

# XC2S400E-6FGG456C Datasheet



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|                              |                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------|
| DiGi Electronics Part Number | XC2S400E-6FGG456C-DG                                                                |
| Manufacturer                 | <a href="#">AMD</a>                                                                 |
| Manufacturer Product Number  | XC2S400E-6FGG456C                                                                   |
| Description                  | IC FPGA 329 I/O 456FBGA                                                             |
| Detailed Description         | Spartan®-IIE Field Programmable Gate Array (FPGA)<br>) IC 329 163840 10800 456-BBGA |



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## Purchase and inquiry

Manufacturer Product Number:

XC2S400E-6FGG456C

Series:

Spartan®-IIE

DiGi-Electronics Programmable:

Not Verified

Number of Logic Elements/Cells:

10800

Number of I/O:

329

Voltage - Supply:

1.71V ~ 1.89V

Operating Temperature:

0°C ~ 85°C (TJ)

Supplier Device Package:

456-FBGA (23x23)

Manufacturer:

AMD

Product Status:

Obsolete

Number of LABs/CLBs:

2400

Total RAM Bits:

163840

Number of Gates:

400000

Mounting Type:

Surface Mount

Package / Case:

456-BBGA

Base Product Number:

XC2S400E

## Environmental & Export classification

Moisture Sensitivity Level (MSL):

3 (168 Hours)

ECCN:

3A991D

REACH Status:

REACH Unaffected

HTSUS:

8542.39.0001



# Spartan-IIE FPGA Family Data Sheet

DS077 August 9, 2013

Product Specification

This document includes all four modules of the Spartan®-IIE FPGA data sheet.

## Module 1: Introduction and Ordering Information

DS077-1 (v3.0) August 9, 2013

- Introduction
- Features
- General Overview
- Product Availability
- User I/O Chart
- Ordering Information

## Module 2: Functional Description

DS077-2 (v3.0) August 9, 2013

- Architectural Description
  - Spartan-IIE Array
  - Input/Output Block
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  - Block RAM
  - Clock Distribution: Delay-Locked Loop
  - Boundary Scan
- Development System
- Configuration

## Module 3: DC and Switching Characteristics

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- DC Specifications
  - Absolute Maximum Ratings
  - Recommended Operating Conditions
  - DC Characteristics
  - Power-On Requirements
  - DC Input and Output Levels
- Switching Characteristics
  - Pin-to-Pin Parameters
  - IOB Switching Characteristics
  - Clock Distribution Characteristics
  - DLL Timing Parameters
  - CLB Switching Characteristics
  - Block RAM Switching Characteristics
  - TBUF Switching Characteristics
  - JTAG Switching Characteristics
  - Configuration Switching Characteristics

## Module 4: Pinout Tables

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- Pin Definitions
- Pinout Tables

**IMPORTANT NOTE:** *The Spartan-IIE FPGA data sheet is in four modules. Each module has its own Revision History at the end. Use the PDF "Bookmarks" for easy navigation in this volume.*



## DS077-1 (v3.0) August 9, 2013

## Product Specification

## DS077-1 (v3.0) August 9, 2013

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

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

## Spartan-II Family Compared to Spartan-II Family

- Higher density and more I/O
- Higher performance
- Unique pinouts in cost-effective packages
- Differential signaling
  - LVDS, Bus LVDS, LVPECL
- $V_{CCINT} = 1.8V$ 
  - Lower power
  - 5V tolerance with external resistor
  - 3V tolerance directly
- PCI, LVTTTL, and LVCMOS2 input buffers powered by  $V_{CCO}$  instead of  $V_{CCINT}$
- Unique larger bitstream

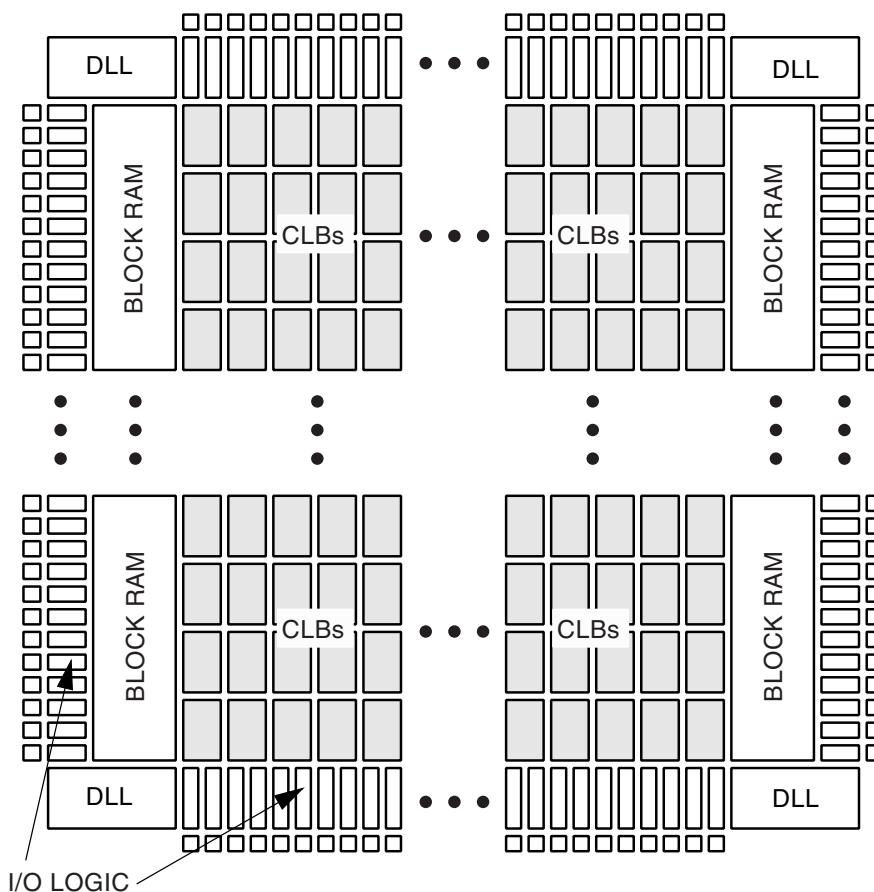


**Figure 1: Basic Spartan-IIe Family FPGA Block Diagram**

## Spartan-II E Product Availability

Table 2 shows the maximum user I/Os available on the device and the number of user I/Os available for each device/package combination.

**Table 2: Spartan-II E FPGA User I/O Chart**

| Device   | Maximum User I/O | Available User I/O According to Package Type |                 |                 |                 |                 |
|----------|------------------|----------------------------------------------|-----------------|-----------------|-----------------|-----------------|
|          |                  | TQ144<br>TQG144                              | PQ208<br>PQG208 | FT256<br>FTG256 | FG456<br>FGG456 | FG676<br>FGG676 |
| XC2S50E  | 182              | 102                                          | 146             | 182             | -               | -               |
| XC2S100E | 202              | 102                                          | 146             | 182             | 202             | -               |
| XC2S150E | 265              | -                                            | 146             | 182             | 265             | -               |
| XC2S200E | 289              | -                                            | 146             | 182             | 289             | -               |
| XC2S300E | 329              | -                                            | 146             | 182             | 329             | -               |
| XC2S400E | 410              | -                                            | -               | 182             | 329             | 410             |
| XC2S600E | 514              | -                                            | -               | -               | 329             | 514             |

**Notes:**

1. User I/O counts include the four global clock/user input pins.

### ***Standard Packaging***

DS077-1 03a 072004

### ***Pb-Free Packaging***

DS077-1 03b 072004

## Device Ordering Options

| Device   | Speed Grade |                                    | Package Type / Number of Pins |                          | Temperature Range (T <sub>J</sub> )( <sup>2</sup> ) |                 |
|----------|-------------|------------------------------------|-------------------------------|--------------------------|-----------------------------------------------------|-----------------|
| XC2S50E  | -6          | Standard Performance               | TQ(G)144                      | 144-pin Plastic Thin QFP | C = Commercial                                      | 0°C to +85°C    |
| XC2S100E | -7          | Higher Performance( <sup>1</sup> ) | PQ(G)208                      | 208-pin Plastic QFP      | I = Industrial                                      | −40°C to +100°C |
| XC2S150E |             |                                    | FT(G)256                      | 256-ball Fine Pitch BGA  |                                                     |                 |
| XC2S200E |             |                                    | FG(G)456                      | 456-ball Fine Pitch BGA  |                                                     |                 |
| XC2S300E |             |                                    | FG(G)676                      | 676-ball Fine Pitch BGA  |                                                     |                 |
| XC2S400E |             |                                    |                               |                          |                                                     |                 |
| XC2S600E |             |                                    |                               |                          |                                                     |                 |

1. The -7 speed grade is exclusively available in the Commercial temperature range.
2. See [www.xilinx.com](http://www.xilinx.com) for information on automotive temperature range devices.

## Device Part Marking

The "7C" and "6I" Speed Grade/Temperature Range part combinations may be dual marked as "7C/6I". Devices with the dual mark can be used as either -7C or -6I devices. Devices with a single mark are only guaranteed for the marked speed grade and temperature range.

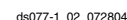


*Figure 2: Spartan-IIE QFP Marking Example*

## Revision History

| Date       | Version | Description                                                                                                                                                                                 |
|------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 06/27/2002 | 1.1     | Updated -7 availability.                                                                                                                                                                    |
| 11/18/2002 | 2.0     | Added XC2S400E and XC2S600E. Corrected XC2S150E max I/O count and XC2S50E differential I/O count and updated availability.                                                                  |
| 07/09/2003 | 2.1     | Noted hot-swap capability. Updated Table 2 to show that all products are available. Clarified device part marking.                                                                          |
| 07/28/2004 | 2.2     | Added information on Pb-free packaging options.                                                                                                                                             |
| 06/18/2008 | 2.3     | Added dual mark information in <a href="#">Device Part Marking</a> . Updated all modules for continuous page, figure, and table numbering. Updated links. Synchronized all modules to v2.3. |
| 08/09/2013 | 3.0     | This product is obsolete/discontinued per <a href="#">XCN12026</a> .                                                                                                                        |





# Spartan-II E FPGA Family: Functional Description

DS077-2 (v3.0) August 9, 2013

## Product Specification

## Architectural Description

## Spartan-IIe FPGA Array

The Spartan®-IIE user-programmable gate array, shown in [Figure 3](#), is composed of five major configurable elements:

- IOBs provide the interface between the package pins and the internal logic
- CLBs provide the functional elements for constructing most logic
- Dedicated block RAM memories of 4096 bits each
- Clock DLLs for clock-distribution delay compensation and clock domain control
- Versatile multi-level interconnect structure

As can be seen in [Figure 3](#), the CLBs form the central logic structure with easy access to all support and routing structures. The IOBs are located around all the logic and memory elements for easy and quick routing of signals on and off the chip.

Values stored in static memory cells control all the configurable logic elements and interconnect resources. These values load into the memory cells on power-up, and can reload if necessary to change the function of the device.

Each of these elements will be discussed in detail in the following sections.

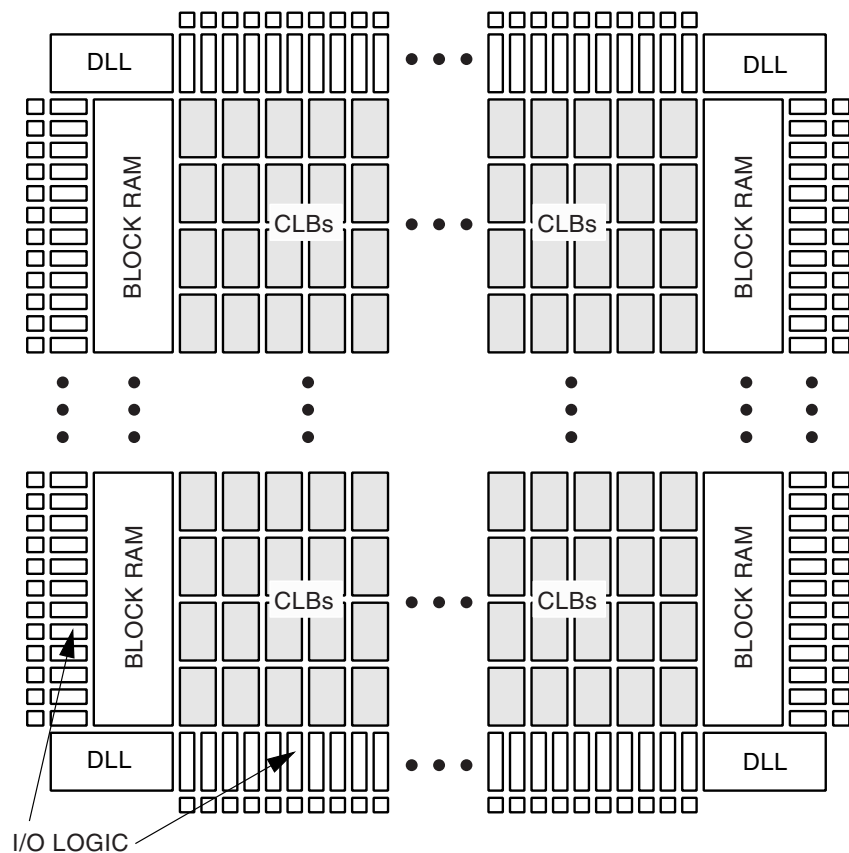


**Figure 3: Basic Spartan-IIe Family FPGA Block Diagram**

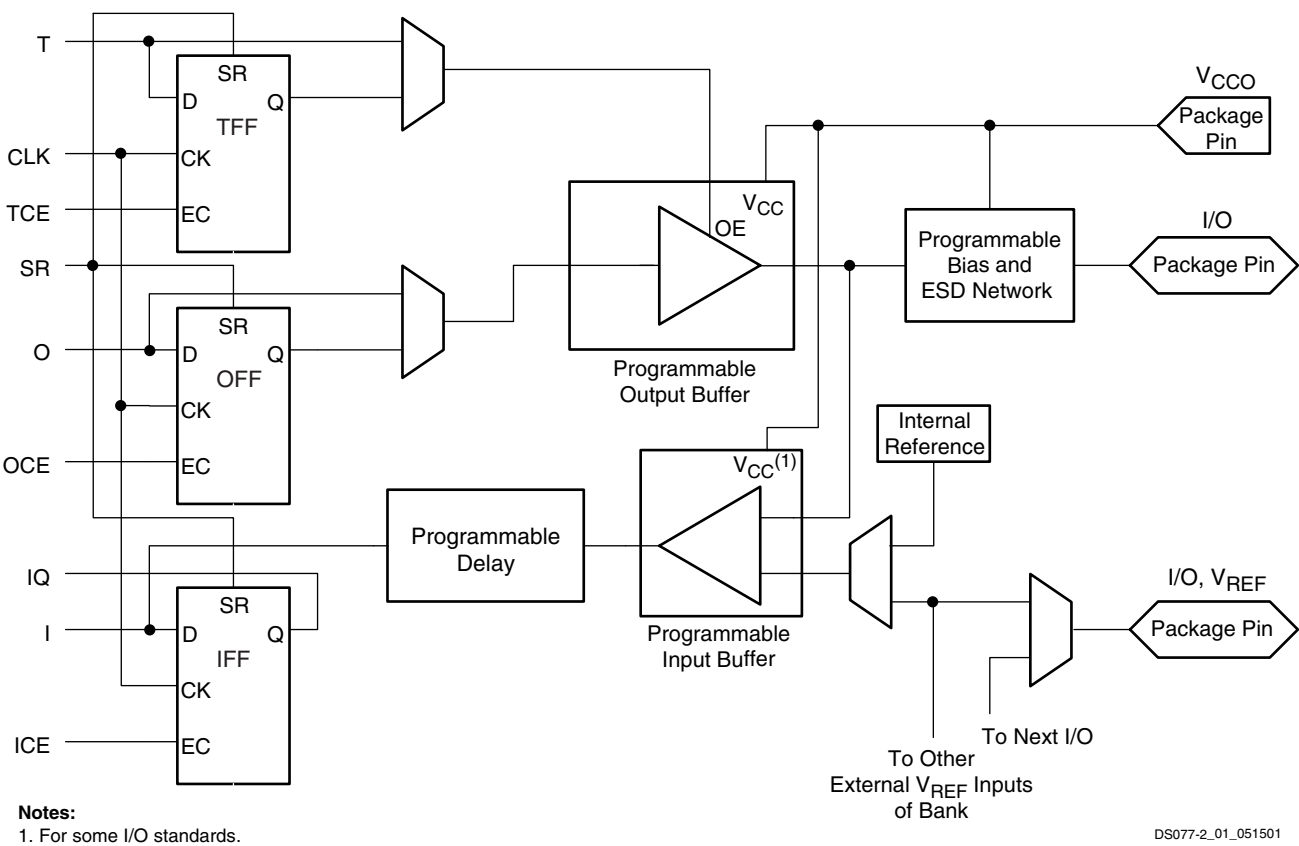


Figure 4: Spartan-II® Input/Output Block (IOB)

Table 3: Standards Supported by I/O (Typical Values)

| I/O Standard            | Input Reference Voltage (V <sub>REF</sub> ) | Input Voltage (V <sub>CCO</sub> ) | Output Source Voltage (V <sub>CCO</sub> ) | Board Termination Voltage (V <sub>TT</sub> ) |
|-------------------------|---------------------------------------------|-----------------------------------|-------------------------------------------|----------------------------------------------|
| LVTTL (2-24 mA)         | N/A                                         | 3.3                               | 3.3                                       | N/A                                          |
| LVC MOS2                | N/A                                         | 2.5                               | 2.5                                       | N/A                                          |
| LVC MOS18               | N/A                                         | 1.8                               | 1.8                                       | N/A                                          |
| PCI (3V, 33 MHz/66 MHz) | N/A                                         | 3.3                               | 3.3                                       | N/A                                          |
| GTL                     | 0.8                                         | N/A                               | N/A                                       | 1.2                                          |
| GTL+                    | 1.0                                         | N/A                               | N/A                                       | 1.5                                          |
| HSTL Class I            | 0.75                                        | N/A                               | 1.5                                       | 0.75                                         |
| HSTL Class III          | 0.9                                         | N/A                               | 1.5                                       | 1.5                                          |
| HSTL Class IV           | 0.9                                         | N/A                               | 1.5                                       | 1.5                                          |
| SSTL3 Class I and II    | 1.5                                         | N/A                               | 3.3                                       | 1.5                                          |
| SSTL2 Class I and II    | 1.25                                        | N/A                               | 2.5                                       | 1.25                                         |
| CTT                     | 1.5                                         | N/A                               | 3.3                                       | 1.5                                          |
| AGP                     | 1.32                                        | N/A                               | 3.3                                       | N/A                                          |
| LVDS, Bus LVDS          | N/A                                         | N/A                               | 2.5                                       | N/A                                          |
| LVPECL                  | N/A                                         | N/A                               | 3.3                                       | N/A                                          |

### Input/Output Block

The Spartan-II® FPGA IOB, as seen in Figure 4, features inputs and outputs that support a wide variety of I/O signaling standards. These high-speed inputs and outputs are capable of supporting various state of the art memory and bus interfaces. The default standard is LVTTL. Table 3 lists several of the standards which are supported along with the required reference (V<sub>REF</sub>), output (V<sub>CCO</sub>) and board termination (V<sub>TT</sub>) voltages needed to meet the standard. For more details on the I/O standards and termination application examples, see XAPP179, "Using SelectIO Interfaces in Spartan-II and Spartan-II® FPGAs."

The three IOB registers function either as edge-triggered D-type flip-flops or as level-sensitive latches. Each IOB has a clock signal (CLK) shared by the three registers and independent Clock Enable (CE) signals for each register.

In addition to the CLK and CE control signals, the three registers share a Set/Reset (SR). For each register, this signal can be independently configured as a synchronous Set, a synchronous Reset, an asynchronous Preset, or an asynchronous Clear.

A feature not shown in the block diagram, but controlled by the software, is polarity control. The input and output buffers and all of the IOB control signals have independent polarity controls.

Optional pull-up and pull-down resistors and an optional weak-keeper circuit are attached to each user I/O pad. Prior to configuration all outputs not involved in configuration are forced into their high-impedance state. The pull-down resistors and the weak-keeper circuits are inactive, but inputs may optionally be pulled up. The activation of pull-up resistors prior to configuration is controlled on a global basis by the configuration mode pins. If the pull-up resistors are not activated, all the pins will float. Consequently, external pull-up or pull-down resistors must be provided on pins required to be at a well-defined logic level prior to configuration.

All pads are protected against damage from electrostatic discharge (ESD) and from over-voltage transients. After configuration, clamping diodes are connected to  $V_{CCO}$  for LVTTTL, PCI, HSTL, SSTL, CTT, and AGP standards.

All Spartan-IIE FPGA IOBs support IEEE 1149.1-compatible boundary scan testing.

### Input Path

A buffer in the IOB input path routes the input signal directly to internal logic and through an optional input flip-flop.

An optional delay element at the D-input of this flip-flop eliminates pad-to-pad hold time. The delay is matched to the internal clock-distribution delay of the FPGA, and when used, assures that the pad-to-pad hold time is zero.

Each input buffer can be configured to conform to any of the low-voltage signaling standards supported. In some of these standards the input buffer utilizes a user-supplied threshold voltage,  $V_{REF}$ . The need to supply  $V_{REF}$  imposes constraints on which standards can be used in close proximity to each other. See [I/O Banking](#).

There are optional pull-up and pull-down resistors at each input for use after configuration.

### Output Path

The output path includes a 3-state output buffer that drives the output signal onto the pad. The output signal can be routed to the buffer directly from the internal logic or through an optional IOB output flip-flop.

The 3-state control of the output can also be routed directly from the internal logic or through a flip-flop that provides synchronous enable and disable.

Each output driver can be individually programmed for a wide range of low-voltage signaling standards. Each output buffer can source up to 24 mA and sink up to 48 mA. Drive strength and slew rate controls minimize bus transients. The default output driver is LVTTTL with 12 mA drive strength and slow slew rate.

In most signaling standards, the output high voltage depends on an externally supplied  $V_{CCO}$  voltage. The need to supply  $V_{CCO}$  imposes constraints on which standards

can be used in close proximity to each other. See [I/O Banking](#).

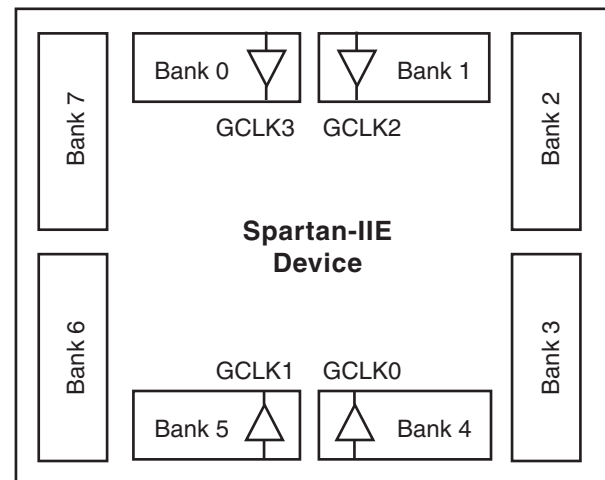
An optional weak-keeper circuit is connected to each output. When selected, the circuit monitors the voltage on the pad and weakly drives the pin High or Low to match the input signal. If the pin is connected to a multiple-source signal, the weak keeper holds the signal in its last state if all drivers are disabled. Maintaining a valid logic level in this way helps eliminate bus chatter.

Because the weak-keeper circuit uses the IOB input buffer to monitor the input level, an appropriate  $V_{REF}$  voltage must be provided if the signaling standard requires one. The provision of this voltage must comply with the I/O banking rules.

### I/O Banking

Some of the I/O standards described above require  $V_{CCO}$  and/or  $V_{REF}$  voltages. These voltages are externally supplied and connected to device pins that serve groups of IOBs, called banks. Consequently, restrictions exist about which I/O standards can be combined within a given bank.

Eight I/O banks result from separating each edge of the FPGA into two banks (see [Figure 5](#)). The pinout tables show the bank affiliation of each I/O (see [Pinout Tables, page 53](#)). Each bank has multiple  $V_{CCO}$  pins which must be connected to the same voltage. Voltage requirements are determined by the output standards in use.



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Figure 5: Spartan-IIE I/O Banks

In the TQ144 and PQ208 packages, the eight banks have  $V_{CCO}$  connected together. Thus, only one  $V_{CCO}$  level is allowed in these packages, although different  $V_{REF}$  values are allowed in each of the eight banks.

Within a bank, standards may be mixed only if they use the same  $V_{CCO}$ . Compatible standards are shown in [Table 4](#). GTL and GTL+ appear under all voltages because their open-drain outputs do not depend on  $V_{CCO}$ . Note that  $V_{CCO}$



## Configurable Logic Block

The basic building block of the Spartan-II<sup>®</sup>E FPGA CLB is the logic cell (LC). An LC includes a 4-input function generator, carry logic, and storage element. The output from the function generator in each LC drives the CLB output or the D input of the flip-flop. Each Spartan-II<sup>®</sup>E FPGA CLB contains four LCs, organized in two similar slices; a single slice is shown in [Figure 6](#).

In addition to the four basic LCs, the Spartan-IIe FPGA CLB contains logic that combines function generators to provide functions of five or six inputs.

## Look-Up Tables

Spartan-II E FPGA function generators are implemented as 4-input look-up tables (LUTs). In addition to operating as a function generator, each LUT can provide a 16 x 1-bit synchronous RAM. Furthermore, the two LUTs within a slice can be combined to create a 16 x 2-bit or 32 x 1-bit synchronous RAM, or a 16 x 1-bit dual-port synchronous RAM.

The Spartan-II E FPGA LUT can also provide a 16-bit shift register that is ideal for capturing high-speed or burst-mode data. This mode can also be used to store data in applications such as Digital Signal Processing.

## Storage Elements

Storage elements in the Spartan-IIe FPGA slice can be configured either as edge-triggered D-type flip-flops or as level-sensitive latches. The D inputs can be driven either by function generators within the slice or directly from slice inputs, bypassing the function generators.

In addition to Clock and Clock Enable signals, each slice has synchronous set and reset signals (SR and BY). SR forces a storage element into the initialization state specified for it in the configuration. BY forces it into the opposite state. Alternatively, these signals may be configured to operate asynchronously.

All control signals are independently invertible, and are shared by the two flip-flops within the slice.

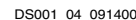


**Figure 6: Spartan-IIe CLB Slice** (two identical slices in each CLB)

### ***Additional Logic***

The F5 multiplexer in each slice combines the function generator outputs (Figure 7). This combination provides either a function generator that can implement any 5-input function, a 4:1 multiplexer, or selected functions of up to nine inputs.

Similarly, the F6 multiplexer combines the outputs of all four function generators in the CLB by selecting one of the two F5-multiplexer outputs. This permits the implementation of any 6-input function, an 8:1 multiplexer, or selected functions of up to 19 inputs.

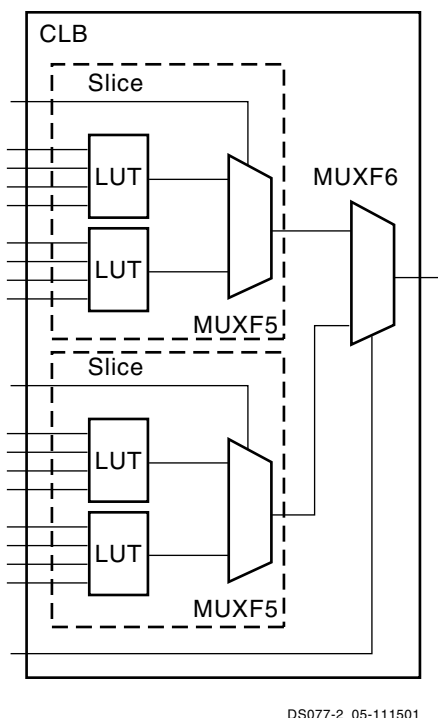


Figure 7: F5 and F6 Multiplexers

Each CLB has four direct feedthrough paths, one per LC. These paths provide extra data input lines or additional local routing that does not consume logic resources.

### Arithmetic Logic

Dedicated carry logic provides capability for high-speed arithmetic functions. The Spartan-IIE FPGA CLB supports two separate carry chains, one per slice. The height of the carry chains is two bits per CLB.

The arithmetic logic includes an XOR gate that allows a 1-bit full adder to be implemented within an LC. In addition, a dedicated AND gate improves the efficiency of multiplier implementations.

The dedicated carry path can also be used to cascade function generators for implementing wide logic functions.

### BUFTs

Each Spartan-IIE FPGA CLB contains two 3-state drivers (BUFTs) that can drive on-chip busses. The IOBs on the left and right sides can also drive the on-chip busses. See [Dedicated Routing, page 17](#). Each Spartan-IIE FPGA BUFT has an independent 3-state control pin and an independent input pin. The 3-state control pin is an active-Low enable (T). When all BUFTs on a net are disabled, the net is High. There is no need to instantiate a pull-up unless desired for simulation purposes. Simultaneously driving BUFTs onto the same net will not cause contention. If driven both High and Low, the net will be Low.

### Block RAM

Spartan-IIE FPGAs incorporate several large block RAM memories. These complement the distributed RAM Look-Up Tables (LUTs) that provide shallow memory structures implemented in CLBs.

Block RAM memory blocks are organized in columns. Most Spartan-IIE devices contain two such columns, one along each vertical edge. The XC2S400E has four block RAM columns and the XC2S600E has six block RAM columns. These columns extend the full height of the chip. Each memory block is four CLBs high, and consequently, a Spartan-IIE device 16 CLBs high will contain four memory blocks per column, and a total of eight blocks.

Table 6: Spartan-IIE Block RAM Amounts

| Spartan-IIE Device | # of Blocks | Total Block RAM Bits |
|--------------------|-------------|----------------------|
| XC2S50E            | 8           | 32K                  |
| XC2S100E           | 10          | 40K                  |
| XC2S150E           | 12          | 48K                  |
| XC2S200E           | 14          | 56K                  |
| XC2S300E           | 16          | 64K                  |
| XC2S400E           | 40          | 160K                 |
| XC2S600E           | 72          | 288K                 |

Each block RAM cell, as illustrated in [Figure 8](#), is a fully synchronous dual-ported 4096-bit RAM with independent control signals for each port. The data widths of the two ports can be configured independently, providing built-in bus-width conversion.

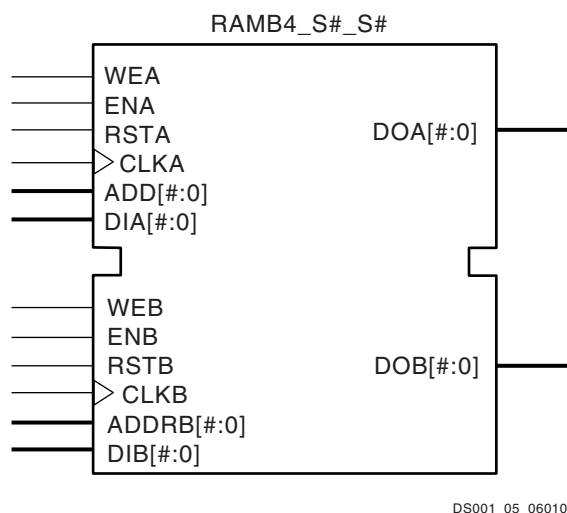


Figure 8: Dual-Port Block RAM

Table 7: Block RAM Port Aspect Ratios

| Width | Depth | ADDR Bus   | Data Bus   |
|-------|-------|------------|------------|
| 1     | 4096  | ADDR<11:0> | DATA<0>    |
| 2     | 2048  | ADDR<10:0> | DATA<1:0>  |
| 4     | 1024  | ADDR<9:0>  | DATA<3:0>  |
| 8     | 512   | ADDR<8:0>  | DATA<7:0>  |
| 16    | 256   | ADDR<7:0>  | DATA<15:0> |

The Spartan-IIe FPGA block RAM also includes dedicated routing to provide an efficient interface with both CLBs and other block RAMs. See Xilinx Application Note [XAPP173](#) for more information on block RAM.

## Programmable Routing

It is the longest delay path that limits the speed of any design. Consequently, the Spartan-II E FPGA routing architecture and its place-and-route software were defined jointly to minimize long-path delays and yield the best system performance.

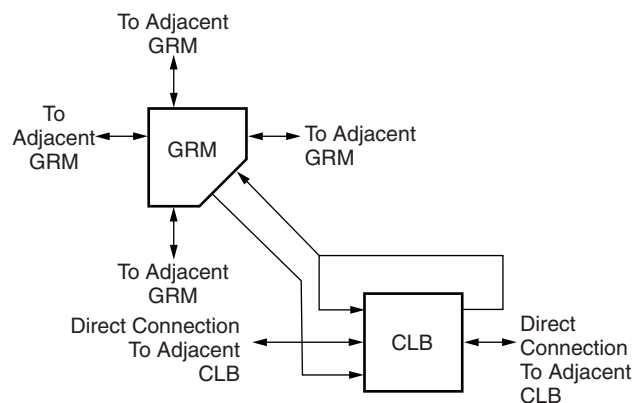
The joint optimization also reduces design compilation times because the architecture is software-friendly. Design cycles are correspondingly reduced due to shorter design iteration times.

The software automatically uses the best available routing based on user timing requirements. The details are provided here for reference.

## Local Routing

The local routing resources, as shown in [Figure 9](#), provide the following three types of connections:

- Interconnections among the LUTs, flip-flops, and General Routing Matrix (GRM), described below.
- Internal CLB feedback paths that provide high-speed connections to LUTs within the same CLB, chaining them together with minimal routing delay
- Direct paths that provide high-speed connections between horizontally adjacent CLBs, eliminating the delay of the GRM



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**Figure 9: Spartan-IIe Local Routing**

## General Purpose Routing

Most Spartan-IIe FPGA signals are routed on the general purpose routing, and consequently, the majority of interconnect resources are associated with this level of the routing hierarchy. The general routing resources are located in horizontal and vertical routing channels associated with the rows and columns of CLBs. The general-purpose routing resources are listed below.

- Adjacent to each CLB is a General Routing Matrix (GRM). The GRM is the switch matrix through which horizontal and vertical routing resources connect, and is also the means by which the CLB gains access to the general purpose routing.
- 24 single-length lines route GRM signals to adjacent GRMs in each of the four directions.
- 96 buffered Hex lines route GRM signals to other GRMs six blocks away in each one of the four directions. Organized in a staggered pattern, Hex lines may be driven only at their endpoints. Hex-line signals can be accessed either at the endpoints or at the midpoint (three blocks from the source). One third of the Hex lines are bidirectional, while the remaining ones are unidirectional.
- 12 Longlines are buffered, bidirectional wires that distribute signals across the device quickly and efficiently. Vertical Longlines span the full height of the device, and horizontal ones span the full width of the device.

## ***I/O Routing***

Spartan-II<sup>®</sup>E devices have additional routing resources around their periphery that form an interface between the CLB array and the IOBs. This additional routing, called the VersaRing<sup>™</sup> routing, facilitates pin-swapping and pin-locking, such that logic redesigns can adapt to existing PCB layouts. Time-to-market is reduced, since PCBs and other system components can be manufactured while the logic design is still in progress.

## ***Dedicated Routing***

Some classes of signal require dedicated routing resources to maximize performance. In the Spartan-II<sup>®</sup> FPGA architecture, dedicated routing resources are provided for two classes of signal.

- Horizontal routing resources are provided for on-chip 3-state busses. Four partitionable bus lines are provided per CLB row, permitting multiple busses within a row, as shown in [Figure 10](#).
- Two dedicated nets per CLB propagate carry signals vertically to the adjacent CLB.

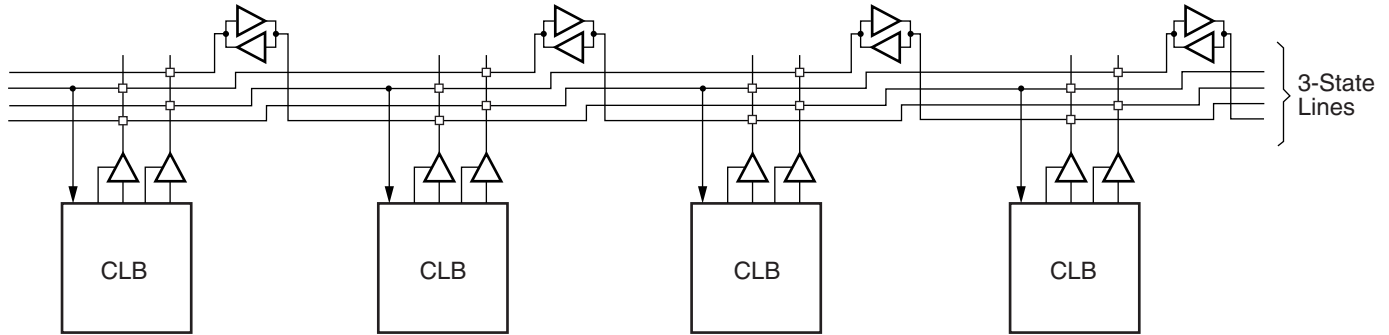


**Figure 10: BUFT Connections to Dedicated Horizontal Bus Lines**

## Global Routing

Global Routing resources distribute clocks and other signals with very high fanout throughout the device. Spartan-IIIE devices include two tiers of global routing resources referred to as primary and secondary global routing resources.

- The primary global routing resources are four dedicated global nets with dedicated input pins that are designed to distribute high-fanout clock signals with minimal skew. Each global clock net can drive all CLB, IOB, and block RAM clock pins. The primary global nets may only be driven by global buffers. There are four global buffers, one for each global net.
- The secondary global routing resources consist of 24 backbone lines, 12 across the top of the chip and 12 across the bottom. From these lines, up to 12 unique signals per column can be distributed via the 12 longlines in the column. These secondary resources are more flexible than the primary resources since they are not restricted to routing only to clock pins.

selected either from these pads or from signals in the general purpose routing.

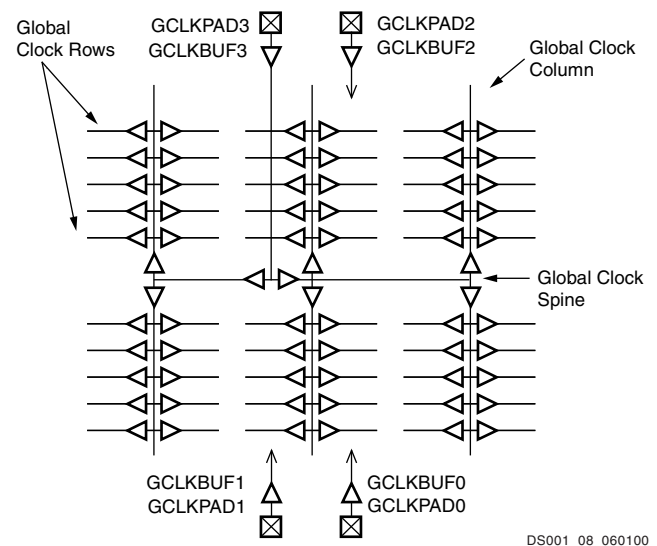


**Figure 11: Global Clock Distribution Network**

## Clock Distribution

The Spartan-IIIE family provides high-speed, low-skew clock distribution through the primary global routing resources described above. A typical clock distribution net is shown in [Figure 11](#).

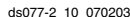
Four global buffers are provided, two at the top center of the device and two at the bottom center. These drive the four primary global nets that in turn drive any clock pin.

Four dedicated clock pads are provided, one adjacent to each of the global buffers. The input to the global buffer is

### ***Delay-Locked Loop (DLL)***

Associated with each global clock input buffer is a fully digital Delay-Locked Loop (DLL) that can eliminate skew between the clock input pad and internal clock-input pins throughout the device. Each DLL can drive two global clock networks. The DLL monitors the input clock and the distributed clock, and automatically adjusts a clock delay element (Figure 12). Additional delay is introduced such that clock edges reach internal flip-flops exactly one clock period after they arrive at the input. This closed-loop system effectively eliminates clock-distribution delay by ensuring that clock

DLL can delay the completion of the configuration process until after it has achieved lock. If the DLL uses external feedback, apply a reset after startup to ensure consistent locking to the external signal. See Xilinx Application Note [XAPP174](#) for more information on DLLs.



## Boundary Scan

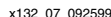
The TAP uses dedicated package pins that always operate using LVTTTL. For TDO to operate using LVTTTL, the  $V_{CCO}$  for Bank 2 must be 3.3V. Otherwise, TDO switches rail-to-rail between ground and  $V_{CCO}$ . The boundary-scan input pins (TDI, TMS, TCK) do not have a  $V_{CCO}$  requirement and operate with either 2.5V or 3.3V input signaling levels. TDI, TMS, and TCK have a default internal weak pull-up resistor, and TDO has no default resistor. Bitstream options allow setting any of the four TAP pins to have an internal pull-up, pull-down, or neither.

Boundary-scan operation is independent of individual IOB configurations, and unaffected by package type. All IOBs, including unbonded ones, are treated as independent 3-state bidirectional pins in a single scan chain. Retention of the bidirectional test capability after configuration facilitates the testing of external interconnections.

**Table 8** lists the boundary-scan instructions supported in Spartan-IIE FPGAs. Internal signals can be captured during EXTEST by connecting them to unbonded or unused IOBs. They may also be connected to the unused outputs of IOBs defined as unidirectional input pins.

Table 8: Boundary-Scan Instructions

| Boundary-Scan Command | Binary Code[4:0] | Description                                    |
|-----------------------|------------------|------------------------------------------------|
| EXTEST                | 00000            | Enables boundary-scan EXTEST operation         |
| SAMPLE/<br>PRELOAD    | 00001            | Enables boundary-scan SAMPLE/PRELOAD operation |
| USER1                 | 00010            | Access user-defined register 1                 |
| USER2                 | 00011            | Access user-defined register 2                 |
| CFG_OUT               | 00100            | Access the configuration bus for Readback      |
| CFG_IN                | 00101            | Access the configuration bus for Configuration |

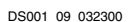


The DLL also operates as a clock mirror. By driving the output from a DLL off-chip and then back on again, the DLL can be used to deskew a board level clock among multiple Spartan-II<sup>®</sup>E devices.

In order to guarantee that the system clock is operating correctly prior to the FPGA starting up after configuration, the

| Boundary-Scan Command | Binary Code[4:0] | Description                                             |
|-----------------------|------------------|---------------------------------------------------------|
| INTEST                | 00111            | Enables boundary-scan INTEST operation                  |
| USERCODE              | 01000            | Enables shifting out USER code                          |
| IDCODE                | 01001            | Enables shifting out of ID Code                         |
| HIGHZ                 | 01010            | Disables output pins while enabling the Bypass Register |
| JSTART                | 01100            | Clock the start-up sequence when StartupClk is TCK      |
| BYPASS                | 11111            | Enables BYPASS                                          |
| RESERVED              | All other codes  | Xilinx reserved instructions                            |

Figure 14 is a diagram of the Spartan-II family boundary scan logic. It includes three bits of Data Register per IOB, the IEEE 1149.1 Test Access Port controller, and the Instruction Register with decodes.



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design, thus allowing the most convenient entry method to be used for each portion of the design.

## Design Implementation

The place-and-route tools automatically provide the implementation flow described in this section. The partitioner takes the EDIF netlist for the design and maps the logic into the architectural resources of the FPGA (CLBs and IOBs, for example). The placer then determines the best locations for these blocks based on their interconnections and the desired performance. Finally, the router interconnects the blocks.

The algorithms support fully automatic implementation of most designs. For demanding applications, however, the user can exercise various degrees of control over the process. User partitioning, placement, and routing information is optionally specified during the design-entry process. The implementation of highly structured designs can benefit greatly from basic floorplanning.

The implementation software incorporates timing-driven placement and routing. Designers specify timing requirements along entire paths during design entry. The timing path analysis routines then recognize these user-specified requirements and accommodate them.

Timing requirements are entered in a form directly relating to the system requirements, such as the targeted clock frequency, or the maximum allowable delay between two registers. In this way, the overall performance of the system along entire signal paths is automatically tailored to user-generated specifications. Specific timing information for individual nets is unnecessary.

## Design Verification

In addition to conventional software simulation, FPGA users can use in-circuit debugging techniques. Because Xilinx devices are infinitely reprogrammable, designs can be verified in real time without the need for extensive sets of software simulation vectors.

The development system supports both software simulation and in-circuit debugging techniques. For simulation, the system extracts the post-layout timing information from the design database, and back-annotates this information into the netlist for use by the simulator. Alternatively, the user can verify timing-critical portions of the design using the static timing analyzer.

For in-circuit debugging, Xilinx offers a download cable, which connects the FPGA in the target system to a PC or workstation. After downloading the design into the FPGA, the designer can read back the contents of the flip-flops, and so observe the internal logic state. Simple modifications can be downloaded into the system in a matter of minutes.

## Configuration

Configuration is the process by which the bitstream of a design, as generated by the Xilinx development software, is loaded into the internal configuration memory of the FPGA. Spartan-II<sup>®</sup>E devices support both serial configuration, using the master/slave serial and JTAG modes, as well as byte-wide configuration employing the Slave Parallel mode.

## Configuration File

Spartan-II-E devices are configured by sequentially loading frames of data that have been concatenated into a configuration file. Table 10 shows how much nonvolatile storage space is needed for Spartan-II-E devices.

It is important to note that, while a PROM is commonly used to store configuration data before loading them into the FPGA, it is by no means required. Any of a number of different kinds of under populated nonvolatile storage already available either on or off the board (for example, hard drives, FLASH cards, and so on) can be used.

Table 10: Spartan-IIE Configuration File Size

| Device   | Configuration File Size (Bits) |
|----------|--------------------------------|
| XC2S50E  | 630,048                        |
| XC2S100E | 863,840                        |
| XC2S150E | 1,134,496                      |
| XC2S200E | 1,442,016                      |
| XC2S300E | 1,875,648                      |
| XC2S400E | 2,693,440                      |
| XC2S600E | 3,961,632                      |

## Modes

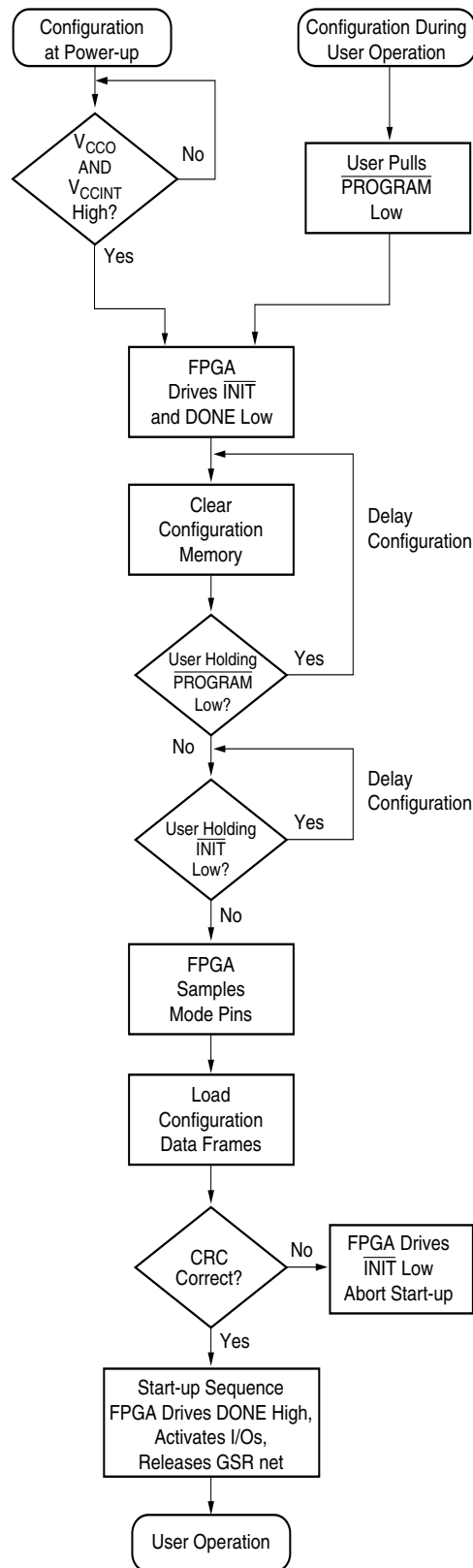
Spartan-II<sup>®</sup>E devices support the following four configuration modes:

- Slave Serial mode
- Master Serial mode
- Slave Parallel mode
- Boundary-scan mode

The Configuration mode pins (M2, M1, M0) select among these configuration modes with the option in each case of having the IOB pins either pulled up or left floating prior to the end of configuration. The selection codes are listed in [Table 11](#).

Configuration through the boundary-scan port is always available, independent of the mode selection. Selecting the boundary-scan mode simply turns off the other modes. The three mode pins have internal pull-up resistors, and default to a logic High if left unconnected.





DS001\_11\_111501

Figure 16: Configuration Flow Diagram

## Clearing Configuration Memory

The device indicates that clearing the configuration memory is in progress by driving  $\overline{\text{INIT}}$  Low.

## Delaying Configuration

At this time, the user can delay configuration by holding either  $\overline{\text{PROGRAM}}$  or  $\overline{\text{INIT}}$  Low, which causes the device to remain in the memory clearing phase. Note that the bidirectional  $\overline{\text{INIT}}$  line is driving a Low logic level during memory clearing. Thus, to avoid contention, use an open-drain driver to keep  $\overline{\text{INIT}}$  Low.

With no delay in force, the device indicates that the memory is completely clear by driving  $\overline{\text{INIT}}$  High. The FPGA samples its mode pins on this Low-to-High transition.

## Loading Configuration Data

Once  $\overline{\text{INIT}}$  is High, the user can begin loading configuration data frames into the device. The details of loading the configuration data are discussed in the sections treating the configuration modes individually. The sequence of operations necessary to load configuration data using the serial modes is shown in Figure 18. Loading data using the Slave Parallel mode is shown in Figure 21, page 28.

## CRC Error Checking

After the loading of configuration data, a CRC value embedded in the configuration file is checked against a CRC value calculated within the FPGA. If the CRC values do not match, the FPGA drives  $\overline{\text{INIT}}$  Low to indicate that an error has occurred and configuration is aborted. Note that attempting to load an incorrect bitstream causes configuration to fail and can damage the device.

To reconfigure the device, the  $\overline{\text{PROGRAM}}$  pin should be asserted to reset the configuration logic. Recycling power also resets the FPGA for configuration. See Clearing Configuration Memory.

## Start-up

The start-up sequence oversees the transition of the FPGA from the configuration state to full user operation. A match of CRC values, indicating a successful loading of the configuration data, initiates the sequence.

During start-up, the device performs four operations:

1. The assertion of DONE. The failure of DONE to go High may indicate the unsuccessful loading of configuration data.
2. The release of the Global Three State (GTS). This activates all the I/Os to which signals are assigned. The remaining I/Os stay in a high-impedance state with internal weak pull-up resistors present.
3. The release of the Global Set Reset (GSR). This allows all flip-flops to change state.
4. The assertion of Global Write Enable (GWE). This allows all RAMs and flip-flops to change state.

By default, these operations are synchronized to CCLK. The entire start-up sequence lasts eight cycles, called C0-C7, after which the loaded design is fully functional. The four operations can be selected to switch on any CCLK cycle C1-C6 through settings in the Xilinx Development Software. The default timing for start-up is shown in the top half of [Figure 17](#); heavy lines show default settings.

The default Start-up sequence is that one CCLK cycle after DONE goes High, the global 3-state signal (GTS) is released. This permits device outputs to turn on as necessary.

One CCLK cycle later, the Global Set/Reset (GSR) and Global Write Enable (GWE) signals are released. This permits the internal storage elements to begin changing state in response to the logic and the user clock.

The bottom half of [Figure 17](#) shows another commonly used version of the start-up timing known as Sync-to-DONE. This version makes the GTS, GSR, and GWE events conditional upon the DONE pin going High. This timing is important for a daisy chain of multiple FPGAs in serial mode, since it ensures that all FPGAs go through start-up together, after all their DONE pins have gone High.

Sync-to-DONE timing is selected by setting the GTS, GSR, and GWE cycles to a value of DONE in the configuration options. This causes these signals to transition one clock cycle after DONE externally transitions High.

The sequence can also be paused at any stage until lock has been achieved on any or all DLLs.

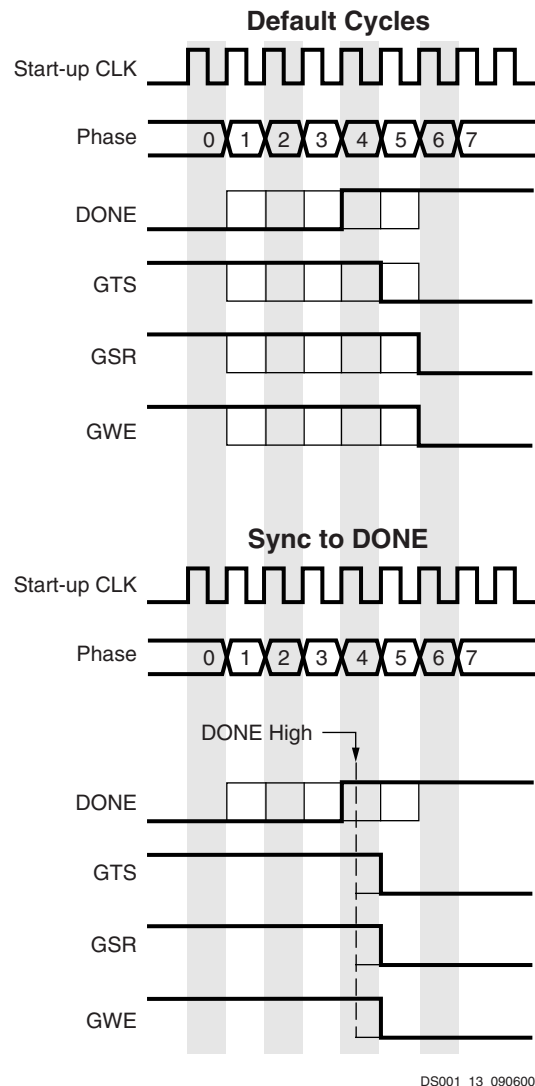


**Figure 17: Start-Up Waveforms**

## Serial Modes

There are two serial configuration modes. In Master Serial mode, the FPGA controls the configuration process by driving CCLK as an output. In Slave Serial mode, the FPGA passively receives CCLK as an input from an external agent (e.g., a microprocessor, CPLD, or second FPGA in master mode) that is controlling the configuration process. In both modes, the FPGA is configured by loading one bit per CCLK cycle. The MSB of each configuration data byte is always written to the DIN pin first.

See [Figure 18](#) for the sequence for loading data into the Spartan-IIe FPGA serially. This is an expansion of the "Load Configuration Data Frames" block in [Figure 16, page 23](#). Note that  $\overline{\text{CS}}$  and  $\overline{\text{WRITE}}$  are not normally used during serial configuration. To ensure successful loading of the FPGA, do not toggle  $\overline{\text{WRITE}}$  with  $\overline{\text{CS}}$  Low during serial configuration.



## Slave Serial Mode

from a PROM. A Spartan-IIIE device in slave serial mode should be connected as shown for the third device from the left. Slave Serial mode is selected by a <11x> on the mode pins (M0, M1, M2). The weak pull-ups on the mode pins make slave serial the default mode if the pins are left unconnected.

Timing for Slave Serial mode is shown in [Figure 24, page 49](#).

## ***Daisy Chain***

Multiple FPGAs in Slave Serial mode can be daisy-chained for configuration from a single source. After an FPGA is configured, data for the next device is sent to the DOUT pin. Data on the DOUT pin changes on the rising edge of CCLK. Note that DOUT changes on the falling edge of CCLK for some Xilinx families but mixed daisy chains are allowed. Configuration must be delayed until  $\overline{\text{INIT}}$  pins of all daisy-chained FPGAs are High. For more information, see [Start-up, page 23](#).

The maximum amount of data that can be sent to the DOUT pin for a serial daisy chain is  $2^{20}-1$  (1,048,575) 32-bit words, or 33,554,400 bits, which is approximately 8 XC2S600E bitstreams. The configuration bitstream of downstream devices is limited to this size.



1. If the DriveDone configuration option is not active for any of the FPGAs, pull up DONE with a  $330\Omega$  resistor.

**Figure 19: Master/Slave Serial Configuration Circuit Diagram**

## Master Serial Mode

In Master Serial mode, the CCLK output of the FPGA drives a Xilinx PROM, which feeds a serial stream of configuration data to the FPGA's DIN input. [Figure 19](#) shows a Master Serial FPGA configuring a Slave Serial FPGA from a PROM. A Spartan-IIE device in Master Serial mode should be connected as shown for the device on the left side. Master Serial mode is selected by a <00x> on the mode pins (M0, M1, M2). The PROM RESET pin is driven by  $\overline{\text{INIT}}$ , and the CE input is driven by DONE. For more information on serial PROMs, see the Xilinx Configuration PROM data sheets at [www.xilinx.com](http://www.xilinx.com).

The interface is identical to the slave serial mode except that an oscillator internal to the FPGA is used to generate the configuration clock (CCLK). Any of a number of different frequencies ranging from 4 to 60 MHz can be set using the ConfigRate option in the Xilinx development software. When selecting a CCLK frequency, ensure that the serial PROM and any daisy-chained FPGAs are fast enough to support the clock rate. On power-up, while the first 60 bytes of the configuration data are being loaded, the CCLK frequency is always 2.5 MHz. This frequency is used until the ConfigRate bits, part of the configuration file, have been loaded into the FPGA, at which point the frequency changes to the selected ConfigRate. Unless a different frequency is specified in the design, the default ConfigRate is 4 MHz. The frequency of the CCLK signal created by the internal oscillator has a variance of +45%, -30% from the specified value.

The FPGA accepts one bit of configuration data on each rising CCLK edge. After the FPGA has been loaded, the data for the next device in a daisy-chain is presented on the DOUT pin after the rising CCLK edge. The timing for Master Serial mode is shown in [Figure 25, page 49](#).

## Slave Parallel Mode (SelectMAP)

The Slave Parallel mode, also known as SelectMAP, is the fastest configuration option. Byte-wide data is written into the FPGA on the D0-D7 pins. Note that D0 is the MSB of each byte for configuration. A BUSY flag is provided for controlling the flow of data at a clock frequency above 50 MHz.

[Figure 20, page 27](#) shows the connections for two Spartan-IIE devices using the Slave Parallel mode. Slave Parallel mode is selected by a <011> on the mode pins (M0, M1, M2).

The agent controlling configuration is not shown. Typically, a processor, a microcontroller, or CPLD controls the Slave Parallel interface. The controlling agent provides byte-wide configuration data, CCLK, a Chip Select ( $\overline{\text{CS}}$ ) signal and a Write signal ( $\overline{\text{WRITE}}$ ). If BUSY is asserted (High) by the FPGA, the data must be held until BUSY goes Low.

After configuration, the pins of the Slave Parallel port (D0-D7) can be used as additional user I/O. Alternatively, the port may be retained to permit high-speed 8-bit read-back. Then data can be read by deasserting  $\overline{\text{WRITE}}$ . If retention is selected, prohibit the D0-D7 pins from being used as user I/O. See [Readback, page 28](#).

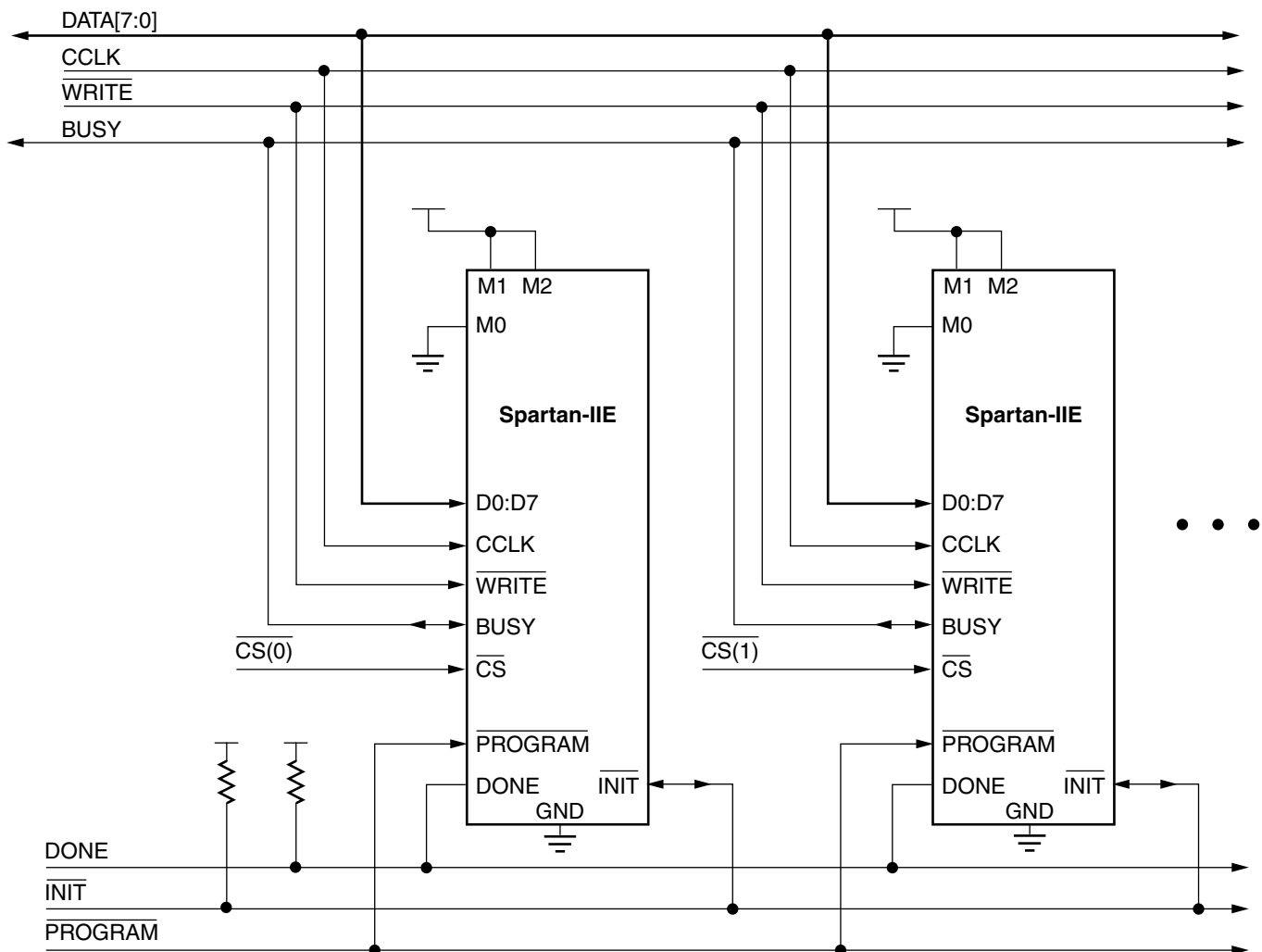


**Figure 20: Slave Parallel Configuration Circuit Diagram**

Multiple Spartan-II<sup>®</sup>E FPGAs can be configured using the Slave Parallel mode, and be made to start-up simultaneously. To configure multiple devices in this way, wire the individual CCLK, Data,  $\overline{\text{WRITE}}$ , and BUSY pins of all the devices in parallel. The individual devices are loaded separately by asserting the  $\overline{\text{CS}}$  pin of each device in turn and writing the appropriate data. Sync-to-DONE start-up timing is used to ensure that the start-up sequence does not begin until all the FPGAs have been loaded. See [Start-up, page 23](#).

## Write

When using the Slave Parallel Mode, write operations send packets of byte-wide configuration data into the FPGA. [Figure 21, page 28](#) shows a flowchart of the write sequence used to load data into the Spartan-IIE FPGA. This is an expansion of the "Load Configuration Data Frames" block in [Figure 16, page 23](#).

The timing for Slave Parallel mode is shown in [Figure 26, page 50](#).

For the present example, the user holds  $\overline{\text{WRITE}}$  and  $\overline{\text{CS}}$  Low throughout the sequence of write operations. Note that when  $\overline{\text{CS}}$  is asserted on successive CCLKs,  $\overline{\text{WRITE}}$  must remain either asserted or deasserted. Otherwise an abort will be initiated, as in the next section.

1. Drive data onto D0-D7. Note that to avoid contention, the data source should not be enabled while  $\overline{CS}$  is Low and  $\overline{WRITE}$  is High. Similarly, while  $\overline{WRITE}$  is High, no more than one device's  $\overline{CS}$  should be asserted.
2. On the rising edge of CCLK: If BUSY is Low, the data is accepted on this clock. If BUSY is High (from a previous write), the data is not accepted. Acceptance will instead occur on the first clock after BUSY goes Low, and the data must be held until this happens.
3. Repeat steps 1 and 2 until all the data has been sent.
4. Deassert  $\overline{CS}$  and  $\overline{WRITE}$ .

tions. However, to avoid aborting configuration,  $\overline{\text{WRITE}}$  must continue to be asserted while  $\overline{\text{CS}}$  is asserted during CCLK transitions.

## ***Abort***

To abort configuration during a write sequence, deassert  $\overline{\text{WRITE}}$  while holding  $\overline{\text{CS}}$  Low. The abort operation is initiated at the rising edge of CCLK. The device will remain BUSY until the aborted operation is complete. After aborting configuration, data is assumed to be unaligned to word boundaries and the FPGA requires a new synchronization word prior to accepting any new packets.

## Boundary-Scan Configuration Mode

In the boundary-scan mode, no nondedicated pins are required, configuration being done entirely through the IEEE 1149.1 Test Access Port (TAP).

Configuration through the TAP uses the special CFG\_IN instruction. This instruction allows data input on TDI to be converted into data packets for the internal configuration bus.

The following steps are required to configure the FPGA through the boundary-scan port.

1. Load the CFG\_IN instruction into the boundary-scan instruction register (IR)
2. Enter the Shift-DR (SDR) state
3. Shift a standard configuration bitstream into TDI
4. Return to Run-Test-Idle (RTI)
5. Load the JSTART instruction into IR
6. Enter the SDR state
7. Clock TCK (if selected) through the startup sequence (the length is programmable)
8. Return to RTI

Configuration and readback via the TAP is always available. The boundary-scan mode simply locks out the other modes. The boundary-scan mode is selected by a <10x> on the mode pins (M0, M1, M2). Note that the PROGRAM pin must be pulled High prior to reconfiguration. A Low on the PROGRAM pin resets the TAP controller and no boundary scan operations can be performed. See Xilinx Application Note [XAPP188](#) for more information on boundary-scan configuration.

## Readback

The configuration data stored in the Spartan-IIe FPGA configuration memory can be read back for verification. Along with the configuration data it is possible to read back the contents of all flip-flops/latches, LUT RAMs, and block RAMs. This capability is used for real-time debugging.

For more detailed information see Xilinx Application Note [XAPP176](#), *Configuration and Readback of the Spartan-II and Spartan-IIE FPGA Families*.

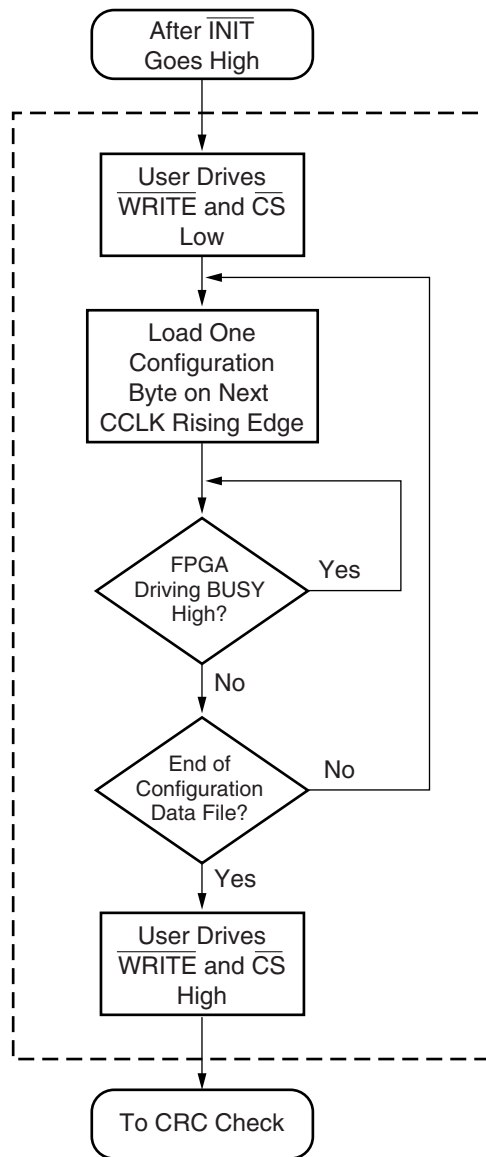


**Figure 21: Loading Configuration Data for the Slave Parallel Mode**

A configuration packet does not have to be written in one continuous stretch, rather it can be split into many write sequences. Each sequence would involve assertion of  $\overline{CS}$ .

In applications where multiple clock cycles may be required to access the configuration data before each byte can be loaded into the Slave Parallel interface, a new byte of data may not be ready for each consecutive CCLK edge. In such a case the  $\overline{\text{CS}}$  signal may be deasserted until the next byte is valid on D0-D7. While  $\overline{\text{CS}}$  is High, the Slave Parallel interface does not expect any data and ignores all CCLK transi-

## Revision History

| Date       | Version | Description                                                                                                                                                                                                                                                                                                                 |
|------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11/15/2001 | 1.0     | Initial Xilinx release.                                                                                                                                                                                                                                                                                                     |
| 11/18/2002 | 2.0     | Added XC2S400E and XC2S600E. Removed Preliminary designation. Clarified details of I/O standards, boundary scan, and configuration.                                                                                                                                                                                         |
| 07/09/2003 | 2.1     | Added hot swap description (see <a href="#">Hot Swap, Hot Insertion, Hot Socketing Support</a> ). Added <a href="#">Table 9</a> containing JTAG IDCODE values. Clarified configuration PROM support.                                                                                                                        |
| 06/18/2008 | 2.3     | Added note that TDI, TMS, and TCK have a default pull-up resistor. Add note on maximum daisy-chain limit. Updated <a href="#">Figure 19</a> since Mode pins can be pulled up to either 2.5V or 3.3V. Updated all modules for continuous page, figure, and table numbering. Updated links. Synchronized all modules to v2.3. |
| 08/09/2013 | 3.0     | This product is obsolete/discontinued per <a href="#">XCN12026</a> .                                                                                                                                                                                                                                                        |





## Spartan-II<sup>E</sup> FPGA Family: DC and Switching Characteristics

DS077-3 (v3.0) August 9, 2013

Product Specification

### Definition of Terms

In this document, some specifications may be designated as Advance or Preliminary. These designations are based on the more detailed timing information used by the development system and reported in the output files. These terms are defined as follows:

**Advance:** Initial estimates based on simulation and/or extrapolation from other speed grades, devices, or families. Values are subject to change. Use as estimates, not for production.

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

Except for pin-to-pin input and output parameters, the AC parameter delay specifications included in this document are derived from measuring internal test patterns. All specifications are representative of worst-case supply voltage and junction temperature conditions. The parameters included are common to popular designs and typical applications. All specifications are subject to change without notice.

### DC Specifications

#### Absolute Maximum Ratings<sup>(1)</sup>

| Symbol      | Description                                      | Min  | Max  | Units |
|-------------|--------------------------------------------------|------|------|-------|
| $V_{CCINT}$ | Supply voltage relative to GND                   | −0.5 | 2.0  | V     |
| $V_{CCO}$   | Supply voltage relative to GND                   | −0.5 | 4.0  | V     |
| $V_{REF}$   | Input reference voltage                          | −0.5 | 4.0  | V     |
| $V_{IN}$    | Input voltage relative to GND <sup>(2,3)</sup>   | −0.5 | 4.0  | V     |
| $V_{TS}$    | Voltage applied to 3-state output <sup>(3)</sup> | −0.5 | 4.0  | V     |
| $T_{STG}$   | Storage temperature (ambient)                    | −65  | +150 | °C    |
| $T_J$       | Junction temperature                             | -    | +125 | °C    |

#### Notes:

- Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those listed under Operating Conditions is not implied. Exposure to Absolute Maximum Ratings conditions for extended periods of time may affect device reliability.
- $V_{IN}$  should not exceed  $V_{CCO}$  by more than 3.6V over extended periods of time (e.g., longer than a day).
- Maximum DC overshoot must be limited to either  $V_{CCO} + 0.5V$  or 10 mA, and undershoot must be limited to −0.5V or 10 mA, whichever is easier to achieve. The Maximum AC conditions are as follows: The device pins may undershoot to −2.0V or overshoot to  $V_{CCO} + 2.0V$ , provided this over/undershoot lasts no more than 11 ns with a forcing current no greater than 100 mA.
- For soldering guidelines, see the Packaging Information on the Xilinx<sup>®</sup> website.

## Recommended Operating Conditions

| Symbol             | Description                                   |            | Min      | Max      | Units |
|--------------------|-----------------------------------------------|------------|----------|----------|-------|
| T <sub>J</sub>     | Junction temperature                          | Commercial | 0        | 85       | °C    |
|                    |                                               | Industrial | −40      | 100      | °C    |
| V <sub>CCINT</sub> | Supply voltage relative to GND <sup>(1)</sup> | Commercial | 1.8 – 5% | 1.8 + 5% | V     |
|                    |                                               | Industrial | 1.8 – 5% | 1.8 + 5% | V     |
| V <sub>CCO</sub>   | Supply voltage relative to GND <sup>(2)</sup> | Commercial | 1.2      | 3.6      | V     |
|                    |                                               | Industrial | 1.2      | 3.6      | V     |
| T <sub>IN</sub>    | Input signal transition time <sup>(3)</sup>   |            | -        | 250      | ns    |

**Notes:**

1. Functional operation is guaranteed down to a minimum  $V_{CCINT}$  of 1.62V (Nominal  $V_{CCINT}$  -10%). For every 50 mV reduction in  $V_{CCINT}$  below 1.71V (nominal  $V_{CCINT}$  -5%), all delay parameters increase by approximately 3%.
2. Minimum and maximum values for  $V_{CCO}$  vary according to the I/O standard selected.
3. Input and output measurement threshold is ~50% of  $V_{CCO}$ . See [Delay Measurement Methodology, page 41](#) for specific details.

## DC Characteristics Over Operating Conditions

| Symbol              | Description                                                                                                |                         |            | Min | Typ | Max  | Units |
|---------------------|------------------------------------------------------------------------------------------------------------|-------------------------|------------|-----|-----|------|-------|
| V <sub>DRINT</sub>  | Data retention V <sub>CCINT</sub> voltage (below which configuration data may be lost)                     |                         |            | 1.5 | -   | -    | V     |
| V <sub>DRIO</sub>   | Data retention V <sub>CCO</sub> voltage (below which configuration data may be lost)                       |                         |            | 1.2 | -   | -    | V     |
| I <sub>CCINTQ</sub> | Quiescent V <sub>CCINT</sub> supply current <sup>(1)</sup>                                                 | XC2S50E                 | Commercial | -   | 10  | 200  | mA    |
|                     |                                                                                                            |                         | Industrial | -   | 10  | 200  | mA    |
|                     |                                                                                                            | XC2S100E                | Commercial | -   | 10  | 200  | mA    |
|                     |                                                                                                            |                         | Industrial | -   | 10  | 200  | mA    |
|                     |                                                                                                            | XC2S150E                | Commercial | -   | 10  | 300  | mA    |
|                     |                                                                                                            |                         | Industrial | -   | 10  | 300  | mA    |
|                     |                                                                                                            | XC2S200E                | Commercial | -   | 10  | 300  | mA    |
|                     |                                                                                                            |                         | Industrial | -   | 10  | 300  | mA    |
|                     |                                                                                                            | XC2S300E                | Commercial | -   | 12  | 300  | mA    |
|                     |                                                                                                            |                         | Industrial | -   | 12  | 300  | mA    |
|                     |                                                                                                            | XC2S400E                | Commercial | -   | 15  | 300  | mA    |
|                     |                                                                                                            |                         | Industrial | -   | 15  | 300  | mA    |
|                     |                                                                                                            | XC2S600E                | Commercial | -   | 15  | 400  | mA    |
|                     |                                                                                                            |                         | Industrial | -   | 15  | 400  | mA    |
| I <sub>CCOQ</sub>   | Quiescent V <sub>CCO</sub> supply current <sup>(1)</sup>                                                   |                         |            | -   | -   | 2    | mA    |
| I <sub>REF</sub>    | V <sub>REF</sub> current per V <sub>REF</sub> pin                                                          |                         |            | -   | -   | 20   | μA    |
| I <sub>L</sub>      | Input or output leakage current per pin                                                                    |                         |            | -10 | -   | +10  | μA    |
| C <sub>IN</sub>     | Input capacitance (sample tested)                                                                          | TQ, PQ, FG, FT packages |            | -   | -   | 8    | pF    |
| I <sub>RPU</sub>    | Pad pull-up (when selected) @ V <sub>IN</sub> = 0V, V <sub>CCO</sub> = 3.3V (sample tested) <sup>(2)</sup> |                         |            | -   | -   | 0.25 | mA    |
| I <sub>RPD</sub>    | Pad pull-down (when selected) @ V <sub>IN</sub> = 3.6V (sample tested) <sup>(2)</sup>                      |                         |            | -   | -   | 0.25 | mA    |

**Notes:**

1. With no output current loads, no active input pull-up resistors, all I/O pins 3-stated and floating.
2. Internal pull-up and pull-down resistors guarantee valid logic levels at unconnected input pins. These pull-up and pull-down resistors do not provide valid logic levels when input pins are connected to other circuits.

## Power-On Requirements

Spartan®-IIE FPGAs require that a minimum supply current  $I_{CCPO}$  be provided to the  $V_{CCINT}$  lines for a successful power-on. If more current is available, the FPGA can consume more than  $I_{CCPO}$  min., though this cannot adversely affect reliability.

A maximum limit for  $I_{CCPO}$  is not specified. Be careful when using foldback/crowbar supplies and fuses. It is possible to control the magnitude of  $I_{CCPO}$  by limiting the supply current available to the FPGA. A current limit below the trip level will avoid inadvertently activating over-current protection circuits.

| Symbol            | Description                                                                                                                 |            |                           |                           | Min <sup>(1)</sup> | Typ | Max | Units |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------|------------|---------------------------|---------------------------|--------------------|-----|-----|-------|
| I <sub>CCPO</sub> | Total V <sub>CCINT</sub> supply current required during power-on                                                            | Commercial | XC2S50E - XC2S300E        | After PCN <sup>(2)</sup>  | 300                | -   | -   | mA    |
|                   |                                                                                                                             |            |                           | Before PCN <sup>(2)</sup> | 500                | -   | -   | mA    |
|                   |                                                                                                                             |            | XC2S400E - XC2S600E       |                           |                    | 500 | -   | -     |
|                   |                                                                                                                             | Industrial | XC2S50E - XC2S300E        | After PCN <sup>(2)</sup>  | 500                | -   | -   | mA    |
|                   |                                                                                                                             |            |                           | Before PCN <sup>(2)</sup> | 2                  | -   | -   | A     |
|                   |                                                                                                                             |            | XC2S400E - XC2S600E       |                           |                    | 700 | -   | -     |
| T <sub>CCPO</sub> | V <sub>CCINT</sub> <sup>(3,4)</sup> ramp time                                                                               |            | After PCN <sup>(2)</sup>  |                           | 500                | -   | -   | μs    |
|                   |                                                                                                                             |            | Before PCN <sup>(2)</sup> |                           | 2                  | -   | 50  | ms    |
| I <sub>HSPO</sub> | AC current per pin during power-on in hot-swap applications when V <sub>IN</sub> > V <sub>CCO</sub> + 0.4V; duration < 10ns |            | After PCN <sup>(2)</sup>  |                           | -                  | ±60 | -   | μA    |

### Notes:

- The  $I_{CCPO}$  requirement applies for a brief time (commonly only a few milliseconds) when  $V_{CCINT}$  ramps from 0 to 1.8V.
- Devices built after the Product Change Notice PCN 2002-05 (see [http://www.xilinx.com/support/documentation/customer\\_notices/pcn2002-05.pdf](http://www.xilinx.com/support/documentation/customer_notices/pcn2002-05.pdf)) have improved power-on requirements. Devices after the PCN have a 'T' preceding the date code as referenced in the PCN. Note that the XC2S150E, XC2S400E, and XC2S600E always have this mark. Devices before the PCN have an 'S' preceding the date code. Note that devices before the PCN are measured with  $V_{CCINT}$  and  $V_{CCO}$  powering up simultaneously.
- The ramp time is measured from GND to 1.8V on a fully loaded board.
- $V_{CCINT}$  must not dip in the negative direction during power on.
- I/Os are not guaranteed to be disabled until  $V_{CCINT}$  is applied.
- For more information on designing to meet the power-on specifications, refer to the application note [XAPP450 "Power-On Current Requirements for the Spartan-II and Spartan-IIE Families"](#).

## DC Input and Output Levels

Values for  $V_{IL}$  and  $V_{IH}$  are recommended input voltages. Values for  $V_{OL}$  and  $V_{OH}$  are guaranteed output voltages over the recommended operating conditions. Only selected standards are tested. These are chosen to ensure that all

standards meet their specifications. The selected standards are tested at minimum  $V_{CCO}$  with the respective  $I_{OL}$  and  $I_{OH}$  currents shown. Other standards are sample tested.

| Input/Output Standard | $V_{IL}$ |                  | $V_{IH}$         |                 | $V_{OL}$      | $V_{OH}$        | $I_{OL}$ | $I_{OH}$ |
|-----------------------|----------|------------------|------------------|-----------------|---------------|-----------------|----------|----------|
|                       | V, Min   | V, Max           | V, Min           | V, Max          | V, Max        | V, Min          | mA       | mA       |
| LVTTL <sup>(1)</sup>  | -0.5     | 0.8              | 2.0              | 3.6             | 0.4           | 2.4             | 24       | -24      |
| LVC MOS2              | -0.5     | 0.7              | 1.7              | 2.7             | 0.4           | 1.9             | 12       | -12      |
| LVC MOS18             | -0.5     | 35% $V_{CCO}$    | 65% $V_{CCO}$    | 1.95            | 0.4           | $V_{CCO} - 0.4$ | 8        | -8       |
| PCI, 3.3V             | -0.5     | 30% $V_{CCO}$    | 50% $V_{CCO}$    | $V_{CCO} + 0.5$ | 10% $V_{CCO}$ | 90% $V_{CCO}$   | Note (2) | Note (2) |
| GTL                   | -0.5     | $V_{REF} - 0.05$ | $V_{REF} + 0.05$ | 3.6             | 0.4           | -               | 40       | -        |
| GTL+                  | -0.5     | $V_{REF} - 0.1$  | $V_{REF} + 0.1$  | 3.6             | 0.6           | -               | 36       | -        |

| Input/Output Standard | V <sub>IL</sub> |                        | V <sub>IH</sub>        |        | V <sub>OL</sub>         | V <sub>OH</sub>         | I <sub>OL</sub> | I <sub>OH</sub> |
|-----------------------|-----------------|------------------------|------------------------|--------|-------------------------|-------------------------|-----------------|-----------------|
|                       | V, Min          | V, Max                 | V, Min                 | V, Max | V, Max                  | V, Min                  | mA              | mA              |
| HSTL I                | −0.5            | V <sub>REF</sub> − 0.1 | V <sub>REF</sub> + 0.1 | 3.6    | 0.4                     | V <sub>CCO</sub> − 0.4  | 8               | −8              |
| HSTL III              | −0.5            | V <sub>REF</sub> − 0.1 | V <sub>REF</sub> + 0.1 | 3.6    | 0.4                     | V <sub>CCO</sub> − 0.4  | 24              | −8              |
| HSTL IV               | −0.5            | V <sub>REF</sub> − 0.1 | V <sub>REF</sub> + 0.1 | 3.6    | 0.4                     | V <sub>CCO</sub> − 0.4  | 48              | −8              |
| SSTL3 I               | −0.5            | V <sub>REF</sub> − 0.2 | V <sub>REF</sub> + 0.2 | 3.6    | V <sub>REF</sub> − 0.6  | V <sub>REF</sub> + 0.6  | 8               | −8              |
| SSTL3 II              | −0.5            | V <sub>REF</sub> − 0.2 | V <sub>REF</sub> + 0.2 | 3.6    | V <sub>REF</sub> − 0.8  | V <sub>REF</sub> + 0.8  | 16              | −16             |
| SSTL2 I               | −0.5            | V <sub>REF</sub> − 0.2 | V <sub>REF</sub> + 0.2 | 3.6    | V <sub>REF</sub> − 0.61 | V <sub>REF</sub> + 0.61 | 7.6             | −7.6            |
| SSTL2 II              | −0.5            | V <sub>REF</sub> − 0.2 | V <sub>REF</sub> + 0.2 | 3.6    | V <sub>REF</sub> − 0.8  | V <sub>REF</sub> + 0.8  | 15.2            | −15.2           |
| CTT                   | −0.5            | V <sub>REF</sub> − 0.2 | V <sub>REF</sub> + 0.2 | 3.6    | V <sub>REF</sub> − 0.4  | V <sub>REF</sub> + 0.4  | 8               | −8              |
| AGP                   | −0.5            | V <sub>REF</sub> − 0.2 | V <sub>REF</sub> + 0.2 | 3.6    | 10% V <sub>CCO</sub>    | 90% V <sub>CCO</sub>    | Note (2)        | Note (2)        |

**Notes:**

1.  $V_{OL}$  and  $V_{OH}$  for lower drive currents are sample tested.
2. Tested according to the relevant specifications.

## LVDS DC Specifications

| Symbol             | Description                                                                                                    | Conditions                                                | Min   | Typ   | Max   | Units |
|--------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-------|-------|-------|-------|
| V <sub>CCO</sub>   | Supply voltage                                                                                                 |                                                           | 2.375 | 2.5   | 2.625 | V     |
| V <sub>OH</sub>    | Output High voltage for Q and $\overline{Q}$                                                                   | R <sub>T</sub> = 100Ω across Q and $\overline{Q}$ signals | 1.25  | 1.425 | 1.6   | V     |
| V <sub>OL</sub>    | Output Low voltage for Q and $\overline{Q}$                                                                    | R <sub>T</sub> = 100Ω across Q and $\overline{Q}$ signals | 0.9   | 1.075 | 1.25  | V     |
| V <sub>ODIFF</sub> | Differential output voltage (Q – $\overline{Q}$ ),<br>Q = High or ( $\overline{Q}$ – Q), $\overline{Q}$ = High | R <sub>T</sub> = 100Ω across Q and $\overline{Q}$ signals | 250   | 350   | 450   | mV    |
| V <sub>OCM</sub>   | Output common-mode voltage                                                                                     | R <sub>T</sub> = 100Ω across Q and $\overline{Q}$ signals | 1.125 | 1.25  | 1.375 | V     |
| V <sub>IDIFF</sub> | Differential input voltage (Q – $\overline{Q}$ ),<br>Q = High or ( $\overline{Q}$ – Q), $\overline{Q}$ = High  | Common-mode input voltage = 1.25 V                        | 100   | 350   | -     | mV    |
| V <sub>ICM</sub>   | Input common-mode voltage                                                                                      | Differential input voltage = ±350 mV                      | 0.2   | 1.25  | 2.2   | V     |

## LVPECL DC Specifications

These values are valid at the output of the source termination pack shown under LVPECL, with a 100Ω differential load only. The  $V_{OH}$  levels are 200 mV below standard

LVPECL levels and are compatible with devices tolerant of lower common-mode ranges. The following table summarizes the DC output specifications of LVPECL.

| DC Parameter               | Min  | Max   | Min  | Max   | Min  | Max   | Units |
|----------------------------|------|-------|------|-------|------|-------|-------|
| V <sub>CCO</sub>           | 3.0  |       | 3.3  |       | 3.6  |       | V     |
| V <sub>OH</sub>            | 1.8  | 2.11  | 1.92 | 2.28  | 2.13 | 2.41  | V     |
| V <sub>OL</sub>            | 0.96 | 1.27  | 1.06 | 1.43  | 1.30 | 1.57  | V     |
| V <sub>IH</sub>            | 1.49 | 2.72  | 1.49 | 2.72  | 1.49 | 2.72  | V     |
| V <sub>IL</sub>            | 0.86 | 2.125 | 0.86 | 2.125 | 0.86 | 2.125 | V     |
| Differential input voltage | 0.3  | -     | 0.3  | -     | 0.3  | -     | V     |



## Global Clock Setup and Hold for LVTTL Standard, *with* DLL (Pin-to-Pin)

| Symbol                                  | Description                                                                                                                        | Speed Grade |         | Units |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|-------|
|                                         |                                                                                                                                    | -7          | -6      |       |
|                                         |                                                                                                                                    | Min         | Min     |       |
| T <sub>PSDLL</sub> / T <sub>PHDLL</sub> | Input setup and hold time relative to global clock input signal for LVTTTL standard, no delay, IFF, <sup>(1)</sup> <i>with</i> DLL | 1.6 / 0     | 1.7 / 0 | ns    |

**Notes:**

1. IFF = Input Flip-Flop or Latch
2. Setup time is measured relative to the Global Clock input signal with the fastest route and the lightest load. Hold time is measured relative to the Global Clock input signal with the slowest route and heaviest load.
3. DLL output jitter is already included in the timing calculation.
4. For data input with different standards, adjust the setup time delay by the values shown in [IOB Input Delay Adjustments for Different Standards, page 38](#). For a global clock input with standards other than LVTTTL, adjust delays with values from the [I/O Standard Global Clock Input Adjustments, page 42](#).
5. A zero hold time listing indicates no hold time or a negative hold time.

## Global Clock Setup and Hold for LVTTTL Standard, *without* DLL (Pin-to-Pin)

| Symbol                                | Description                                                                                                                            | Device   | Speed Grade |         | Units |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------|-------------|---------|-------|
|                                       |                                                                                                                                        |          | -7          | -6      |       |
|                                       |                                                                                                                                        |          | Min         | Min     |       |
| T <sub>PSFD</sub> / T <sub>PHFD</sub> | Input setup and hold time relative to global clock input signal for LVTTL standard, with delay, IFF, <sup>(1)</sup> <i>without</i> DLL | XC2S50E  | 1.8 / 0     | 1.8 / 0 | ns    |
|                                       |                                                                                                                                        | XC2S100E | 1.8 / 0     | 1.8 / 0 | ns    |
|                                       |                                                                                                                                        | XC2S150E | 1.9 / 0     | 1.9 / 0 | ns    |
|                                       |                                                                                                                                        | XC2S200E | 1.9 / 0     | 1.9 / 0 | ns    |
|                                       |                                                                                                                                        | XC2S300E | 2.0 / 0     | 2.0 / 0 | ns    |
|                                       |                                                                                                                                        | XC2S400E | 2.0 / 0     | 2.0 / 0 | ns    |
|                                       |                                                                                                                                        | XC2S600E | 2.1 / 0     | 2.1 / 0 | ns    |

**Notes:**

1. IFF = Input Flip-Flop or Latch
2. Setup time is measured relative to the Global Clock input signal with the fastest route and the lightest load. Hold time is measured relative to the Global Clock input signal with the slowest route and heaviest load.
3. For data input with different standards, adjust the setup time delay by the values shown in [IOB Input Delay Adjustments for Different Standards, page 38](#). For a global clock input with standards other than LVTTTL, adjust delays with values from the [I/O Standard Global Clock Input Adjustments, page 42](#).

## IOB Input Switching Characteristics<sup>(1)</sup>

Input delays associated with the pad are specified for LVTTTL levels. For other standards, adjust the delays with the values shown in [IOB Input Delay Adjustments for Different Standards, page 38](#).

| Symbol                                       | Description                                        | Device   | Speed Grade |     |            |     | Units |
|----------------------------------------------|----------------------------------------------------|----------|-------------|-----|------------|-----|-------|
|                                              |                                                    |          | -7          |     | -6         |     |       |
|                                              |                                                    |          | Min         | Max | Min        | Max |       |
| Propagation Delays                           |                                                    |          |             |     |            |     |       |
| T <sub>IOPI</sub>                            | Pad to I output, no delay                          | All      | 0.4         | 0.8 | 0.4        | 0.8 | ns    |
| T <sub>IOPID</sub>                           | Pad to I output, with delay                        | All      | 0.5         | 1.0 | 0.5        | 1.0 | ns    |
| T <sub>IOPLI</sub>                           | Pad to output IQ via transparent latch, no delay   | All      | 0.7         | 1.5 | 0.7        | 1.6 | ns    |
| T <sub>IOPLID</sub>                          | Pad to output IQ via transparent latch, with delay | XC2S50E  | 1.3         | 3.0 | 1.3        | 3.1 | ns    |
|                                              |                                                    | XC2S100E | 1.3         | 3.0 | 1.3        | 3.1 | ns    |
|                                              |                                                    | XC2S150E | 1.3         | 3.2 | 1.3        | 3.3 | ns    |
|                                              |                                                    | XC2S200E | 1.3         | 3.2 | 1.3        | 3.3 | ns    |
|                                              |                                                    | XC2S300E | 1.3         | 3.2 | 1.3        | 3.3 | ns    |
|                                              |                                                    | XC2S400E | 1.4         | 3.2 | 1.4        | 3.4 | ns    |
|                                              |                                                    | XC2S600E | 1.5         | 3.5 | 1.5        | 3.7 | ns    |
| Sequential Delays                            |                                                    |          |             |     |            |     |       |
| T <sub>IOCKIQ</sub>                          | Clock CLK to output IQ                             | All      | 0.1         | 0.7 | 0.1        | 0.7 | ns    |
| Setup/Hold Times with Respect to Clock CLK   |                                                    |          |             |     |            |     |       |
| T <sub>IOPICK</sub> / T <sub>IOICKP</sub>    | Pad, no delay                                      | All      | 1.4 / 0     | -   | 1.5 / 0    | -   | ns    |
| T <sub>IOPICKD</sub> / T <sub>IOICKPD</sub>  | Pad, with delay                                    | XC2S50E  | 2.9 / 0     | -   | 2.9 / 0    | -   | ns    |
|                                              |                                                    | XC2S100E | 2.9 / 0     | -   | 2.9 / 0    | -   | ns    |
|                                              |                                                    | XC2S150E | 3.1 / 0     | -   | 3.1 / 0    | -   | ns    |
|                                              |                                                    | XC2S200E | 3.1 / 0     | -   | 3.1 / 0    | -   | ns    |
|                                              |                                                    | XC2S300E | 3.1 / 0     | -   | 3.1 / 0    | -   | ns    |
|                                              |                                                    | XC2S400E | 3.2 / 0     | -   | 3.2 / 0    | -   | ns    |
|                                              |                                                    | XC2S600E | 3.5 / 0     | -   | 3.5 / 0    | -   | ns    |
| T <sub>IOICECK</sub> / T <sub>IOICKICE</sub> | ICE input                                          | All      | 0.7 / 0.01  | -   | 0.7 / 0.01 | -   | ns    |
| Set/Reset Delays                             |                                                    |          |             |     |            |     |       |
| T <sub>IOSRCKI</sub>                         | SR input (IFF, synchronous)                        | All      | 0.9         | -   | 1.0        | -   | ns    |
| T <sub>IOSRIQ</sub>                          | SR input to IQ (asynchronous)                      | All      | 0.5         | 1.2 | 0.5        | 1.4 | ns    |
| T <sub>GSRQ</sub>                            | GSR to output IQ                                   | All      | 3.8         | 8.5 | 3.8        | 9.7 | ns    |

### Notes:

- Input timing for LVTTTL is measured at 1.4V. For other I/O standards, see the table [Delay Measurement Methodology, page 41](#).

## IOB Input Delay Adjustments for Different Standards

Input delays associated with the pad are specified for LVTTTL. For other standards, adjust the delays by the values shown. A delay adjusted in this way constitutes a worst-case limit.

| Symbol                       | Description                                    | Standard          | Speed Grade |       | Units |
|------------------------------|------------------------------------------------|-------------------|-------------|-------|-------|
|                              |                                                |                   | -7          | -6    |       |
| Data Input Delay Adjustments |                                                |                   |             |       |       |
| T <sub>ILVTTTL</sub>         | Standard-specific data input delay adjustments | LVTTTL            | 0           | 0     | ns    |
| T <sub>ILVCMOS2</sub>        |                                                | LVCMOS2           | 0           | 0     | ns    |
| T <sub>ILVCMOS18</sub>       |                                                | LVCMOS18          | 0.20        | 0.20  | ns    |
| T <sub>ILVDS</sub>           |                                                | LVDS              | 0.15        | 0.15  | ns    |
| T <sub>ILVPECL</sub>         |                                                | LVPECL            | 0.15        | 0.15  | ns    |
| T <sub>IPCI33_3</sub>        |                                                | PCI, 33 MHz, 3.3V | 0.08        | 0.08  | ns    |
| T <sub>IPCI66_3</sub>        |                                                | PCI, 66 MHz, 3.3V | −0.11       | −0.11 | ns    |
| T <sub>IGTL</sub>            |                                                | GTL               | 0.14        | 0.14  | ns    |
| T <sub>IGTLP</sub>           |                                                | GTL+              | 0.14        | 0.14  | ns    |
| T <sub>IHSTL</sub>           |                                                | HSTL              | 0.04        | 0.04  | ns    |
| T <sub>ISSTL2</sub>          |                                                | SSTL2             | 0.04        | 0.04  | ns    |
| T <sub>ISSTL3</sub>          |                                                | SSTL3             | 0.04        | 0.04  | ns    |
| T <sub>ICTT</sub>            |                                                | CTT               | 0.10        | 0.10  | ns    |
| T <sub>IAGP</sub>            |                                                | AGP               | 0.04        | 0.04  | ns    |

## IOB Output Switching Characteristics

Output delays terminating at a pad are specified for LVTTTL with 12 mA drive and fast slew rate. For other standards, adjust the delays with the values shown in [IOB Output Delay Adjustments for Different Standards\(1\)](#), page 40.

| Symbol                                      | Description                                                        | Speed Grade |     |         |     | Units |
|---------------------------------------------|--------------------------------------------------------------------|-------------|-----|---------|-----|-------|
|                                             |                                                                    | -7          |     | -6      |     |       |
|                                             |                                                                    | Min         | Max | Min     | Max |       |
| Propagation Delays                          |                                                                    |             |     |         |     |       |
| T <sub>IOOP</sub>                           | O input to pad                                                     | 1.0         | 2.7 | 1.0     | 2.9 | ns    |
| T <sub>IOOLP</sub>                          | O input to pad via transparent latch                               | 1.2         | 3.1 | 1.2     | 3.4 | ns    |
| 3-state Delays                              |                                                                    |             |     |         |     |       |
| T <sub>IOTHZ</sub>                          | T input to pad high impedance <sup>(1)</sup>                       | 0.7         | 1.7 | 0.7     | 1.9 | ns    |
| T <sub>IOTON</sub>                          | T input to valid data on pad                                       | 1.1         | 2.9 | 1.1     | 3.1 | ns    |
| T <sub>IOTLPHZ</sub>                        | T input to pad high impedance via transparent latch <sup>(1)</sup> | 0.8         | 2.0 | 0.8     | 2.2 | ns    |
| T <sub>IOTLPON</sub>                        | T input to valid data on pad via transparent latch                 | 1.2         | 3.2 | 1.2     | 3.4 | ns    |
| T <sub>GTS</sub>                            | GTS to pad high impedance <sup>(1)</sup>                           | 1.9         | 4.6 | 1.9     | 4.9 | ns    |
| Sequential Delays                           |                                                                    |             |     |         |     |       |
| T <sub>IOCKP</sub>                          | Clock CLK to pad                                                   | 0.9         | 2.8 | 0.9     | 2.9 | ns    |
| T <sub>IOCKHZ</sub>                         | Clock CLK to pad high impedance (synchronous) <sup>(1)</sup>       | 0.7         | 2.0 | 0.7     | 2.2 | ns    |
| T <sub>IOCKON</sub>                         | Clock CLK to valid data on pad (synchronous)                       | 1.1         | 3.2 | 1.1     | 3.4 | ns    |
| Setup/Hold Times with Respect to Clock CLK  |                                                                    |             |     |         |     |       |
| T <sub>IOOCK</sub> / T <sub>IOCKO</sub>     | O input                                                            | 1.0 / 0     | -   | 1.1 / 0 | -   | ns    |
| T <sub>IOOCECK</sub> / T <sub>IOCKOCE</sub> | OCE input                                                          | 0.7 / 0     | -   | 0.7 / 0 | -   | ns    |
| T <sub>IOSRCKO</sub> / T <sub>IOCKOSR</sub> | SR input (OFF)                                                     | 0.9 / 0     | -   | 1.0 / 0 | -   | ns    |
| T <sub>IOTCK</sub> / T <sub>IOCKT</sub>     | 3-state setup times, T input                                       | 0.6 / 0     | -   | 0.7 / 0 | -   | ns    |
| T <sub>IOTCECK</sub> / T <sub>IOCKTCE</sub> | 3-state setup times, TCE input                                     | 0.6 / 0     | -   | 0.8 / 0 | -   | ns    |
| T <sub>IOSRCKT</sub> / T <sub>IOCKTSR</sub> | 3-state setup times, SR input (TFF)                                | 0.9 / 0     | -   | 1.0 / 0 | -   | ns    |
| Set/Reset Delays                            |                                                                    |             |     |         |     |       |
| T <sub>IOSRP</sub>                          | SR input to pad (asynchronous)                                     | 1.2         | 3.3 | 1.2     | 3.5 | ns    |
| T <sub>IOSRHZ</sub>                         | SR input to pad high impedance (asynchronous) <sup>(1)</sup>       | 1.0         | 2.4 | 1.0     | 2.7 | ns    |
| T <sub>IOSRON</sub>                         | SR input to valid data on pad (asynchronous)                       | 1.4         | 3.7 | 1.4     | 3.9 | ns    |
| T <sub>IOGSRQ</sub>                         | GSR to pad                                                         | 3.8         | 8.5 | 3.8     | 9.7 | ns    |

### Notes:

1. Three-state turn-off delays should not be adjusted.

## IOB Output Delay Adjustments for Different Standards(1)

Output delays terminating at a pad are specified for LVTTTL with 12 mA drive and fast slew rate. For other standards, adjust the delays by the values shown. A delay adjusted in this way constitutes a worst-case limit.

| Symbol                         | Description                                                                                                               | Standard           | Speed Grade |       | Units |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------|-------------|-------|-------|
|                                |                                                                                                                           |                    | -7          | -6    |       |
| Output Delay Adjustments (Adj) |                                                                                                                           |                    |             |       |       |
| T <sub>OLVTTL_S2</sub>         | Standard-specific adjustments for output delays terminating at pads (based on standard capacitive load, C <sub>SL</sub> ) | LVTTTL, Slow, 2 mA | 14.7        | 14.7  | ns    |
| T <sub>OLVTTL_S4</sub>         |                                                                                                                           | 4 mA               | 7.5         | 7.5   | ns    |
| T <sub>OLVTTL_S6</sub>         |                                                                                                                           | 6 mA               | 4.8         | 4.8   | ns    |
| T <sub>OLVTTL_S8</sub>         |                                                                                                                           | 8 mA               | 3.0         | 3.0   | ns    |
| T <sub>OLVTTL_S12</sub>        |                                                                                                                           | 12 mA              | 1.9         | 1.9   | ns    |
| T <sub>OLVTTL_S16</sub>        |                                                                                                                           | 16 mA              | 1.7         | 1.7   | ns    |
| T <sub>OLVTTL_S24</sub>        |                                                                                                                           | 24 mA              | 1.3         | 1.3   | ns    |
| T <sub>OLVTTL_F2</sub>         |                                                                                                                           | LVTTTL, Fast, 2 mA | 13.1        | 13.1  | ns    |
| T <sub>OLVTTL_F4</sub>         |                                                                                                                           | 4 mA               | 5.3         | 5.3   | ns    |
| T <sub>OLVTTL_F6</sub>         |                                                                                                                           | 6 mA               | 3.1         | 3.1   | ns    |
| T <sub>OLVTTL_F8</sub>         |                                                                                                                           | 8 mA               | 1.0         | 1.0   | ns    |
| T <sub>OLVTTL_F12</sub>        |                                                                                                                           | 12 mA              | 0           | 0     | ns    |
| T <sub>OLVTTL_F16</sub>        |                                                                                                                           | 16 mA              | −0.05       | −0.05 | ns    |
| T <sub>OLVTTL_F24</sub>        |                                                                                                                           | 24 mA              | −0.20       | −0.20 | ns    |
| T <sub>OLVCMOS2</sub>          |                                                                                                                           | LVCMOS2            | 0.09        | 0.09  | ns    |
| T <sub>OLVCMOS18</sub>         |                                                                                                                           | LVCMOS18           | 0.7         | 0.7   | ns    |
| T <sub>OLVDS</sub>             |                                                                                                                           | LVDS               | −1.2        | −1.2  | ns    |
| T <sub>OLVPECL</sub>           |                                                                                                                           | LVPECL             | −0.41       | −0.41 | ns    |
| T <sub>OPCI33_3</sub>          |                                                                                                                           | PCI, 33 MHz, 3.3V  | 2.3         | 2.3   | ns    |
| T <sub>OPCI66_3</sub>          |                                                                                                                           | PCI, 66 MHz, 3.3V  | −0.41       | −0.41 | ns    |
| T <sub>OGTL</sub>              |                                                                                                                           | GTL                | 0.49        | 0.49  | ns    |
| T <sub>OGTLP</sub>             |                                                                                                                           | GTL+               | 0.8         | 0.8   | ns    |
| T <sub>OHSTL_I</sub>           |                                                                                                                           | HSTL I             | −0.51       | −0.51 | ns    |
| T <sub>OHSTL_III</sub>         |                                                                                                                           | HSTL III           | −0.91       | −0.91 | ns    |
| T <sub>OHSTL_IV</sub>          |                                                                                                                           | HSTL IV            | −1.01       | −1.01 | ns    |
| T <sub>OSSTL2_I</sub>          |                                                                                                                           | SSTL2 I            | −0.51       | −0.51 | ns    |
| T <sub>OSSTL2_II</sub>         |                                                                                                                           | SSTL2 II           | −0.91       | −0.91 | ns    |
| T <sub>OSSTL3_I</sub>          |                                                                                                                           | SSTL3 I            | −0.51       | −0.51 | ns    |
| T <sub>OSSTL3_II</sub>         |                                                                                                                           | SSTL3 II           | −1.01       | −1.01 | ns    |
| T <sub>OCTT</sub>              |                                                                                                                           | CTT                | −0.61       | −0.61 | ns    |
| T <sub>OAGP</sub>              |                                                                                                                           | AGP                | −0.91       | −0.91 | ns    |

### Notes:

- Output timing is measured at 1.4V with 35 pF external capacitive load for LVTTTL. For other I/O standards and different loads, see the tables [Constants for Calculating T<sub>IOOP</sub>](#) and [Delay Measurement Methodology, page 41](#).

## Calculation of $T_{IOP}$ as a Function of Capacitance

$T_{IOP}$  is the propagation delay from the O Input of the IOB to the pad. The values for  $T_{IOP}$  are based on the standard capacitive load ( $C_{SL}$ ) for each I/O standard as listed in the table [Constants for Calculating  \$T\_{IOP}\$](#) , below.

For other capacitive loads, use the formulas below to calculate an adjusted propagation delay,  $T_{IOP1}$ .

$$T_{\text{LOOP1}} = T_{\text{LOOP}} + \text{Adj} + (C_{\text{LOAD}} - C_{\text{SL}}) * F_L$$

Where:

Adj is selected from **IOB Output Delay Adjustments for Different Standards(1)**, page 40, according to the I/O standard used

$C_{LOAD}$  is the capacitive load for the design

$F_1$  is the capacitance scaling factor

## Delay Measurement Methodology

| Standard       | $V_L^{(1)}$                      | $V_H^{(1)}$                      | Meas. Point | $V_{REF}^{Typ(2)}$ |
|----------------|----------------------------------|----------------------------------|-------------|--------------------|
| LVTTTL         | 0                                | 3                                | 1.4         | -                  |
| LVC MOS2       | 0                                | 2.5                              | 1.125       | -                  |
| PCI33_3        | Per PCI Spec                     |                                  |             | -                  |
| PCI66_3        | Per PCI Spec                     |                                  |             | -                  |
| GTL            | $V_{REF} - 0.2$                  | $V_{REF} + 0.2$                  | $V_{REF}$   | 0.80               |
| GTL+           | $V_{REF} - 0.2$                  | $V_{REF} + 0.2$                  | $V_{REF}$   | 1.0                |
| HSTL Class I   | $V_{REF} - 0.5$                  | $V_{REF} + 0.5$                  | $V_{REF}$   | 0.75               |
| HSTL Class III | $V_{REF} - 0.5$                  | $V_{REF} + 0.5$                  | $V_{REF}$   | 0.90               |
| HSTL Class IV  | $V_{REF} - 0.5$                  | $V_{REF} + 0.5$                  | $V_{REF}$   | 0.90               |
| SSTL3 I and II | $V_{REF} - 1.0$                  | $V_{REF} + 1.0$                  | $V_{REF}$   | 1.5                |
| SSTL2 I and II | $V_{REF} - 0.75$                 | $V_{REF} + 0.75$                 | $V_{REF}$   | 1.25               |
| CTT            | $V_{REF} - 0.2$                  | $V_{REF} + 0.2$                  | $V_{REF}$   | 1.5                |
| AGP            | $V_{REF} - (0.2 \times V_{CCO})$ | $V_{REF} + (0.2 \times V_{CCO})$ | $V_{REF}$   | Per AGP Spec       |
| LVDS           | $1.2 - 0.125$                    | $1.2 + 0.125$                    | 1.2         |                    |
| LVPECL         | $1.6 - 0.3$                      | $1.6 + 0.3$                      | 1.6         |                    |

**Notes:**

1. Input waveform switches between  $V_L$  and  $V_H$ .
2. Measurements are made at  $V_{REF}$  Typ, Maximum, and Minimum. Worst-case values are reported.
3. I/O parameter measurements are made with the capacitance values shown in the following table, [Constants for Calculating  \$T\_{IOOP}\$](#) . Refer to Application Note [XAPP179](#) for appropriate terminations.
4. I/O standard measurements are reflected in the IBIS model information except where the IBIS format precludes it.

## Constants for Calculating $T_{loop}$

| Standard                          | C <sub>SL</sub> <sup>(1)</sup><br>(pF) | F <sub>L</sub><br>(ns/pF) |
|-----------------------------------|----------------------------------------|---------------------------|
| LVTTL Fast Slew Rate, 2 mA drive  | 35                                     | 0.41                      |
| LVTTL Fast Slew Rate, 4 mA drive  | 35                                     | 0.20                      |
| LVTTL Fast Slew Rate, 6 mA drive  | 35                                     | 0.13                      |
| LVTTL Fast Slew Rate, 8 mA drive  | 35                                     | 0.079                     |
| LVTTL Fast Slew Rate, 12 mA drive | 35                                     | 0.044                     |
| LVTTL Fast Slew Rate, 16 mA drive | 35                                     | 0.043                     |
| LVTTL Fast Slew Rate, 24 mA drive | 35                                     | 0.033                     |
| LVTTL Slow Slew Rate, 2 mA drive  | 35                                     | 0.41                      |
| LVTTL Slow Slew Rate, 4 mA drive  | 35                                     | 0.20                      |
| LVTTL Slow Slew Rate, 6 mA drive  | 35                                     | 0.100                     |
| LVTTL Slow Slew Rate, 8 mA drive  | 35                                     | 0.086                     |
| LVTTL Slow Slew Rate, 12 mA drive | 35                                     | 0.058                     |
| LVTTL Slow Slew Rate, 16 mA drive | 35                                     | 0.050                     |
| LVTTL Slow Slew Rate, 24 mA drive | 35                                     | 0.048                     |
| LVC MOS2                          | 35                                     | 0.041                     |
| LVC MOS18                         | 35                                     | 0.050                     |
| PCI 33 MHz 3.3V                   | 10                                     | 0.050                     |
| PCI 66 MHz 3.3V                   | 10                                     | 0.033                     |
| GTL                               | 0                                      | 0.014                     |
| GTL+                              | 0                                      | 0.017                     |
| HSTL Class I                      | 20                                     | 0.022                     |
| HSTL Class III                    | 20                                     | 0.016                     |
| HSTL Class IV                     | 20                                     | 0.014                     |
| SSTL2 Class I                     | 30                                     | 0.028                     |
| SSTL2 Class II                    | 30                                     | 0.016                     |
| SSTL3 Class I                     | 30                                     | 0.029                     |
| SSTL3 Class II                    | 30                                     | 0.016                     |
| CTT                               | 20                                     | 0.035                     |
| AGP                               | 10                                     | 0.037                     |

**Notes:**

1. I/O parameter measurements are made with the capacitance values shown above. Refer to Application Note [XAPP179](#) for appropriate terminations.
2. I/O standard measurements are reflected in the IBIS model information except where the IBIS format precludes it.



## DLL Timing Parameters

Because of the difficulty in directly measuring many internal timing parameters, those parameters are derived from benchmark timing patterns. The following guidelines reflect

worst-case values across the recommended operating conditions.

| Symbol               | Description                      | F <sub>CLKIN</sub> | Speed Grade |     |     |     | Units |
|----------------------|----------------------------------|--------------------|-------------|-----|-----|-----|-------|
|                      |                                  |                    | -7          |     | -6  |     |       |
|                      |                                  |                    | Min         | Max | Min | Max |       |
| F <sub>CLKINHF</sub> | Input clock frequency (CLKDLLHF) | -                  | 60          | 320 | 60  | 275 | MHz   |
| F <sub>CLKINLF</sub> | Input clock frequency (CLKDLL)   | -                  | 25          | 160 | 25  | 135 | MHz   |
| T <sub>DLLPW</sub>   | Input clock pulse width          | ≥25 MHz            | 5.0         | -   | 5.0 | -   | ns    |
|                      |                                  | ≥50 MHz            | 3.0         | -   | 3.0 | -   | ns    |
|                      |                                  | ≥100 MHz           | 2.4         | -   | 2.4 | -   | ns    |
|                      |                                  | ≥150 MHz           | 2.0         | -   | 2.0 | -   | ns    |
|                      |                                  | ≥200 MHz           | 1.8         | -   | 1.8 | -   | ns    |
|                      |                                  | ≥250 MHz           | 1.5         | -   | 1.5 | -   | ns    |
|                      |                                  | ≥300 MHz           | 1.3         | -   | NA  | -   |       |

## DLL Clock Tolerance, Jitter, and Phase Information

All DLL output jitter and phase specifications were determined through statistical measurement at the package pins using a clock mirror configuration and matched drivers.

Figure 22, page 44, provides definitions for various parameters in the table below.

| Symbol              | Description                                                            | F <sub>CLKIN</sub> | CLKDLLHF |      | CLKDLL |      | Units |
|---------------------|------------------------------------------------------------------------|--------------------|----------|------|--------|------|-------|
|                     |                                                                        |                    | Min      | Max  | Min    | Max  |       |
| T <sub>IPTOL</sub>  | Input clock period tolerance                                           |                    | -        | 1.0  | -      | 1.0  | ns    |
| T <sub>IJITCC</sub> | Input clock jitter tolerance (cycle-to-cycle)                          |                    | -        | ±150 | -      | ±300 | ps    |
| T <sub>LOCK</sub>   | Time required for DLL to acquire lock <sup>(1)</sup>                   | > 60 MHz           | -        | 20   | -      | 20   | μs    |
|                     |                                                                        | 50-60 MHz          | -        | -    | -      | 25   | μs    |
|                     |                                                                        | 40-50 MHz          | -        | -    | -      | 50   | μs    |
|                     |                                                                        | 30-40 MHz          | -        | -    | -      | 90   | μs    |
|                     |                                                                        | 25-30 MHz          | -        | -    | -      | 120  | μs    |
| T <sub>OJITCC</sub> | Output jitter (cycle-to-cycle) for any DLL clock output <sup>(2)</sup> |                    | -        | ±60  | -      | ±60  | ps    |
| T <sub>PHIO</sub>   | Phase offset between CLKIN and CLKO <sup>(3)</sup>                     |                    | -        | ±100 | -      | ±100 | ps    |
| T <sub>PHOO</sub>   | Phase offset between clock outputs on the DLL <sup>(4)</sup>           |                    | -        | ±140 | -      | ±140 | ps    |
| T <sub>PHIOM</sub>  | Phase difference between CLKIN and CLKO <sup>(5)</sup>                 |                    | -        | ±160 | -      | ±160 | ps    |
| T <sub>PHOOM</sub>  | Phase difference between clock outputs on the DLL <sup>(6)</sup>       |                    | -        | ±200 | -      | ±200 | ps    |

### Notes:

- Commercial operating conditions. Add 30% for Industrial operating conditions.
- Output Jitter** is cycle-to-cycle jitter measured on the DLL output clock, *excluding* input clock jitter.
- Phase Offset between CLKIN and CLKO** is the worst-case fixed time difference between rising edges of CLKIN and CLKO, *excluding* output jitter and input clock jitter.
- Phase Offset between Clock Outputs on the DLL** is the worst-case fixed time difference between rising edges of any two DLL outputs, *excluding* output jitter and input clock jitter.
- Maximum Phase Difference between CLKIN and CLKO** is the sum of output jitter and phase offset between CLKIN and CLKO, or the greatest difference between CLKIN and CLKO rising edges due to DLL alone (*excluding* input clock jitter).
- Maximum Phase Difference between Clock Outputs on the DLL** is the sum of output jitter and phase offset between any two DLL clock outputs, or the greatest difference between any two DLL output rising edges due to DLL alone (*excluding* input clock jitter).

$$T_{\text{CLKIN}} = \frac{1}{F_{\text{CLKIN}}}$$

### Phase Offset and Maximum Phase Difference

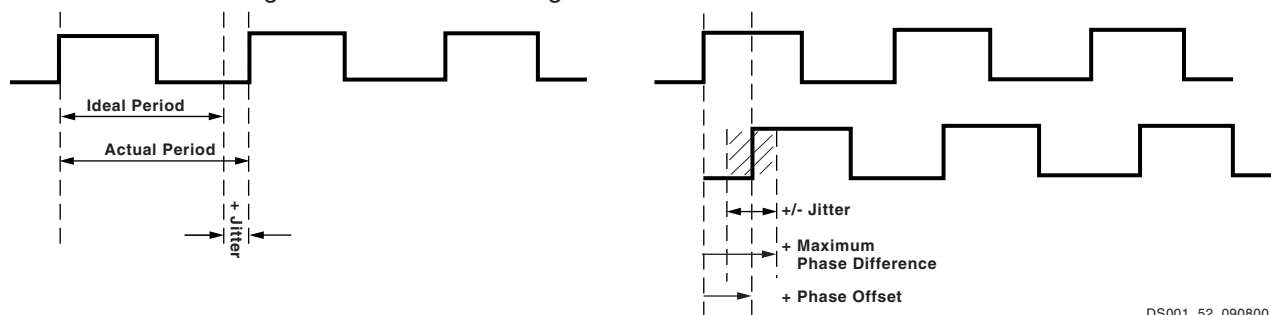


**Figure 22: Period Tolerance and Clock Jitter**

Delays originating at F/G inputs vary slightly according to the input used. The values listed below are worst-case. Precise values are provided by the timing analyzer.

| Symbol                                     | Description                                                          | Speed Grade |      |         |      | Units |
|--------------------------------------------|----------------------------------------------------------------------|-------------|------|---------|------|-------|
|                                            |                                                                      | -7          |      | -6      |      |       |
|                                            |                                                                      | Min         | Max  | Min     | Max  |       |
| Combinatorial Delays                       |                                                                      |             |      |         |      |       |
| T <sub>ILO</sub>                           | 4-input function: F/G inputs to X/Y outputs                          | 0.18        | 0.42 | 0.18    | 0.47 | ns    |
| T <sub>IF5</sub>                           | 5-input function: F/G inputs to F5 output                            | 0.3         | 0.8  | 0.3     | 0.9  | ns    |
| T <sub>IF5X</sub>                          | 5-input function: F/G inputs to X output                             | 0.3         | 0.8  | 0.3     | 0.9  | ns    |
| T <sub>IF6Y</sub>                          | 6-input function: F/G inputs to Y output via F6 MUX                  | 0.3         | 0.9  | 0.3     | 1.0  | ns    |
| T <sub>F5INY</sub>                         | 6-input function: F5IN input to Y output                             | 0.04        | 0.2  | 0.04    | 0.22 | ns    |
| T <sub>IFNCTL</sub>                        | Incremental delay routing through transparent latch to XQ/YQ outputs | -           | 0.7  | -       | 0.8  | ns    |
| T <sub>BYYB</sub>                          | BY input to YB output                                                | 0.18        | 0.46 | 0.18    | 0.51 | ns    |
| Sequential Delays                          |                                                                      |             |      |         |      |       |
| T <sub>CKO</sub>                           | FF clock CLK to XQ/YQ outputs                                        | 0.3         | 0.9  | 0.3     | 1.0  | ns    |
| T <sub>CKLO</sub>                          | Latch clock CLK to XQ/YQ outputs                                     | 0.3         | 0.9  | 0.3     | 1.0  | ns    |
| Setup/Hold Times with Respect to Clock CLK |                                                                      |             |      |         |      |       |
| T <sub>ICK</sub> / T <sub>CKI</sub>        | 4-input function: F/G inputs                                         | 1.0 / 0     | -    | 1.1 / 0 | -    | ns    |
| T <sub>IF5CK</sub> / T <sub>CKIF5</sub>    | 5-input function: F/G inputs                                         | 1.4 / 0     | -    | 1.5 / 0 | -    | ns    |
| T <sub>F5INCK</sub> / T <sub>CKF5IN</sub>  | 6-input function: F5IN input                                         | 0.8 / 0     | -    | 0.8 / 0 | -    | ns    |
| T <sub>IF6CK</sub> / T <sub>CKIF6</sub>    | 6-input function: F/G inputs via F6 MUX                              | 1.5 / 0     | -    | 1.6 / 0 | -    | ns    |
| T <sub>DICK</sub> / T <sub>CKDI</sub>      | BX/BY inputs                                                         | 0.7 / 0     | -    | 0.8 / 0 | -    | ns    |
| T <sub>CECK</sub> / T <sub>CKCE</sub>      | CE input                                                             | 0.7 / 0     | -    | 0.7 / 0 | -    | ns    |
| T <sub>RCK</sub> / T <sub>CKR</sub>        | SR/BY inputs (synchronous)                                           | 0.52 / 0    | -    | 0.6 / 0 | -    | ns    |
| Clock CLK                                  |                                                                      |             |      |         |      |       |
| T <sub>CH</sub>                            | Pulse width, High                                                    | 1.3         | -    | 1.4     | -    | ns    |
| T <sub>CL</sub>                            | Pulse width, Low                                                     | 1.3         | -    | 1.4     | -    | ns    |
| Set/Reset                                  |                                                                      |             |      |         |      |       |
| T <sub>RPW</sub>                           | Pulse width, SR/BY inputs                                            | 2.1         | -    | 2.4     | -    | ns    |
| T <sub>RQ</sub>                            | Delay from SR/BY inputs to XQ/YQ outputs (asynchronous)              | 0.3         | 0.9  | 0.3     | 1.0  | ns    |
| F <sub>TOG</sub>                           | Toggle frequency (for export control)                                | -           | 400  | -       | 357  | MHz   |

| Symbol                                            | Description                                | Speed Grade |      |         |      | Units |
|---------------------------------------------------|--------------------------------------------|-------------|------|---------|------|-------|
|                                                   |                                            | -7          |      | -6      |      |       |
|                                                   |                                            | Min         | Max  | Min     | Max  |       |
| <b>Combinatorial Delays</b>                       |                                            |             |      |         |      |       |
| T <sub>OPX</sub>                                  | F operand inputs to X via XOR              | -           | 0.8  | -       | 0.8  | ns    |
| T <sub>OPXB</sub>                                 | F operand input to XB output               | -           | 0.8  | -       | 0.9  | ns    |
| T <sub>OPY</sub>                                  | F operand input to Y via XOR               | -           | 1.4  | -       | 1.5  | ns    |
| T <sub>OPYB</sub>                                 | F operand input to YB output               | -           | 1.1  | -       | 1.3  | ns    |
| T <sub>OPCYF</sub>                                | F operand input to COUT output             | -           | 0.9  | -       | 1.0  | ns    |
| T <sub>OPGY</sub>                                 | G operand inputs to Y via XOR              | -           | 0.8  | -       | 0.9  | ns    |
| T <sub>OPGYB</sub>                                | G operand input to YB output               | -           | 1.2  | -       | 1.3  | ns    |
| T <sub>OPCYG</sub>                                | G operand input to COUT output             | -           | 0.9  | -       | 1.0  | ns    |
| T <sub>BXCY</sub>                                 | BX initialization input to COUT            | -           | 0.51 | -       | 0.6  | ns    |
| T <sub>CINX</sub>                                 | CIN input to X output via XOR              | -           | 0.6  | -       | 0.7  | ns    |
| T <sub>CINXB</sub>                                | CIN input to XB                            | -           | 0.07 | -       | 0.1  | ns    |
| T <sub>CINY</sub>                                 | CIN input to Y via XOR                     | -           | 0.7  | -       | 0.7  | ns    |
| T <sub>CINYB</sub>                                | CIN input to YB                            | -           | 0.4  | -       | 0.5  | ns    |
| T <sub>BYP</sub>                                  | CIN input to COUT output                   | -           | 0.14 | -       | 0.15 | ns    |
| <b>Multiplier Operation</b>                       |                                            |             |      |         |      |       |
| T <sub>FANDXB</sub>                               | F1/2 operand inputs to XB output via AND   | -           | 0.35 | -       | 0.4  | ns    |
| T <sub>FANDYB</sub>                               | F1/2 operand inputs to YB output via AND   | -           | 0.7  | -       | 0.8  | ns    |
| T <sub>FANDCY</sub>                               | F1/2 operand inputs to COUT output via AND | -           | 0.5  | -       | 0.6  | ns    |
| T <sub>GANDYB</sub>                               | G1/2 operand inputs to YB output via AND   | -           | 0.6  | -       | 0.7  | ns    |
| T <sub>GANDCY</sub>                               | G1/2 operand inputs to COUT output via AND | -           | 0.3  | -       | 0.4  | ns    |
| <b>Setup/Hold Times with Respect to Clock CLK</b> |                                            |             |      |         |      |       |
| T <sub>CCKX</sub> / T <sub>CKCX</sub>             | CIN input to FFX                           | 1.2 / 0     | -    | 1.3 / 0 | -    | ns    |
| T <sub>CCKY</sub> / T <sub>CKCY</sub>             | CIN input to FFY                           | 1.2 / 0     | -    | 1.3 / 0 | -    | ns    |

## CLB Distributed RAM Switching Characteristics

| Symbol                                     | Description                                       | Speed Grade |     |         |     | Units |
|--------------------------------------------|---------------------------------------------------|-------------|-----|---------|-----|-------|
|                                            |                                                   | -7          |     | -6      |     |       |
|                                            |                                                   | Min         | Max | Min     | Max |       |
| Sequential Delays                          |                                                   |             |     |         |     |       |
| T <sub>SHCKO16</sub>                       | Clock CLK to X/Y outputs (WE active, 16 x 1 mode) | 0.6         | 1.5 | 0.6     | 1.7 | ns    |
| T <sub>SHCKO32</sub>                       | Clock CLK to X/Y outputs (WE active, 32 x 1 mode) | 0.8         | 1.9 | 0.8     | 2.1 | ns    |
| Setup/Hold Times with Respect to Clock CLK |                                                   |             |     |         |     |       |
| T <sub>AS</sub> / T <sub>AH</sub>          | F/G address inputs                                | 0.42 / 0    | -   | 0.5 / 0 | -   | ns    |
| T <sub>DS</sub> / T <sub>DH</sub>          | BX/BY data inputs (DIN)                           | 0.53 / 0    | -   | 0.6 / 0 | -   | ns    |
| T <sub>WS</sub> / T <sub>WH</sub>          | CE input (WS)                                     | 0.7 / 0     | -   | 0.8 / 0 | -   | ns    |
| Clock CLK                                  |                                                   |             |     |         |     |       |
| T <sub>WPH</sub>                           | Pulse width, High                                 | 2.1         | -   | 2.4     | -   | ns    |
| T <sub>WPL</sub>                           | Pulse width, Low                                  | 2.1         | -   | 2.4     | -   | ns    |
| T <sub>WC</sub>                            | Clock period to meet address write cycle time     | 4.2         | -   | 4.8     | -   | ns    |

## CLB Shift Register Switching Characteristics

| Symbol                                     | Description              | Speed Grade |     |         |     | Units |
|--------------------------------------------|--------------------------|-------------|-----|---------|-----|-------|
|                                            |                          | -7          |     | -6      |     |       |
|                                            |                          | Min         | Max | Min     | Max |       |
| Sequential Delays                          |                          |             |     |         |     |       |
| T <sub>REG</sub>                           | Clock CLK to X/Y outputs | 1.2         | 2.9 | 1.2     | 3.2 | ns    |
| Setup/Hold Times with Respect to Clock CLK |                          |             |     |         |     |       |
| T <sub>SHDICK</sub>                        | BX/BY data inputs (DIN)  | 0.53 / 0    | -   | 0.6 / 0 | -   | ns    |
| T <sub>SHCECK</sub>                        | CE input (WS)            | 0.7 / 0     | -   | 0.8 / 0 | -   | ns    |
| Clock CLK                                  |                          |             |     |         |     |       |
| T <sub>SRPH</sub>                          | Pulse width, High        | 2.1         | -   | 2.4     | -   | ns    |
| T <sub>SRPL</sub>                          | Pulse width, Low         | 2.1         | -   | 2.4     | -   | ns    |

## Block RAM Switching Characteristics

| Symbol                                     | Description                                 | Speed Grade |     |         |     | Units |
|--------------------------------------------|---------------------------------------------|-------------|-----|---------|-----|-------|
|                                            |                                             | -7          |     | -6      |     |       |
|                                            |                                             | Min         | Max | Min     | Max |       |
| Sequential Delays                          |                                             |             |     |         |     |       |
| T <sub>BCKO</sub>                          | Clock CLK to DOUT output                    | 0.6         | 3.1 | 0.6     | 3.5 | ns    |
| Setup/Hold Times with Respect to Clock CLK |                                             |             |     |         |     |       |
| T <sub>BACK</sub> / T <sub>BCKA</sub>      | ADDR inputs                                 | 1.0 / 0     | -   | 1.1 / 0 | -   | ns    |
| T <sub>BDCK</sub> / T <sub>BCKD</sub>      | DIN inputs                                  | 1.0 / 0     | -   | 1.1 / 0 | -   | ns    |
| T <sub>BECK</sub> / T <sub>BCKE</sub>      | EN inputs                                   | 2.2 / 0     | -   | 2.5 / 0 | -   | ns    |
| T <sub>BRCK</sub> / T <sub>BCKR</sub>      | RST input                                   | 2.1 / 0     | -   | 2.3 / 0 | -   | ns    |
| T <sub>BWCK</sub> / T <sub>BCKW</sub>      | WEN input                                   | 2.0 / 0     | -   | 2.2 / 0 | -   | ns    |
| Clock CLK                                  |                                             |             |     |         |     |       |
| T <sub>BPWH</sub>                          | Pulse width, High                           | 1.4         | -   | 1.5     | -   | ns    |
| T <sub>BPWL</sub>                          | Pulse width, Low                            | 1.4         | -   | 1.5     | -   | ns    |
| T <sub>BCCS</sub>                          | CLKA -> CLKB setup time for different ports | 2.7         | -   | 3.0     | -   | ns    |

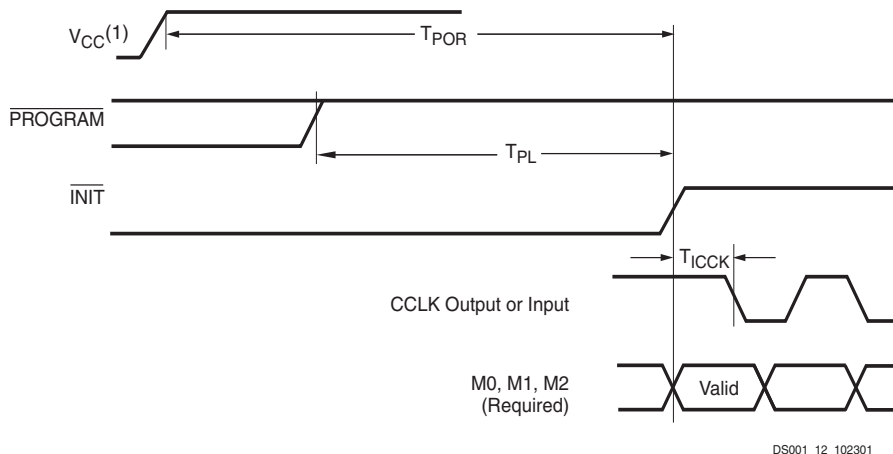
## TBUF Switching Characteristics

| Symbol    | Description                            | Speed Grade |      | Units |
|-----------|----------------------------------------|-------------|------|-------|
|           |                                        | -7          | -6   |       |
|           |                                        | Max         | Max  |       |
| $T_{IO}$  | IN input to OUT output                 | 0           | 0    | ns    |
| $T_{OFF}$ | TRI input to OUT output high impedance | 0.1         | 0.11 | ns    |
| $T_{ON}$  | TRI input to valid data on OUT output  | 0.1         | 0.11 | ns    |

## JTAG Test Access Port Switching Characteristics

| Symbol                                    | Description                               | Speed Grade |      |           |      | Units |
|-------------------------------------------|-------------------------------------------|-------------|------|-----------|------|-------|
|                                           |                                           | -7          |      | -6        |      |       |
|                                           |                                           | Min         | Max  | Min       | Max  |       |
| Setup/Hold Times with Respect to TCK      |                                           |             |      |           |      |       |
| T <sub>TAPTCK</sub> / T <sub>TCKTAP</sub> | TMS and TDI setup times and hold times    | 4.0 / 2.0   | -    | 4.0 / 2.0 | -    | ns    |
| Sequential Delays                         |                                           |             |      |           |      |       |
| T <sub>TCKTDO</sub>                       | Output delay from clock TCK to output TDO | -           | 11.0 | -         | 11.0 | ns    |
| F <sub>TCK</sub>                          | TCK clock frequency                       | -           | 33   | -         | 33   | MHz   |

## Configuration Switching Characteristics



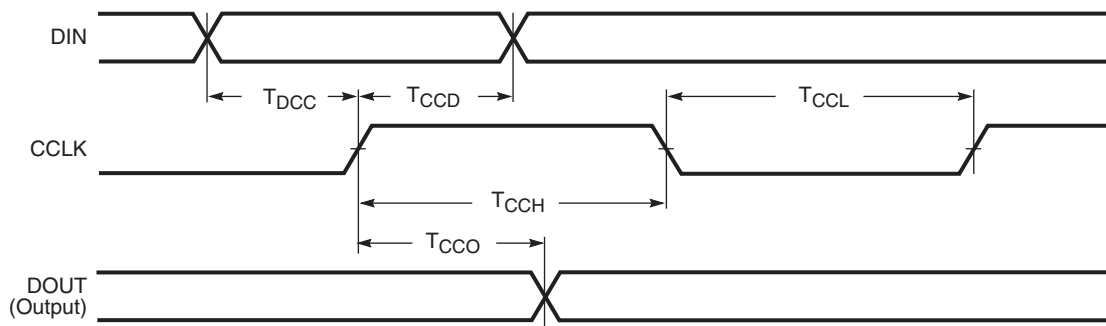
DS001\_12\_102301

| Symbol        | Description                                 | All Devices |     | Units   |
|---------------|---------------------------------------------|-------------|-----|---------|
|               |                                             | Min         | Max |         |
| $T_{POR}$     | Power-on reset                              | -           | 2   | ms      |
| $T_{PL}$      | Program latency                             | -           | 100 | $\mu$ s |
| $T_{ICCK}$    | CCLK output delay (Master serial mode only) | 0.5         | 4   | $\mu$ s |
| $T_{PROGRAM}$ | Program pulse width                         | 300         | -   | ns      |

### Notes:

- Before configuration can begin,  $V_{CCINT}$  and  $V_{CCO}$  Bank 2 must reach the recommended operating voltage.

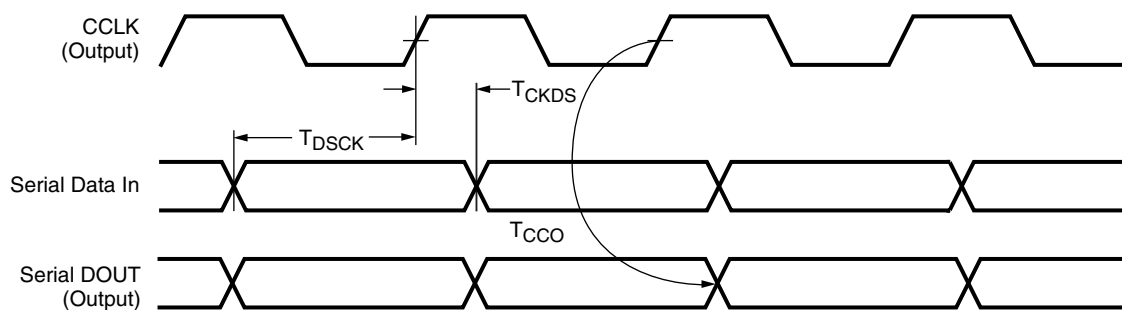
Figure 23: Configuration Timing on Power-Up



DS001\_16\_032300

| Symbol              |      | Description       | All Devices |     | Units |
|---------------------|------|-------------------|-------------|-----|-------|
|                     |      |                   | Min         | Max |       |
| $T_{DCC} / T_{CCD}$ | CCLK | DIN setup/hold    | 5 / 0       | -   | ns    |
| $T_{CCO}$           |      | DOUT              | -           | 12  | ns    |
| $T_{CCH}$           |      | High time         | 5           | -   | ns    |
| $T_{CCL}$           |      | Low time          | 5           | -   | ns    |
| $F_{CC}$            |      | Maximum frequency | -           | 66  | MHz   |

Figure 24: Slave Serial Mode Timing



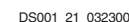
DS001\_17\_110101

| Symbol                |      | Description                                 | All Devices |      | Units |
|-----------------------|------|---------------------------------------------|-------------|------|-------|
|                       |      |                                             | Min         | Max  |       |
| $T_{DSCK} / T_{CKDS}$ | CCLK | DIN setup/hold                              | 5 / 0       | -    | ns    |
| $T_{CCO}$             |      | DOUT                                        | -           | 12   | ns    |
| $F_{CC}$              |      | Frequency tolerance with respect to nominal | -30%        | +45% | -     |

Figure 25: Master Serial Mode Timing



**Figure 26: Slave Parallel (SelectMAP) Mode Write Timing**



DS077-3 (v3.0) August 9, 2013  
**Product Specification**

## Revision History

| Date       | Version | Description                                                                                                                                                                                                                                                                                                                                                                    |
|------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11/15/2001 | 1.0     | Initial Xilinx release.                                                                                                                                                                                                                                                                                                                                                        |
| 06/28/2002 | 1.1     | Added -7 speed grade and extended DLL specs to Industrial.                                                                                                                                                                                                                                                                                                                     |
| 11/18/2002 | 2.0     | Added XC2S400E and XC2S600E. Added minimum specifications. Added reference to XAPP450 for Power-On Requirements. Removed Preliminary designation.                                                                                                                                                                                                                              |
| 07/09/2003 | 2.1     | Added <a href="#">I<sub>CCINTQ</sub></a> typical values. Reduced <a href="#">I<sub>CCPO</sub></a> power-on current requirements. Relaxed <a href="#">T<sub>CCPO</sub></a> power-on ramp requirements. Added <a href="#">I<sub>HSP0</sub></a> to describe current in hot-swap applications. Updated <a href="#">TPSFD / TPHFD</a> description to indicate use of delay element. |
| 06/18/2008 | 2.3     | Updated I/O measurement thresholds. Updated all modules for continuous page, figure, and table numbering. Updated links. Synchronized all modules to v2.3.                                                                                                                                                                                                                     |
| 08/09/2013 | 3.0     | This product is obsolete/discontinued per <a href="#">XCN12026</a> .                                                                                                                                                                                                                                                                                                           |





## Product Specification

## Pin Types

Most pins on a Spartan-II<sup>®</sup>E FPGA are general-purpose, user-defined I/O pins. There are, however, different functional types of pins on Spartan-II<sup>®</sup>E FPGA packages, as outlined below.

| Pad Name                    | Dedicated Pin | Direction                  | Description                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------|---------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GCK0, GCK1, GCK2, GCK3      | No            | Input                      | Clock input pins that connect to Global Clock buffers or DLL inputs. These pins become user inputs when not needed for clocks.                                                                                                                                                                                                                                         |
| DLL                         | No            | Input                      | Clock input pins that connect to DLL input or feedback clocks. Differential clock input (N input of pair) when paired with adjacent GCK input. Becomes a user I/O when not needed for clocks.                                                                                                                                                                          |
| M0, M1, M2                  | Yes           | Input                      | Mode pins used to specify the configuration mode.                                                                                                                                                                                                                                                                                                                      |
| CCLK                        | Yes           | Input or Output            | The configuration Clock I/O pin. It is an input for Slave Parallel and Slave Serial modes, and output in Master Serial mode. After configuration, it is an input only with Don't Care logic levels.                                                                                                                                                                    |
| $\overline{\text{PROGRAM}}$ | Yes           | Input                      | Initiates a configuration sequence when asserted Low.                                                                                                                                                                                                                                                                                                                  |
| DONE                        | Yes           | Bidirectional              | Indicates that configuration loading is complete, and that the start-up sequence is in progress. The output may be open drain.                                                                                                                                                                                                                                         |
| $\overline{\text{INIT}}$    | No            | Bidirectional (Open-drain) | When Low, indicates that the configuration memory is being cleared. Goes High to indicate the end of initialization. Goes back Low to indicate a CRC error. This pin becomes a user I/O after configuration.                                                                                                                                                           |
| DOUT/BUSY                   | No            | Output                     | In Slave Parallel mode, BUSY controls the rate at which configuration data can be loaded. It is not needed below 50 MHz. This pin becomes a user I/O after configuration unless the Slave Parallel port is retained.<br><br>In serial modes, DOUT provides configuration data to downstream devices in a daisy-chain. This pin becomes a user I/O after configuration. |



## Spartan-IIE Package Pinouts

The Spartan®-IIE family of FPGAs is available in five popular, low-cost packages, including plastic quad flat packs and fine-pitch ball grid arrays. Family members have footprint compatibility across devices provided in the same package, with minor exceptions due to the smaller number of I/O in smaller devices or due to LVDS/LVPECL pin pairing. The

Spartan-IIE family is not footprint compatible with any other FPGA family. The following package-specific pinout tables indicate function, pin, and bank information for all devices available in that package. The pinouts follow the pad locations around the die, starting from pin 1 on the QFP packages.

Table 12: Spartan-IIE Family Package Options

| Package        | Leads | Type                                   | Maximum I/O | Lead Pitch (mm) | Footprint Area (mm) | Height (mm) | Mass <sup>(1)</sup> (g) |
|----------------|-------|----------------------------------------|-------------|-----------------|---------------------|-------------|-------------------------|
| TQ144 / TQG144 | 144   | Thin Quad Flat Pack (TQFP)             | 102         | 0.5             | 22 x 22             | 1.60        | 1.4                     |
| PQ208 / PQG208 | 208   | Plastic Quad Flat Pack (PQFP)          | 146         | 0.5             | 30.6 x 30.6         | 3.70        | 5.3                     |
| FT256 / FTG256 | 256   | Fine-pitch Thin Ball Grid Array (FBGA) | 182         | 1.0             | 17 x 17             | 1.55        | 1.0                     |
| FG456 / FGG456 | 456   | Fine-pitch Ball Grid Array (FBGA)      | 329         | 1.0             | 23 x 23             | 2.60        | 2.2                     |
| FG676 / FGG676 | 676   | Fine-pitch Ball Grid Array (FBGA)      | 514         | 1.0             | 27 x 27             | 2.60        | 3.1                     |

### Notes:

1. Package mass is  $\pm 10\%$ .

## Package Overview

Table 12 shows the five low-cost, space-saving production package styles for the Spartan-IIE family.

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 "TQ144" package becomes "TQG144" when ordered as the Pb-free option. Leaded (non-Pb-free) packages may be available for selected devices, with the same pin-out and without the "G" in the ordering code; contact Xilinx® sales for more information. The mechanical dimensions of the standard and Pb-free packages are similar, as shown in the mechanical drawings provided in Table 13.

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

## Mechanical Drawings

Detailed mechanical drawings for each package type are available from the Xilinx web site at the specified location in Table 13.

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

Table 13: Xilinx Package Documentation

| Package | Drawing                         | MDDS                         |
|---------|---------------------------------|------------------------------|
| TQ144   | <a href="#">Package Drawing</a> | <a href="#">PK169_TQ144</a>  |
| TQG144  |                                 | <a href="#">PK126_TQG144</a> |
| PQ208   | <a href="#">Package Drawing</a> | <a href="#">PK166_PQ208</a>  |
| PQG208  |                                 | <a href="#">PK123_PQG208</a> |
| FT256   | <a href="#">Package Drawing</a> | <a href="#">PK158_FT256</a>  |
| FTG256  |                                 | <a href="#">PK115_FTG256</a> |
| FG456   | <a href="#">Package Drawing</a> | <a href="#">PK154_FG456</a>  |
| FGG456  |                                 | <a href="#">PK109_FGG456</a> |
| FG676   | <a href="#">Package Drawing</a> | <a href="#">PK155_FG676</a>  |
| FGG676  |                                 | <a href="#">PK111_FGG676</a> |

## Package Thermal Characteristics

Table 14 provides the thermal characteristics for the various Spartan-II E FPGA package offerings. This information is also available using the Thermal Query tool on [www.xilinx.com](http://www.xilinx.com/cgi-bin/thermal/thermal.pl) ([www.xilinx.com/cgi-bin/thermal/thermal.pl](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 die 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 14: Spartan-II E Package Thermal Characteristics

| Package         | Device   | Junction-to-Case ( $\theta_{JC}$ ) | Junction-to-Board ( $\theta_{JB}$ ) | Junction-to-Ambient ( $\theta_{JA}$ )<br>at Different Air Flows |         |         |         | Units   |
|-----------------|----------|------------------------------------|-------------------------------------|-----------------------------------------------------------------|---------|---------|---------|---------|
|                 |          |                                    |                                     | Still Air<br>(0 LFM)                                            | 250 LFM | 500 LFM | 750 LFM |         |
| TQ144<br>TQG144 | XC2S50E  | 5.8                                | N/A                                 | 32.3                                                            | 25.1    | 21.5    | 20.1    | °C/Watt |
|                 | XC2S100E | 5.3                                | N/A                                 | 31.4                                                            | 24.4    | 20.8    | 19.6    | °C/Watt |
| PQ208<br>PQG208 | XC2S50E  | 7.1                                | N/A                                 | 35.1                                                            | 25.9    | 22.9    | 21.2    | °C/Watt |
|                 | XC2S100E | 6.1                                | N/A                                 | 34.2                                                            | 25.2    | 22.3    | 20.7    | °C/Watt |
|                 | XC2S150E | 6.0                                | N/A                                 | 34.1                                                            | 25.2    | 22.2    | 20.6    | °C/Watt |
|                 | XC2S200E | 4.6                                | N/A                                 | 32.4                                                            | 23.9    | 21.2    | 19.6    | °C/Watt |
|                 | XC2S300E | 4.0                                | N/A                                 | 31.6                                                            | 23.3    | 20.6    | 19.1    | °C/Watt |
| FT256<br>FTG256 | XC2S50E  | 7.3                                | 17.8                                | 27.4                                                            | 21.6    | 20.4    | 20.0    | °C/Watt |
|                 | XC2S100E | 5.8                                | 15.1                                | 25.0                                                            | 19.5    | 18.2    | 17.8    | °C/Watt |
|                 | XC2S150E | 5.7                                | 14.8                                | 24.8                                                            | 19.3    | 18.0    | 17.6    | °C/Watt |
|                 | XC2S200E | 3.9                                | 11.4                                | 21.9                                                            | 16.6    | 15.2    | 14.7    | °C/Watt |
|                 | XC2S300E | 3.2                                | 10.1                                | 20.8                                                            | 15.6    | 14.2    | 13.7    | °C/Watt |
|                 | XC2S400E | 2.5                                | 8.8                                 | 19.7                                                            | 14.5    | 13.2    | 12.6    | °C/Watt |
| FG456<br>FGG456 | XC2S100E | 8.4                                | 14.9                                | 24.3                                                            | 19.2    | 18.1    | 17.4    | °C/Watt |
|                 | XC2S150E | 8.2                                | 14.6                                | 24.1                                                            | 19.0    | 17.9    | 17.1    | °C/Watt |
|                 | XC2S200E | 6.3                                | 11.6                                | 21.0                                                            | 16.1    | 15.0    | 14.3    | °C/Watt |
|                 | XC2S300E | 5.6                                | 10.4                                | 19.9                                                            | 15.1    | 13.9    | 13.2    | °C/Watt |
|                 | XC2S400E | 3.6                                | 6.5                                 | 17.7                                                            | 11.7    | 10.5    | 10.0    | °C/Watt |
|                 | XC2S600E | 2.7                                | 5.0                                 | 17.3                                                            | 11.2    | 10.0    | 9.5     | °C/Watt |
| FG676<br>FGG676 | XC2S400E | 4.1                                | 7.9                                 | 15.6                                                            | 11.1    | 9.8     | 9.2     | °C/Watt |
|                 | XC2S600E | 3.4                                | 6.9                                 | 14.5                                                            | 9.9     | 8.6     | 7.9     | °C/Watt |

## Low Voltage Differential Signals (LVDS and LVPECL)

The Spartan-II<sup>E</sup> family features low-voltage differential signaling (LVDS and LVPECL). Each signal utilizes two pins on the Spartan-II<sup>E</sup> device, known as differential pin pairs. Each differential pin pair has a Positive (P) and a Negative (N) pin. These pairs are labeled in the following manner.

I/O, L#[P/N][-/\_Y/\_YY]

where

L = LVDS or LVPECL pin

# = Pin pair number

P = Positive

N = Negative

**\_Y** = Asynchronous output allowed (device-dependent)

**\_YY** = Asynchronous output allowed (all devices)

## Available Differential Pairs According to Package Type

| Device   | TQ144 | PQ208 | FT256 | FG456 | FG676 |
|----------|-------|-------|-------|-------|-------|
| XC2S50E  | 28    | 50    | 83    | -     | -     |
| XC2S100E | 28    | 50    | 83    | 86    | -     |
| XC2S150E | -     | 50    | 83    | 114   | -     |
| XC2S200E | -     | 50    | 83    | 120   | -     |
| XC2S300E | -     | 50    | 83    | 120   | -     |
| XC2S400E | -     | -     | 83    | 120   | 172   |
| XC2S600E | -     | -     | -     | 120   | 205   |

## Synchronous or Asynchronous

I/O pins for differential signals can either be synchronous or asynchronous, input or output. Differential signaling requires the pins of each pair to switch simultaneously. If the output signals driving the pins are from IOB flip-flops, they are synchronous. If the signals driving the pins are from internal logic, they are asynchronous, and therefore more care must be taken that they are simultaneous. Any differential pairs can be used for synchronous input and output signals as well as asynchronous input signals.

However, only the differential pairs with the \_Y or \_YY suffix can be used for asynchronous output signals.

### Asynchronous Output Pad Name Designation

Because of differences between densities, the differential pairs that can be used for asynchronous outputs vary by device. The pairs that are available in all densities for a given package have the `_YY` suffix. These pins should be used for differential asynchronous outputs if the design may later move to a different density. All other differential pairs that can be used for asynchronous outputs have the `_Y` suffix.

To simplify the following tables, the "Pad Name" column shows the part of the name that is common across densities. The "Pad Name" column leaves out the \_Y suffix and the "LVDS Asynchronous Output Option" column indicates the densities that allow asynchronous outputs for LVDS or LVPECL on the given pin.

## DLL Pins

Pins labeled "I/O (DLL)" can be used as general-purpose I/O or as inputs to the DLL. Adjacent DLL pins form a differential pair. They reside in two different banks, so if they are outputs the  $V_{CCO}$  level must be the same for both banks. Each DLL pin can also be paired with the adjacent GCK clock pin for a differential clock input. The "I/O (DLL)" pin always becomes the N terminal when paired with GCK, even if it is labeled "P" for its pairing with the adjacent DLL pin.

## VREF Pins

Pins labeled "I/O, VREF" can be used as either an I/O or a VREF pin. If any I/O pin within the bank requires a VREF input, all the VREF pins in the bank must be connected to the same voltage. See the I/O banking rules in the [Functional Description](#) module for more detail. If no pin in a given bank requires VREF, then that bank's VREF pins can be used as general I/O.

To simplify the following tables, the "Pad Name" column shows the part of the name that is common across densities. When VREF is only available in limited densities, the "Pad Name" column leaves out the VREF designation and the "VREF Option" column indicates the densities that provide VREF on the given pin.

## VCCO Banks

In the TQ144 and PQ208 packages, the eight banks have VCCO connected together. Thus, only one VCCO is allowed in these packages, although different VREF values are allowed in each of the eight banks. See [I/O Banking](#).



### TQ144 Pinouts (XC2S50E and XC2S100E) (Continued)

| Pad Name                                  |      | Pin | LVDS Async. Output Option | V <sub>REF</sub> Option |
|-------------------------------------------|------|-----|---------------------------|-------------------------|
| Function                                  | Bank |     |                           |                         |
| I/O (DLL), L17P                           | 4    | P56 | -                         | -                       |
| I/O                                       | 4    | P57 | -                         | -                       |
| I/O, VREF Bank 4                          | 4    | P58 | -                         | All                     |
| I/O, L16N_YY                              | 4    | P59 | All                       | -                       |
| I/O, L16P_YY                              | 4    | P60 | All                       | -                       |
| VCCINT                                    | -    | P61 | -                         | -                       |
| GND                                       | -    | P62 | -                         | -                       |
| I/O, L15N_YY                              | 4    | P63 | All                       | -                       |
| I/O, L15P_YY                              | 4    | P64 | All                       | XC2S100E                |
| I/O                                       | 4    | P65 | -                         | -                       |
| I/O, VREF Bank 4                          | 4    | P66 | -                         | All                     |
| I/O                                       | 4    | P67 | -                         | -                       |
| I/O, L14N_YY                              | 4    | P68 | All                       | -                       |
| I/O, L14P_YY                              | 4    | P69 | All                       | -                       |
| GND                                       | -    | P70 | -                         | -                       |
|                                           |      |     |                           |                         |
| DONE                                      | 3    | P71 | -                         | -                       |
| VCCO                                      | -    | P72 | -                         | -                       |
| PROGRAM                                   | -    | P73 | -                         | -                       |
| I/O ( $\overline{\text{INIT}}$ ), L13N_YY | 3    | P74 | All                       | -                       |
| I/O (D7), L13P_YY                         | 3    | P75 | All                       | -                       |
| I/O                                       | 3    | P76 | -                         | -                       |
| I/O, VREF Bank 3                          | 3    | P77 | -                         | All                     |
| I/O                                       | 3    | P78 | -                         | -                       |
| I/O, L12N                                 | 3    | P79 | XC2S50E                   | XC2S100E                |
| I/O (D6), L12P                            | 3    | P80 | XC2S50E                   | -                       |
| GND                                       | -    | P81 | -                         | -                       |
| I/O (D5), L11N_YY                         | 3    | P82 | All                       | -                       |
| I/O, L11P_YY                              | 3    | P83 | All                       | -                       |
| I/O                                       | 3    | P84 | -                         | -                       |

### TQ144 Pinouts (XC2S50E and XC2S100E) (Continued)

| Pad Name                 |      | Pin  | LVDS Async. Output Option | V <sub>REF</sub> Option |
|--------------------------|------|------|---------------------------|-------------------------|
| Function                 | Bank |      |                           |                         |
| I/O, VREF Bank 3, L10N   | 3    | P85  | XC2S50E                   | All                     |
| I/O (D4), L10P           | 3    | P86  | XC2S50E                   | -                       |
| I/O                      | 3    | P87  | -                         | -                       |
| VCCINT                   | -    | P88  | -                         | -                       |
| I/O (TRDY)               | 3    | P89  | -                         | -                       |
| VCCO                     | -    | P90  | -                         | -                       |
| GND                      | -    | P91  | -                         | -                       |
|                          |      |      |                           |                         |
| I/O (IRDY)               | 2    | P92  | -                         | -                       |
| I/O                      | 2    | P93  | -                         | -                       |
| I/O (D3), L9N            | 2    | P94  | XC2S50E                   | -                       |
| I/O, VREF Bank 2, L9P    | 2    | P95  | XC2S50E                   | All                     |
| I/O                      | 2    | P96  | -                         | -                       |
| I/O, L8N_YY              | 2    | P97  | All                       | -                       |
| I/O (D2), L8P_YY         | 2    | P98  | All                       | -                       |
| GND                      | -    | P99  | -                         | -                       |
| I/O (D1), L7N            | 2    | P100 | XC2S50E                   | -                       |
| I/O, L7P                 | 2    | P101 | XC2S50E                   | XC2S100E                |
| I/O                      | 2    | P102 | -                         | -                       |
| I/O, VREF Bank 2         | 2    | P103 | -                         | All                     |
| I/O                      | 2    | P104 | -                         | -                       |
| I/O (DIN, D0), L6N_YY    | 2    | P105 | All                       | -                       |
| I/O (DOUT, BUSY), L6P_YY | 2    | P106 | All                       | -                       |
| CCLK                     | 2    | P107 | -                         | -                       |
| VCCO                     | -    | P108 | -                         | -                       |
| TDO                      | 2    | P109 | -                         | -                       |
| GND                      | -    | P110 | -                         | -                       |
| TDI                      | -    | P111 | -                         | -                       |

### TQ144 Pinouts (XC2S50E and XC2S100E) (Continued)

| Pad Name                                  |      | Pin  | LVDS Async. Output Option | V <sub>REF</sub> Option |
|-------------------------------------------|------|------|---------------------------|-------------------------|
| Function                                  | Bank |      |                           |                         |
|                                           |      |      |                           |                         |
| I/O ( $\overline{\text{CS}}$ ), L5P_YY    | 1    | P112 | All                       | -                       |
| I/O ( $\overline{\text{WRITE}}$ ), L5N_YY | 1    | P113 | All                       | -                       |
| I/O                                       | 1    | P114 | -                         | -                       |
| I/O, VREF Bank 1                          | 1    | P115 | -                         | All                     |
| I/O                                       | 1    | P116 | -                         | -                       |
| I/O, L4P_YY                               | 1    | P117 | All                       | XC2S100E                |
| I/O, L4N_YY                               | 1    | P118 | All                       | -                       |
| GND                                       | -    | P119 | -                         | -                       |
| VCCINT                                    | -    | P120 | -                         | -                       |
| I/O, L3P_YY                               | 1    | P121 | All                       | -                       |
| I/O, L3N_YY                               | 1    | P122 | All                       | -                       |
| I/O, VREF Bank 1                          | 1    | P123 | -                         | All                     |
| I/O                                       | 1    | P124 | -                         | -                       |
| I/O (DLL), L2P                            | 1    | P125 | -                         | -                       |
| GCK2, I                                   | 1    | P126 | -                         | -                       |
| GND                                       | -    | P127 | -                         | -                       |
| VCCO                                      | -    | P128 | -                         | -                       |
|                                           |      |      |                           |                         |
| GCK3, I                                   | 0    | P129 | -                         | -                       |
| VCCINT                                    | -    | P130 | -                         | -                       |
| I/O (DLL), L2N                            | 0    | P131 | -                         | -                       |
| I/O, VREF Bank 0                          | 0    | P132 | -                         | All                     |
| I/O, L1P_YY                               | 0    | P133 | All                       | -                       |
| I/O, L1N_YY                               | 0    | P134 | All                       | -                       |
| VCCINT                                    | -    | P135 | -                         | -                       |
| GND                                       | -    | P136 | -                         | -                       |
| I/O, L0P_YY                               | 0    | P137 | All                       | -                       |
| I/O, L0N_YY                               | 0    | P138 | All                       | XC2S100E                |

### TQ144 Pinouts (XC2S50E and XC2S100E) (Continued)

| Pad Name         |      | Pin  | LVDS Async. Output Option | V <sub>REF</sub> Option |
|------------------|------|------|---------------------------|-------------------------|
| Function         | Bank |      |                           |                         |
| I/O              | 0    | P139 | -                         | -                       |
| I/O, VREF Bank 0 | 0    | P140 | -                         | All                     |
| I/O              | 0    | P141 | -                         | -                       |
| I/O              | 0    | P142 | -                         | -                       |
| TCK              | -    | P143 | -                         | -                       |
| VCCO             | -    | P144 | -                         | -                       |

## TQ144 Differential Clock Pins

| Clock | Bank | P    |         | N    |                 |
|-------|------|------|---------|------|-----------------|
|       |      | Pin  | Name    | Pin  | Name            |
| GCK0  | 4    | P55  | GCK0, I | P56  | I/O (DLL), L17P |
| GCK1  | 5    | P52  | GCK1, I | P50  | I/O (DLL), L17N |
| GCK2  | 1    | P126 | GCK2, I | P125 | I/O (DLL), L2P  |
| GCK3  | 0    | P129 | GCK3, I | P131 | I/O (DLL), L2N  |

In the PQ208 package, all VCCO pins must be connected to the same voltage.

## PQ208 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E)

| Pad Name               |      | Pin | LVDS Async. Output Option | V <sub>REF</sub> Option    |
|------------------------|------|-----|---------------------------|----------------------------|
| Function               | Bank |     |                           |                            |
| GND                    | -    | P1  | -                         | -                          |
| TMS                    | -    | P2  | -                         | -                          |
| I/O                    | 7    | P3  | -                         | -                          |
| I/O                    | 7    | P4  | -                         | XC2S200E, 300E             |
| I/O                    | 7    | P5  | -                         | -                          |
| I/O, VREF Bank 7, L49P | 7    | P6  | XC2S50E, 150E, 200E, 300E | All                        |
| I/O, L49N              | 7    | P7  | XC2S50E, 150E, 200E, 300E | -                          |
| I/O                    | 7    | P8  | -                         | -                          |
| I/O                    | 7    | P9  | -                         | -                          |
| I/O, L48P              | 7    | P10 | XC2S50E, 300E             | XC2S100E, 150E, 200E, 300E |
| I/O, L48N              | 7    | P11 | XC2S50E, 300E             | -                          |
| GND                    | -    | P12 | -                         | -                          |
| VCCO                   | -    | P13 | -                         | -                          |
| VCCINT                 | -    | P14 | -                         | -                          |
| I/O, L47P_YY           | 7    | P15 | All                       | -                          |
| I/O, L47N_YY           | 7    | P16 | All                       | -                          |
| I/O, L46P_YY           | 7    | P17 | All                       | -                          |
| I/O, L46N_YY           | 7    | P18 | All                       | -                          |
| GND                    | -    | P19 | -                         | -                          |
| I/O, VREF Bank 7, L45P | 7    | P20 | XC2S50E, 300E             | All                        |
| I/O, L45N              | 7    | P21 | XC2S50E, 300E             | -                          |

## PQ208 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E)

| Pad Name               |      | Pin | LVDS Async. Output Option | V <sub>REF</sub> Option    |
|------------------------|------|-----|---------------------------|----------------------------|
| Function               | Bank |     |                           |                            |
| I/O                    | 7    | P22 | -                         | -                          |
| I/O, L44P_YY           | 7    | P23 | All                       | -                          |
| I/O (IRDY), L44N_YY    | 7    | P24 | All                       | -                          |
| GND                    | -    | P25 | -                         | -                          |
| VCCO                   | -    | P26 | -                         | -                          |
|                        |      |     |                           |                            |
| I/O (TRDY)             | 6    | P27 | -                         | -                          |
| VCCINT                 | -    | P28 | -                         | -                          |
| I/O                    | 6    | P29 | -                         | -                          |
| I/O, L43P              | 6    | P30 | XC2S50E, 300E             | -                          |
| I/O, VREF Bank 6, L43N | 6    | P31 | XC2S50E, 300E             | All                        |
| GND                    | -    | P32 | -                         | -                          |
| I/O, L42P_YY           | 6    | P33 | All                       | -                          |
| I/O, L42N_YY           | 6    | P34 | All                       | -                          |
| I/O, L41P_YY           | 6    | P35 | All                       | -                          |
| I/O, L41N_YY           | 6    | P36 | All                       | -                          |
| VCCINT                 | -    | P37 | -                         | -                          |
| VCCO                   | -    | P38 | -                         | -                          |
| GND                    | -    | P39 | -                         | -                          |
| I/O, L40P              | 6    | P40 | XC2S50E, 300E             | -                          |
| I/O, L40N              | 6    | P41 | XC2S50E, 300E             | XC2S100E, 150E, 200E, 300E |
| I/O                    | 6    | P42 | -                         | -                          |
| I/O                    | 6    | P43 | -                         | -                          |
| I/O                    | 6    | P44 | -                         | -                          |

## PQ208 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E)

| Pad Name                  |      | Pin | LVDS Async. Output Option | V <sub>REF</sub> Option    |
|---------------------------|------|-----|---------------------------|----------------------------|
| Function                  | Bank |     |                           |                            |
| I/O, VREF Bank 6, L39P    | 6    | P45 | XC2S100E, 150E            | All                        |
| I/O, L39N                 | 6    | P46 | XC2S100E, 150E            | -                          |
| I/O                       | 6    | P47 | -                         | XC2S200E, 300E             |
| I/O, L38P_YY              | 6    | P48 | All                       | -                          |
| I/O, L38N_YY              | 6    | P49 | All                       | -                          |
| M1                        | -    | P50 | -                         | -                          |
| GND                       | -    | P51 | -                         | -                          |
| M0                        | -    | P52 | -                         | -                          |
| VCCO                      | -    | P53 | -                         | -                          |
| M2                        | -    | P54 | -                         | -                          |
|                           |      |     |                           |                            |
| I/O, L37N_YY              | 5    | P55 | All                       | -                          |
| I/O, L37P_YY              | 5    | P56 | All                       | -                          |
| I/O                       | 5    | P57 | -                         | XC2S200E, 300E             |
| I/O                       | 5    | P58 | -                         | -                          |
| I/O, VREF Bank 5, L36N_YY | 5    | P59 | All                       | All                        |
| I/O, L36P_YY              | 5    | P60 | All                       | -                          |
| I/O, L35N                 | 5    | P61 | XC2S50E, 100E, 300E       | -                          |
| I/O, L35P                 | 5    | P62 | XC2S50E, 100E, 300E       | -                          |
| I/O, L34N                 | 5    | P63 | XC2S50E, 100E, 200E, 300E | XC2S100E, 150E, 200E, 300E |
| I/O, L34P                 | 5    | P64 | XC2S50E, 100E, 200E, 300E | -                          |
| GND                       | -    | P65 | -                         | -                          |

## PQ208 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E)

| Pad Name               |      | Pin | LVDS Async. Output Option | V <sub>REF</sub> Option |
|------------------------|------|-----|---------------------------|-------------------------|
| Function               | Bank |     |                           |                         |
| VCCO                   | -    | P66 | -                         | -                       |
| VCCINT                 | -    | P67 | -                         | -                       |
| I/O, L33N              | 5    | P68 | XC2S50E, 100E, 200E, 300E | -                       |
| I/O, L33P              | 5    | P69 | XC2S50E, 100E, 200E, 300E | -                       |
| I/O                    | 5    | P70 | -                         | -                       |
| I/O, L32N              | 5    | P71 | XC2S100E, 150E            | -                       |
| GND                    | -    | P72 | -                         | -                       |
| I/O, VREF Bank 5, L32P | 5    | P73 | XC2S100E, 150E            | All                     |
| I/O                    | 5    | P74 | -                         | -                       |
| I/O (DLL), L31N        | 5    | P75 | -                         | -                       |
| VCCINT                 | -    | P76 | -                         | -                       |
| GCK1, I                | 5    | P77 | -                         | -                       |
| VCCO                   | -    | P78 | -                         | -                       |
| GND                    | -    | P79 | -                         | -                       |
|                        |      |     |                           |                         |
| GCK0, I                | 4    | P80 | -                         | -                       |
| I/O (DLL), L31P        | 4    | P81 | -                         | -                       |
| I/O                    | 4    | P82 | -                         | -                       |
| I/O, L30N              | 4    | P83 | XC2S50E, 200E, 300E       | -                       |
| I/O, VREF Bank 4, L30P | 4    | P84 | XC2S50E, 200E, 300E       | All                     |
| GND                    | -    | P85 | -                         | -                       |
| I/O, L29N              | 4    | P86 | XC2S50E, 200E, 300E       | -                       |
| I/O, L29P              | 4    | P87 | XC2S50E, 200E, 300E       | -                       |
| I/O, L28N              | 4    | P88 | XC2S50E, 100E, 200E, 300E | -                       |

## PQ208 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E)

| Pad Name                  |      | Pin  | LVDS Async. Output Option | V <sub>REF</sub> Option    |
|---------------------------|------|------|---------------------------|----------------------------|
| Function                  | Bank |      |                           |                            |
| I/O, L28P                 | 4    | P89  | XC2S50E, 100E, 200E, 300E | -                          |
| VCCINT                    | -    | P90  | -                         | -                          |
| VCCO                      | -    | P91  | -                         | -                          |
| GND                       | -    | P92  | -                         | -                          |
| I/O, L27N                 | 4    | P93  | XC2S50E, 100E, 200E, 300E | -                          |
| I/O, L27P                 | 4    | P94  | XC2S50E, 100E, 200E, 300E | XC2S100E, 150E, 200E, 300E |
| I/O                       | 4    | P95  | -                         | -                          |
| I/O                       | 4    | P96  | -                         | -                          |
| I/O, L26N_YY              | 4    | P97  | All                       | -                          |
| I/O, VREF Bank 4, L26P_YY | 4    | P98  | All                       | All                        |
| I/O                       | 4    | P99  | -                         | -                          |
| I/O                       | 4    | P100 | -                         | XC2S200E, 300E             |
| I/O, L25N_YY              | 4    | P101 | All                       | -                          |
| I/O, L25P_YY              | 4    | P102 | All                       | -                          |
| GND                       | -    | P103 | -                         | -                          |
|                           |      |      |                           |                            |
| DONE                      | 3    | P104 | -                         | -                          |
| VCCO                      | -    | P105 | -                         | -                          |
| PROGRAM                   | -    | P106 | -                         | -                          |
| I/O (INIT), L24N_YY       | 3    | P107 | All                       | -                          |
| I/O (D7), L24P_YY         | 3    | P108 | All                       | -                          |
| I/O                       | 3    | P109 | -                         | XC2S200E, 300E             |
| I/O                       | 3    | P110 | -                         | -                          |

## PQ208 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E)

| Pad Name               |      | Pin  | LVDS Async. Output Option | V <sub>REF</sub> Option    |
|------------------------|------|------|---------------------------|----------------------------|
| Function               | Bank |      |                           |                            |
| I/O, VREF Bank 3, L23N | 3    | P111 | XC2S50E, 150E, 200E, 300E | All                        |
| I/O, L23P              | 3    | P112 | XC2S50E, 150E, 200E, 300E | -                          |
| I/O                    | 3    | P113 | -                         | -                          |
| I/O                    | 3    | P114 | -                         | -                          |
| I/O, L22N              | 3    | P115 | XC2S50E, 300E             | XC2S100E, 150E, 200E, 300E |
| I/O (D6), L22P         | 3    | P116 | XC2S50E, 300E             | -                          |
| GND                    | -    | P117 | -                         | -                          |
| VCCO                   | -    | P118 | -                         | -                          |
| VCCINT                 | -    | P119 | -                         | -                          |
| I/O (D5), L21N_YY      | 3    | P120 | All                       | -                          |
| I/O, L21P_YY           | 3    | P121 | All                       | -                          |
| I/O, L20N_YY           | 3    | P122 | All                       | -                          |
| I/O, L20P_YY           | 3    | P123 | All                       | -                          |
| GND                    | -    | P124 | -                         | -                          |
| I/O, VREF Bank 3, L19N | 3    | P125 | XC2S50E, 300E             | All                        |
| I/O (D4), L19P         | 3    | P126 | XC2S50E, 300E             | -                          |
| I/O                    | 3    | P127 | -                         | -                          |
| VCCINT                 | -    | P128 | -                         | -                          |
| I/O (TRDY)             | 3    | P129 | -                         | -                          |
| VCCO                   | -    | P130 | -                         | -                          |
| GND                    | -    | P131 | -                         | -                          |
|                        |      |      |                           |                            |
| I/O (IRDY), L18N_YY    | 2    | P132 | All                       | -                          |
| I/O, L18P_YY           | 2    | P133 | All                       | -                          |



## PQ208 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E)

| Pad Name              |      | Pin  | LVDS Async. Output Option | V <sub>REF</sub> Option    |
|-----------------------|------|------|---------------------------|----------------------------|
| Function              | Bank |      |                           |                            |
| I/O, VREF Bank 1, L6P | 1    | P178 | XC2S50E, 200E, 300E       | All                        |
| I/O, L6N              | 1    | P179 | XC2S50E, 200E, 300E       | -                          |
| I/O                   | 1    | P180 | -                         | -                          |
| I/O (DLL), L5P        | 1    | P181 | -                         | -                          |
| GCK2, I               | 1    | P182 | -                         | -                          |
| GND                   | -    | P183 | -                         | -                          |
| VCCO                  | -    | P184 | -                         | -                          |
|                       |      |      |                           |                            |
| GCK3, I               | 0    | P185 | -                         | -                          |
| VCCINT                | -    | P186 | -                         | -                          |
| I/O (DLL), L5N        | 0    | P187 | -                         | -                          |
| I/O, L4P              | 0    | P188 | XC2S50E, 200E, 300E       | -                          |
| I/O, VREF Bank 0, L4N | 0    | P189 | XC2S50E, 200E, 300E       | All                        |
| GND                   | -    | P190 | -                         | -                          |
| I/O, L3P              | 0    | P191 | XC2S50E, 200E, 300E       | -                          |
| I/O, L3N              | 0    | P192 | XC2S50E, 200E, 300E       | -                          |
| I/O, L2P              | 0    | P193 | XC2S50E, 100E, 200E, 300E | -                          |
| I/O, L2N              | 0    | P194 | XC2S50E, 100E, 200E, 300E | -                          |
| VCCINT                | -    | P195 | -                         | -                          |
| VCCO                  | -    | P196 | -                         | -                          |
| GND                   | -    | P197 | -                         | -                          |
| I/O, L1P              | 0    | P198 | XC2S50E, 100E, 200E, 300E | -                          |
| I/O, L1N              | 0    | P199 | XC2S50E, 100E, 200E, 300E | XC2S100E, 150E, 200E, 300E |
| I/O                   | 0    | P200 | -                         | -                          |

## PQ208 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E)

| Pad Name                       |      | Pin  | LVDS<br>Async.<br>Output<br>Option | V <sub>REF</sub><br>Option |
|--------------------------------|------|------|------------------------------------|----------------------------|
| Function                       | Bank |      |                                    |                            |
| I/O                            | 0    | P201 | -                                  | -                          |
| I/O,<br>L0P_YY                 | 0    | P202 | All                                | -                          |
| I/O, VREF<br>Bank 0,<br>L0N_YY | 0    | P203 | All                                | All                        |
| I/O                            | 0    | P204 | -                                  | -                          |
| I/O                            | 0    | P205 | -                                  | XC2S200E,<br>300E          |
| I/O                            | 0    | P206 | -                                  | -                          |
| TCK                            | -    | P207 | -                                  | -                          |
| VCCO                           | -    | P208 | -                                  | -                          |

## PQ208 Differential Clock Pins

| Clock | Bank | P    |         | N    |                 |
|-------|------|------|---------|------|-----------------|
|       |      | Pin  | Name    | Pin  | Name            |
| GCK0  | 4    | P80  | GCK0, I | P81  | I/O (DLL), L31P |
| GCK1  | 5    | P77  | GCK1, I | P75  | I/O (DLL), L31N |
| GCK2  | 1    | P182 | GCK2, I | P181 | I/O (DLL), L5P  |
| GCK3  | 0    | P185 | GCK3, I | P187 | I/O (DLL), L5N  |

**FT256 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E)**

| Pad Name               |      | Pin | LVDS Async. Output Option       | V <sub>REF</sub> Option          |
|------------------------|------|-----|---------------------------------|----------------------------------|
| Function               | Bank |     |                                 |                                  |
| TMS                    | -    | B1  | -                               | -                                |
| I/O                    | 7    | D3  | -                               | -                                |
| I/O, L83P              | 7    | C2  | XC2S100E, 150E                  | -                                |
| I/O, L83N              | 7    | C1  | XC2S100E, 150E                  | XC2S200E, 300E, 400E             |
| I/O, L82P_YY           | 7    | D2  | All                             | -                                |
| I/O, L82N_YY           | 7    | D1  | All                             | -                                |
| I/O, VREF Bank 7, L81P | 7    | E3  | XC2S50E, 150E, 200E, 300E, 400E | All                              |
| I/O, L81N              | 7    | E4  | XC2S50E, 150E, 200E, 300E, 400E | -                                |
| I/O, L80P              | 7    | E2  | XC2S200E, 400E                  | -                                |
| I/O, L80N              | 7    | E1  | XC2S200E, 400E                  | -                                |
| I/O, L79P              | 7    | F4  | XC2S50E, 300E, 400E             | XC2S100E, 150E, 200E, 300E, 400E |
| I/O, L79N              | 7    | F3  | XC2S50E, 300E, 400E             | -                                |
| I/O, L78P_YY           | 7    | F2  | All                             | -                                |
| I/O, L78N_YY           | 7    | F1  | All                             | -                                |
| I/O, L77P              | 7    | F5  | XC2S100E, 150E                  | -                                |
| I/O, L77N              | 7    | G5  | XC2S100E, 150E                  | -                                |
| I/O, L76P_YY           | 7    | G3  | All                             | -                                |
| I/O, L76N_YY           | 7    | G4  | All                             | -                                |
| I/O, VREF Bank 7, L75P | 7    | G2  | XC2S50E, 300E, 400E             | All                              |
| I/O, L75N              | 7    | G1  | XC2S50E, 300E, 400E             | -                                |

**FT256 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E) (Continued)**

| Pad Name               |      | Pin | LVDS Async. Output Option  | V <sub>REF</sub> Option          |
|------------------------|------|-----|----------------------------|----------------------------------|
| Function               | Bank |     |                            |                                  |
| I/O, L74P              | 7    | H4  | XC2S100E, 150E, 200E       | -                                |
| I/O, L74N              | 7    | H3  | XC2S100E, 150E, 200E       | XC2S400E                         |
| I/O, L73P_YY           | 7    | H2  | All                        | -                                |
| I/O (IRDY), L73N_YY    | 7    | H1  | All                        | -                                |
|                        |      |     |                            |                                  |
| I/O (TRDY)             | 6    | J4  | -                          | -                                |
| I/O, L72P              | 6    | J2  | XC2S100E, 150E, 200E, 400E | XC2S400E                         |
| I/O, L72N              | 6    | J3  | XC2S100E, 150E, 200E, 400E | -                                |
| I/O, L71P              | 6    | J1  | XC2S50E, 300E, 400E        | -                                |
| I/O, VREF Bank 6, L71N | 6    | K1  | XC2S50E, 300E, 400E        | All                              |
| I/O, L70P_YY           | 6    | K2  | All                        | -                                |
| I/O, L70N_YY           | 6    | K3  | All                        | -                                |
| I/O, L69P              | 6    | L1  | XC2S100E, 150E, 400E       | -                                |
| I/O, L69N              | 6    | L2  | XC2S100E, 150E, 400E       | -                                |
| I/O, L68P_YY           | 6    | K4  | All                        | -                                |
| I/O, L68N_YY           | 6    | K5  | All                        | -                                |
| I/O, L67P              | 6    | L3  | XC2S50E, 300E, 400E        | -                                |
| I/O, L67N              | 6    | M2  | XC2S50E, 300E, 400E        | XC2S100E, 150E, 200E, 300E, 400E |
| I/O, L66P              | 6    | M1  | XC2S150E, 200E, 400E       | -                                |
| I/O, L66N              | 6    | N1  | XC2S150E, 200E, 400E       | -                                |

**FT256 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E)  
(Continued)**

| Pad Name                  |      | Pin | LVDS Async. Output Option       | V <sub>REF</sub> Option |
|---------------------------|------|-----|---------------------------------|-------------------------|
| Function                  | Bank |     |                                 |                         |
| I/O, L65P                 | 6    | L4  | XC2S50E, 150E, 200E, 300E, 400E | -                       |
| I/O, VREF Bank 6, L65N    | 6    | L5  | XC2S50E, 150E, 200E, 300E, 400E | All                     |
| I/O, L64P_YY              | 6    | M3  | All                             | -                       |
| I/O, L64N_YY              | 6    | M4  | All                             | -                       |
| I/O, L63P                 | 6    | N2  | XC2S100E, 200E, 300E            | -                       |
| I/O, L63N                 | 6    | N3  | XC2S100E, 200E, 300E            | XC2S200E, 300E, 400E    |
| I/O, L62P_YY              | 6    | P1  | All                             | -                       |
| I/O, L62N_YY              | 6    | P2  | All                             | -                       |
| M1                        | -    | R1  | -                               | -                       |
| M0                        | -    | T2  | -                               | -                       |
| M2                        | -    | R3  | -                               | -                       |
|                           |      |     |                                 |                         |
| I/O, L61N_YY              | 5    | P4  | All                             | -                       |
| I/O, L61P_YY              | 5    | R4  | All                             | -                       |
| I/O, L60N                 | 5    | T3  | XC2S50E, 100E, 200E, 300E, 400E | XC2S200E, 300E, 400E    |
| I/O, L60P                 | 5    | T4  | XC2S50E, 100E, 200E, 300E, 400E | -                       |
| I/O, L59N_YY              | 5    | N5  | All                             | -                       |
| I/O, L59P_YY              | 5    | P5  | All                             | -                       |
| I/O, VREF Bank 5, L58N_YY | 5    | R5  | All                             | All                     |
| I/O, L58P_YY              | 5    | T5  | All                             | -                       |
| I/O, L57N                 | 5    | N6  | XC2S50E, 100E, 150E, 300E       | -                       |

**FT256 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E)  
(Continued)**

| Pad Name               |      | Pin | LVDS Async. Output Option       | V <sub>REF</sub> Option          |
|------------------------|------|-----|---------------------------------|----------------------------------|
| Function               | Bank |     |                                 |                                  |
| I/O, L57P              | 5    | P6  | XC2S50E, 100E, 150E, 300E       | -                                |
| I/O, L56N              | 5    | R6  | XC2S50E, 100E, 200E, 300E, 400E | XC2S100E, 150E, 200E, 300E, 400E |
| I/O, L56P              | 5    | T6  | XC2S50E, 100E, 200E, 300E, 400E | -                                |
| I/O, L55N              | 5    | M6  | XC2S50E, 100E, 200E, 300E, 400E | -                                |
| I/O, L55P              | 5    | N7  | XC2S50E, 100E, 200E, 300E, 400E | -                                |
| I/O                    | 5    | P7  | -                               | -                                |
| I/O, L54N              | 5    | R7  | XC2S50E, 200E, 300E, 400E       | -                                |
| I/O, L54P              | 5    | T7  | XC2S50E, 200E, 300E, 400E       | -                                |
| I/O, VREF Bank 5, L53N | 5    | M7  | XC2S50E, 200E, 300E, 400E       | All                              |
| I/O, L53P              | 5    | N8  | XC2S50E, 200E, 300E, 400E       | -                                |
| I/O                    | 5    | P8  | -                               | XC2S400E                         |
| I/O (DLL), L52N        | 5    | R8  | -                               | -                                |
| GCK1, I                | 5    | T8  | -                               | -                                |
|                        |      |     |                                 |                                  |
| GCK0, I                | 4    | T9  | -                               | -                                |
| I/O (DLL), L52P        | 4    | R9  | -                               | -                                |
| I/O, L51N              | 4    | P9  | XC2S50E, 150E, 200E, 400E       | XC2S400E                         |



**FT256 Pinouts (XC2S50E, XC2S100E,  
XC2S150E, XC2S200E, XC2S300E, XC2S400E)  
(Continued)**

| Pad Name               |      | Pin | LVDS Async. Output Option                      | V <sub>REF</sub> Option |
|------------------------|------|-----|------------------------------------------------|-------------------------|
| Function               | Bank |     |                                                |                         |
| I/O (D5), L35N_YY      | 3    | L13 | All                                            | -                       |
| I/O, L35P_YY           | 3    | K14 | All                                            | -                       |
| I/O, L34N              | 3    | K15 | XC2S100E, 150E, 400E                           | -                       |
| I/O, L34P              | 3    | K16 | XC2S100E, 150E, 400E                           | -                       |
| I/O, L33N              | 3    | L12 | XC2S50E, 100E, 150E, 200E, 300E <sup>(1)</sup> | -                       |
| I/O, L33P              | 3    | K12 | XC2S50E, 100E, 150E, 200E, 300E <sup>(1)</sup> | -                       |
| I/O, VREF Bank 3, L32N | 3    | K13 | XC2S50E, 300E, 400E                            | All                     |
| I/O (D4), L32P         | 3    | J14 | XC2S50E, 300E, 400E                            | -                       |
| I/O, L31N              | 3    | J15 | XC2S100E, 150E, 200E, 400E                     | -                       |
| I/O, L31P              | 3    | J16 | XC2S100E, 150E, 200E, 400E                     | XC2S400E                |
| I/O (TRDY)             | 3    | J13 | -                                              | -                       |
|                        |      |     |                                                |                         |
| I/O (IRDY), L30N_YY    | 2    | H16 | All                                            | -                       |
| I/O, L30P_YY           | 2    | G16 | All                                            | -                       |
| I/O, L29N              | 2    | H14 | XC2S100E, 150E, 200E, 400E                     | XC2S400E                |
| I/O, L29P              | 2    | H15 | XC2S100E, 150E, 200E, 400E                     | -                       |
| I/O (D3), L28N         | 2    | G15 | XC2S50E, 300E, 400E                            | -                       |

**FT256 Pinouts (XC2S50E, XC2S100E,  
XC2S150E, XC2S200E, XC2S300E, XC2S400E)  
(Continued)**

| Pad Name               |      | Pin | LVDS Async. Output Option                      | V <sub>REF</sub> Option          |
|------------------------|------|-----|------------------------------------------------|----------------------------------|
| Function               | Bank |     |                                                |                                  |
| I/O, VREF Bank 2, L28P | 2    | F16 | XC2S50E, 300E, 400E                            | All                              |
| I/O, L27N              | 2    | H13 | XC2S50E, 100E, 150E, 200E, 300E <sup>(1)</sup> | -                                |
| I/O, L27P              | 2    | G14 | XC2S50E, 100E, 150E, 200E, 300E <sup>(2)</sup> | -                                |
| I/O, L26N              | 2    | F15 | XC2S100E, 150E, 400E                           | -                                |
| I/O, L26P              | 2    | E16 | XC2S100E, 150E, 400E                           | -                                |
| I/O, L25N_YY           | 2    | G13 | All                                            | -                                |
| I/O (D2), L25P_YY      | 2    | F14 | All                                            | -                                |
| I/O (D1), L24N         | 2    | E15 | XC2S50E, 300E, 400E                            | -                                |
| I/O, L24P              | 2    | D16 | XC2S50E, 300E, 400E                            | XC2S100E, 150E, 200E, 300E, 400E |
| I/O, L23N              | 2    | F13 | XC2S150E, 200E, 400E                           | -                                |
| I/O, L23P              | 2    | E14 | XC2S150E, 200E, 400E                           | -                                |
| I/O, L22N              | 2    | D15 | XC2S50E, 150E, 200E, 300E, 400E                | -                                |
| I/O, VREF Bank 2, L22P | 2    | C16 | XC2S50E, 150E, 200E, 300E, 400E                | All                              |
| I/O, L21N              | 2    | G12 | XC2S50E, 100E, 200E, 300E                      | -                                |
| I/O, L21P              | 2    | F12 | XC2S50E, 100E, 200E, 300E                      | -                                |
| I/O, L20N              | 2    | E13 | XC2S100E, 200E, 300E                           | -                                |

**FT256 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E)  
(Continued)**

| Pad Name                                   |      | Pin | LVDS Async. Output Option       | V <sub>REF</sub> Option          |
|--------------------------------------------|------|-----|---------------------------------|----------------------------------|
| Function                                   | Bank |     |                                 |                                  |
| I/O, L20P                                  | 2    | D14 | XC2S100E, 200E, 300E            | XC2S200E, 300E, 400E             |
| I/O (DIN, D0), L19N_YY                     | 2    | B16 | All                             | -                                |
| I/O (DOUT, BUSY), L19P_YY                  | 2    | C15 | All                             | -                                |
| CCLK                                       | 2    | A15 | -                               | -                                |
| TDO                                        | 2    | B14 | -                               | -                                |
| TDI                                        | -    | C13 | -                               | -                                |
|                                            |      |     |                                 |                                  |
| I/O ( $\overline{\text{CS}}$ ), L18P_YY    | 1    | A14 | All                             | -                                |
| I/O ( $\overline{\text{WRITE}}$ ), L18N_YY | 1    | A13 | All                             | -                                |
| I/O, L17P                                  | 1    | B13 | XC2S50E, 100E, 200E, 300E, 400E | XC2S200E, 300E, 400E             |
| I/O, L17N                                  | 1    | C12 | XC2S50E, 100E, 200E, 300E, 400E | -                                |
| I/O, L16P_YY                               | 1    | B12 | All                             | -                                |
| I/O, L16N_YY                               | 1    | A12 | All                             | -                                |
| I/O, VREF Bank 1, L15P_YY                  | 1    | D12 | All                             | All                              |
| I/O, L15N_YY                               | 1    | E11 | All                             | -                                |
| I/O, L14P                                  | 1    | D11 | XC2S50E, 100E, 150E, 300E       | -                                |
| I/O, L14N                                  | 1    | C11 | XC2S50E, 100E, 150E, 300E       | -                                |
| I/O, L13P                                  | 1    | B11 | XC2S50E, 100E, 200E, 300E, 400E | XC2S100E, 150E, 200E, 300E, 400E |
| I/O, L13N                                  | 1    | A11 | XC2S50E, 100E, 200E, 300E, 400E | -                                |

**FT256 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E)  
(Continued)**

| Pad Name               |      | Pin | LVDS Async. Output Option       | V <sub>REF</sub> Option |
|------------------------|------|-----|---------------------------------|-------------------------|
| Function               | Bank |     |                                 |                         |
| I/O, L12P              | 1    | E10 | XC2S50E, 100E, 200E, 300E, 400E | -                       |
| I/O, L12N              | 1    | D10 | XC2S50E, 100E, 200E, 300E, 400E | -                       |
| I/O                    | 1    | C10 | -                               | -                       |
| I/O, L11P              | 1    | B10 | XC2S50E, 200E, 300E, 400E       | -                       |
| I/O, L11N              | 1    | A10 | XC2S50E, 200E, 300E, 400E       | -                       |
| I/O, VREF Bank 1, L10P | 1    | D9  | XC2S50E, 200E, 300E, 400E       | All                     |
| I/O, L10N              | 1    | C9  | XC2S50E, 200E, 300E, 400E       | -                       |
| I/O, L9P               | 1    | B9  | XC2S50E, 150E, 200E, 400E       | -                       |
| I/O, L9N               | 1    | A9  | XC2S50E, 150E, 200E, 400E       | XC2S400E                |
| I/O (DLL), L8P         | 1    | A8  | -                               | -                       |
| GCK2, I                | 1    | B8  | -                               | -                       |
|                        |      |     |                                 |                         |
| GCK3, I                | 0    | C8  | -                               | -                       |
| I/O (DLL), L8N         | 0    | D8  | -                               | -                       |
| I/O                    | 0    | A7  | -                               | XC2S400E                |
| I/O, L7P               | 0    | E7  | XC2S50E, 200E, 300E, 400E       | -                       |
| I/O, VREF Bank 0, L7N  | 0    | D7  | XC2S50E, 200E, 300E, 400E       | All                     |

**FT256 Pinouts (XC2S50E, XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E)  
(Continued)**

| Pad Name                 |      | Pin | LVDS Async. Output Option       | V <sub>REF</sub> Option          |
|--------------------------|------|-----|---------------------------------|----------------------------------|
| Function                 | Bank |     |                                 |                                  |
| I/O, L6P                 | 0    | C7  | XC2S50E, 200E, 300E, 400E       | -                                |
| I/O, L6N                 | 0    | B7  | XC2S50E, 200E, 300E, 400E       | -                                |
| I/O                      | 0    | A6  | -                               | -                                |
| I/O, L5P                 | 0    | B6  | XC2S50E, 100E, 200E, 300E, 400E | -                                |
| I/O, L5N                 | 0    | C6  | XC2S50E, 100E, 200E, 300E, 400E | -                                |
| I/O, L4P                 | 0    | A5  | XC2S50E, 100E, 200E, 300E, 400E | -                                |
| I/O, L4N                 | 0    | B5  | XC2S50E, 100E, 200E, 300E, 400E | XC2S100E, 150E, 200E, 300E, 400E |
| I/O, L3P                 | 0    | D6  | XC2S50E, 100E, 300E             | -                                |
| I/O, L3N                 | 0    | E6  | XC2S50E, 100E, 300E             | -                                |
| I/O, L2P_YY              | 0    | D5  | All                             | -                                |
| I/O, VREF Bank 0, L2N_YY | 0    | C5  | All                             | All                              |
| I/O, L1P_YY              | 0    | B4  | All                             | -                                |
| I/O, L1N_YY              | 0    | C4  | All                             | -                                |
| I/O, L0P_YY              | 0    | A4  | All                             | -                                |
| I/O, L0N_YY              | 0    | A3  | All                             | XC2S200E, 300E, 400E             |
| I/O                      | 0    | B3  | -                               | -                                |
| TCK                      | -    | A2  | -                               | -                                |

**Notes:**

- Although designated with the \_YY suffix in the XC2S50E, XC2S100E, XC2S150E, XC2S200E, and XC2S300E, these differential pairs are not asynchronous in the XC2S400E.
- There is no pair L37.

**FT256 Differential Clock Pins**

| Clock | Bank | P   |         | N   |                 |
|-------|------|-----|---------|-----|-----------------|
|       |      | Pin | Name    | Pin | Name            |
| GCK0  | 4    | T9  | GCK0, I | R9  | I/O (DLL), L52P |
| GCK1  | 5    | T8  | GCK1, I | R8  | I/O (DLL), L52N |
| GCK2  | 1    | B8  | GCK2, I | A8  | I/O (DLL), L8P  |
| GCK3  | 0    | C8  | GCK3, I | D8  | I/O (DLL), L8N  |

**Additional FT256 Package Pins**

| VCCINT Pins      |     |     |     |     |
|------------------|-----|-----|-----|-----|
| C3               | C14 | D4  | D13 | E5  |
| E12              | M5  | M12 | N4  | N13 |
| P3               | P14 | -   | -   | -   |
| VCCO Bank 0 Pins |     |     |     |     |
| E8               | F7  | F8  | -   | -   |
| VCCO Bank 1 Pins |     |     |     |     |
| E9               | F9  | F10 | -   | -   |
| VCCO Bank 2 Pins |     |     |     |     |
| G11              | H11 | H12 | -   | -   |
| VCCO Bank 3 Pins |     |     |     |     |
| J11              | J12 | K11 | -   | -   |
| VCCO Bank 4 Pins |     |     |     |     |
| L9               | L10 | M9  | -   | -   |

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### FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)

| Pad Name                |      | Pin | LVDS Async. Output Option        | V <sub>REF</sub> Option    | Device-Specific Pinouts: XC2S |                           |                           |                           |                           |                           |
|-------------------------|------|-----|----------------------------------|----------------------------|-------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Function                | Bank |     |                                  |                            | 100E                          | 150E                      | 200E                      | 300E                      | 400E                      | 600E                      |
| TMS                     | -    | E4  | -                                | -                          | TMS                           | TMS                       | TMS                       | TMS                       | TMS                       | TMS                       |
| I/O                     | 7    | D3  | XC2S150E                         | -                          | I/O                           | I/O, L113P_Y              | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O                     | 7    | C2  | -                                | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O                     | 7    | C1  | XC2S150E                         | -                          | -                             | I/O, L113N_Y              | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#P_Y              | 7    | D2  | XC2S150E, 200E, 300E, 400E       | -                          | -                             | I/O, L112P_Y              | I/O, L119P_Y              | I/O, L119P_Y              | I/O, L119P_Y              | I/O, L119P                |
| I/O, L#N_Y              | 7    | D1  | XC2S150E, 200E, 300E, 400E       | -                          | I/O                           | I/O, L112N_Y              | I/O, L119N_Y              | I/O, L119N_Y              | I/O, L119N_Y              | I/O, L119N                |
| I/O, L#P_Y              | 7    | E2  | XC2S100E, 200E, 300E, 600E       | XC2S200E, 300E, 400E, 600E | I/O, L85P_Y                   | I/O, L111P                | I/O, VREF Bank 7, L118P_Y | I/O, VREF Bank 7, L118P_Y | I/O, VREF Bank 7, L118P   | I/O, VREF Bank 7, L118P_Y |
| I/O, L#N_Y              | 7    | E3  | XC2S100E, 200E, 300E, 600E       | -                          | I/O, L85N_Y                   | I/O, L111N                | I/O, L118N_Y              | I/O, L118N_Y              | I/O, L118N                | I/O, L118N_Y              |
| I/O                     | 7    | E1  | -                                | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O                     | 7    | F5  | -                                | -                          | -                             | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#P_Y              | 7    | F4  | XC2S100E, 200E, 300E, 600E       | -                          | I/O, L84P_Y                   | I/O, L110P                | I/O, L117P_Y              | I/O, L117P_Y              | I/O, L117P                | I/O, L117P_Y              |
| I/O, L#N_Y              | 7    | F3  | XC2S100E, 200E, 300E, 600E       | -                          | I/O, L84N_Y                   | I/O, L110N                | I/O, L117N_Y              | I/O, L117N_Y              | I/O, L117N                | I/O, L117N_Y              |
| I/O, VREF Bank 7, L#P_Y | 7    | F2  | XC2S150E, 200E, 300E, 400E, 600E | All                        | I/O, VREF Bank 7, L83P        | I/O, VREF Bank 7, L109P_Y | I/O, VREF Bank 7, L116P_Y | I/O, VREF Bank 7, L116P_Y | I/O, VREF Bank 7, L116P_Y | I/O, VREF Bank 7, L116P_Y |
| I/O, L#N_Y              | 7    | F1  | XC2S150E, 200E, 300E, 400E, 600E | -                          | I/O, L83N                     | I/O, L109N_Y              | I/O, L116N_Y              | I/O, L116N_Y              | I/O, L116N_Y              | I/O, L116N_Y              |
| I/O                     | 7    | G5  | -                                | -                          | -                             | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#P_Y              | 7    | G4  | XC2S150E, 200E, 300E, 400E       | -                          | -                             | I/O, L108P_Y              | I/O, L115P_Y              | I/O, L115P_Y              | I/O, L115P_Y              | I/O, L115P                |
| I/O, L#N_Y              | 7    | G3  | XC2S150E, 200E, 300E, 400E       | -                          | I/O                           | I/O, L108N_Y              | I/O, L115N_Y              | I/O, L115N_Y              | I/O, L115N_Y              | I/O, L115N                |
| I/O, L#P_Y              | 7    | G2  | XC2S100E, 150E, 300E, 600E       | XC2S600E                   | I/O, L82P_Y                   | I/O, L107P_Y              | I/O, L114P                | I/O, L114P_Y              | I/O, L114P                | I/O, VREF Bank 7, L114P_Y |
| I/O, L#N_Y              | 7    | G1  | XC2S100E, 150E, 300E, 600E       | -                          | I/O, L82N_Y                   | I/O, L107N_Y              | I/O, L114N                | I/O, L114N_Y              | I/O, L114N                | I/O, L114N_Y              |

## FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)

| Pad Name                |      | Pin | LVDS Async. Output Option                       | V <sub>REF</sub> Option | Device-Specific Pinouts: XC2S |                         |                         |                           |                           |                           |
|-------------------------|------|-----|-------------------------------------------------|-------------------------|-------------------------------|-------------------------|-------------------------|---------------------------|---------------------------|---------------------------|
| Function                | Bank |     |                                                 |                         | 100E                          | 150E                    | 200E                    | 300E                      | 400E                      | 600E                      |
| I/O                     | 7    | H5  | -                                               | -                       | -                             | -                       | -                       | I/O                       | I/O                       | I/O                       |
| I/O, VREF Bank 7, L#P_Y | 7    | H3  | XC2S300E, 400E, 600E                            | All                     | I/O, VREF Bank 7, L81P        | I/O, VREF Bank 7, L106P | I/O, VREF Bank 7, L113P | I/O, VREF Bank 7, L113P_Y | I/O, VREF Bank 7, L113P_Y | I/O, VREF Bank 7, L113P_Y |
| I/O, L#N_Y              | 7    | H4  | XC2S300E, 400E, 600E                            | -                       | I/O, L81N                     | I/O, L106N              | I/O, L113N              | I/O, L113N_Y              | I/O, L113N_Y              | I/O, L113N_Y              |
| I/O, L#P_YY             | 7    | H2  | All                                             | -                       | I/O, L80P_YY                  | I/O, L105P_YY           | I/O, L112P_YY           | I/O, L112P_YY             | I/O, L112P_YY             | I/O, L112P_YY             |
| I/O, L#N_YY             | 7    | H1  | All                                             | -                       | I/O, L80N_YY                  | I/O, L105N_YY           | I/O, L112N_YY           | I/O, L112N_YY             | I/O, L112N_YY             | I/O, L112N_YY             |
| I/O                     | 7    | J6  | -                                               | -                       | -                             | -                       | I/O                     | I/O                       | I/O                       | I/O                       |
| I/O, L#P_Y              | 7    | J4  | XC2S150E, 200E, 300E, 400E                      | -                       | -                             | I/O, L104P_Y            | I/O, L111P_Y            | I/O, L111P_Y              | I/O, L111P_Y              | I/O, L111P                |
| I/O, L#N_Y              | 7    | J5  | XC2S100E, 150E, 200E, 300E, 400E                | -                       | I/O, L79P_Y                   | I/O, L104N_Y            | I/O, L111N_Y            | I/O, L111N_Y              | I/O, L111N_Y              | I/O, L111N                |
| I/O, L#P_Y              | 7    | J3  | XC2S100E, 150E, 200E, 300E, 600E                | -                       | I/O, L79N_Y                   | I/O, L103P_Y            | I/O, L110P_Y            | I/O, L110P_Y              | I/O, L110P                | I/O, L110P_Y              |
| I/O, L#N_Y              | 7    | J2  | XC2S150E, 200E, 300E, 600E                      | -                       | -                             | I/O, L103N_Y            | I/O, L110N_Y            | I/O, L110N_Y              | I/O, L110N                | I/O, L110N_Y              |
| I/O                     | 7    | J1  | -                                               | -                       | -                             | -                       | I/O                     | I/O                       | I/O                       | I/O                       |
| I/O, L#P                | 7    | K5  | XC2S100E, 150E, 200E, 300E, 600E <sup>(1)</sup> | -                       | I/O, L78P_YY                  | I/O, L102P_YY           | I/O, L109P_YY           | I/O, L109P_YY             | I/O, L109P                | I/O, L109P_Y              |
| I/O, L#N                | 7    | K6  | XC2S100E, 150E, 200E, 300E, 600E <sup>(1)</sup> | -                       | I/O, L78N_YY                  | I/O, L102N_YY           | I/O, L109N_YY           | I/O, L109N_YY             | I/O, L109N                | I/O, L109N_Y              |
| I/O, VREF Bank 7, L#P_Y | 7    | K3  | XC2S300E, 400E, 600E                            | All                     | I/O, VREF Bank 7, L77P        | I/O, VREF Bank 7, L101P | I/O, VREF Bank 7, L108P | I/O, VREF Bank 7, L108P_Y | I/O, VREF Bank 7, L108P_Y | I/O, VREF Bank 7, L108P_Y |
| I/O, L#N_Y              | 7    | K4  | XC2S300E, 400E, 600E                            | -                       | I/O, L77N                     | I/O, L101N              | I/O, L108N              | I/O, L108N_Y              | I/O, L108N_Y              | I/O, L108N_Y              |
| I/O                     | 7    | K2  | -                                               | -                       | -                             | -                       | -                       | I/O                       | I/O                       | I/O                       |
| I/O, L#P_Y              | 7    | K1  | XC2S300E, 400E                                  | -                       | -                             | -                       | I/O, L107P              | I/O, L107P_Y              | I/O, L107P_Y              | I/O, L107P                |
| I/O, L#N_Y              | 7    | L1  | XC2S100E, 150E, 300E, 400E                      | -                       | I/O, L76P_Y                   | I/O, L100P_Y            | I/O, L107N              | I/O, L107N_Y              | I/O, L107N_Y              | I/O, L107N                |
| I/O, L#P_Y              | 7    | L3  | XC2S100E, 150E, 200E, 300E, 600E                | XC2S400E, 600E          | I/O, L76N_Y                   | I/O, L100N_Y            | I/O, L106P_Y            | I/O, L106P_Y              | I/O, VREF Bank 7, L106P   | I/O, VREF Bank 7, L106P_Y |
| I/O, L#N_Y              | 7    | L2  | XC2S200E, 300E, 600E                            | -                       | -                             | I/O                     | I/O, L106N_Y            | I/O, L106N_Y              | I/O, L106N                | I/O, L106N_Y              |
| I/O                     | 7    | L4  | -                                               | -                       | -                             | -                       | -                       | I/O                       | I/O                       | I/O                       |

## FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)

| Pad Name              |      | Pin | LVDS Async. Output Option        | V <sub>REF</sub> Option | Device-Specific Pinouts: XC2S |                        |                           |                         |                           |                           |
|-----------------------|------|-----|----------------------------------|-------------------------|-------------------------------|------------------------|---------------------------|-------------------------|---------------------------|---------------------------|
| Function              | Bank |     |                                  |                         | 100E                          | 150E                   | 200E                      | 300E                    | 400E                      | 600E                      |
| I/O, L#P_YY           | 7    | L5  | All                              | -                       | I/O, L75P_YY                  | I/O, L99P_YY           | I/O, L105P_YY             | I/O, L105P_YY           | I/O, L105P_YY             | I/O, L105P_YY             |
| I/O (IRDY), L#N_YY    | 7    | L6  | All                              | -                       | I/O (IRDY), L75N_YY           | I/O (IRDY), L99N_YY    | I/O (IRDY), L105N_YY      | I/O (IRDY), L105N_YY    | I/O (IRDY), L105N_YY      | I/O (IRDY), L105N_YY      |
|                       |      |     |                                  |                         |                               |                        |                           |                         |                           |                           |
| I/O (TRDY)            | 6    | M1  | -                                | -                       | I/O (TRDY)                    | I/O (TRDY)             | I/O (TRDY)                | I/O (TRDY)              | I/O (TRDY)                | I/O (TRDY)                |
| I/O                   | 6    | M2  | -                                | -                       | -                             | -                      | -                         | I/O                     | I/O                       | I/O                       |
| I/O, L#P_Y            | 6    | M3  | XC2S200E, 300E, 600E             | -                       | -                             | I/O                    | I/O, L104P_Y              | I/O, L104P_Y            | I/O, L104P                | I/O, L104P_Y              |
| I/O, L#N_Y            | 6    | M4  | XC2S100E, 150E, 200E, 300E, 600E | XC2S400E, 600E          | I/O, L74P_Y                   | I/O, L98P_Y            | I/O, L104N_Y              | I/O, L104N_Y            | I/O, VREF Bank 6, L104N   | I/O, VREF Bank 6, L104N_Y |
| I/O, L#P_Y            | 6    | M5  | XC2S100E, 150E, 300E, 400E       | -                       | I/O, L74N_Y                   | I/O, L98N_Y            | I/O, L103P                | I/O, L103P_Y            | I/O, L103P_Y              | I/O, L103P                |
| I/O, L#N_Y            | 6    | M6  | XC2S300E, 400E                   | -                       | -                             | -                      | I/O, L103N                | I/O, L103N_Y            | I/O, L103N_Y              | I/O, L103N                |
| I/O                   | 6    | N1  | -                                | -                       | -                             | -                      | -                         | I/O                     | I/O                       | I/O                       |
| I/O                   | 6    | N2  | -                                | -                       | I/O, L73P                     | I/O, L97P              | I/O                       | I/O                     | I/O                       | I/O                       |
| I/O, VREF Bank 6, L#P | 6    | N3  | XC2S200E, 400E                   | All                     | I/O, VREF Bank 6, L73N        | I/O, VREF Bank 6, L97N | I/O, VREF Bank 6, L102P_Y | I/O, VREF Bank 6, L102P | I/O, VREF Bank 6, L102P_Y | I/O, VREF Bank 6, L102P   |
| I/O, L#N              | 6    | N4  | XC2S100E, 150E, 200E, 400E       | -                       | I/O, L72P_Y                   | I/O, L96P_Y            | I/O, L102N_Y              | I/O, L102N              | I/O, L102N_Y              | I/O, L102N                |
| I/O, L#P_Y            | 6    | N5  | XC2S100E, 150E, 300E, 600E       | -                       | I/O, L72N_Y                   | I/O, L96N_Y            | I/O, L101P                | I/O, L101P_Y            | I/O, L101P                | I/O, L101P_Y              |
| I/O, L#N_Y            | 6    | N6  | XC2S300E, 600E                   | -                       | -                             | -                      | I/O, L101N                | I/O, L101N_Y            | I/O, L101N                | I/O, L101N_Y              |
| I/O, L#P_Y            | 6    | P1  | XC2S150E, 200E, 300E, 600E       | -                       | -                             | I/O, L95P_Y            | I/O, L100P_Y              | I/O, L100P_Y            | I/O, L100P                | I/O, L100P_Y              |
| I/O, L#N_Y            | 6    | P2  | XC2S100E, 150E, 200E, 300E, 600E | -                       | I/O, L71P_Y                   | I/O, L95N_Y            | I/O, L100N_Y              | I/O, L100N_Y            | I/O, L100N                | I/O, L100N_Y              |
| I/O                   | 6    | R1  | XC2S100E, 150E                   | -                       | I/O, L71N_Y                   | I/O, L94P_Y            | I/O                       | I/O                     | I/O                       | I/O                       |
| I/O, L#P_Y            | 6    | P3  | XC2S150E, 200E, 300E, 400E, 600E | -                       | -                             | I/O, L94N_Y            | I/O, L99P_Y               | I/O, L99P_Y             | I/O, L99P_Y               | I/O, L99P_Y               |
| I/O, L#N_Y            | 6    | P4  | XC2S200E, 300E, 400E, 600E       | -                       | -                             | -                      | I/O, L99N_Y               | I/O, L99N_Y             | I/O, L99N_Y               | I/O, L99N_Y               |
| I/O, L#P_YY           | 6    | P5  | All                              | -                       | I/O, L70P_YY                  | I/O, L93P_YY           | I/O, L98P_YY              | I/O, L98P_YY            | I/O, L98P_YY              | I/O, L98P_YY              |
| I/O, L#N_YY           | 6    | P6  | All                              | -                       | I/O, L70N_YY                  | I/O, L93N_YY           | I/O, L98N_YY              | I/O, L98N_YY            | I/O, L98N_YY              | I/O, L98N_YY              |

## FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)

| Pad Name                |      | Pin | LVDS Async. Output Option              | V <sub>REF</sub> Option    | Device-Specific Pinouts: XC2S |                          |                          |                          |                          |                          |
|-------------------------|------|-----|----------------------------------------|----------------------------|-------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Function                | Bank |     |                                        |                            | 100E                          | 150E                     | 200E                     | 300E                     | 400E                     | 600E                     |
| I/O, L#P_Y              | 6    | R2  | XC2S300E, 400E, 600E                   | -                          | I/O, L69P                     | I/O, L92P                | I/O, L97P                | I/O, L97P_Y              | I/O, L97P_Y              | I/O, L97P_Y              |
| I/O, VREF Bank 6, L#N_Y | 6    | R3  | XC2S300E, 400E, 600E                   | All                        | I/O, VREF Bank 6, L69N        | I/O, VREF Bank 6, L92N   | I/O, VREF Bank 6, L97N   | I/O, VREF Bank 6, L97N_Y | I/O, VREF Bank 6, L97N_Y | I/O, VREF Bank 6, L97N_Y |
| I/O                     | 6    | R4  | -                                      | -                          | -                             | -                        | -                        | I/O                      | I/O                      | I/O                      |
| I/O                     | 6    | R5  | -                                      | -                          | I/O                           | I/O                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P                | 6    | T2  | XC2S200E, 400E, 600E                   | XC2S600E                   | I/O, L68P                     | I/O, L91P                | I/O, L96P_Y              | I/O, L96P                | I/O, L96P_Y              | I/O, VREF Bank 6, L96P_Y |
| I/O, L#N                | 6    | T3  | XC2S200E, 400E, 600E                   | -                          | I/O, L68N                     | I/O, L91N                | I/O, L96N_Y              | I/O, L96N                | I/O, L96N_Y              | I/O, L96N_Y              |
| I/O, L#P_Y              | 6    | T4  | XC2S150E, 300E, 400E                   | -                          | -                             | I/O, L90P_Y              | I/O, L95P                | I/O, L95P_Y              | I/O, L95P_Y              | I/O, L95P                |
| I/O, L#N_Y              | 6    | T5  | XC2S150E, 300E, 400E                   | -                          | -                             | I/O, L90N_Y              | I/O, L95N                | I/O, L95N_Y              | I/O, L95N_Y              | I/O, L95N                |
| I/O, L#P_Y              | 6    | T1  | XC2S150E, 200E, 300E, 400E, 600E       | -                          | I/O, L67P                     | I/O, L89P_Y              | I/O, L94P_Y              | I/O, L94P_Y              | I/O, L94P_Y              | I/O, L94P_Y              |
| I/O, VREF Bank 6, L#N_Y | 6    | U1  | XC2S150E, 200E, 300E, 400E, 600E       | All                        | I/O, VREF Bank 6, L67N        | I/O, VREF Bank 6, L89N_Y | I/O, VREF Bank 6, L94N_Y | I/O, VREF Bank 6, L94N_Y | I/O, VREF Bank 6, L94N_Y | I/O, VREF Bank 6, L94N_Y |
| I/O                     | 6    | U2  | XC2S100E                               | -                          | I/O, L66P_Y                   | I/O                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P_Y              | 6    | U3  | XC2S100E, 150E, 200E, 300E, 400E, 600E | -                          | I/O, L66N_Y                   | I/O, L88P_Y              | I/O, L93P_Y              | I/O, L93P_Y              | I/O, L93P_Y              | I/O, L93P_Y              |
| I/O, L#N_Y              | 6    | U4  | XC2S150E, 200E, 300E, 400E, 600E       | -                          | -                             | I/O, L88N_Y              | I/O, L93N_Y              | I/O, L93N_Y              | I/O, L93N_Y              | I/O, L93N_Y              |
| I/O                     | 6    | V1  | -                                      | -                          | -                             | -                        | -                        | I/O                      | I/O                      | I/O                      |
| I/O, L#P_Y              | 6    | W1  | XC2S100E, 200E, 300E, 600E             | -                          | I/O, L65P_Y                   | I/O, L87P                | I/O, L92P_Y              | I/O, L92P_Y              | I/O, L92P                | I/O, L92P_Y              |
| I/O, L#N_Y              | 6    | V2  | XC2S100E, 200E, 300E, 600E             | XC2S200E, 300E, 400E, 600E | I/O, L65N_Y                   | I/O, L87N                | I/O, VREF Bank 6, L92N_Y | I/O, VREF Bank 6, L92N_Y | I/O, VREF Bank 6, L92N   | I/O, VREF Bank 6, L92N_Y |
| I/O                     | 6    | W2  | -                                      | -                          | I/O                           | I/O                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P_Y              | 6    | V3  | XC2S200E, 300E, 400E                   | -                          | -                             | I/O, L86P                | I/O, L91P_Y              | I/O, L91P_Y              | I/O, L91P_Y              | I/O, L91P                |
| I/O, L#N_Y              | 6    | V4  | XC2S200E, 300E, 400E                   | -                          | -                             | I/O, L86N                | I/O, L91N_Y              | I/O, L91N_Y              | I/O, L91N_Y              | I/O, L91N                |
| I/O                     | 6    | Y1  | -                                      | -                          | -                             | -                        | -                        | I/O                      | I/O                      | I/O                      |
| I/O, L#P_YY             | 6    | Y2  | All                                    | -                          | I/O, L64P_YY                  | I/O, L85P_YY             | I/O, L90P_YY             | I/O, L90P_YY             | I/O, L90P_YY             | I/O, L90P_YY             |
| I/O, L#N_YY             | 6    | W3  | All                                    | -                          | I/O, L64N_YY                  | I/O, L85N_YY             | I/O, L90N_YY             | I/O, L90N_YY             | I/O, L90N_YY             | I/O, L90N_YY             |
| M1                      | -    | U5  | -                                      | -                          | M1                            | M1                       | M1                       | M1                       | M1                       | M1                       |

## FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)

| Pad Name                 |      | Pin | LVDS Async. Output Option              | V <sub>REF</sub> Option    | Device-Specific Pinouts: XC2S |                           |                           |                           |                           |                           |
|--------------------------|------|-----|----------------------------------------|----------------------------|-------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Function                 | Bank |     |                                        |                            | 100E                          | 150E                      | 200E                      | 300E                      | 400E                      | 600E                      |
| M0                       | -    | AA1 | -                                      | -                          | M0                            | M0                        | M0                        | M0                        | M0                        | M0                        |
| M2                       | -    | AB2 | -                                      | -                          | M2                            | M2                        | M2                        | M2                        | M2                        | M2                        |
|                          |      |     |                                        |                            |                               |                           |                           |                           |                           |                           |
| I/O, L#N_Y               | 5    | AA3 | XC2S150E, 200E, 300E, 400E, 600E       | -                          | -                             | I/O, L84N_Y               | I/O, L89N_Y               | I/O, L89N_Y               | I/O, L89N_Y               | I/O, L89N_Y               |
| I/O, L#P_Y               | 5    | AB3 | XC2S150E, 200E, 300E, 400E, 600E       | -                          | -                             | I/O, L84P_Y               | I/O, L89P_Y               | I/O, L89P_Y               | I/O, L89P_Y               | I/O, L89P_Y               |
| I/O                      | 5    | AB4 | -                                      | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O                      | 5    | AA5 | XC2S100E, 150E                         | -                          | I/O, L63N_Y                   | I/O, L83N_Y               | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#N_Y               | 5    | W5  | XC2S100E, 150E, 200E, 300E, 400E, 600E | -                          | I/O, L63P_Y                   | I/O, L83P_Y               | I/O, L88N_Y               | I/O, L88N_Y               | I/O, L88N_Y               | I/O, L88N_Y               |
| I/O, L#P_Y               | 5    | Y5  | XC2S200E, 300E, 400E, 600E             | -                          | I/O                           | I/O                       | I/O, L88P_Y               | I/O, L88P_Y               | I/O, L88P_Y               | I/O, L88P_Y               |
| I/O, L#N_Y               | 5    | AB5 | XC2S100E, 200E, 300E, 400E, 600E       | XC2S200E, 300E, 400E, 600E | I/O, L62N_Y                   | I/O, L82N                 | I/O, VREF Bank 5, L87N_Y  | I/O, VREF Bank 5, L87N_Y  | I/O, VREF Bank 5, L87N_Y  | I/O, VREF Bank 5, L87N_Y  |
| I/O, L#P_Y               | 5    | AB6 | XC2S100E, 200E, 300E, 400E, 600E       | -                          | I/O, L62P_Y                   | I/O, L82P                 | I/O, L87P_Y               | I/O, L87P_Y               | I/O, L87P_Y               | I/O, L87P_Y               |
| I/O                      | 5    | Y6  | -                                      | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O                      | 5    | AA6 | -                                      | -                          | -                             | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#N_YY              | 5    | V6  | All                                    | -                          | I/O, L61N_YY                  | I/O, L81N_YY              | I/O, L86N_YY              | I/O, L86N_YY              | I/O, L86N_YY              | I/O, L86N_YY              |
| I/O, L#P_YY              | 5    | W6  | All                                    | -                          | I/O, L61P_YY                  | I/O, L81P_YY              | I/O, L86P_YY              | I/O, L86P_YY              | I/O, L86P_YY              | I/O, L86P_YY              |
| I/O, VREF Bank 5, L#N_YY | 5    | AB7 | All                                    | All                        | I/O, VREF Bank 5, L60N_YY     | I/O, VREF Bank 5, L80N_YY | I/O, VREF Bank 5, L85N_YY | I/O, VREF Bank 5, L85N_YY | I/O, VREF Bank 5, L85N_YY | I/O, VREF Bank 5, L85N_YY |
| I/O, L#P_YY              | 5    | AA7 | All                                    | -                          | I/O, L60P_YY                  | I/O, L80P_YY              | I/O, L85P_YY              | I/O, L85P_YY              | I/O, L85P_YY              | I/O, L85P_YY              |
| I/O                      | 5    | Y7  | -                                      | -                          | -                             | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#N_Y               | 5    | V7  | XC2S300E, 600E                         | -                          | -                             | I/O, L79N                 | I/O, L84N                 | I/O, L84N_Y               | I/O, L84N                 | I/O, L84N_Y               |
| I/O, L#P_Y               | 5    | W7  | XC2S300E, 600E                         | -                          | I/O                           | I/O, L79P                 | I/O, L84P                 | I/O, L84P_Y               | I/O, L84P                 | I/O, L84P_Y               |
| I/O, L#N_Y               | 5    | AB8 | XC2S100E, 300E, 600E                   | XC2S600E                   | I/O, L59N_Y                   | I/O, L78N                 | I/O, L83N                 | I/O, L83N_Y               | I/O, L83N                 | I/O, VREF Bank 5, L83N_Y  |
| I/O, L#P_Y               | 5    | AA8 | XC2S100E, 300E, 600E                   | -                          | I/O, L59P_Y                   | I/O, L78P                 | I/O, L83P                 | I/O, L83P_Y               | I/O, L83P                 | I/O, L83P_Y               |
| I/O                      | 5    | Y8  | -                                      | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |

**FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)**

| Pad Name                |      | Pin  | LVDS Async. Output Option        | V <sub>REF</sub> Option | Device-Specific Pinouts: XC2S |                        |                          |                          |                          |                          |
|-------------------------|------|------|----------------------------------|-------------------------|-------------------------------|------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Function                | Bank |      |                                  |                         | 100E                          | 150E                   | 200E                     | 300E                     | 400E                     | 600E                     |
| I/O, VREF Bank 5, L#N_Y | 5    | V8   | XC2S100E, 200E, 300E, 400E, 600E | All                     | I/O, VREF Bank 5, L58N_Y      | I/O, VREF Bank 5, L77N | I/O, VREF Bank 5, L82N_Y | I/O, VREF Bank 5, L82N_Y | I/O, VREF Bank 5, L82N_Y | I/O, VREF Bank 5, L82N_Y |
| I/O, L#P_Y              | 5    | W8   | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L58P_Y                   | I/O, L77P              | I/O, L82P_Y              | I/O, L82P_Y              | I/O, L82P_Y              | I/O, L82P_Y              |
| I/O, L#N_Y              | 5    | AB9  | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L57N_Y                   | I/O, L76N              | I/O, L81N_Y              | I/O, L81N_Y              | I/O, L81N_Y              | I/O, L81N_Y              |
| I/O, L#P_Y              | 5    | AA9  | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L57P_Y                   | I/O, L76P              | I/O, L81P_Y              | I/O, L81P_Y              | I/O, L81P_Y              | I/O, L81P_Y              |
| I/O                     | 5    | AB10 | -                                | -                       | -                             | -                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N_Y              | 5    | W9   | XC2S150E, 300E, 400E, 600E       | -                       | -                             | I/O, L75N_Y            | I/O, L80N                | I/O, L80N_Y              | I/O, L80N_Y              | I/O, L80N_Y              |
| I/O, L#P_Y              | 5    | Y9   | XC2S100E, 150E, 300E, 400E, 600E | -                       | I/O, L56N_Y                   | I/O, L75P_Y            | I/O, L80P                | I/O, L80P_Y              | I/O, L80P_Y              | I/O, L80P_Y              |
| I/O, L#N_Y              | 5    | V9   | XC2S100E, 150E, 300E, 400E, 600E | -                       | I/O, L56P_Y                   | I/O, L74N_Y            | I/O, L79N                | I/O, L79N_Y              | I/O, L79N_Y              | I/O, L79N_Y              |
| I/O, L#P_Y              | 5    | U9   | XC2S150E, 300E, 400E, 600E       | -                       | -                             | I/O, L74P_Y            | I/O, L79P                | I/O, L79P_Y              | I/O, L79P_Y              | I/O, L79P_Y              |
| I/O                     | 5    | AA10 | -                                | -                       | -                             | -                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N_Y              | 5    | W10  | XC2S200E, 300E, 400E, 600E       | -                       | I/O, L55N                     | I/O, L73N              | I/O, L78N_Y              | I/O, L78N_Y              | I/O, L78N_Y              | I/O, L78N_Y              |
| I/O, L#P_Y              | 5    | Y10  | XC2S200E, 300E, 400E, 600E       | -                       | I/O, L55P                     | I/O, L73P              | I/O, L78P_Y              | I/O, L78P_Y              | I/O, L78P_Y              | I/O, L78P_Y              |
| I/O, VREF Bank 5, L#N_Y | 5    | V10  | XC2S200E, 300E, 400E, 600E       | All                     | I/O, VREF Bank 5, L54N        | I/O, VREF Bank 5, L72N | I/O, VREF Bank 5, L77N_Y | I/O, VREF Bank 5, L77N_Y | I/O, VREF Bank 5, L77N_Y | I/O, VREF Bank 5, L77N_Y |
| I/O, L#P_Y              | 5    | U10  | XC2S200E, 300E, 400E, 600E       | -                       | I/O, L54P                     | I/O, L72P              | I/O, L77P_Y              | I/O, L77P_Y              | I/O, L77P_Y              | I/O, L77P_Y              |
| I/O                     | 5    | U11  | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O                     | 5    | V11  | -                                | -                       | -                             | -                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N                | 5    | W11  | XC2S200E, 400E                   | -                       | I/O                           | I/O, L71N              | I/O, L76N_Y              | I/O, L76N                | I/O, L76N_Y              | I/O, L76N                |
| I/O, L#P                | 5    | Y11  | XC2S200E, 400E                   | XC2S400E, 600E          | -                             | I/O, L71P              | I/O, L76P_Y              | I/O, L76P                | I/O, VREF Bank 5, L76P_Y | I/O, VREF Bank 5, L76P   |
| I/O                     | 5    | AA11 | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O (DLL), L#N          | 5    | AB11 | -                                | -                       | I/O (DLL), L53N               | I/O (DLL), L70N        | I/O (DLL), L75N          | I/O (DLL), L75N          | I/O (DLL), L75N          | I/O (DLL), L75N          |
| GCK1, I                 | 5    | AB12 | -                                | -                       | GCK1, I                       | GCK1, I                | GCK1, I                  | GCK1, I                  | GCK1, I                  | GCK1, I                  |

**FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)**

| Pad Name              |      | Pin  | LVDS Async. Output Option        | V <sub>REF</sub> Option | Device-Specific Pinouts: XC2S |                        |                          |                          |                          |                          |
|-----------------------|------|------|----------------------------------|-------------------------|-------------------------------|------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Function              | Bank |      |                                  |                         | 100E                          | 150E                   | 200E                     | 300E                     | 400E                     | 600E                     |
| GCK0, I               | 4    | AA12 | -                                | -                       | GCK0, I                       | GCK0, I                | GCK0, I                  | GCK0, I                  | GCK0, I                  | GCK0, I                  |
| I/O (DLL), L#P        | 4    | Y12  | -                                | -                       | I/O (DLL), L53P               | I/O (DLL), L70P        | I/O (DLL), L75P          | I/O (DLL), L75P          | I/O (DLL), L75P          | I/O (DLL), L75P          |
| I/O                   | 4    | W12  | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 4    | V12  | XC2S150E, 300E, 600E             | -                       | -                             | I/O, L69N_Y            | I/O, L74N                | I/O, L74N_Y              | I/O, L74N                | I/O, L74N_Y              |
| I/O, L#P              | 4    | U12  | XC2S150E, 300E, 600E             | XC2S400E, 600E          | I/O, L52N                     | I/O, L69P_Y            | I/O, L74P                | I/O, L74P_Y              | I/O, VREF Bank 4, L74P   | I/O, VREF Bank 4, L74P_Y |
| I/O, L#N              | 4    | AB13 | XC2S300E, 600E                   | -                       | I/O, L52P                     | I/O                    | I/O, L73N                | I/O, L73N_Y              | I/O, L73N                | I/O, L73N_Y              |
| I/O, L#P              | 4    | AA13 | XC2S300E, 600E                   | -                       | -                             | -                      | I/O, L73P                | I/O, L73P_Y              | I/O, L73P                | I/O, L73P_Y              |
| I/O                   | 4    | Y13  | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 4    | W13  | XC2S200E, 300E, 400E, 600E       | -                       | I/O, L51N                     | I/O, L68N              | I/O, L72N_Y              | I/O, L72N_Y              | I/O, L72N_Y              | I/O, L72N_Y              |
| I/O, VREF Bank 4, L#P | 4    | V13  | XC2S200E, 300E, 400E, 600E       | All                     | I/O, VREF Bank 4, L51P        | I/O, VREF Bank 4, L68P | I/O, VREF Bank 4, L72P_Y | I/O, VREF Bank 4, L72P_Y | I/O, VREF Bank 4, L72P_Y | I/O, VREF Bank 4, L72P_Y |
| I/O                   | 4    | U13  | -                                | -                       | I/O, L50N                     | I/O, L67N              | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 4    | AB14 | -                                | -                       | I/O, L50P                     | I/O, L67P              | I/O, L71N                | I/O, L71N                | I/O, L71N                | I/O, L71N                |
| I/O, L#P              | 4    | AA14 | -                                | -                       | -                             | -                      | I/O, L71P                | I/O, L71P                | I/O, L71P                | I/O, L71P                |
| I/O                   | 4    | AB15 | -                                | -                       | -                             | -                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 4    | Y14  | XC2S100E, 150E, 200E             | -                       | I/O, L49N_Y                   | I/O, L66N_Y            | I/O, L70N_Y              | I/O, L70N                | I/O, L70N                | I/O, L70N                |
| I/O, L#P              | 4    | W14  | XC2S100E, 150E, 200E             | -                       | I/O, L49P_Y                   | I/O, L66P_Y            | I/O, L70P_Y              | I/O, L70P                | I/O, L70P                | I/O, L70P                |
| I/O, L#N              | 4    | U14  | XC2S150E, 200E                   | -                       | -                             | I/O, L65N_Y            | I/O, L69N_Y              | I/O, L69N                | I/O, L69N                | I/O, L69N                |
| I/O, L#P              | 4    | V14  | XC2S150E, 200E                   | -                       | -                             | I/O, L65P_Y            | I/O, L69P_Y              | I/O, L69P                | I/O, L69P                | I/O, L69P                |
| I/O, L#N              | 4    | AA15 | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L48N_Y                   | I/O, L64N              | I/O, L68N_Y              | I/O, L68N_Y              | I/O, L68N_Y              | I/O, L68N_Y              |
| I/O, L#P              | 4    | Y15  | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L48P_Y                   | I/O, L64P              | I/O, L68P_Y              | I/O, L68P_Y              | I/O, L68P_Y              | I/O, L68P_Y              |
| I/O, L#N              | 4    | W15  | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L47N_Y                   | I/O, L63N              | I/O, L67N_Y              | I/O, L67N_Y              | I/O, L67N_Y              | I/O, L67N_Y              |
| I/O, VREF Bank 4, L#P | 4    | V15  | XC2S100E, 200E, 300E, 400E, 600E | All                     | I/O, VREF Bank 4, L47P_Y      | I/O, VREF Bank 4, L63P | I/O, VREF Bank 4, L67P_Y | I/O, VREF Bank 4, L67P_Y | I/O, VREF Bank 4, L67P_Y | I/O, VREF Bank 4, L67P_Y |
| I/O                   | 4    | AB16 | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O                   | 4    | AB17 | -                                | -                       | I/O                           | I/O                    | I/O                      | I/O                      | I/O                      | I/O                      |

| Pad Name                 |      | Pin  | LVDS Async. Output Option        | V <sub>REF</sub> Option    | Device-Specific Pinouts: XC2S |                           |                           |                           |                           |                           |
|--------------------------|------|------|----------------------------------|----------------------------|-------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Function                 | Bank |      |                                  |                            | 100E                          | 150E                      | 200E                      | 300E                      | 400E                      | 600E                      |
| I/O, L#N                 | 4    | AA16 | XC2S150E, 200E, 400E             | XC2S600E                   | I/O, L46N                     | I/O, L62N_Y               | I/O, L66N_Y               | I/O, L66N                 | I/O, L66N_Y               | I/O, VREF Bank 4, L66N    |
| I/O, L#P                 | 4    | Y16  | XC2S150E, 200E, 400E             | -                          | I/O, L46P                     | I/O, L62P_Y               | I/O, L66P_Y               | I/O, L66P                 | I/O, L66P_Y               | I/O, L66P                 |
| I/O, L#N                 | 4    | W16  | XC2S150E, 200E                   | -                          | -                             | I/O, L61N_Y               | I/O, L65N_Y               | I/O, L65N                 | I/O, L65N                 | I/O, L65N                 |
| I/O, L#P                 | 4    | V16  | XC2S150E, 200E                   | -                          | -                             | I/O, L61P_Y               | I/O, L65P_Y               | I/O, L65P                 | I/O, L65P                 | I/O, L65P                 |
| I/O, L#N_YY              | 4    | AA17 | All                              | -                          | I/O, L45N_YY                  | I/O, L60N_YY              | I/O, L64N_YY              | I/O, L64N_YY              | I/O, L64N_YY              | I/O, L64N_YY              |
| I/O, VREF Bank 4, L#P_YY | 4    | Y17  | All                              | All                        | I/O, VREF Bank 4, L45P_YY     | I/O, VREF Bank 4, L60P_YY | I/O, VREF Bank 4, L64P_YY | I/O, VREF Bank 4, L64P_YY | I/O, VREF Bank 4, L64P_YY | I/O, VREF Bank 4, L64P_YY |
| I/O                      | 4    | AB18 | XC2S100E                         | -                          | I/O, L44N_Y                   | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#N                 | 4    | W17  | XC2S100E, 400E, 600E             | -                          | I/O, L44P_Y                   | I/O, L59N                 | I/O, L63N                 | I/O, L63N                 | I/O, L63N_Y               | I/O, L63N_Y               |
| I/O, L#P                 | 4    | V17  | XC2S400E, 600E                   | -                          | -                             | I/O, L59P                 | I/O, L63P                 | I/O, L63P                 | I/O, L63P_Y               | I/O, L63P_Y               |
| I/O                      | 4    | AA18 | -                                | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O, L#N                 | 4    | Y18  | XC2S100E, 200E, 300E, 400E, 600E | -                          | I/O, L43N_Y                   | I/O, L58N                 | I/O, L62N_Y               | I/O, L62N_Y               | I/O, L62N_Y               | I/O, L62N_Y               |
| I/O, L#P                 | 4    | W18  | XC2S100E, 200E, 300E, 400E, 600E | XC2S200E, 300E, 400E, 600E | I/O, L43P_Y                   | I/O, L58P                 | I/O, VREF Bank 4, L62P_Y  | I/O, VREF Bank 4, L62P_Y  | I/O, VREF Bank 4, L62P_Y  | I/O, VREF Bank 4, L62P_Y  |
| I/O                      | 4    | AB19 | -                                | -                          | I/O                           | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#N                 | 4    | AA19 | XC2S150E, 400E                   | -                          | -                             | I/O, L57N_Y               | I/O, L61N                 | I/O, L61N                 | I/O, L61N_Y               | I/O, L61N                 |
| I/O, L#P                 | 4    | Y19  | XC2S150E, 400E                   | -                          | -                             | I/O, L57P_Y               | I/O, L61P                 | I/O, L61P                 | I/O, L61P_Y               | I/O, L61P                 |
| I/O                      | 4    | AB21 | -                                | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O, L#N_YY              | 4    | AB20 | All                              | -                          | I/O, L42N_YY                  | I/O, L56N_YY              | I/O, L60N_YY              | I/O, L60N_YY              | I/O, L60N_YY              | I/O, L60N_YY              |
| I/O, L#P_YY              | 4    | AA20 | All                              | -                          | I/O, L42P_YY                  | I/O, L56P_YY              | I/O, L60P_YY              | I/O, L60P_YY              | I/O, L60P_YY              | I/O, L60P_YY              |
|                          |      |      |                                  |                            |                               |                           |                           |                           |                           |                           |
| DONE                     | 3    | W20  | -                                | -                          | DONE                          | DONE                      | DONE                      | DONE                      | DONE                      | DONE                      |
| PROGRAM                  | -    | Y21  | -                                | -                          | PROGRAM                       | PROGRAM                   | PROGRAM                   | PROGRAM                   | PROGRAM                   | PROGRAM                   |
| I/O (INIT), L#N_YY       | 3    | W21  | All                              | -                          | I/O (INIT), L41N_YY           | I/O (INIT), L55N_YY       | I/O (INIT), L59N_YY       | I/O (INIT), L59N_YY       | I/O (INIT), L59N_YY       | I/O (INIT), L59N_YY       |
| I/O (D7), L#P_YY         | 3    | Y22  | All                              | -                          | I/O (D7), L41P_YY             | I/O (D7), L55P_YY         | I/O (D7), L59P_YY         | I/O (D7), L59P_YY         | I/O (D7), L59P_YY         | I/O (D7), L59P_YY         |
| I/O                      | 3    | W22  | -                                | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O                      | 3    | V21  | -                                | -                          | -                             | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |

## FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)

| Pad Name              |      | Pin | LVDS Async. Output Option        | V <sub>REF</sub> Option    | Device-Specific Pinouts: XC2S |                          |                          |                          |                          |                          |
|-----------------------|------|-----|----------------------------------|----------------------------|-------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Function              | Bank |     |                                  |                            | 100E                          | 150E                     | 200E                     | 300E                     | 400E                     | 600E                     |
| I/O, L#N              | 3    | V19 | XC2S150E, 200E, 300E, 400E       | -                          | -                             | I/O, L54N_Y              | I/O, L58N_Y              | I/O, L58N_Y              | I/O, L58N_Y              | I/O, L58N                |
| I/O, L#P              | 3    | V20 | XC2S150E, 200E, 300E, 400E       | -                          | I/O                           | I/O, L54P_Y              | I/O, L58P_Y              | I/O, L58P_Y              | I/O, L58P_Y              | I/O, L58P                |
| I/O, L#N              | 3    | V22 | XC2S100E, 200E, 300E, 600E       | XC2S200E, 300E, 400E, 600E | I/O, L40N_Y                   | I/O, L53N                | I/O, VREF Bank 3, L57N_Y | I/O, VREF Bank 3, L57N_Y | I/O, VREF Bank 3, L57N   | I/O, VREF Bank 3, L57N_Y |
| I/O, L#P              | 3    | U22 | XC2S100E, 200E, 300E, 600E       | -                          | I/O, L40P_Y                   | I/O, L53P                | I/O, L57P_Y              | I/O, L57P_Y              | I/O, L57P                | I/O, L57P_Y              |
| I/O                   | 3    | U21 | -                                | -                          | -                             | -                        | -                        | I/O                      | I/O                      | I/O                      |
| I/O                   | 3    | U20 | -                                | -                          | -                             | I/O                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 3    | U18 | XC2S100E, 200E, 300E, 600E       | -                          | I/O, L39N_Y                   | I/O, L52N                | I/O, L56N_Y              | I/O, L56N_Y              | I/O, L56N                | I/O, L56N_Y              |
| I/O, L#P              | 3    | U19 | XC2S100E, 200E, 300E, 600E       | -                          | I/O, L39P_Y                   | I/O, L52P                | I/O, L56P_Y              | I/O, L56P_Y              | I/O, L56P                | I/O, L56P_Y              |
| I/O, VREF Bank 3, L#N | 3    | T21 | XC2S150E, 200E, 300E, 400E, 600E | All                        | I/O, VREF Bank 3, L38N        | I/O, VREF Bank 3, L51N_Y | I/O, VREF Bank 3, L55N_Y | I/O, VREF Bank 3, L55N_Y | I/O, VREF Bank 3, L55N_Y | I/O, VREF Bank 3, L55N_Y |
| I/O, L#P              | 3    | T22 | XC2S150E, 200E, 300E, 400E, 600E | -                          | I/O, L38P                     | I/O, L51P_Y              | I/O, L55P_Y              | I/O, L55P_Y              | I/O, L55P_Y              | I/O, L55P_Y              |
| I/O                   | 3    | T20 | -                                | -                          | -                             | I/O                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 3    | T18 | XC2S150E, 200E, 300E, 400E       | -                          | -                             | I/O, L50N_Y              | I/O, L54N_Y              | I/O, L54N_Y              | I/O, L54N_Y              | I/O, L54N                |
| I/O, L#P              | 3    | T19 | XC2S150E, 200E, 300E, 400E       | -                          | I/O                           | I/O, L50P_Y              | I/O, L54P_Y              | I/O, L54P_Y              | I/O, L54P_Y              | I/O, L54P                |
| I/O, L#N              | 3    | R21 | XC2S100E, 150E, 300E, 600E       | XC2S600E                   | I/O, L37N_Y                   | I/O, L49N_Y              | I/O, L53N                | I/O, L53N_Y              | I/O, L53N                | I/O, VREF Bank 3, L53N_Y |
| I/O, L#P              | 3    | R22 | XC2S100E, 150E, 300E, 600E       | -                          | I/O, L37P_Y                   | I/O, L49P_Y              | I/O, L53P                | I/O, L53P_Y              | I/O, L53P                | I/O, L53P_Y              |
| I/O                   | 3    | R20 | -                                | -                          | -                             | -                        | -                        | I/O                      | I/O                      | I/O                      |
| I/O, VREF Bank 3, L#N | 3    | R18 | XC2S300E, 400E, 600E             | All                        | I/O, VREF Bank 3, L36N        | I/O, VREF Bank 3, L48N   | I/O, VREF Bank 3, L52N   | I/O, VREF Bank 3, L52N_Y | I/O, VREF Bank 3, L52N_Y | I/O, VREF Bank 3, L52N_Y |
| I/O (D6), L#P         | 3    | R19 | XC2S300E, 400E, 600E             | -                          | I/O (D6), L36P                | I/O (D6), L48P           | I/O (D6), L52P           | I/O (D6), L52P_Y         | I/O (D6), L52P_Y         | I/O (D6), L52P_Y         |
| I/O (D5), L#N_YY      | 3    | P22 | All                              | -                          | I/O (D5), L35N_YY             | I/O (D5), L47N_YY        | I/O (D5), L51N_YY        | I/O (D5), L51N_YY        | I/O (D5), L51N_YY        | I/O (D5), L51N_YY        |
| I/O, L#P_YY           | 3    | P21 | All                              | -                          | I/O, L35P_YY                  | I/O, L47P_YY             | I/O, L51P_YY             | I/O, L51P_YY             | I/O, L51P_YY             | I/O, L51P_YY             |

**FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)**

| Pad Name              |      | Pin | LVDS Async. Output Option                       | V <sub>REF</sub> Option | Device-Specific Pinouts: XC2S |                        |                        |                          |                          |                          |
|-----------------------|------|-----|-------------------------------------------------|-------------------------|-------------------------------|------------------------|------------------------|--------------------------|--------------------------|--------------------------|
| Function              | Bank |     |                                                 |                         | 100E                          | 150E                   | 200E                   | 300E                     | 400E                     | 600E                     |
| I/O                   | 3    | P20 | -                                               | -                       | -                             | -                      | I/O                    | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 3    | P18 | XC2S150E, 200E, 300E, 400E                      | -                       | -                             | I/O, L46N_Y            | I/O, L50N_Y            | I/O, L50N_Y              | I/O, L50N_Y              | I/O, L50N                |
| I/O, L#P              | 3    | P19 | XC2S100E, 150E, 200E, 300E, 400E                | -                       | I/O, L34N_Y                   | I/O, L46P_Y            | I/O, L50P_Y            | I/O, L50P_Y              | I/O, L50P_Y              | I/O, L50P                |
| I/O, L#N              | 3    | N22 | XC2S100E, 150E, 200E, 300E, 600E                | -                       | I/O, L34P_Y                   | I/O, L45N_Y            | I/O, L49N_Y            | I/O, L49N_Y              | I/O, L49N                | I/O, L49N_Y              |
| I/O, L#P              | 3    | N21 | XC2S150E, 200E, 300E, 600E                      | -                       | -                             | I/O, L45P_Y            | I/O, L49P_Y            | I/O, L49P_Y              | I/O, L49P                | I/O, L49P_Y              |
| I/O                   | 3    | P17 | -                                               | -                       | -                             | -                      | I/O                    | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 3    | N19 | XC2S100E, 150E, 200E, 300E, 600E <sup>(1)</sup> | -                       | I/O, L33N_YY                  | I/O, L44N_YY           | I/O, L48N_YY           | I/O, L48N_YY             | I/O, L48N                | I/O, L48N_Y              |
| I/O, L#P              | 3    | N20 | XC2S100E, 150E, 200E, 300E, 600E <sup>(1)</sup> | -                       | I/O, L33P_YY                  | I/O, L44P_YY           | I/O, L48P_YY           | I/O, L48P_YY             | I/O, L48P                | I/O, L48P_Y              |
| I/O, VREF Bank 3, L#N | 3    | N18 | XC2S300E, 400E, 600E                            | All                     | I/O, VREF Bank 3, L32N        | I/O, VREF Bank 3, L43N | I/O, VREF Bank 3, L47N | I/O, VREF Bank 3, L47N_Y | I/O, VREF Bank 3, L47N_Y | I/O, VREF Bank 3, L47N_Y |
| I/O (D4), L#P         | 3    | N17 | XC2S300E, 400E, 600E                            | -                       | I/O (D4), L32P                | I/O (D4), L43P         | I/O (D4), L47P         | I/O (D4), L47P_Y         | I/O (D4), L47P_Y         | I/O (D4), L47P_Y         |
| I/O                   | 3    | M22 | -                                               | -                       | -                             | -                      | -                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 3    | M20 | XC2S300E, 400E                                  | -                       | -                             | -                      | I/O, L46N              | I/O, L46N_Y              | I/O, L46N_Y              | I/O, L46N                |
| I/O, L#P              | 3    | M21 | XC2S100E, 150E, 300E, 400E                      | -                       | I/O, L31N_Y                   | I/O, L42N_Y            | I/O, L46P              | I/O, L46P_Y              | I/O, L46P_Y              | I/O, L46P                |
| I/O, L#N              | 3    | M18 | XC2S100E, 150E, 200E, 300E, 600E                | XC2S400E, 600E          | I/O, L31P_Y                   | I/O, L42P_Y            | I/O, L45N_Y            | I/O, L45N_Y              | I/O, VREF Bank 3, L45N   | I/O, VREF Bank 3, L45N_Y |
| I/O, L#P              | 3    | M19 | XC2S200E, 300E, 600E                            | -                       | -                             | I/O                    | I/O, L45P_Y            | I/O, L45P_Y              | I/O, L45P                | I/O, L45P_Y              |
| I/O                   | 3    | M17 | -                                               | -                       | -                             | -                      | -                      | I/O                      | I/O                      | I/O                      |
| I/O (TRDY)            | 3    | L22 | -                                               | -                       | I/O (TRDY)                    | I/O (TRDY)             | I/O (TRDY)             | I/O (TRDY)               | I/O (TRDY)               | I/O (TRDY)               |
| I/O (IRDY), L#N_YY    | 2    | L21 | All                                             | -                       | I/O (IRDY), L30N_YY           | I/O (IRDY), L41N_YY    | I/O (IRDY), L44N_YY    | I/O (IRDY), L44N_YY      | I/O (IRDY), L44N_YY      | I/O (IRDY), L44N_YY      |
| I/O, L#P_YY           | 2    | L20 | All                                             | -                       | I/O, L30P_YY                  | I/O, L41P_YY           | I/O, L44P_YY           | I/O, L44P_YY             | I/O, L44P_YY             | I/O, L44P_YY             |
| I/O                   | 2    | L19 | -                                               | -                       | -                             | -                      | -                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 2    | L18 | XC2S200E, 300E, 600E                            | -                       | -                             | I/O                    | I/O, L43N_Y            | I/O, L43N_Y              | I/O, L43N                | I/O, L43N_Y              |

## FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)

| Pad Name              |      | Pin | LVDS Async. Output Option        | V <sub>REF</sub> Option | Device-Specific Pinouts: XC2S |                        |                          |                          |                          |                          |
|-----------------------|------|-----|----------------------------------|-------------------------|-------------------------------|------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Function              | Bank |     |                                  |                         | 100E                          | 150E                   | 200E                     | 300E                     | 400E                     | 600E                     |
| I/O, L#P              | 2    | L17 | XC2S100E, 150E, 200E, 300E, 600E | XC2S400E, 600E          | I/O, L29N_Y                   | I/O, L40N_Y            | I/O, L43P_Y              | I/O, L43P_Y              | I/O, VREF Bank 2, L43P   | I/O, VREF Bank 2, L43P_Y |
| I/O, L#N              | 2    | K22 | XC2S100E, 150E, 300E, 400E       | -                       | I/O, L29P_Y                   | I/O, L40P_Y            | I/O, L42N                | I/O, L42N_Y              | I/O, L42N_Y              | I/O, L42N                |
| I/O, L#P              | 2    | K21 | XC2S300E, 400E                   | -                       | -                             | -                      | I/O, L42P                | I/O, L42P_Y              | I/O, L42P_Y              | I/O, L42P                |
| I/O                   | 2    | K20 | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O (D3)              | 2    | K19 | -                                | -                       | I/O (D3)                      | I/O (D3), L39N         | I/O (D3)                 | I/O (D3)                 | I/O (D3)                 | I/O (D3)                 |
| I/O, VREF Bank 2, L#N | 2    | K18 | XC2S100E, 200E, 400E             | All                     | I/O, VREF Bank 2, L28N_Y      | I/O, VREF Bank 2, L39P | I/O, VREF Bank 2, L41N_Y | I/O, VREF Bank 2, L41N   | I/O, VREF Bank 2, L41N_Y | I/O, VREF Bank 2, L41N   |
| I/O, L#P              | 2    | K17 | XC2S100, 150E, 200E, 400E        | -                       | I/O, L28P_Y                   | I/O, L38N_Y            | I/O, L41P_Y              | I/O, L41P                | I/O, L41P_Y              | I/O, L41P                |
| I/O, L#N              | 2    | J22 | XC2S150E, 300E, 600E             | -                       | I/O                           | I/O, L38P_Y            | I/O, L40N                | I/O, L40N_Y              | I/O, L40N                | I/O, L40N_Y              |
| I/O, L#P              | 2    | J21 | XC2S300E, 600E                   | -                       | -                             | -                      | I/O, L40P                | I/O, L40P_Y              | I/O, L40P                | I/O, L40P_Y              |
| I/O, L#N              | 2    | J20 | XC2S150E, 200E, 300E, 600E       | -                       | -                             | I/O, L37N_Y            | I/O, L39N_Y              | I/O, L39N_Y              | I/O, L39N                | I/O, L39N_Y              |
| I/O, L#P              | 2    | J19 | XC2S100E, 150E, 200E, 300E, 600E | -                       | I/O, L27N_Y                   | I/O, L37P_Y            | I/O, L39P_Y              | I/O, L39P_Y              | I/O, L39P                | I/O, L39P_Y              |
| I/O                   | 2    | H22 | XC2S100E, 150E                   | -                       | I/O, L27P_Y                   | I/O, L36N_Y            | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#N              | 2    | J18 | XC2S150E, 200E, 300E, 400E, 600E | -                       | -                             | I/O, L36P_Y            | I/O, L38N_Y              | I/O, L38N_Y              | I/O, L38N_Y              | I/O, L38N_Y              |
| I/O, L#P              | 2    | J17 | XC2S200E, 300E, 400E, 600E       | -                       | -                             | -                      | I/O, L38P_Y              | I/O, L38P_Y              | I/O, L38P_Y              | I/O, L38P_Y              |
| I/O, L#N              | 2    | H21 | XC2S150E, 200E, 300E, 400E, 600E | -                       | I/O                           | I/O, L35N_Y            | I/O, L37N_Y              | I/O, L37N_Y              | I/O, L37N_Y              | I/O, L37N_Y              |
| I/O (D2), L#P         | 2    | H20 | XC2S150E, 200E, 300E, 400E, 600E | -                       | I/O (D2)                      | I/O (D2), L35P_Y       | I/O (D2), L37P_Y         | I/O (D2), L37P_Y         | I/O (D2), L37P_Y         | I/O (D2), L37P_Y         |
| I/O (D1), L#N         | 2    | H19 | XC2S300E, 400E, 600E             | -                       | I/O (D1), L26N                | I/O (D1), L34N         | I/O (D1), L36N           | I/O (D1), L36N_Y         | I/O (D1), L36N_Y         | I/O (D1), L36N_Y         |
| I/O, VREF Bank 2, L#P | 2    | H18 | XC2S300E, 400E, 600E             | All                     | I/O, VREF Bank 2, L26P        | I/O, VREF Bank 2, L34P | I/O, VREF Bank 2, L36P   | I/O, VREF Bank 2, L36P_Y | I/O, VREF Bank 2, L36P_Y | I/O, VREF Bank 2, L36P_Y |
| I/O                   | 2    | G22 | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O                   | 2    | F22 | -                                | -                       | I/O                           | I/O                    | I/O                      | I/O                      | I/O                      | I/O                      |

DS077-4 (v3.0) August 9, 2013  
**Product Specification**

**FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)**

| Pad Name                 |      | Pin | LVDS Async. Output Option        | V <sub>REF</sub> Option    | Device-Specific Pinouts: XC2S |                           |                           |                           |                           |                           |
|--------------------------|------|-----|----------------------------------|----------------------------|-------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Function                 | Bank |     |                                  |                            | 100E                          | 150E                      | 200E                      | 300E                      | 400E                      | 600E                      |
| I/O (WRITE), L#N_YY      | 1    | A20 | All                              | -                          | I/O (WRITE), L20N_YY          | I/O (WRITE), L26N_YY      | I/O (WRITE), L28N_YY      | I/O (WRITE), L28N_YY      | I/O (WRITE), L28N_YY      | I/O (WRITE), L28N_YY      |
| I/O                      | 1    | D18 | -                                | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O                      | 1    | C18 | -                                | -                          | -                             | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#P                 | 1    | B19 | XC2S200E, 300E, 400E, 600E       | -                          | -                             | I/O, L25P                 | I/O, L27P_Y               | I/O, L27P_Y               | I/O, L27P_Y               | I/O, L27P_Y               |
| I/O, L#N                 | 1    | A19 | XC2S200E, 300E, 400E, 600E       | -                          | I/O                           | I/O, L25N                 | I/O, L27N_Y               | I/O, L27N_Y               | I/O, L27N_Y               | I/O, L27N_Y               |
| I/O, L#P                 | 1    | B18 | XC2S100E, 200E, 300E, 400E, 600E | XC2S200E, 300E, 400E, 600E | I/O, L19P_Y                   | I/O, L24P                 | I/O, VREF Bank 1, L26P_Y  | I/O, VREF Bank 1, L26P_Y  | I/O, VREF Bank 1, L26P_Y  | I/O, VREF Bank 1, L26P_Y  |
| I/O, L#N                 | 1    | A18 | XC2S100E, 200E, 300E, 400E, 600E | -                          | I/O, L19N_Y                   | I/O, L24N                 | I/O, L26N_Y               | I/O, L26N_Y               | I/O, L26N_Y               | I/O, L26N_Y               |
| I/O                      | 1    | D17 | -                                | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O                      | 1    | C17 | -                                | -                          | -                             | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#P_YY              | 1    | B17 | All                              | -                          | I/O, L18P_YY                  | I/O, L23P_YY              | I/O, L25P_YY              | I/O, L25P_YY              | I/O, L25P_YY              | I/O, L25P_YY              |
| I/O, L#N_YY              | 1    | A17 | All                              | -                          | I/O, L18N_YY                  | I/O, L23N_YY              | I/O, L25N_YY              | I/O, L25N_YY              | I/O, L25N_YY              | I/O, L25N_YY              |
| I/O, VREF Bank 1, L#P_YY | 1    | E16 | All                              | All                        | I/O, VREF Bank 1, L17P_YY     | I/O, VREF Bank 1, L22P_YY | I/O, VREF Bank 1, L24P_YY | I/O, VREF Bank 1, L24P_YY | I/O, VREF Bank 1, L24P_YY | I/O, VREF Bank 1, L24P_YY |
| I/O, L#N_YY              | 1    | E17 | All                              | -                          | I/O, L17N_YY                  | I/O, L22N_YY              | I/O, L24N_YY              | I/O, L24N_YY              | I/O, L24N_YY              | I/O, L24N_YY              |
| I/O                      | 1    | E15 | -                                | -                          | -                             | I/O                       | I/O                       | I/O                       | I/O                       | I/O                       |
| I/O, L#P                 | 1    | D16 | XC2S300E, 600E                   | -                          | -                             | I/O, L21P                 | I/O, L23P                 | I/O, L23P_Y               | I/O, L23P                 | I/O, L23P_Y               |
| I/O, L#N                 | 1    | C16 | XC2S300E, 600E                   | -                          | I/O                           | I/O, L21N                 | I/O, L23N                 | I/O, L23N_Y               | I/O, L23N                 | I/O, L23N_Y               |
| I/O, L#P                 | 1    | B16 | XC2S100E, 300E, 600E             | XC2S600E                   | I/O, L16P_Y                   | I/O, L20P                 | I/O, L22P                 | I/O, L22P_Y               | I/O, L22P                 | I/O, VREF Bank 1, L22P_Y  |
| I/O, L#N                 | 1    | A16 | XC2S100E, 300E, 600E             | -                          | I/O, L16N_Y                   | I/O, L20N                 | I/O, L22N                 | I/O, L22N_Y               | I/O, L22N                 | I/O, L22N_Y               |
| I/O                      | 1    | F14 | -                                | -                          | -                             | -                         | -                         | I/O                       | I/O                       | I/O                       |
| I/O, VREF Bank 1, L#P    | 1    | D15 | XC2S100E, 200E, 300E, 400E, 600E | All                        | I/O, VREF Bank 1, L15P_Y      | I/O, VREF Bank 1, L19P    | I/O, VREF Bank 1, L21P_Y  | I/O, VREF Bank 1, L21P_Y  | I/O, VREF Bank 1, L21P_Y  | I/O, VREF Bank 1, L21P_Y  |
| I/O, L#N                 | 1    | C15 | XC2S100E, 200E, 300E, 400E, 600E | -                          | I/O, L15N_Y                   | I/O, L19N                 | I/O, L21N_Y               | I/O, L21N_Y               | I/O, L21N_Y               | I/O, L21N_Y               |
| I/O, L#P                 | 1    | B15 | XC2S100E, 200E, 300E, 400E, 600E | -                          | I/O, L14P_Y                   | I/O, L18P                 | I/O, L20P_Y               | I/O, L20P_Y               | I/O, L20P_Y               | I/O, L20P_Y               |

**FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)**

| Pad Name              |      | Pin | LVDS Async. Output Option        | V <sub>REF</sub> Option | Device-Specific Pinouts: XC2S |                        |                          |                          |                          |                          |
|-----------------------|------|-----|----------------------------------|-------------------------|-------------------------------|------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Function              | Bank |     |                                  |                         | 100E                          | 150E                   | 200E                     | 300E                     | 400E                     | 600E                     |
| I/O, L#N              | 1    | A15 | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L14N_Y                   | I/O, L18N              | I/O, L20N_Y              | I/O, L20N_Y              | I/O, L20N_Y              | I/O, L20N_Y              |
| I/O                   | 1    | E14 | -                                | -                       | -                             | -                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P              | 1    | D14 | XC2S150E, 300E, 400E, 600E       | -                       | -                             | I/O, L17P_Y            | I/O, L19P                | I/O, L19P_Y              | I/O, L19P_Y              | I/O, L19P_Y              |
| I/O, L#N              | 1    | C14 | XC2S100E, 150E, 300E, 400E, 600E | -                       | I/O, L13P_Y                   | I/O, L17N_Y            | I/O, L19N                | I/O, L19N_Y              | I/O, L19N_Y              | I/O, L19N_Y              |
| I/O, L#P              | 1    | B14 | XC2S100E, 150E, 300E, 400E, 600E | -                       | I/O, L13N_Y                   | I/O, L16P_Y            | I/O, L18P                | I/O, L18P_Y              | I/O, L18P_Y              | I/O, L18P_Y              |
| I/O, L#N              | 1    | A14 | XC2S150E, 300E, 400E, 600E       | -                       | -                             | I/O, L16N_Y            | I/O, L18N                | I/O, L18N_Y              | I/O, L18N_Y              | I/O, L18N_Y              |
| I/O                   | 1    | E13 | -                                | -                       | -                             | -                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P              | 1    | D13 | XC2S200E, 300E, 400E, 600E       | -                       | I/O, L12P                     | I/O, L15P              | I/O, L17P_Y              | I/O, L17P_Y              | I/O, L17P_Y              | I/O, L17P_Y              |
| I/O, L#N              | 1    | C13 | XC2S200E, 300E, 400E, 600E       | -                       | I/O, L12N                     | I/O, L15N              | I/O, L17N_Y              | I/O, L17N_Y              | I/O, L17N_Y              | I/O, L17N_Y              |
| I/O, VREF Bank 1, L#P | 1    | B13 | XC2S200E, 300E, 400E, 600E       | All                     | I/O, VREF Bank 1, L11P        | I/O, VREF Bank 1, L14P | I/O, VREF Bank 1, L16P_Y | I/O, VREF Bank 1, L16P_Y | I/O, VREF Bank 1, L16P_Y | I/O, VREF Bank 1, L16P_Y |
| I/O, L#N              | 1    | A13 | XC2S200E, 300E, 400E, 600E       | -                       | I/O, L11N                     | I/O, L14N              | I/O, L16N_Y              | I/O, L16N_Y              | I/O, L16N_Y              | I/O, L16N_Y              |
| I/O                   | 1    | F13 | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O, L#P              | 1    | C12 | XC2S300E, 600E                   | -                       | -                             | -                      | I/O, L15P                | I/O, L15P_Y              | I/O, L15P                | I/O, L15P_Y              |
| I/O, L#N              | 1    | B12 | XC2S300E, 600E                   | -                       | I/O, L10P                     | I/O                    | I/O, L15N                | I/O, L15N_Y              | I/O, L15N                | I/O, L15N_Y              |
| I/O, L#P              | 1    | D12 | XC2S150E, 300E, 600E             | XC2S400E, 600E          | I/O, L10N                     | I/O, L13P_Y            | I/O, L14P                | I/O, L14P_Y              | I/O, VREF Bank 1, L14P   | I/O, VREF Bank 1, L14P_Y |
| I/O, L#N              | 1    | E12 | XC2S150E, 300E, 600E             | -                       | -                             | I/O, L13N_Y            | I/O, L14N                | I/O, L14N_Y              | I/O, L14N                | I/O, L14N_Y              |
| I/O                   | 1    | F12 | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O (DLL), L#P        | 1    | A12 | -                                | -                       | I/O (DLL), L9P                | I/O (DLL), L12P        | I/O (DLL), L13P          | I/O (DLL), L13P          | I/O (DLL), L13P          | I/O (DLL), L13P          |
| GCK2, I               | 1    | A11 | -                                | -                       | GCK2, I                       | GCK2, I                | GCK2, I                  | GCK2, I                  | GCK2, I                  | GCK2, I                  |
|                       |      |     |                                  |                         |                               |                        |                          |                          |                          |                          |
| GCK3, I               | 0    | C11 | -                                | -                       | GCK3, I                       | GCK3, I                | GCK3, I                  | GCK3, I                  | GCK3, I                  | GCK3, I                  |
| I/O (DLL), L#N        | 0    | B11 | -                                | -                       | I/O (DLL), L9N                | I/O (DLL), L12N        | I/O (DLL), L13N          | I/O (DLL), L13N          | I/O (DLL), L13N          | I/O (DLL), L13N          |
| I/O                   | 0    | D11 | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |

**FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)**

| Pad Name              |      | Pin | LVDS Async. Output Option        | V <sub>REF</sub> Option | Device-Specific Pinouts: XC2S |                        |                          |                          |                          |                          |
|-----------------------|------|-----|----------------------------------|-------------------------|-------------------------------|------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Function              | Bank |     |                                  |                         | 100E                          | 150E                   | 200E                     | 300E                     | 400E                     | 600E                     |
| I/O                   | 0    | F11 | -                                | XC2S400E, 600E          | -                             | -                      | I/O                      | I/O                      | I/O, VREF Bank 0         | I/O, VREF Bank 0         |
| I/O, L#P              | 0    | A10 | XC2S300E, 600E                   | -                       | I/O                           | I/O, L11P              | I/O, L12P                | I/O, L12P_Y              | I/O, L12P                | I/O, L12P_Y              |
| I/O, L#N              | 0    | B10 | XC2S300E, 600E                   | -                       | -                             | I/O, L11N              | I/O, L12N                | I/O, L12N_Y              | I/O, L12N                | I/O, L12N_Y              |
| I/O                   | 0    | E11 | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O, L#P              | 0    | C10 | XC2S200E, 300E, 400E, 600E       | -                       | I/O, L8P                      | I/O, L10P              | I/O, L11P_Y              | I/O, L11P_Y              | I/O, L11P_Y              | I/O, L11P_Y              |
| I/O, VREF Bank 0, L#N | 0    | D10 | XC2S200E, 300E, 400E, 600E       | All                     | I/O, VREF Bank 0, L8N         | I/O, VREF Bank 0, L10N | I/O, VREF Bank 0, L11N_Y | I/O, VREF Bank 0, L11N_Y | I/O, VREF Bank 0, L11N_Y | I/O, VREF Bank 0, L11N_Y |
| I/O                   | 0    | F10 | -                                | -                       | I/O, L7P                      | I/O                    | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P              | 0    | A9  | -                                | -                       | I/O, L7N                      | I/O                    | I/O, L10P                | I/O, L10P                | I/O, L10P                | I/O, L10P                |
| I/O, L#N              | 0    | B9  | -                                | -                       | -                             | -                      | I/O, L10N                | I/O, L10N                | I/O, L10N                | I/O, L10N                |
| I/O                   | 0    | E10 | -                                | -                       | -                             | -                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P              | 0    | C9  | XC2S100E, 150E, 200E             | -                       | I/O, L6P_Y                    | I/O, L9P_Y             | I/O, L9P_Y               | I/O, L9P                 | I/O, L9P                 | I/O, L9P                 |
| I/O, L#N              | 0    | D9  | XC2S100E, 150E, 200E             | -                       | I/O, L6N_Y                    | I/O, L9N_Y             | I/O, L9N_Y               | I/O, L9N                 | I/O, L9N                 | I/O, L9N                 |
| I/O, L#P              | 0    | F9  | XC2S150E, 200E                   | -                       | -                             | I/O, L8P_Y             | I/O, L8P_Y               | I/O, L8P                 | I/O, L8P                 | I/O, L8P                 |
| I/O, L#N              | 0    | E9  | XC2S150E, 200E                   | -                       | -                             | I/O, L8N_Y             | I/O, L8N_Y               | I/O, L8N                 | I/O, L8N                 | I/O, L8N                 |
| I/O, L#P              | 0    | A8  | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L5P_Y                    | I/O, L7P               | I/O, L7P_Y               | I/O, L7P_Y               | I/O, L7P_Y               | I/O, L7P_Y               |
| I/O, L#N              | 0    | B8  | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L5N_Y                    | I/O, L7N               | I/O, L7N_Y               | I/O, L7N_Y               | I/O, L7N_Y               | I/O, L7N_Y               |
| I/O, L#P              | 0    | C8  | XC2S100E, 200E, 300E, 400E, 600E | -                       | I/O, L4P_Y                    | I/O, L6P               | I/O, L6P_Y               | I/O, L6P_Y               | I/O, L6P_Y               | I/O, L6P_Y               |
| I/O, VREF Bank 0, L#N | 0    | D8  | XC2S100E, 200E, 300E, 400E, 600E | All                     | I/O, VREF Bank 0, L4N_Y       | I/O, VREF Bank 0, L6N  | I/O, VREF Bank 0, L6N_Y  | I/O, VREF Bank 0, L6N_Y  | I/O, VREF Bank 0, L6N_Y  | I/O, VREF Bank 0, L6N_Y  |
| I/O                   | 0    | A7  | -                                | -                       | -                             | -                      | -                        | I/O                      | I/O                      | I/O                      |
| I/O                   | 0    | B7  | -                                | -                       | I/O                           | I/O                    | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P              | 0    | C7  | XC2S150E, 200E                   | XC2S600E                | I/O, L3P                      | I/O, L5P_Y             | I/O, L5P_Y               | I/O, L5P                 | I/O, L5P                 | I/O, VREF Bank 0, L5P    |
| I/O, L#N              | 0    | D7  | XC2S150E, 200E                   | -                       | I/O, L3N                      | I/O, L5N_Y             | I/O, L5N_Y               | I/O, L5N                 | I/O, L5N                 | I/O, L5N                 |
| I/O, L#P              | 0    | E8  | XC2S150E, 200E                   | -                       | -                             | I/O, L4P_Y             | I/O, L4P_Y               | I/O, L4P                 | I/O, L4P                 | I/O, L4P                 |
| I/O, L#N              | 0    | E7  | XC2S150E, 200E                   | -                       | -                             | I/O, L4N_Y             | I/O, L4N_Y               | I/O, L4N                 | I/O, L4N                 | I/O, L4N                 |

## FG456 Pinouts (XC2S100E, XC2S150E, XC2S200E, XC2S300E, XC2S400E, XC2S600E)

| Pad Name                 |      | Pin | LVDS Async. Output Option        | V <sub>REF</sub> Option    | Device-Specific Pinouts: XC2S |                          |                          |                          |                          |                          |
|--------------------------|------|-----|----------------------------------|----------------------------|-------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Function                 | Bank |     |                                  |                            | 100E                          | 150E                     | 200E                     | 300E                     | 400E                     | 600E                     |
| I/O, L#P_YY              | 0    | A6  | All                              | -                          | I/O, L2P_YY                   | I/O, L3P_YY              | I/O, L3P_YY              | I/O, L3P_YY              | I/O, L3P_YY              | I/O, L3P_YY              |
| I/O, VREF Bank 0, L#N_YY | 0    | B6  | All                              | All                        | I/O, VREF Bank 0, L2N_YY      | I/O, VREF Bank 0, L3N_YY | I/O, VREF Bank 0, L3N_YY | I/O, VREF Bank 0, L3N_YY | I/O, VREF Bank 0, L3N_YY | I/O, VREF Bank 0, L3N_YY |
| I/O                      | 0    | C6  | XC2S100E                         | -                          | I/O, L1P_Y                    | I/O                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P                 | 0    | A5  | XC2S100E                         | -                          | I/O, L1N_Y                    | I/O, L2P                 | I/O, L2P                 | I/O, L2P                 | I/O, L2P                 | I/O, L2P                 |
| I/O, L#N                 | 0    | B5  | -                                | -                          | -                             | I/O, L2N                 | I/O, L2N                 | I/O, L2N                 | I/O, L2N                 | I/O, L2N                 |
| I/O                      | 0    | D6  | -                                | -                          | -                             | -                        | -                        | I/O                      | I/O                      | I/O                      |
| I/O, L#P                 | 0    | B4  | XC2S100E, 200E, 300E, 400E, 600E | -                          | I/O, L0P_Y                    | I/O, L1P                 | I/O, L1P_Y               | I/O, L1P_Y               | I/O, L1P_Y               | I/O, L1P_Y               |
| I/O, L#N                 | 0    | C5  | XC2S100E, 200E, 300E, 400E, 600E | XC2S200E, 300E, 400E, 600E | I/O, L0N_Y                    | I/O, L1N                 | I/O, VREF Bank 0, L1N_Y  | I/O, VREF Bank 0, L1N_Y  | I/O, VREF Bank 0, L1N_Y  | I/O, VREF Bank 0, L1N_Y  |
| I/O                      | 0    | A4  | -                                | -                          | I/O                           | I/O                      | I/O                      | I/O                      | I/O                      | I/O                      |
| I/O, L#P                 | 0    | A3  | XC2S150E, 400E, 600E             | -                          | -                             | I/O, L0P_Y               | I/O, L0P                 | I/O, L0P                 | I/O, L0P_Y               | I/O, L0P_Y               |
| I/O, L#N                 | 0    | B3  | XC2S150E, 400E, 600E             | -                          | -                             | I/O, L0N_Y               | I/O, L0N                 | I/O, L0N                 | I/O, L0N_Y               | I/O, L0N_Y               |
| I/O                      | 0    | C4  | -                                | -                          | -                             | -                        | -                        | I/O                      | I/O                      | I/O                      |
| I/O                      | 0    | D5  | -                                | -                          | I/O                           | I/O                      | I/O                      | I/O                      | I/O                      | I/O                      |
| TCK                      | -    | E6  | -                                | -                          | TCK                           | TCK                      | TCK                      | TCK                      | TCK                      | TCK                      |

### Notes:

- Although designated with the \_YY suffix in the XC2S100E, XC2S150E, XC2S200E, and XC2S300E, these differential pairs are not asynchronous in the XC2S400E.

## FG456 Differential Clock Pins

| Clock | Bank | P    |         | N    |                |
|-------|------|------|---------|------|----------------|
|       |      | Pin  | Name    | Pin  | Name           |
| GCK0  | 4    | AA12 | GCK0, I | Y12  | I/O (DLL), L#P |
| GCK1  | 5    | AB12 | GCK1, I | AB11 | I/O (DLL), L#N |
| GCK2  | 1    | A11  | GCK2, I | A12  | I/O (DLL), L#P |
| GCK3  | 0    | C11  | GCK3, I | B11  | I/O (DLL), L#N |

## Additional FG456 Package Pins

| VCCINT Pins       |                    |     |     |                   |                    |    |     |     |
|-------------------|--------------------|-----|-----|-------------------|--------------------|----|-----|-----|
| D4 <sup>(1)</sup> | D19 <sup>(1)</sup> | E5  | E18 | F6                | F17                | G7 | G8  | G15 |
| G16               | H7                 | H16 | R7  | R16               | T7                 | T8 | T15 | T16 |
| U6                | U17                | V5  | V18 | W4 <sup>(1)</sup> | W19 <sup>(1)</sup> | -  | -   | -   |
| VCCO Bank 0 Pins  |                    |     |     |                   |                    |    |     |     |
| F7                | F8                 | G9  | G10 | -                 | -                  | -  | -   | -   |

### Additional FG456 Package Pins (Continued)

|                           |                   |                    |                    |                     |                    |                   |                    |                     |
|---------------------------|-------------------|--------------------|--------------------|---------------------|--------------------|-------------------|--------------------|---------------------|
| <b>VCCO Bank 1 Pins</b>   |                   |                    |                    |                     |                    |                   |                    |                     |
| F15                       | F16               | G13                | G14                | -                   | -                  | -                 | -                  | -                   |
| <b>VCCO Bank 2 Pins</b>   |                   |                    |                    |                     |                    |                   |                    |                     |
| G17                       | H17               | J16                | K16                | -                   | -                  | -                 | -                  | -                   |
| <b>VCCO Bank 3 Pins</b>   |                   |                    |                    |                     |                    |                   |                    |                     |
| N16                       | P16               | R17                | T17                | -                   | -                  | -                 | -                  | -                   |
| <b>VCCO Bank 4 Pins</b>   |                   |                    |                    |                     |                    |                   |                    |                     |
| T13                       | T14               | U15                | U16                | -                   | -                  | -                 | -                  | -                   |
| <b>VCCO Bank 5 Pins</b>   |                   |                    |                    |                     |                    |                   |                    |                     |
| T9                        | T10               | U7                 | U8                 | -                   | -                  | -                 | -                  | -                   |
| <b>VCCO Bank 6 Pins</b>   |                   |                    |                    |                     |                    |                   |                    |                     |
| N7                        | P7                | R6                 | T6                 | -                   | -                  | -                 | -                  | -                   |
| <b>VCCO Bank 7 Pins</b>   |                   |                    |                    |                     |                    |                   |                    |                     |
| G6                        | H6                | J7                 | K7                 | -                   | -                  | -                 | -                  | -                   |
| <b>GND Pins</b>           |                   |                    |                    |                     |                    |                   |                    |                     |
| A1                        | A2 <sup>(2)</sup> | A22                | B1 <sup>(2)</sup>  | B2                  | B21                | C3                | C20                | G11                 |
| G12                       | J9                | J10                | J11                | J12                 | J13                | J14               | K9                 | K10                 |
| K11                       | K12               | K13                | K14                | L7                  | L9                 | L10               | L11                | L12                 |
| L13                       | L14               | L16                | M7                 | M9                  | M10                | M11               | M12                | M13                 |
| M14                       | M16               | N9                 | N10                | N11                 | N12                | N13               | N14                | P9                  |
| P10                       | P11               | P12                | P13                | P14                 | T11                | T12               | Y20                | Y3                  |
| Y4 <sup>(2)</sup>         | AA2               | AA4 <sup>(2)</sup> | AA21               | AA22 <sup>(2)</sup> | AB1                | AB22              | -                  | -                   |
| <b>Not Connected Pins</b> |                   |                    |                    |                     |                    |                   |                    |                     |
| A2 <sup>(2)</sup>         | B1 <sup>(2)</sup> | D4 <sup>(1)</sup>  | D19 <sup>(1)</sup> | W4 <sup>(1)</sup>   | W19 <sup>(1)</sup> | Y4 <sup>(2)</sup> | AA4 <sup>(2)</sup> | AA22 <sup>(2)</sup> |

**Notes:**

- VCCINT connections in XC2S400E and XC2S600E. No Connects (no internal connection) in XC2S100E, XC2S150E, XC2S200E, and XC2S300E.
- GND connections in XC2S400E and XC2S600E. No Connects (no internal connection) in XC2S100E, XC2S150E, XC2S200E, and XC2S300E.

### FG676 Pinouts (XC2S400E, XC2S600E)

| Pad Name      |      | Pin | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts |               |
|---------------|------|-----|------------------------------|----------------|-------------------------|---------------|
| Function      | Bank |     |                              |                | XC2S400E                | XC2S600E      |
| TMS           | -    | B1  | -                            | -              | TMS                     | TMS           |
| I/O           | 7    | D3  | -                            | -              | I/O                     | I/O           |
| I/O, L204P    | 7    | C2  | -                            | -              | -                       | I/O, L204P    |
| I/O, L204N    | 7    | C1  | -                            | -              | -                       | I/O, L204N    |
| I/O, L203P    | 7    | D2  | XC2S600E                     | -              | -                       | I/O, L203P_Y  |
| I/O, L203N    | 7    | D1  | XC2S600E                     | -              | I/O                     | I/O, L203N_Y  |
| I/O, L202P_YY | 7    | E2  | All                          | -              | I/O, L202P_YY           | I/O, L202P_YY |
| I/O, L202N_YY | 7    | E1  | All                          | -              | I/O, L202N_YY           | I/O, L202N_YY |

**FG676 Pinouts (XC2S400E, XC2S600E) (Continued)**

| Pad Name                      |      | Pin | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts       |                               |
|-------------------------------|------|-----|------------------------------|----------------|-------------------------------|-------------------------------|
| Function                      | Bank |     |                              |                | XC2S400E                      | XC2S600E                      |
| I/O, L201P                    | 7    | E4  | XC2S400E                     | -              | I/O, L201P_Y                  | I/O, L201P                    |
| I/O, L201N                    | 7    | F5  | XC2S400E                     | -              | I/O, L201N_Y                  | I/O, L201N                    |
| I/O, VREF Bank 7,<br>L200P    | 7    | F4  | XC2S600E                     | All            | I/O, VREF Bank 7,<br>L200P    | I/O, VREF Bank 7,<br>L200P_Y  |
| I/O, L200N                    | 7    | F3  | XC2S600E                     | -              | I/O, L200N                    | I/O, L200N_Y                  |
| I/O, L199P                    | 7    | F2  | XC2S600E                     | -              | -                             | I/O, L199P_Y                  |
| I/O, L199N                    | 7    | F1  | XC2S600E                     | -              | I/O                           | I/O, L199N_Y                  |
| I/O, L198P                    | 7    | G6  | XC2S400E                     | -              | I/O, L198P_Y                  | I/O, L198P                    |
| I/O, L198N                    | 7    | G5  | XC2S400E                     | -              | I/O, L198N_Y                  | I/O, L198N                    |
| I/O, L197P                    | 7    | G4  | XC2S600E                     | -              | I/O, L197P                    | I/O, L197P_Y                  |
| I/O, L197N                    | 7    | G3  | XC2S600E                     | -              | I/O, L197N                    | I/O, L197N_Y                  |
| I/O, VREF Bank 7,<br>L196P_YY | 7    | G2  | All                          | All            | I/O, VREF Bank 7,<br>L196P_YY | I/O, VREF Bank 7,<br>L196P_YY |
| I/O, L196N_YY                 | 7    | G1  | All                          | -              | I/O, L196N_YY                 | I/O, L196N_YY                 |
| I/O                           | 7    | H7  | -                            | -              | I/O                           | I/O                           |
| I/O, L195P_YY                 | 7    | H6  | All                          | -              | I/O, L195P_YY                 | I/O, L195P_YY                 |
| I/O, L195N_YY                 | 7    | H5  | All                          | -              | I/O, L195N_YY                 | I/O, L195N_YY                 |
| I/O                           | 7    | J8  | -                            | -              | -                             | I/O                           |
| I/O, L194P                    | 7    | H2  | XC2S400E                     | -              | I/O, L194P_Y                  | I/O, L194P                    |
| I/O, L194N                    | 7    | H1  | XC2S400E                     | -              | I/O, L194N_Y                  | I/O, L194N                    |
| I/O, L193P                    | 7    | J7  | XC2S600E                     | XC2S600E       | I/O                           | I/O, VREF Bank 7,<br>L193P_Y  |
| I/O, L193N                    | 7    | J6  | XC2S600E                     | -              | -                             | I/O, L193N_Y                  |
| I/O                           | 7    | J5  | -                            | -              | I/O                           | I/O                           |
| I/O, L192P_YY                 | 7    | J4  | All                          | -              | I/O, L192P_YY                 | I/O, L192P_YY                 |
| I/O, L192N_YY                 | 7    | J3  | All                          | -              | I/O, L192N_YY                 | I/O, L192N_YY                 |
| I/O                           | 7    | K5  | -                            | -              | I/O                           | I/O                           |
| I/O, VREF Bank 7,<br>L191P_YY | 7    | J2  | All                          | All            | I/O, VREF Bank 7,<br>L191P_YY | I/O, VREF Bank 7,<br>L191P_YY |
| I/O, L191N_YY                 | 7    | J1  | All                          | -              | I/O, L191N_YY                 | I/O, L191N_YY                 |
| I/O, L190P_YY                 | 7    | K8  | All                          | -              | I/O, L190P_YY                 | I/O, L190P_YY                 |
| I/O, L190N_YY                 | 7    | K7  | All                          | -              | I/O, L190N_YY                 | I/O, L190N_YY                 |
| I/O                           | 7    | K4  | -                            | -              | -                             | I/O                           |
| I/O, L189P_YY                 | 7    | K3  | All                          | -              | I/O, L189P_YY                 | I/O, L189P_YY                 |
| I/O, L189N_YY                 | 7    | K2  | All                          | -              | I/O, L189N_YY                 | I/O, L189N_YY                 |
| I/O                           | 7    | K1  | -                            | -              | -                             | I/O                           |

### FG676 Pinouts (XC2S400E, XC2S600E) (Continued)

| Pad Name                      |      | Pin | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts       |                               |
|-------------------------------|------|-----|------------------------------|----------------|-------------------------------|-------------------------------|
| Function                      | Bank |     |                              |                | XC2S400E                      | XC2S600E                      |
| I/O, L188P                    | 7    | L8  | XC2S400E                     | -              | I/O, L188P_Y                  | I/O, L188P                    |
| I/O, L188N                    | 7    | L7  | XC2S400E                     | -              | I/O, L188N_Y                  | I/O, L188N                    |
| I/O, L187P                    | 7    | L6  | XC2S600E                     | -              | I/O, L187P                    | I/O, L187P_Y                  |
| I/O, L187N                    | 7    | L5  | XC2S600E                     | -              | I/O, L187N                    | I/O, L187N_Y                  |
| I/O                           | 7    | L3  | -                            | -              | -                             | I/O                           |
| I/O, L186P                    | 7    | L2  | XC2S600E                     | -              | I/O, L186P                    | I/O, L186P_Y                  |
| I/O, L186N                    | 7    | L1  | XC2S600E                     | -              | I/O, L186N                    | I/O, L186N_Y                  |
| I/O                           | 7    | M9  | -                            | -              | -                             | I/O                           |
| I/O, L185P                    | 7    | M8  | XC2S600E                     | -              | I/O, L185P                    | I/O, L185P_Y                  |
| I/O, L185N                    | 7    | M7  | XC2S600E                     | -              | I/O, L185N                    | I/O, L185N_Y                  |
| I/O, VREF Bank 7,<br>L184P_YY | 7    | M6  | All                          | All            | I/O, VREF Bank 7,<br>L184P_YY | I/O, VREF Bank 7,<br>L184P_YY |
| I/O, L184N_YY                 | 7    | M5  | All                          | -              | I/O, L184N_YY                 | I/O, L184N_YY                 |
| I/O                           | 7    | M4  | -                            | -              | -                             | I/O                           |
| I/O, L183P_YY                 | 7    | M2  | All                          | -              | I/O, L183P_YY                 | I/O, L183P_YY                 |
| I/O, L183N_YY                 | 7    | M1  | All                          | -              | I/O, L183N_YY                 | I/O, L183N_YY                 |
| I/O                           | 7    | N9  | -                            | -              | -                             | I/O                           |
| I/O, L182P                    | 7    | N8  | XC2S400E                     | -              | I/O, L182P_Y                  | I/O, L182P                    |
| I/O, L182N                    | 7    | N7  | XC2S400E                     | -              | I/O, L182N_Y                  | I/O, L182N                    |
| I/O, VREF Bank 7,<br>L181P    | 7    | N6  | XC2S600E                     | All            | I/O, VREF Bank 7,<br>L181P    | I/O, VREF Bank 7,<br>L181P_Y  |
| I/O, L181N                    | 7    | N5  | XC2S600E                     | -              | I/O, L181N                    | I/O, L181N_Y                  |
| I/O                           | 7    | N4  | -                            | -              | -                             | I/O                           |
| I/O, L180P_YY                 | 7    | N3  | All                          | -              | I/O, L180P_YY                 | I/O, L180P_YY                 |
| I/O, L180N_YY                 | 7    | N2  | All                          | -              | I/O, L180N_YY                 | I/O, L180N_YY                 |
| I/O                           | 7    | N1  | -                            | -              | -                             | I/O                           |
| I/O, L179P_YY                 | 7    | P1  | All                          | -              | I/O, L179P_YY                 | I/O, L179P_YY                 |
| I/O (IRDY), L179N_YY          | 7    | P2  | All                          | -              | I/O (IRDY),<br>L179N_YY       | I/O (IRDY), L179N_YY          |
|                               |      |     |                              |                |                               |                               |
| I/O (TRDY), L178P             | 6    | P3  | XC2S600E                     | -              | I/O (TRDY)                    | I/O (TRDY), L178P_Y           |
| I/O, L178N                    | 6    | P4  | XC2S600E                     | -              | -                             | I/O, L178N_Y                  |
| I/O, L177P                    | 6    | P5  | XC2S600E                     | -              | -                             | I/O, L177P_Y                  |
| I/O, L177N                    | 6    | P6  | XC2S600E                     | -              | I/O                           | I/O, L177N_Y                  |
| I/O                           | 6    | P7  | -                            | -              | I/O                           | I/O                           |
| I/O, L176P                    | 6    | P8  | XC2S600E                     | -              | I/O, L176P                    | I/O, L176P_Y                  |

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### FG676 Pinouts (XC2S400E, XC2S600E) (Continued)

| Pad Name                      |      | Pin | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts       |                               |
|-------------------------------|------|-----|------------------------------|----------------|-------------------------------|-------------------------------|
| Function                      | Bank |     |                              |                | XC2S400E                      | XC2S600E                      |
| I/O, L164N                    | 6    | W2  | XC2S600E                     | XC2S600E       | I/O, L164N                    | I/O, VREF Bank 6,<br>L164N_Y  |
| I/O, L163P                    | 6    | W5  | XC2S400E                     | -              | I/O, L163P_Y                  | I/O, L163P                    |
| I/O, L163N                    | 6    | W6  | XC2S400E                     | -              | I/O, L163N_Y                  | I/O, L163N                    |
| I/O                           | 6    | W7  | -                            | -              | I/O                           | I/O                           |
| I/O, L162P_YY                 | 6    | Y1  | All                          | -              | I/O, L162P_YY                 | I/O, L162P_YY                 |
| I/O, L162N_YY                 | 6    | Y2  | All                          | -              | I/O, L162N_YY                 | I/O, L162N_YY                 |
| I/O                           | 6    | Y3  | -                            | -              | -                             | I/O                           |
| I/O, L161P_YY                 | 6    | Y4  | All                          | -              | I/O, L161P_YY                 | I/O, L161P_YY                 |
| I/O, VREF Bank 6,<br>L161N_YY | 6    | Y5  | All                          | All            | I/O, VREF Bank 6,<br>L161N_YY | I/O, VREF Bank 6,<br>L161N_YY |
| I/O                           | 6    | Y6  | -                            | -              | I/O                           | I/O                           |
| I/O, L160P_YY                 | 6    | AA1 | All                          | -              | I/O, L160P_YY                 | I/O, L160P_YY                 |
| I/O, L160N_YY                 | 6    | AA2 | All                          | -              | I/O, L160N_YY                 | I/O, L160N_YY                 |
| I/O, L159P                    | 6    | AA3 | XC2S600E                     | -              | I/O, L159P                    | I/O, L159P_Y                  |
| I/O, L159N                    | 6    | AA4 | XC2S600E                     | -              | I/O, L159N                    | I/O, L159N_Y                  |
| I/O                           | 6    | Y7  | -                            | -              | -                             | I/O                           |
| I/O, L158P                    | 6    | AA5 | XC2S600E                     | -              | I/O, L158P                    | I/O, L158P_Y                  |
| I/O, VREF Bank 6,<br>L158N    | 6    | AB5 | XC2S600E                     | All            | I/O, VREF Bank 6,<br>L158N    | I/O, VREF Bank 6,<br>L158N_Y  |
| I/O, L157P                    | 6    | AB1 | XC2S400E                     | -              | I/O, L157P_Y                  | I/O, L157P                    |
| I/O, L157N                    | 6    | AB2 | XC2S400E                     | -              | I/O, L157N_Y                  | I/O, L157N                    |
| I/O, L156P                    | 6    | AC1 | XC2S600E                     | -              | -                             | I/O, L156P_Y                  |
| I/O, L156N                    | 6    | AC2 | XC2S600E                     | -              | I/O                           | I/O, L156N_Y                  |
| I/O, L155P_YY                 | 6    | AC3 | All                          | -              | I/O, L155P_YY                 | I/O, L155P_YY                 |
| I/O, L155N_YY                 | 6    | AB4 | All                          | -              | I/O, L155N_YY                 | I/O, L155N_YY                 |
| I/O, L154P                    | 6    | AD1 | -                            | -              | -                             | I/O, L154P                    |
| I/O, L154N                    | 6    | AD2 | -                            | -              | -                             | I/O, L154N                    |
| I/O, L153P_YY                 | 6    | AE1 | All                          | -              | I/O, L153P_YY                 | I/O, L153P_YY                 |
| I/O, L153N_YY                 | 6    | AF2 | All                          | -              | I/O, L153N_YY                 | I/O, L153N_YY                 |
| M1                            | -    | AE3 | -                            | -              | M1                            | M1                            |
| M0                            | -    | AF3 | -                            | -              | M0                            | M0                            |
| M2                            | -    | AD4 | -                            | -              | M2                            | M2                            |

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### FG676 Pinouts (XC2S400E, XC2S600E) (Continued)

| Pad Name                      |      | Pin  | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts       |                               |
|-------------------------------|------|------|------------------------------|----------------|-------------------------------|-------------------------------|
| Function                      | Bank |      |                              |                | XC2S400E                      | XC2S600E                      |
| I/O, L138P_YY                 | 5    | Y10  | All                          | -              | I/O, L138P_YY                 | I/O, L138P_YY                 |
| I/O, L137N_YY                 | 5    | AB10 | All                          | -              | I/O, L137N_YY                 | I/O, L137N_YY                 |
| I/O, L137P_YY                 | 5    | AC10 | All                          | -              | I/O, L137P_YY                 | I/O, L137P_YY                 |
| I/O                           | 5    | AD10 | -                            | -              | -                             | I/O                           |
| I/O, L136N                    | 5    | AE10 | XC2S600E                     | -              | I/O, L136N                    | I/O, L136N_Y                  |
| I/O, L136P                    | 5    | AF10 | XC2S600E                     | -              | I/O, L136P                    | I/O, L136P_Y                  |
| I/O                           | 5    | AD11 | -                            | -              | -                             | I/O                           |
| I/O, L135N_YY                 | 5    | W11  | All                          | -              | I/O, L135N_YY                 | I/O, L135N_YY                 |
| I/O, L135P_YY                 | 5    | Y11  | All                          | -              | I/O, L135P_YY                 | I/O, L135P_YY                 |
| I/O, L134N_YY                 | 5    | AA11 | All                          | -              | I/O, L134N_YY                 | I/O, L134N_YY                 |
| I/O, L134P_YY                 | 5    | AB11 | All                          | -              | I/O, L134P_YY                 | I/O, L134P_YY                 |
| I/O                           | 5    | V12  | -                            | -              | -                             | I/O                           |
| I/O, L133N                    | 5    | AE11 | -                            | -              | I/O, L133N                    | I/O, L133N                    |
| I/O, L133P                    | 5    | AF11 | -                            | -              | I/O, L133P                    | I/O, L133P                    |
| I/O                           | 5    | W12  | -                            | -              | -                             | I/O                           |
| I/O, L132N_YY                 | 5    | Y12  | All                          | -              | I/O, L132N_YY                 | I/O, L132N_YY                 |
| I/O, L132P_YY                 | 5    | AA12 | All                          | -              | I/O, L132P_YY                 | I/O, L132P_YY                 |
| I/O, VREF Bank 5,<br>L131N_YY | 5    | AB12 | All                          | All            | I/O, VREF Bank 5,<br>L131N_YY | I/O, VREF Bank 5,<br>L131N_YY |
| I/O, L131P_YY                 | 5    | AC12 | All                          | -              | I/O, L131P_YY                 | I/O, L131P_YY                 |
| I/O                           | 5    | V13  | -                            | -              | -                             | I/O                           |
| I/O, L130N_YY                 | 5    | AE12 | All                          | -              | I/O, L130N_YY                 | I/O, L130N_YY                 |
| I/O, L130P_YY                 | 5    | AF12 | All                          | -              | I/O, L130P_YY                 | I/O, L130P_YY                 |
| I/O                           | 5    | W13  | -                            | -              | -                             | I/O                           |
| I/O, L129N                    | 5    | Y13  | XC2S600E                     | -              | I/O, L129N                    | I/O, L129N_Y                  |
| I/O, L129P                    | 5    | AA13 | XC2S600E                     | -              | I/O, L129P                    | I/O, L129P_Y                  |
| I/O, VREF Bank 5,<br>L128N    | 5    | AB13 | XC2S600E                     | All            | I/O, VREF Bank 5,<br>L128N    | I/O, VREF Bank 5,<br>L128N_Y  |
| I/O, L128P                    | 5    | AC13 | XC2S600E                     | -              | I/O, L128P                    | I/O, L128P_Y                  |
| I/O                           | 5    | AD13 | -                            | -              | -                             | I/O                           |
| I/O, L127N                    | 5    | V14  | -                            | -              | I/O                           | I/O, L127N                    |
| I/O, L127P                    | 5    | W14  | -                            | -              | -                             | I/O, L127P                    |
| I/O (DLL), L126N              | 5    | AE13 | -                            | -              | I/O (DLL), L126N              | I/O (DLL), L126N              |
| GCK1, I                       | 5    | AF13 | -                            | -              | GCK1, I                       | GCK1, I                       |



### FG676 Pinouts (XC2S400E, XC2S600E) (Continued)

| Pad Name                      |      | Pin  | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts       |                               |
|-------------------------------|------|------|------------------------------|----------------|-------------------------------|-------------------------------|
| Function                      | Bank |      |                              |                | XC2S400E                      | XC2S600E                      |
| I/O                           | 4    | AC18 | -                            | -              | I/O                           | I/O                           |
| I/O, VREF Bank 4,<br>L114N    | 4    | AB18 | -                            | All            | I/O, VREF Bank 4,<br>L114N    | I/O, VREF Bank 4,<br>L114N    |
| I/O, L114P                    | 4    | AA18 | -                            | -              | I/O, L114P                    | I/O, L114P                    |
| I/O, L113N                    | 4    | Y18  | -                            | -              | I/O, L113N                    | I/O, L113N                    |
| I/O, L113P                    | 4    | W18  | -                            | -              | I/O, L113P                    | I/O, L113P                    |
| I/O                           | 4    | AB19 | -                            | -              | I/O                           | I/O                           |
| I/O, L112N                    | 4    | AF19 | XC2S600E                     | -              | I/O                           | I/O, L112N_Y                  |
| I/O, L112P                    | 4    | AE19 | XC2S600E                     | XC2S600E       | -                             | I/O, VREF Bank 4,<br>L112P_Y  |
| I/O, L111N                    | 4    | AA19 | XC2S600E                     | -              | I/O, L111N                    | I/O, L111N_Y                  |
| I/O, L111P                    | 4    | Y19  | XC2S600E                     | -              | I/O, L111P                    | I/O, L111P_Y                  |
| I/O                           | 4    | AF20 | -                            | -              | -                             | I/O                           |
| I/O, L110N                    | 4    | AE20 | XC2S600E                     | -              | I/O, L110N                    | I/O, L110N_Y                  |
| I/O, L110P                    | 4    | AD20 | XC2S600E                     | -              | I/O, L110P                    | I/O, L110P_Y                  |
| I/O                           | 4    | AC20 | -                            | -              | I/O                           | I/O                           |
| I/O, L109N_YY                 | 4    | AB20 | All                          | -              | I/O, L109N_YY                 | I/O, L109N_YY                 |
| I/O, VREF Bank 4,<br>L109P_YY | 4    | AA20 | All                          | All            | I/O, VREF Bank 4,<br>L109P_YY | I/O, VREF Bank 4,<br>L109P_YY |
| I/O                           | 4    | Y20  | -                            | -              | I/O                           | I/O                           |
| I/O, L108N                    | 4    | AF21 | -                            | -              | I/O, L108N                    | I/O, L108N                    |
| I/O, L108P                    | 4    | AE21 | -                            | -              | I/O, L108P                    | I/O, L108P                    |
| I/O, L107N                    | 4    | AD21 | -                            | -              | I/O, L107N                    | I/O, L107N                    |
| I/O, L107P                    | 4    | AC21 | -                            | -              | I/O, L107P                    | I/O, L107P                    |
| I/O                           | 4    | AC22 | -                            | -              | -                             | I/O                           |
| I/O, L106N_YY                 | 4    | AF22 | All                          | -              | I/O, L106N_YY                 | I/O, L106N_YY                 |
| I/O, VREF Bank 4,<br>L106P_YY | 4    | AE22 | All                          | All            | I/O, VREF Bank 4,<br>L106P_YY | I/O, VREF Bank 4,<br>L106P_YY |
| I/O, L105N_YY                 | 4    | AB21 | All                          | -              | I/O, L105N_YY                 | I/O, L105N_YY                 |
| I/O, L105P_YY                 | 4    | AA21 | All                          | -              | I/O, L105P_YY                 | I/O, L105P_YY                 |
| I/O, L104N_YY                 | 4    | AF23 | All                          | -              | I/O, L104N_YY                 | I/O, L104N_YY                 |
| I/O, L104P_YY                 | 4    | AE23 | All                          | -              | I/O, L104P_YY                 | I/O, L104P_YY                 |
| I/O, L103N                    | 4    | AD23 | XC2S600E                     | -              | I/O                           | I/O, L103N_Y                  |
| I/O, L103P                    | 4    | AE24 | XC2S600E                     | -              | -                             | I/O, L103P_Y                  |
| I/O, L102N_YY                 | 4    | AF24 | All                          | -              | I/O, L102N_YY                 | I/O, L102N_YY                 |
| I/O, L102P_YY                 | 4    | AF25 | All                          | -              | I/O, L102P_YY                 | I/O, L102P_YY                 |



### FG676 Pinouts (XC2S400E, XC2S600E) (Continued)

| Pad Name                  |      | Pin | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts   |                           |
|---------------------------|------|-----|------------------------------|----------------|---------------------------|---------------------------|
| Function                  | Bank |     |                              |                | XC2S400E                  | XC2S600E                  |
| I/O, L88P_YY              | 3    | V25 | All                          | -              | I/O, L88P_YY              | I/O, L88P_YY              |
| I/O                       | 3    | V26 | -                            | -              | I/O                       | I/O                       |
| I/O, VREF Bank 3, L87N_YY | 3    | U19 | All                          | All            | I/O, VREF Bank 3, L87N_YY | I/O, VREF Bank 3, L87N_YY |
| I/O (D6), L87P_YY         | 3    | U20 | All                          | -              | I/O (D6), L87P_YY         | I/O (D6), L87P_YY         |
| I/O (D5), L86N_YY         | 3    | U22 | All                          | -              | I/O (D5), L86N_YY         | I/O (D5), L86N_YY         |
| I/O, L86P_YY              | 3    | U23 | All                          | -              | I/O, L86P_YY              | I/O, L86P_YY              |
| I/O                       | 3    | U24 | -                            | -              | -                         | I/O                       |
| I/O, L85N                 | 3    | U25 | XC2S600E                     | -              | -                         | I/O, L85N_Y               |
| I/O, L85P                 | 3    | U26 | XC2S600E                     | -              | I/O                       | I/O, L85P_Y               |
| I/O                       | 3    | R18 | -                            | -              | I/O                       | I/O                       |
| I/O, L84N                 | 3    | T19 | XC2S400E                     | -              | I/O, L84N_Y               | I/O, L84N                 |
| I/O, L84P                 | 3    | T20 | XC2S400E                     | -              | I/O, L84P_Y               | I/O, L84P                 |
| I/O, L83N                 | 3    | T21 | XC2S600E                     | -              | I/O, L83N                 | I/O, L83N_Y               |
| I/O, L83P                 | 3    | T22 | XC2S600E                     | -              | I/O, L83P                 | I/O, L83P_Y               |
| I/O                       | 3    | T24 | -                            | -              | -                         | I/O                       |
| I/O, L82N                 | 3    | T25 | XC2S600E                     | -              | I/O, L82N                 | I/O, L82N_Y               |
| I/O, L82P                 | 3    | T26 | XC2S600E                     | -              | I/O, L82P                 | I/O, L82P_Y               |
| I/O                       | 3    | R19 | -                            | -              | -                         | I/O                       |
| I/O, L81N                 | 3    | R20 | XC2S600E                     | -              | I/O, L81N                 | I/O, L81N_Y               |
| I/O, L81P                 | 3    | R21 | XC2S600E                     | -              | I/O, L81P                 | I/O, L81P_Y               |
| I/O, VREF Bank 3, L80N_YY | 3    | R22 | All                          | All            | I/O, VREF Bank 3, L80N_YY | I/O, VREF Bank 3, L80N_YY |
| I/O (D4), L80P_YY         | 3    | R23 | All                          | -              | I/O (D4), L80P_YY         | I/O (D4), L80P_YY         |
| I/O                       | 3    | P18 | -                            | -              | -                         | I/O                       |
| I/O, L79N_YY              | 3    | R25 | All                          | -              | I/O, L79N_YY              | I/O, L79N_YY              |
| I/O, L79P_YY              | 3    | R26 | All                          | -              | I/O, L79P_YY              | I/O, L79P_YY              |
| I/O                       | 3    | P19 | -                            | -              | -                         | I/O                       |
| I/O, L78N                 | 3    | P20 | XC2S400E                     | -              | I/O, L78N_Y               | I/O, L78N                 |
| I/O, L78P                 | 3    | P21 | XC2S400E                     | -              | I/O, L78P_Y               | I/O, L78P                 |
| I/O, VREF Bank 3, L77N    | 3    | P22 | XC2S600E                     | All            | I/O, VREF Bank 3, L77N    | I/O, VREF Bank 3, L77N_Y  |
| I/O, L77P                 | 3    | P23 | XC2S600E                     | -              | I/O, L77P                 | I/O, L77P_Y               |
| I/O                       | 3    | P24 | -                            | -              | -                         | I/O                       |
| I/O, L76N_YY              | 3    | P25 | All                          | -              | I/O, L76N_YY              | I/O, L76N_YY              |
| I/O, L76P_YY              | 3    | P26 | All                          | -              | I/O, L76P_YY              | I/O, L76P_YY              |



### FG676 Pinouts (XC2S400E, XC2S600E) (Continued)

| Pad Name                  |      | Pin | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts   |                           |
|---------------------------|------|-----|------------------------------|----------------|---------------------------|---------------------------|
| Function                  | Bank |     |                              |                | XC2S400E                  | XC2S600E                  |
| I/O, L64N_YY              | 2    | J25 | All                          | -              | I/O, L64N_YY              | I/O, L64N_YY              |
| I/O (D2), L64P_YY         | 2    | J24 | All                          | -              | I/O (D2), L64P_YY         | I/O (D2), L64P_YY         |
| I/O (D1)                  | 2    | J23 | -                            | -              | I/O (D1)                  | I/O (D1)                  |
| I/O, VREF Bank 2, L63N_YY | 2    | J22 | All                          | All            | I/O, VREF Bank 2, L63N_YY | I/O, VREF Bank 2, L63N_YY |
| I/O, L63P_YY              | 2    | J21 | All                          | -              | I/O, L63P_YY              | I/O, L63P_YY              |
| I/O, L62N_YY              | 2    | J20 | All                          | -              | I/O, L62N_YY              | I/O, L62N_YY              |
| I/O, L62P_YY              | 2    | J19 | All                          | -              | I/O, L62P_YY              | I/O, L62P_YY              |
| I/O                       | 2    | H22 | -                            | -              | I/O                       | I/O                       |
| I/O, L61N                 | 2    | H26 | XC2S600E                     | -              | I/O                       | I/O, L61N_Y               |
| I/O, L61P                 | 2    | H25 | XC2S600E                     | XC2S600E       | -                         | I/O, VREF Bank 2, L61P_Y  |
| I/O, L60N                 | 2    | H21 | XC2S400E                     | -              | I/O, L60N_Y               | I/O, L60N                 |
| I/O, L60P                 | 2    | H20 | XC2S400E                     | -              | I/O, L60P_Y               | I/O, L60P                 |
| I/O                       | 2    | G26 | -                            | -              | -                         | I/O                       |
| I/O, L59N_YY              | 2    | G25 | All                          | -              | I/O, L59N_YY              | I/O, L59N_YY              |
| I/O, L59P_YY              | 2    | G24 | All                          | -              | I/O, L59P_YY              | I/O, L59P_YY              |
| I/O                       | 2    | G23 | -                            | -              | I/O                       | I/O                       |
| I/O, L58N_YY              | 2    | G22 | All                          | -              | I/O, L58N_YY              | I/O, L58N_YY              |
| I/O, VREF Bank 2, L58P_YY | 2    | G21 | All                          | All            | I/O, VREF Bank 2, L58P_YY | I/O, VREF Bank 2, L58P_YY |
| I/O                       | 2    | G20 | -                            | -              | I/O                       | I/O                       |
| I/O, L57N_YY              | 2    | F26 | All                          | -              | I/O, L57N_YY              | I/O, L57N_YY              |
| I/O, L57P_YY              | 2    | F25 | All                          | -              | I/O, L57P_YY              | I/O, L57P_YY              |
| I/O, L56N                 | 2    | F24 | XC2S600E                     | -              | I/O, L56N                 | I/O, L56N_Y               |
| I/O, L56P                 | 2    | F23 | XC2S600E                     | -              | I/O, L56P                 | I/O, L56P_Y               |
| I/O                       | 2    | F22 | -                            | -              | -                         | I/O                       |
| I/O, L55N                 | 2    | E26 | XC2S600E                     | -              | I/O, L55N                 | I/O, L55N_Y               |
| I/O, VREF Bank 2, L55P    | 2    | E25 | XC2S600E                     | All            | I/O, VREF Bank 2, L55P    | I/O, VREF Bank 2, L55P_Y  |
| I/O, L54N                 | 2    | E23 | XC2S400E                     | -              | I/O, L54N_Y               | I/O, L54N                 |
| I/O, L54P                 | 2    | E22 | XC2S400E                     | -              | I/O, L54P_Y               | I/O, L54P                 |
| I/O, L53N_YY              | 2    | F21 | All                          | -              | I/O, L53N_YY              | I/O, L53N_YY              |
| I/O, L53P_YY              | 2    | E21 | All                          | -              | I/O, L53P_YY              | I/O, L53P_YY              |
| I/O, L52N                 | 2    | D26 | XC2S600E                     | -              | I/O                       | I/O, L52N_Y               |
| I/O, L52P                 | 2    | D25 | XC2S600E                     | -              | -                         | I/O, L52P_Y               |



### FG676 Pinouts (XC2S400E, XC2S600E) (Continued)

| Pad Name                     |      | Pin | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts      |                              |
|------------------------------|------|-----|------------------------------|----------------|------------------------------|------------------------------|
| Function                     | Bank |     |                              |                | XC2S400E                     | XC2S600E                     |
| I/O, L39N                    | 1    | F18 | XC2S600E                     | -              | I/O, L39N                    | I/O, L39N_Y                  |
| I/O, L38P                    | 1    | D18 | XC2S600E                     | XC2S600E       | -                            | I/O, VREF Bank 1,<br>L38P_Y  |
| I/O, L38N                    | 1    | C18 | XC2S600E                     | -              | I/O                          | I/O, L38N_Y                  |
| I/O, L37P_YY                 | 1    | B18 | All                          | -              | I/O, L37P_YY                 | I/O, L37P_YY                 |
| I/O, L37N_YY                 | 1    | A18 | All                          | -              | I/O, L37N_YY                 | I/O, L37N_YY                 |
| I/O, L36P_YY                 | 1    | H17 | All                          | -              | I/O, L36P_YY                 | I/O, L36P_YY                 |
| I/O, L36N_YY                 | 1    | G17 | All                          | -              | I/O, L36N_YY                 | I/O, L36N_YY                 |
| I/O, VREF Bank 1,<br>L35P_YY | 1    | E18 | All                          | All            | I/O, VREF Bank 1,<br>L35P_YY | I/O, VREF Bank 1,<br>L35P_YY |
| I/O, L35N_YY                 | 1    | E17 | All                          | -              | I/O, L35N_YY                 | I/O, L35N_YY                 |
| I/O, L34P_YY                 | 1    | D17 | All                          | -              | I/O, L34P_YY                 | I/O, L34P_YY                 |
| I/O, L34N_YY                 | 1    | C17 | All                          | -              | I/O, L34N_YY                 | I/O, L34N_YY                 |
| I/O                          | 1    | H16 | -                            | -              | -                            | I/O                          |
| I/O, L33P                    | 1    | B17 | XC2S600E                     | -              | I/O, L33P                    | I/O, L33P_Y                  |
| I/O, L33N                    | 1    | A17 | XC2S600E                     | -              | I/O, L33N                    | I/O, L33N_Y                  |
| I/O                          | 1    | G16 | -                            | -              | -                            | I/O                          |
| I/O, L32P_YY                 | 1    | F16 | All                          | -              | I/O, L32P_YY                 | I/O, L32P_YY                 |
| I/O, L32N_YY                 | 1    | E16 | All                          | -              | I/O, L32N_YY                 | I/O, L32N_YY                 |
| I/O, L31P_YY                 | 1    | C16 | All                          | -              | I/O, L31P_YY                 | I/O, L31P_YY                 |
| I/O, L31N_YY                 | 1    | B16 | All                          | -              | I/O, L31N_YY                 | I/O, L31N_YY                 |
| I/O                          | 1    | A16 | -                            | -              | -                            | I/O                          |
| I/O, L30P                    | 1    | J15 | -                            | -              | I/O, L30P                    | I/O, L30P                    |
| I/O, L30N                    | 1    | H15 | -                            | -              | I/O, L30N                    | I/O, L30N                    |
| I/O                          | 1    | G15 | -                            | -              | -                            | I/O                          |
| I/O, L29P_YY                 | 1    | F15 | All                          | -              | I/O, L29P_YY                 | I/O, L29P_YY                 |
| I/O, L29N_YY                 | 1    | E15 | All                          | -              | I/O, L29N_YY                 | I/O, L29N_YY                 |
| I/O, VREF Bank 1,<br>L28P_YY | 1    | B15 | All                          | All            | I/O, VREF Bank 1,<br>L28P_YY | I/O, VREF Bank 1,<br>L28P_YY |
| I/O, L28N_YY                 | 1    | A15 | All                          | -              | I/O, L28N_YY                 | I/O, L28N_YY                 |
| I/O                          | 1    | D15 | -                            | -              | -                            | I/O                          |
| I/O, L27P_YY                 | 1    | J14 | All                          | -              | I/O, L27P_YY                 | I/O, L27P_YY                 |
| I/O, L27N_YY                 | 1    | H14 | All                          | -              | I/O, L27N_YY                 | I/O, L27N_YY                 |
| I/O                          | 1    | G14 | -                            | -              | -                            | I/O                          |
| I/O, L26P                    | 1    | F14 | XC2S600E                     | -              | I/O, L26P                    | I/O, L26P_Y                  |
| I/O, L26N                    | 1    | E14 | XC2S600E                     | -              | I/O, L26N                    | I/O, L26N_Y                  |



### FG676 Pinouts (XC2S400E, XC2S600E) (Continued)

| Pad Name                 |      | Pin | LVDS Async.<br>Output Option | VREF<br>Option | Device-Specific Pinouts  |                          |
|--------------------------|------|-----|------------------------------|----------------|--------------------------|--------------------------|
| Function                 | Bank |     |                              |                | XC2S400E                 | XC2S600E                 |
| I/O, L14N_YY             | 0    | E10 | All                          | -              | I/O, L14N_YY             | I/O, L14N_YY             |
| I/O                      | 0    | G10 | -                            | -              | -                        | I/O                      |
| I/O, L13P                | 0    | A9  | XC2S600E                     | -              | I/O, L13P                | I/O, L13P_Y              |
| I/O, L13N                | 0    | B9  | XC2S600E                     | -              | I/O, L13N                | I/O, L13N_Y              |
| I/O                      | 0    | H10 | -                            | -              | -                        | I/O                      |
| I/O, L12P_YY             | 0    | C9  | All                          | -              | I/O, L12P_YY             | I/O, L12P_YY             |
| I/O, L12N_YY             | 0    | D9  | All                          | -              | I/O, L12N_YY             | I/O, L12N_YY             |
| I/O                      | 0    | E9  | -                            | -              | I/O                      | I/O                      |
| I/O, VREF Bank 0, L11P   | 0    | F9  | -                            | All            | I/O, VREF Bank 0, L11P   | I/O, VREF Bank 0, L11P   |
| I/O, L11N                | 0    | G9  | -                            | -              | I/O, L11N                | I/O, L11N                |
| I/O, L10P                | 0    | A8  | -                            | -              | I/O, L10P                | I/O, L10P                |
| I/O, L10N                | 0    | B8  | -                            | -              | I/O, L10N                | I/O, L10N                |
| I/O                      | 0    | H9  | -                            | -              | I/O                      | I/O                      |
| I/O, L9P                 | 0    | E8  | XC2S600E                     | -              | I/O                      | I/O, L9P_Y               |
| I/O, L9N                 | 0    | F8  | XC2S600E                     | XC2S600E       | -                        | I/O, VREF Bank 0, L9N_Y  |
| I/O, L8P                 | 0    | A7  | XC2S600E                     | -              | I/O, L8P                 | I/O, L8P_Y               |
| I/O, L8N                 | 0    | B7  | XC2S600E                     | -              | I/O, L8N                 | I/O, L8N_Y               |
| I/O                      | 0    | G8  | -                            | -              | I/O                      | I/O                      |
| I/O, L7P_YY              | 0    | C7  | All                          | -              | I/O, L7P_YY              | I/O, L7P_YY              |
| I/O, L7N_YY              | 0    | D7  | All                          | -              | I/O, L7N_YY              | I/O, L7N_YY              |
| I/O                      | 0    | E7  | -                            | -              | -                        | I/O                      |
| I/O, L6P_YY              | 0    | F7  | All                          | -              | I/O, L6P_YY              | I/O, L6P_YY              |
| I/O, VREF Bank 0, L6N_YY | 0    | G7  | All                          | All            | I/O, VREF Bank 0, L6N_YY | I/O, VREF Bank 0, L6N_YY |
| I/O                      | 0    | A6  | -                            | -              | I/O                      | I/O                      |
| I/O, L5P                 | 0    | B6  | -                            | -              | I/O, L5P                 | I/O, L5P                 |
| I/O, L5N                 | 0    | C6  | -                            | -              | I/O, L5N                 | I/O, L5N                 |
| I/O, L4P                 | 0    | D6  | -                            | -              | I/O, L4P                 | I/O, L4P                 |
| I/O, L4N                 | 0    | E6  | -                            | -              | I/O, L4N                 | I/O, L4N                 |
| I/O                      | 0    | F6  | -                            | -              | -                        | I/O                      |
| I/O, L3P_YY              | 0    | A5  | All                          | -              | I/O, L3P_YY              | I/O, L3P_YY              |
| I/O, VREF Bank 0, L3N_YY | 0    | B5  | All                          | All            | I/O, VREF Bank 0, L3N_YY | I/O, VREF Bank 0, L3N_YY |
| I/O, L2P_YY              | 0    | D5  | All                          | -              | I/O, L2P_YY              | I/O, L2P_YY              |



### Additional FG676 Package Pins (Continued)

| GND Pins                           |      |      |      |      |      |      |
|------------------------------------|------|------|------|------|------|------|
| A1                                 | A26  | B2   | B25  | C3   | C12  | C15  |
| C24                                | D4   | D8   | D19  | D23  | F10  | F17  |
| H4                                 | H23  | K6   | K21  | L11  | L12  | L13  |
| L14                                | L15  | L16  | M3   | M11  | M12  | M13  |
| M14                                | M15  | M16  | M24  | N11  | N12  | N13  |
| N14                                | N15  | N16  | P11  | P12  | P13  | P14  |
| P15                                | P16  | R3   | R11  | R12  | R13  | R14  |
| R15                                | R16  | R24  | T11  | T12  | T13  | T14  |
| T15                                | T16  | U6   | U21  | W4   | W23  | AA10 |
| AA17                               | AC4  | AC8  | AC19 | AC23 | AD3  | AD12 |
| AD15                               | AD24 | AE2  | AE25 | AF1  | AF26 | -    |
| Not Connected Pins (XC2S400E Only) |      |      |      |      |      |      |
| A12                                | A16  | A23  | B3   | C1   | C2   | C10  |
| C11                                | C25  | D2   | D15  | D18  | D24  | D25  |
| E7                                 | E13  | E19  | F2   | F6   | F8   | F12  |
| F20                                | F22  | G10  | G14  | G15  | G16  | G26  |
| H10                                | H13  | H16  | H25  | J6   | J8   | J12  |
| J13                                | K1   | K4   | K22  | K24  | L3   | L19  |
| L22                                | L26  | M4   | M9   | M22  | N1   | N4   |
| N9                                 | N18  | N19  | N23  | P4   | P5   | P18  |
| P19                                | P24  | R4   | R7   | R19  | T3   | T24  |
| U1                                 | U4   | U7   | U24  | U25  | V8   | V12  |
| V13                                | V21  | W12  | W13  | W14  | W16  | Y3   |
| Y7                                 | Y21  | AA7  | AA9  | AA22 | AB15 | AB16 |
| AB17                               | AB22 | AC1  | AC15 | AC22 | AC25 | AC26 |
| AD1                                | AD2  | AD10 | AD11 | AD13 | AD14 | AE5  |
| AE19                               | AE24 | AF4  | AF16 | AF18 | AF20 | -    |

| Date       | Version | Description                                                                                                                                                                     |
|------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11/15/2001 | 1.0     | Initial Xilinx release.                                                                                                                                                         |
| 12/20/2001 | 1.1     | Corrected differential pin pair designations.                                                                                                                                   |
| 11/18/2002 | 2.0     | Added XC2S400E and XC2S600E and FG676. Removed L37 designation from FT256 pinouts. Minor corrections and clarifications to pinout definitions. Removed Preliminary designation. |
| 02/14/2003 | 2.1     | Added differential pairs table on <a href="#">page 57</a> , fixed 3 P/N designation typos introduced in v2.0. Clarified that XC2S50E has two VREF pins per bank.                |
| 06/18/2008 | 2.3     | Added <a href="#">Package Overview</a> section. Updated all modules for continuous page, figure, and table numbering. Updated links. Synchronized all modules to v2.3.          |
| 08/09/2013 | 3.0     | This product is obsolete/discontinued per <a href="#">XCN12026</a> .                                                                                                            |

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