figure 22</a> and for XC3S1400AN FGG676 in <a href="#">Table 82</a> and <a href="#">Figure 23</a> .   |
| 11/19/09 | 3.2     | Renamed package 'Footprint Area' to 'Body Area' throughout document. Noted in <a href="#">Introduction</a> that references to Pb-free package code also apply to the Pb package. Added Pb packages to <a href="#">Table 65</a> and <a href="#">Table 66</a> . Changed Body Area of TQ144/TQG144 packages in <a href="#">Table 65</a> . Corrected bank designation for SUSPEND to VCCAUX. Noted that non-Pb-free (Pb) packages are available for selected devices. Updated <a href="#">Table 79</a> and <a href="#">Figure 22</a> for I/O vs. Input pin counts.  |
| 12/02/10 | 4.0     | Upgraded <a href="#">Notice of Disclaimer</a> .   |
| 04/01/11 | 4.1     | Updated the CLK description in <a href="#">Table 62</a> . In <a href="#">Table 64</a> , added device/package combinations for the XC3S50AN and XC3S400AN in the FT(G)256 package and the XC3S1400AN in the FG(G)484 package. In <a href="#">Table 65</a> , updated the maximum I/Os for the FG484/FGG484 packages, removed the Mass column, and updated Note 1. In <a href="#">Table 65</a> , changed the FTG256 link from <a href="#">PK115_FTG256</a> , FGG676 link from <a href="#">PK111_FGG676</a> , and the TQG144 link from <a href="#">PK126_TQG144</a> . Completely replaced the section <a href="#">FTG256: 256-Ball Fine-Pitch, Thin Ball Grid Array</a> with new information on the added device/package combinations and new figures and tables. Revised U16, U7, and T8 in <a href="#">Table 78</a> . Added <a href="#">Table 80</a> and <a href="#">Table 81</a> and updated <a href="#">Figure 23</a> . |

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### Наши контакты:

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331