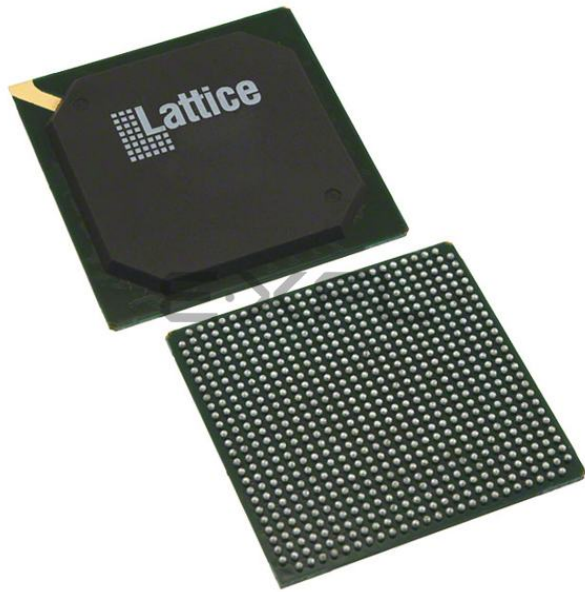




Welcome to [E-XFL.COM](https://www.e-xfl.com)

## Understanding [Embedded - FPGAs \(Field Programmable Gate Array\)](#)

Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling customized functionality tailored to specific applications. This reprogrammability allows developers to iterate designs quickly and implement complex functions without the need for custom hardware.

## Applications of Embedded - FPGAs

The versatility of Embedded - FPGAs makes them indispensable in numerous fields. In telecommunications.

### Details

|                                |                                                                                                                                                                       |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Status                 | Obsolete                                                                                                                                                              |
| Number of LABs/CLBs            | -                                                                                                                                                                     |
| Number of Logic Elements/Cells | 32800                                                                                                                                                                 |
| Total RAM Bits                 | 434176                                                                                                                                                                |
| Number of I/O                  | 496                                                                                                                                                                   |
| Number of Gates                | -                                                                                                                                                                     |
| Voltage - Supply               | 1.14V ~ 1.26V                                                                                                                                                         |
| Mounting Type                  | Surface Mount                                                                                                                                                         |
| Operating Temperature          | 0°C ~ 85°C (TJ)                                                                                                                                                       |
| Package / Case                 | 672-BBGA                                                                                                                                                              |
| Supplier Device Package        | 672-FPBGA (27x27)                                                                                                                                                     |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/lattice-semiconductor/lfecp33e-5fn672c">https://www.e-xfl.com/product-detail/lattice-semiconductor/lfecp33e-5fn672c</a> |

## Introduction

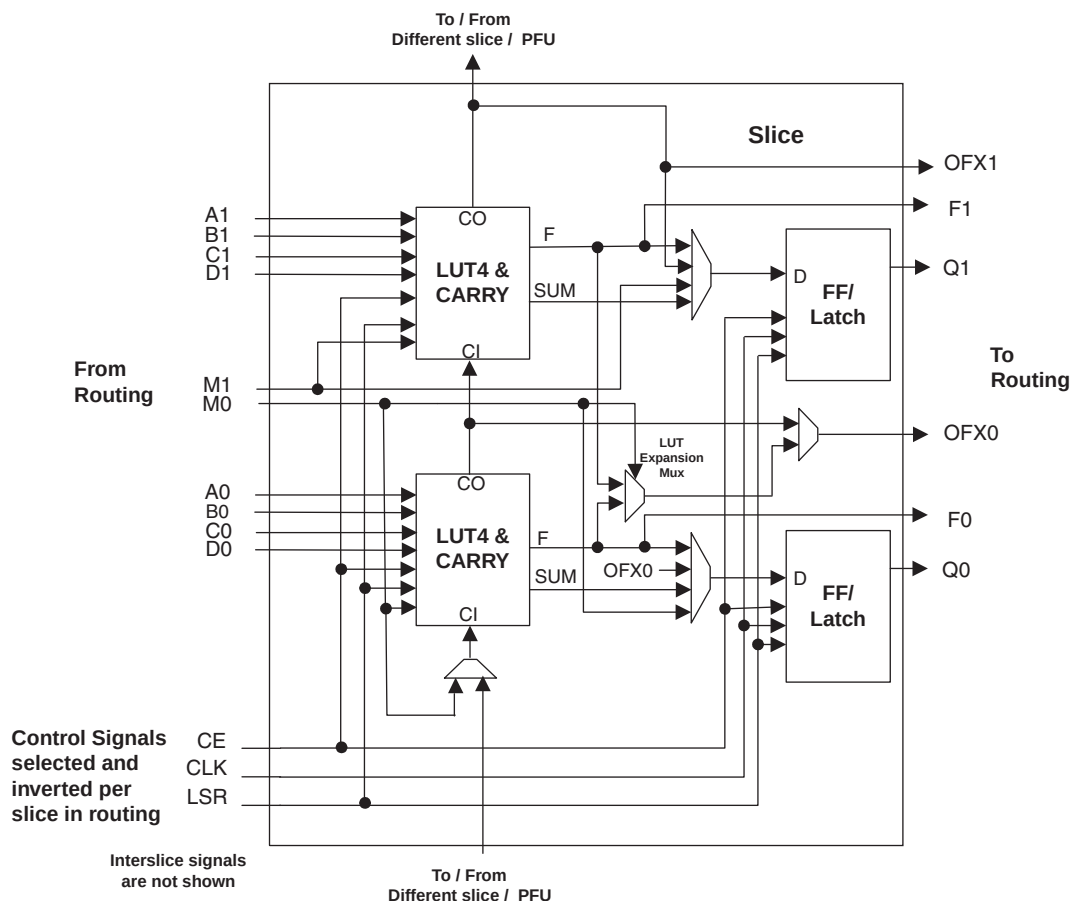
The LatticeECP/EC family of FPGA devices is optimized to deliver mainstream FPGA features at low cost. For maximum performance and value, the LatticeECP™ (Economy Plus) FPGA concept combines an efficient FPGA fabric with high-speed dedicated functions. Lattice's first family to implement this approach is the LatticeECP-DSP™ (Economy Plus DSP) family, providing dedicated high-performance DSP blocks on-chip. The LatticeEC™ (Economy) family supports all the general purpose features of LatticeECP devices without dedicated function blocks to achieve lower cost solutions.

The LatticeECP/EC FPGA fabric, which was designed from the outset with low cost in mind, contains all the critical FPGA elements: LUT-based logic, distributed and embedded memory, PLLs and support for mainstream I/Os. Dedicated DDR memory interface logic is also included to support this memory that is becoming increasingly prevalent in cost-sensitive applications.

The ispLEVER® design tool suite from Lattice allows large complex designs to be efficiently implemented using the LatticeECP/EC FPGA family. Synthesis library support for LatticeECP/EC is available for popular logic synthesis tools. The ispLEVER tool uses the synthesis tool output along with the constraints from its floor planning tools to place and route the design in the LatticeECP/EC device. The ispLEVER tool extracts the timing from the routing and back-annotates it into the design for timing verification.

Lattice provides many pre-designed IP (Intellectual Property) ispLeverCORE™ modules for the LatticeECP/EC family. By using these IPs as standardized blocks, designers are free to concentrate on the unique aspects of their design, increasing their productivity.

**Figure 2-4. Slice Diagram**



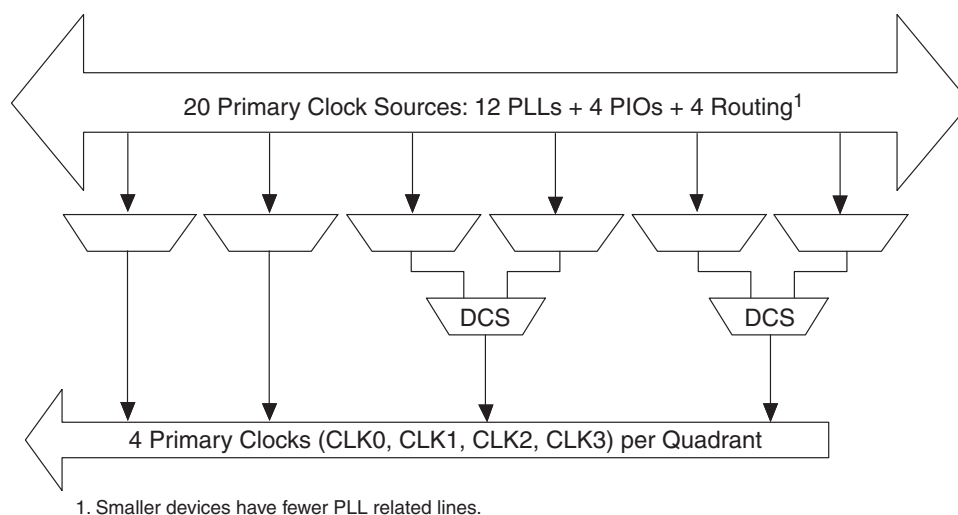
**Table 2-1. Slice Signal Descriptions**

| Function | Type             | Signal Names   | Description                                                          |
|----------|------------------|----------------|----------------------------------------------------------------------|
| Input    | Data signal      | A0, B0, C0, D0 | Inputs to LUT4                                                       |
| Input    | Data signal      | A1, B1, C1, D1 | Inputs to LUT4                                                       |
| Input    | Multi-purpose    | M0             | Multipurpose Input                                                   |
| Input    | Multi-purpose    | M1             | Multipurpose Input                                                   |
| Input    | Control signal   | CE             | Clock Enable                                                         |
| Input    | Control signal   | LSR            | Local Set/Reset                                                      |
| Input    | Control signal   | CLK            | System Clock                                                         |
| Input    | Inter-PFU signal | FCIN           | Fast Carry In <sup>1</sup>                                           |
| Output   | Data signals     | F0, F1         | LUT4 output register bypass signals                                  |
| Output   | Data signals     | Q0, Q1         | Register Outputs                                                     |
| Output   | Data signals     | OFX0           | Output of a LUT5 MUX                                                 |
| Output   | Data signals     | OFX1           | Output of a LUT6, LUT7, LUT8 <sup>2</sup> MUX depending on the slice |
| Output   | Inter-PFU signal | FCO            | For the right most PFU the fast carry chain output <sup>1</sup>      |

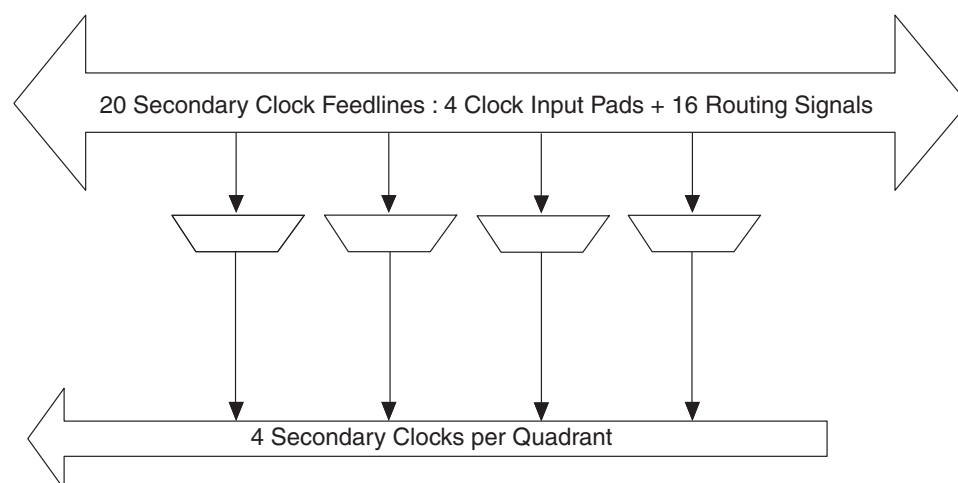
1. See Figure 2-3 for connection details.

2. Requires two PFUs.

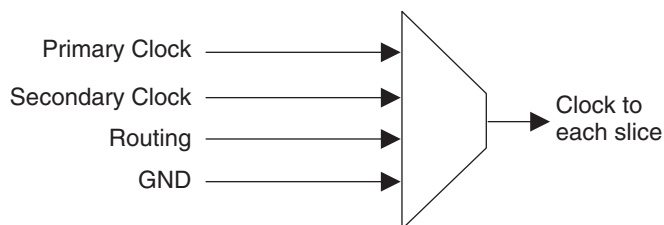
**Figure 2-8. Per Quadrant Primary Clock Selection**



**Figure 2-9. Per Quadrant Secondary Clock Selection**



**Figure 2-10. Slice Clock Selection**

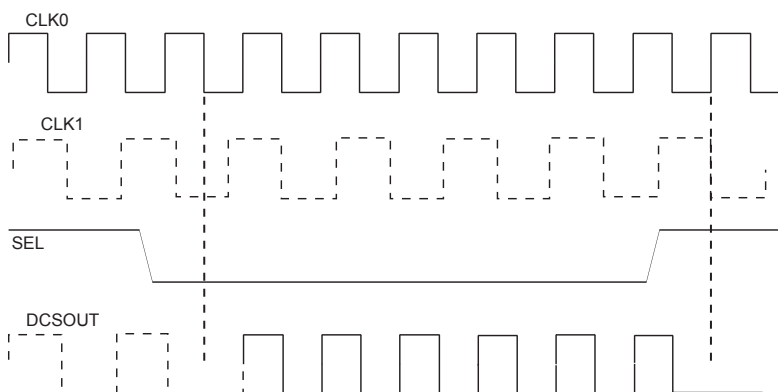


## sysCLOCK Phase Locked Loops (PLLs)

The PLL clock input, from pin or routing, feeds into an input clock divider. There are three sources of feedback signal to the feedback divider: from CLKOP (PLL Internal), from clock net (CLKOP) or from a user clock (PIN or logic). There is a PLL\_LOCK signal to indicate that VCO has locked on to the input clock signal. Figure 2-11 shows the sysCLOCK PLL diagram.

The setup and hold times of the device can be improved by programming a delay in the feedback or input path of the PLL which will advance or delay the output clock with reference to the input clock. This delay can be either pro-

**Figure 2-14. DCS Waveforms**



## sysMEM Memory

The LatticeECP/EC devices contain a number of sysMEM Embedded Block RAM (EBR). The EBR consists of a 9-Kbit RAM, with dedicated input and output registers.

### sysMEM Memory Block

The sysMEM block can implement single port, dual port or pseudo dual port memories. Each block can be used in a variety of depths and widths as shown in Table 2-6.

**Table 2-6. sysMEM Block Configurations**

| Memory Mode      | Configurations |
|------------------|----------------|
| Single Port      | 8,192 x 1      |
|                  | 4,096 x 2      |
|                  | 2,048 x 4      |
|                  | 1,024 x 9      |
|                  | 512 x 18       |
|                  | 256 x 36       |
| True Dual Port   | 8,192 x 1      |
|                  | 4,096 x 2      |
|                  | 2,048 x 4      |
|                  | 1,024 x 9      |
|                  | 512 x 18       |
| Pseudo Dual Port | 8,192 x 1      |
|                  | 4,096 x 2      |
|                  | 2,048 x 4      |
|                  | 1,024 x 9      |
|                  | 512 x 18       |
|                  | 256 x 36       |

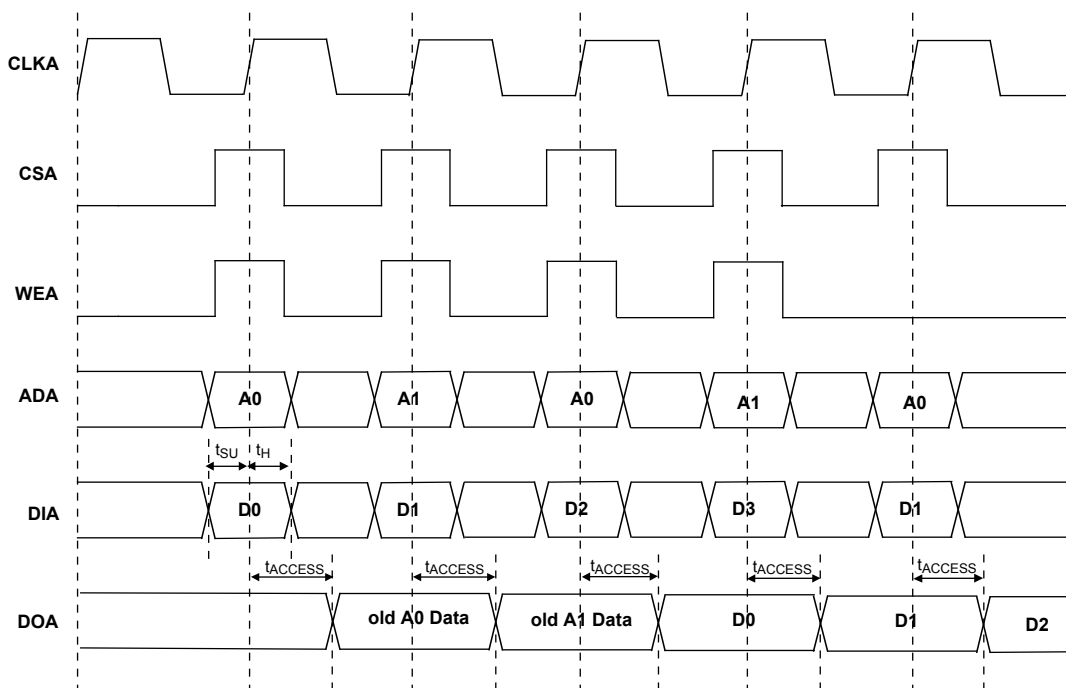
## Bus Size Matching

All of the multi-port memory modes support different widths on each of the ports. The RAM bits are mapped LSB word 0 to MSB word 0, LSB word 1 to MSB word 1 and so on. Although the word size and number of words for each port varies, this mapping scheme applies to each port.

## RAM Initialization and ROM Operation

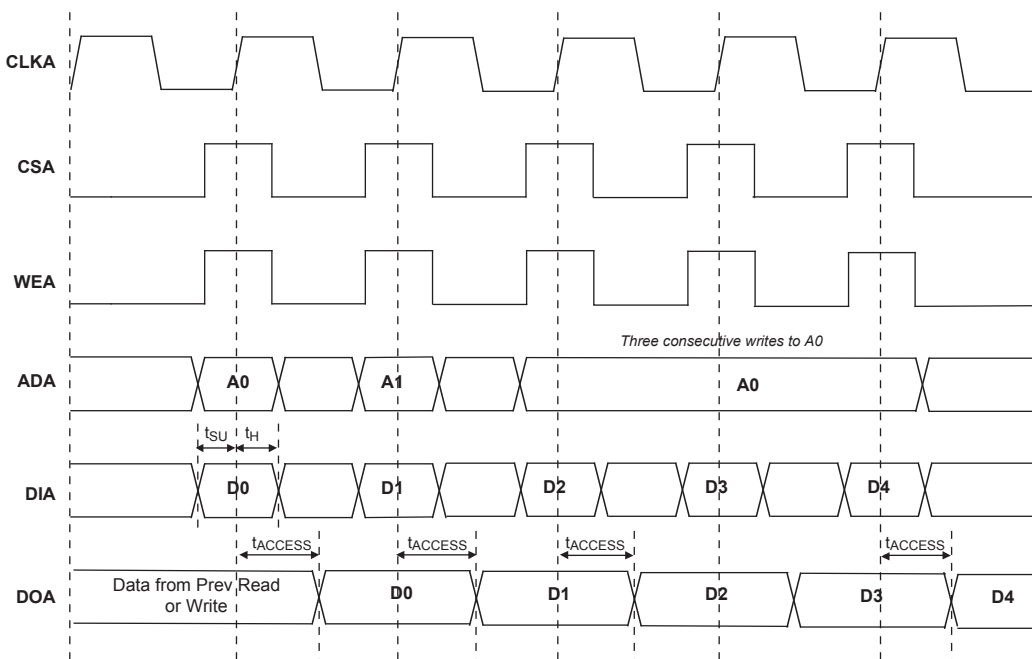
If desired, the contents of the RAM can be pre-loaded during device configuration. By preloading the RAM block during the chip configuration cycle and disabling the write controls, the sysMEM block can also be utilized as a ROM.

**Figure 3-10. Read Before Write (SP Read/Write on Port A, Input Registers Only)**



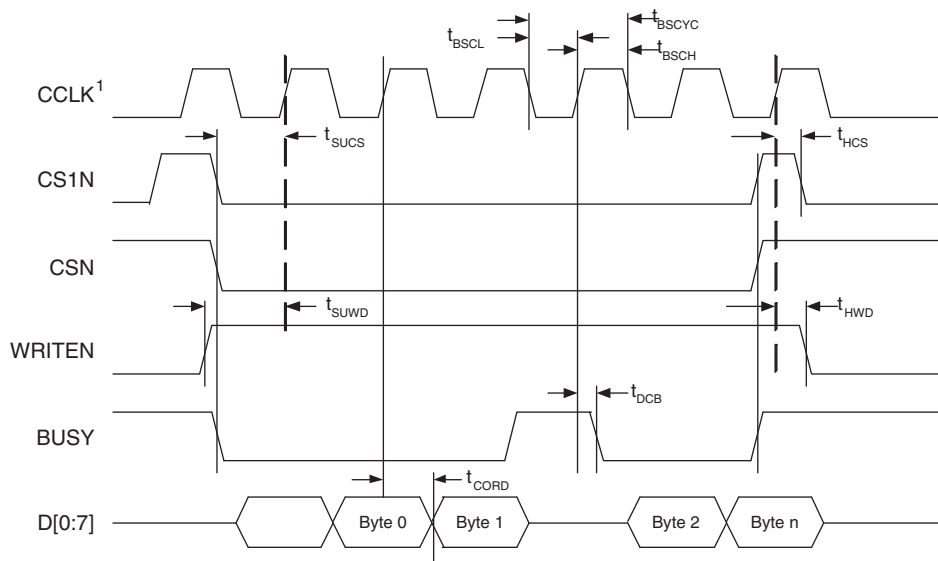
Note: Input data and address are registered at the positive edge of the clock and output data appears after the positive edge of the clock.

**Figure 3-11. Write Through (SP Read/Write On Port A, Input Registers Only)**



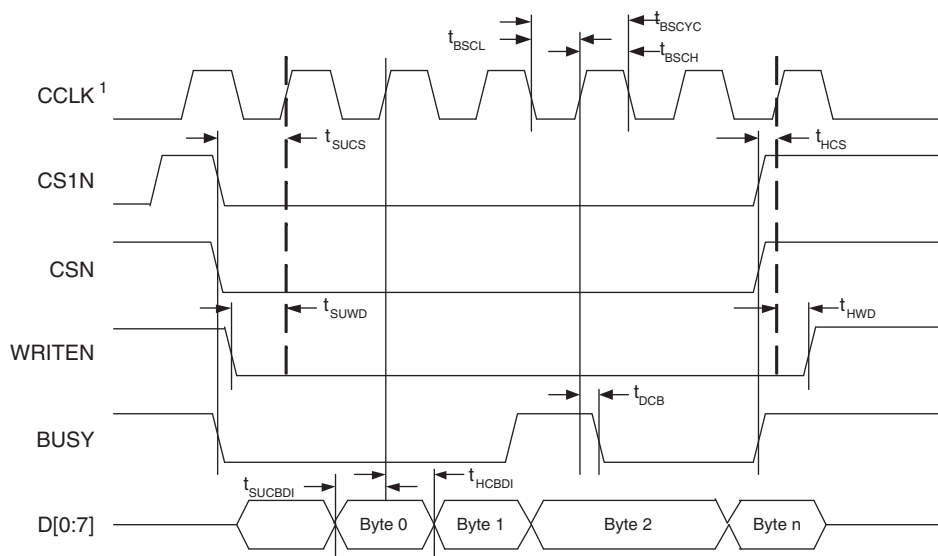
Note: Input data and address are registered at the positive edge of the clock and output data appears after the positive edge of the clock.

**Figure 3-12. sysCONFIG Parallel Port Read Cycle**



1. In Master Parallel Mode the FPGA provides CCLK. In Slave Parallel Mode the external device provides CCLK.

**Figure 3-13. sysCONFIG Parallel Port Write Cycle**



1. In Master Parallel Mode the FPGA provides CCLK. In Slave Parallel Mode the external device provides CCLK.

## Signal Descriptions (Cont.)

| Signal Name                                       | I/O | Description                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TDI                                               | I   | Test Data in pin. Used to load data into device using 1149.1 state machine. After power-up, this TAP port can be activated for configuration by sending appropriate command. (Note: once a configuration port is selected it is locked. Another configuration port cannot be selected until the power-up sequence). Pull-up is enabled during configuration. |
| TDO                                               | O   | Output pin. Test Data out pin used to shift data out of device using 1149.1.                                                                                                                                                                                                                                                                                 |
| V <sub>CCJ</sub>                                  | —   | V <sub>CCJ</sub> - The power supply pin for JTAG Test Access Port.                                                                                                                                                                                                                                                                                           |
| <b>Configuration Pads</b> (used during sysCONFIG) |     |                                                                                                                                                                                                                                                                                                                                                              |
| CFG[2:0]                                          | I   | Mode pins used to specify configuration modes values latched on rising edge of INITN. During configuration, a pull-up is enabled. These are dedicated pins.                                                                                                                                                                                                  |
| INITN                                             | I/O | Open Drain pin. Indicates the FPGA is ready to be configured. During configuration, a pull-up is enabled. It is a dedicated pin.                                                                                                                                                                                                                             |
| PROGRAMN                                          | I   | Initiates configuration sequence when asserted low. This pin always has an active pull-up. This is a dedicated pin.                                                                                                                                                                                                                                          |
| DONE                                              | I/O | Open Drain pin. Indicates that the configuration sequence is complete, and the startup sequence is in progress. This is a dedicated pin.                                                                                                                                                                                                                     |
| CCLK                                              | I/O | Configuration Clock for configuring an FPGA in sysCONFIG mode.                                                                                                                                                                                                                                                                                               |
| BUSY/SISPI                                        | I/O | Read control command in SPI3 or SPIX mode.                                                                                                                                                                                                                                                                                                                   |
| CSN                                               | I   | sysCONFIG chip select (Active low). During configuration, a pull-up is enabled.                                                                                                                                                                                                                                                                              |
| CS1N                                              | I   | sysCONFIG chip select (Active low). During configuration, a pull-up is enabled.                                                                                                                                                                                                                                                                              |
| WRITEN                                            | I   | Write Data on Parallel port (Active low).                                                                                                                                                                                                                                                                                                                    |
| D[7:0]/SPID[0:7]                                  | I/O | sysCONFIG Port Data I/O.                                                                                                                                                                                                                                                                                                                                     |
| DOUT/CSO                                          | O   | Output for serial configuration data (rising edge of CCLK) when using sysCONFIG port.                                                                                                                                                                                                                                                                        |
| DI/CSSPIN                                         | I/O | Input for serial configuration data (clocked with CCLK) when using sysCONFIG port. During configuration, a pull-up is enabled. Output when used in SPI/SPIX modes.                                                                                                                                                                                           |



**LFEC1, LFEC3 Logic Signal Connections: 100 TQFP**

| Pin Number | LFEC1        |      |      |                | LFEC3        |      |      |                |
|------------|--------------|------|------|----------------|--------------|------|------|----------------|
|            | Pin Function | Bank | LVDS | Dual Function  | Pin Function | Bank | LVDS | Dual Function  |
| 1*         | GND0<br>GND7 | -    |      |                | GND0<br>GND7 | -    |      |                |
| 2          | VCCIO7       | 7    |      |                | VCCIO7       | 7    |      |                |
| 3          | PL2A         | 7    | T    | VREF2_7        | PL2A         | 7    | T    | VREF2_7        |
| 4          | PL2B         | 7    | C    | VREF1_7        | PL2B         | 7    | C    | VREF1_7        |
| 5          | PL3A         | 7    | T    |                | PL7A         | 7    | T    |                |
| 6          | PL3B         | 7    | C    |                | PL7B         | 7    | C    |                |
| 7          | PL4A         | 7    | T    |                | PL8A         | 7    | T    |                |
| 8          | PL4B         | 7    | C    |                | PL8B         | 7    | C    |                |
| 9          | PL5A         | 7    | T    | PCLKT7_0       | PL9A         | 7    | T    | PCLKT7_0       |
| 10         | PL5B         | 7    | C    | PCLKC7_0       | PL9B         | 7    | C    | PCLKC7_0       |
| 11         | XRES         | 6    |      |                | XRES         | 6    |      |                |
| 12         | VCC          | -    |      |                | VCC          | -    |      |                |
| 13         | TCK          | 6    |      |                | TCK          | 6    |      |                |
| 14         | GND          | -    |      |                | GND          | -    |      |                |
| 15         | TDI          | 6    |      |                | TDI          | 6    |      |                |
| 16         | TMS          | 6    |      |                | TMS          | 6    |      |                |
| 17         | TDO          | 6    |      |                | TDO          | 6    |      |                |
| 18         | VCCJ         | 6    |      |                | VCCJ         | 6    |      |                |
| 19         | PL7A         | 6    | T    | LLM0_PLLT_IN_A | PL11A        | 6    | T    | LUM0_PLLT_IN_A |
| 20         | PL7B         | 6    | C    | LLM0_PLLC_IN_A | PL11B        | 6    | C    | LUM0_PLLC_IN_A |
| 21         | PL8A         | 6    | T    | LLM0_PLLT_FB_A | PL12A        | 6    | T    | LUM0_PLLT_FB_A |
| 22         | PL8B         | 6    | C    | LLM0_PLLC_FB_A | PL12B        | 6    | C    | LUM0_PLLC_FB_A |
| 23         | PL14A        | 6    |      | VREF1_6        | PL18A        | 6    |      | VREF1_6        |
| 24         | VCCIO6       | 6    |      |                | VCCIO6       | 6    |      |                |
| 25*        | GND5<br>GND6 | -    |      |                | GND5<br>GND6 | -    |      |                |
| 26         | VCCIO5       | 5    |      |                | VCCIO5       | 5    |      |                |
| 27         | PB2A         | 5    | T    |                | PB10A        | 5    | T    |                |
| 28         | PB2B         | 5    | C    |                | PB10B        | 5    | C    |                |
| 29         | PB3A         | 5    | T    |                | PB11A        | 5    | T    |                |
| 30         | PB3B         | 5    | C    |                | PB11B        | 5    | C    |                |
| 31         | PB6A         | 5    |      | BDQS6          | PB14A        | 5    |      | BDQS14         |
| 32         | PB8A         | 5    | T    | VREF2_5        | PB16A        | 5    | T    | VREF2_5        |
| 33         | PB8B         | 5    | C    | VREF1_5        | PB16B        | 5    | C    | VREF1_5        |
| 34         | PB9A         | 5    | T    | PCLKT5_0       | PB17A        | 5    | T    | PCLKT5_0       |
| 35         | GND5         | 5    |      |                | GND5         | 5    |      |                |
| 36         | PB9B         | 5    | C    | PCLKC5_0       | PB17B        | 5    | C    | PCLKC5_0       |
| 37         | VCCAUX       | -    |      |                | VCCAUX       | -    |      |                |
| 38         | VCCIO4       | 4    |      |                | VCCIO4       | 4    |      |                |
| 39         | PB10A        | 4    | T    | WRITEN         | PB18A        | 4    | T    | WRITEN         |
| 40         | PB10B        | 4    | C    | CS1N           | PB18B        | 4    | C    | CS1N           |

**LFEC3 and LFECP/EC6 Logic Signal Connections: 256 fpBGA (Cont.)**

| Ball Number | LFEC3         |      |      |                | LFECP6/LFEC6  |      |      |                |
|-------------|---------------|------|------|----------------|---------------|------|------|----------------|
|             | Ball Function | Bank | LVDS | Dual Function  | Ball Function | Bank | LVDS | Dual Function  |
| K2          | PL11A         | 6    | T    | LLM0_PLLT_IN_A | PL20A         | 6    | T    | LLM0_PLLT_IN_A |
| K1          | PL11B         | 6    | C    | LLM0_PLLC_IN_A | PL20B         | 6    | C    | LLM0_PLLC_IN_A |
| L2          | PL12A         | 6    | T    | LLM0_PLLT_FB_A | PL21A         | 6    | T    | LLM0_PLLT_FB_A |
| L1          | PL12B         | 6    | C    | LLM0_PLLC_FB_A | PL21B         | 6    | C    | LLM0_PLLC_FB_A |
| M2          | PL13A         | 6    | T    |                | PL22A         | 6    | T    |                |
| M1          | PL13B         | 6    | C    |                | PL22B         | 6    | C    |                |
| N1          | PL14A         | 6    | T    |                | PL23A         | 6    | T    |                |
| GND         | GND6          | 6    |      |                | GND6          | 6    |      |                |
| N2          | PL14B         | 6    | C    |                | PL23B         | 6    | C    |                |
| M4          | PL15A         | 6    | T    | LDQS15         | PL24A         | 6    | T    | LDQS24         |
| M3          | PL15B         | 6    | C    |                | PL24B         | 6    | C    |                |
| P1          | PL16A         | 6    | T    |                | PL25A         | 6    | T    |                |
| R1          | PL16B         | 6    | C    |                | PL25B         | 6    | C    |                |
| P2          | PL17A         | 6    | T    |                | PL26A         | 6    | T    |                |
| P3          | PL17B         | 6    | C    |                | PL26B         | 6    | C    |                |
| N3          | PL18A         | 6    | T    | VREF1_6        | PL27A         | 6    | T    | VREF1_6        |
| N4          | PL18B         | 6    | C    | VREF2_6        | PL27B         | 6    | C    | VREF2_6        |
| GND         | GND6          | 6    |      |                | GND6          | 6    |      |                |
| GND         | GND5          | 5    |      |                | GND5          | 5    |      |                |
| P4          | PB2A          | 5    | T    |                | PB2A          | 5    | T    |                |
| N5          | PB2B          | 5    | C    |                | PB2B          | 5    | C    |                |
| P5          | PB3A          | 5    | T    |                | PB3A          | 5    | T    |                |
| P6          | PB3B          | 5    | C    |                | PB3B          | 5    | C    |                |
| R4          | PB4A          | 5    | T    |                | PB4A          | 5    | T    |                |
| R3          | PB4B          | 5    | C    |                | PB4B          | 5    | C    |                |
| T2          | PB5A          | 5    | T    |                | PB5A          | 5    | T    |                |
| T3          | PB5B          | 5    | C    |                | PB5B          | 5    | C    |                |
| R5          | PB6A          | 5    | T    | BDQS6          | PB6A          | 5    | T    | BDQS6          |
| R6          | PB6B          | 5    | C    |                | PB6B          | 5    | C    |                |
| T4          | PB7A          | 5    | T    |                | PB7A          | 5    | T    |                |
| T5          | PB7B          | 5    | C    |                | PB7B          | 5    | C    |                |
| N6          | PB8A          | 5    | T    |                | PB8A          | 5    | T    |                |
| M6          | PB8B          | 5    | C    |                | PB8B          | 5    | C    |                |
| T6          | PB9A          | 5    | T    |                | PB9A          | 5    | T    |                |
| GND         | GND5          | 5    |      |                | GND5          | 5    |      |                |
| T7          | PB9B          | 5    | C    |                | PB9B          | 5    | C    |                |
| P7          | PB10A         | 5    | T    |                | PB10A         | 5    | T    |                |
| N7          | PB10B         | 5    | C    |                | PB10B         | 5    | C    |                |
| R7          | PB11A         | 5    | T    |                | PB11A         | 5    | T    |                |
| R8          | PB11B         | 5    | C    |                | PB11B         | 5    | C    |                |
| M7          | PB12A         | 5    | T    |                | PB12A         | 5    | T    |                |
| M8          | PB12B         | 5    | C    |                | PB12B         | 5    | C    |                |
| T8          | PB13A         | 5    | T    |                | PB13A         | 5    | T    |                |

**LFECP/EC10 and LFECP/EC15 Logic Signal Connections: 256 fpBGA (Cont.)**

| Ball Number | LFECP10/LFEC10 |      |      |               | LFECP15/LFEC15 |      |      |               |
|-------------|----------------|------|------|---------------|----------------|------|------|---------------|
|             | Ball Function  | Bank | LVDS | Dual Function | Ball Function  | Bank | LVDS | Dual Function |
| G9          | GND            | -    |      |               | GND            | -    |      |               |
| H10         | GND            | -    |      |               | GND            | -    |      |               |
| H7          | GND            | -    |      |               | GND            | -    |      |               |
| H8          | GND            | -    |      |               | GND            | -    |      |               |
| H9          | GND            | -    |      |               | GND            | -    |      |               |
| J10         | GND            | -    |      |               | GND            | -    |      |               |
| J7          | GND            | -    |      |               | GND            | -    |      |               |
| J8          | GND            | -    |      |               | GND            | -    |      |               |
| J9          | GND            | -    |      |               | GND            | -    |      |               |
| K10         | GND            | -    |      |               | GND            | -    |      |               |
| K7          | GND            | -    |      |               | GND            | -    |      |               |
| K8          | GND            | -    |      |               | GND            | -    |      |               |
| K9          | GND            | -    |      |               | GND            | -    |      |               |
| T1          | GND            | -    |      |               | GND            | -    |      |               |
| T16         | GND            | -    |      |               | GND            | -    |      |               |
| E12         | VCC            | -    |      |               | VCC            | -    |      |               |
| E5          | VCC            | -    |      |               | VCC            | -    |      |               |
| E8          | VCC            | -    |      |               | VCC            | -    |      |               |
| M12         | VCC            | -    |      |               | VCC            | -    |      |               |
| M5          | VCC            | -    |      |               | VCC            | -    |      |               |
| M9          | VCC            | -    |      |               | VCC            | -    |      |               |
| B15         | VCCAUX         | -    |      |               | VCCAUX         | -    |      |               |
| R2          | VCCAUX         | -    |      |               | VCCAUX         | -    |      |               |
| F7          | VCCIO0         | 0    |      |               | VCCIO0         | 0    |      |               |
| F8          | VCCIO0         | 0    |      |               | VCCIO0         | 0    |      |               |
| F10         | VCCIO1         | 1    |      |               | VCCIO1         | 1    |      |               |
| F9          | VCCIO1         | 1    |      |               | VCCIO1         | 1    |      |               |
| G11         | VCCIO2         | 2    |      |               | VCCIO2         | 2    |      |               |
| H11         | VCCIO2         | 2    |      |               | VCCIO2         | 2    |      |               |
| J11         | VCCIO3         | 3    |      |               | VCCIO3         | 3    |      |               |
| K11         | VCCIO3         | 3    |      |               | VCCIO3         | 3    |      |               |
| L10         | VCCIO4         | 4    |      |               | VCCIO4         | 4    |      |               |
| L9          | VCCIO4         | 4    |      |               | VCCIO4         | 4    |      |               |
| L7          | VCCIO5         | 5    |      |               | VCCIO5         | 5    |      |               |
| L8          | VCCIO5         | 5    |      |               | VCCIO5         | 5    |      |               |
| J6          | VCCIO6         | 6    |      |               | VCCIO6         | 6    |      |               |
| K6          | VCCIO6         | 6    |      |               | VCCIO6         | 6    |      |               |
| G6          | VCCIO7         | 7    |      |               | VCCIO7         | 7    |      |               |
| H6          | VCCIO7         | 7    |      |               | VCCIO7         | 7    |      |               |
| F6          | VCC            | -    |      |               | VCC            | -    |      |               |
| F11         | VCC            | -    |      |               | VCC            | -    |      |               |
| L11         | VCC            | -    |      |               | VCC            | -    |      |               |
| L6          | VCC            | -    |      |               | VCC            | -    |      |               |

## LFEC6/EC6, LFEC6/EC10, LFEC6/EC15 Logic Signal Connections: 484 fpBGA (Cont.)

| LFEC6/LFEC6 |               |      |      |               | LFEC10/LFEC10 |               |      |      |               | LFEC6/LFEC15 |               |      |      |               |
|-------------|---------------|------|------|---------------|---------------|---------------|------|------|---------------|--------------|---------------|------|------|---------------|
| Ball Number | Ball Function | Bank | LVDS | Dual Function | Ball Number   | Ball Function | Bank | LVDS | Dual Function | Ball Number  | Ball Function | Bank | LVDS | Dual Function |
| N13         | GND           | -    |      |               | N13           | GND           | -    |      |               | N13          | GND           | -    |      |               |
| N14         | GND           | -    |      |               | N14           | GND           | -    |      |               | N14          | GND           | -    |      |               |
| N9          | GND           | -    |      |               | N9            | GND           | -    |      |               | N9           | GND           | -    |      |               |
| P10         | GND           | -    |      |               | P10           | GND           | -    |      |               | P10          | GND           | -    |      |               |
| P11         | GND           | -    |      |               | P11           | GND           | -    |      |               | P11          | GND           | -    |      |               |
| P12         | GND           | -    |      |               | P12           | GND           | -    |      |               | P12          | GND           | -    |      |               |
| P13         | GND           | -    |      |               | P13           | GND           | -    |      |               | P13          | GND           | -    |      |               |
| P14         | GND           | -    |      |               | P14           | GND           | -    |      |               | P14          | GND           | -    |      |               |
| P9          | GND           | -    |      |               | P9            | GND           | -    |      |               | P9           | GND           | -    |      |               |
| R15         | GND           | -    |      |               | R15           | GND           | -    |      |               | R15          | GND           | -    |      |               |
| R8          | GND           | -    |      |               | R8            | GND           | -    |      |               | R8           | GND           | -    |      |               |
| J16         | VCC           | -    |      |               | J16           | VCC           | -    |      |               | J16          | VCC           | -    |      |               |
| J7          | VCC           | -    |      |               | J7            | VCC           | -    |      |               | J7           | VCC           | -    |      |               |
| K16         | VCC           | -    |      |               | K16           | VCC           | -    |      |               | K16          | VCC           | -    |      |               |
| K17         | VCC           | -    |      |               | K17           | VCC           | -    |      |               | K17          | VCC           | -    |      |               |
| K6          | VCC           | -    |      |               | K6            | VCC           | -    |      |               | K6           | VCC           | -    |      |               |
| K7          | VCC           | -    |      |               | K7            | VCC           | -    |      |               | K7           | VCC           | -    |      |               |
| L17         | VCC           | -    |      |               | L17           | VCC           | -    |      |               | L17          | VCC           | -    |      |               |
| L6          | VCC           | -    |      |               | L6            | VCC           | -    |      |               | L6           | VCC           | -    |      |               |
| M17         | VCC           | -    |      |               | M17           | VCC           | -    |      |               | M17          | VCC           | -    |      |               |
| M6          | VCC           | -    |      |               | M6            | VCC           | -    |      |               | M6           | VCC           | -    |      |               |
| N16         | VCC           | -    |      |               | N16           | VCC           | -    |      |               | N16          | VCC           | -    |      |               |
| N17         | VCC           | -    |      |               | N17           | VCC           | -    |      |               | N17          | VCC           | -    |      |               |
| N6          | VCC           | -    |      |               | N6            | VCC           | -    |      |               | N6           | VCC           | -    |      |               |
| N7          | VCC           | -    |      |               | N7            | VCC           | -    |      |               | N7           | VCC           | -    |      |               |
| P16         | VCC           | -    |      |               | P16           | VCC           | -    |      |               | P16          | VCC           | -    |      |               |
| P7          | VCC           | -    |      |               | P7            | VCC           | -    |      |               | P7           | VCC           | -    |      |               |
| G11         | VCCIO0        | 0    |      |               | G11           | VCCIO0        | 0    |      |               | G11          | VCCIO0        | 0    |      |               |
| H10         | VCCIO0        | 0    |      |               | H10           | VCCIO0        | 0    |      |               | H10          | VCCIO0        | 0    |      |               |
| H11         | VCCIO0        | 0    |      |               | H11           | VCCIO0        | 0    |      |               | H11          | VCCIO0        | 0    |      |               |
| H9          | VCCIO0        | 0    |      |               | H9            | VCCIO0        | 0    |      |               | H9           | VCCIO0        | 0    |      |               |
| G12         | VCCIO1        | 1    |      |               | G12           | VCCIO1        | 1    |      |               | G12          | VCCIO1        | 1    |      |               |
| H12         | VCCIO1        | 1    |      |               | H12           | VCCIO1        | 1    |      |               | H12          | VCCIO1        | 1    |      |               |
| H13         | VCCIO1        | 1    |      |               | H13           | VCCIO1        | 1    |      |               | H13          | VCCIO1        | 1    |      |               |
| H14         | VCCIO1        | 1    |      |               | H14           | VCCIO1        | 1    |      |               | H14          | VCCIO1        | 1    |      |               |
| J15         | VCCIO2        | 2    |      |               | J15           | VCCIO2        | 2    |      |               | J15          | VCCIO2        | 2    |      |               |
| K15         | VCCIO2        | 2    |      |               | K15           | VCCIO2        | 2    |      |               | K15          | VCCIO2        | 2    |      |               |
| L15         | VCCIO2        | 2    |      |               | L15           | VCCIO2        | 2    |      |               | L15          | VCCIO2        | 2    |      |               |
| L16         | VCCIO2        | 2    |      |               | L16           | VCCIO2        | 2    |      |               | L16          | VCCIO2        | 2    |      |               |
| M15         | VCCIO3        | 3    |      |               | M15           | VCCIO3        | 3    |      |               | M15          | VCCIO3        | 3    |      |               |
| M16         | VCCIO3        | 3    |      |               | M16           | VCCIO3        | 3    |      |               | M16          | VCCIO3        | 3    |      |               |
| N15         | VCCIO3        | 3    |      |               | N15           | VCCIO3        | 3    |      |               | N15          | VCCIO3        | 3    |      |               |
| P15         | VCCIO3        | 3    |      |               | P15           | VCCIO3        | 3    |      |               | P15          | VCCIO3        | 3    |      |               |
| R12         | VCCIO4        | 4    |      |               | R12           | VCCIO4        | 4    |      |               | R12          | VCCIO4        | 4    |      |               |
| R13         | VCCIO4        | 4    |      |               | R13           | VCCIO4        | 4    |      |               | R13          | VCCIO4        | 4    |      |               |
| R14         | VCCIO4        | 4    |      |               | R14           | VCCIO4        | 4    |      |               | R14          | VCCIO4        | 4    |      |               |
| T12         | VCCIO4        | 4    |      |               | T12           | VCCIO4        | 4    |      |               | T12          | VCCIO4        | 4    |      |               |
| R10         | VCCIO5        | 5    |      |               | R10           | VCCIO5        | 5    |      |               | R10          | VCCIO5        | 5    |      |               |
| R11         | VCCIO5        | 5    |      |               | R11           | VCCIO5        | 5    |      |               | R11          | VCCIO5        | 5    |      |               |
| R9          | VCCIO5        | 5    |      |               | R9            | VCCIO5        | 5    |      |               | R9           | VCCIO5        | 5    |      |               |

## LFEC6/EC6, LFEC6/EC10, LFEC6/EC15 Logic Signal Connections: 484 fpBGA (Cont.)

| LFEC6/LFEC6 |               |      |      |               | LFEC10/LFEC10 |               |      |      |               | LFEC6/LFEC15 |               |      |      |               |
|-------------|---------------|------|------|---------------|---------------|---------------|------|------|---------------|--------------|---------------|------|------|---------------|
| Ball Number | Ball Function | Bank | LVDS | Dual Function | Ball Number   | Ball Function | Bank | LVDS | Dual Function | Ball Number  | Ball Function | Bank | LVDS | Dual Function |
| T11         | VCCIO5        | 5    |      |               | T11           | VCCIO5        | 5    |      |               | T11          | VCCIO5        | 5    |      |               |
| M7          | VCCIO6        | 6    |      |               | M7            | VCCIO6        | 6    |      |               | M7           | VCCIO6        | 6    |      |               |
| M8          | VCCIO6        | 6    |      |               | M8            | VCCIO6        | 6    |      |               | M8           | VCCIO6        | 6    |      |               |
| N8          | VCCIO6        | 6    |      |               | N8            | VCCIO6        | 6    |      |               | N8           | VCCIO6        | 6    |      |               |
| P8          | VCCIO6        | 6    |      |               | P8            | VCCIO6        | 6    |      |               | P8           | VCCIO6        | 6    |      |               |
| J8          | VCCIO7        | 7    |      |               | J8            | VCCIO7        | 7    |      |               | J8           | VCCIO7        | 7    |      |               |
| K8          | VCCIO7        | 7    |      |               | K8            | VCCIO7        | 7    |      |               | K8           | VCCIO7        | 7    |      |               |
| L7          | VCCIO7        | 7    |      |               | L7            | VCCIO7        | 7    |      |               | L7           | VCCIO7        | 7    |      |               |
| L8          | VCCIO7        | 7    |      |               | L8            | VCCIO7        | 7    |      |               | L8           | VCCIO7        | 7    |      |               |
| G15         | VCCAUX        | -    |      |               | G15           | VCCAUX        | -    |      |               | G15          | VCCAUX        | -    |      |               |
| G16         | VCCAUX        | -    |      |               | G16           | VCCAUX        | -    |      |               | G16          | VCCAUX        | -    |      |               |
| G7          | VCCAUX        | -    |      |               | G7            | VCCAUX        | -    |      |               | G7           | VCCAUX        | -    |      |               |
| G8          | VCCAUX        | -    |      |               | G8            | VCCAUX        | -    |      |               | G8           | VCCAUX        | -    |      |               |
| H16         | VCCAUX        | -    |      |               | H16           | VCCAUX        | -    |      |               | H16          | VCCAUX        | -    |      |               |
| H7          | VCCAUX        | -    |      |               | H7            | VCCAUX        | -    |      |               | H7           | VCCAUX        | -    |      |               |
| R16         | VCCAUX        | -    |      |               | R16           | VCCAUX        | -    |      |               | R16          | VCCAUX        | -    |      |               |
| R7          | VCCAUX        | -    |      |               | R7            | VCCAUX        | -    |      |               | R7           | VCCAUX        | -    |      |               |
| T15         | VCCAUX        | -    |      |               | T15           | VCCAUX        | -    |      |               | T15          | VCCAUX        | -    |      |               |
| T16         | VCCAUX        | -    |      |               | T16           | VCCAUX        | -    |      |               | T16          | VCCAUX        | -    |      |               |
| T7          | VCCAUX        | -    |      |               | T7            | VCCAUX        | -    |      |               | T7           | VCCAUX        | -    |      |               |
| T8          | VCCAUX        | -    |      |               | T8            | VCCAUX        | -    |      |               | T8           | VCCAUX        | -    |      |               |
| J6          | VCC           | -    |      |               | J6            | VCC           | -    |      |               | J6           | VCC           | -    |      |               |
| J17         | VCC           | -    |      |               | J17           | VCC           | -    |      |               | J17          | VCC           | -    |      |               |
| P6          | VCC           | -    |      |               | P6            | VCC           | -    |      |               | P6           | VCC           | -    |      |               |
| P17         | VCC           | -    |      |               | P17           | VCC           | -    |      |               | P17          | VCC           | -    |      |               |
| A2          | NC            | -    |      |               | A2            | NC            | -    |      |               | A2           | NC            | -    |      |               |
| AB2         | NC            | -    |      |               | AB2           | NC            | -    |      |               | AB2          | NC            | -    |      |               |
| A21         | NC            | -    |      |               | A21           | NC            | -    |      |               | A21          | NC            | -    |      |               |

**LFEC20/EC20 and LFEC20/EC33 Logic Signal Connections: 484 fpBGA (Cont.)**

| LFEC20/LFEC20 |               |      |       |                | LFEC20/LFEC33 |               |      |       |                |
|---------------|---------------|------|-------|----------------|---------------|---------------|------|-------|----------------|
| Ball Number   | Ball Function | Bank | LVD S | Dual Function  | Ball Number   | Ball Function | Bank | LVD S | Dual Function  |
| W20           | PR48B         | 3    | C     | VREF2_3        | W20           | PR68B         | 3    | C     | VREF2_3        |
| Y20           | PR48A         | 3    | T     | VREF1_3        | Y20           | PR68A         | 3    | T     | VREF1_3        |
| GND           | -             | -    |       |                | GND           | GND3          | 3    |       |                |
| GND           | -             | -    |       |                | GND           | GND3          | 3    |       |                |
| AA21          | PR47B         | 3    | C     |                | AA21          | PR59B         | 3    | C     |                |
| AB21          | PR47A         | 3    | T     |                | AB21          | PR59A         | 3    | T     |                |
| W19           | PR46B         | 3    | C     |                | W19           | PR58B         | 3    | C     |                |
| V19           | PR46A         | 3    | T     |                | V19           | PR58A         | 3    | T     |                |
| Y21           | PR45B         | 3    | C     |                | Y21           | PR57B         | 3    | C     |                |
| AA22          | PR45A         | 3    | T     | RDQS45         | AA22          | PR57A         | 3    | T     | RDQS57         |
| V20           | PR44B         | 3    | C     | RLM0_PLLC_IN_A | V20           | PR56B         | 3    | C     | RLM0_PLLC_IN_A |
| GND           | GND3          | 3    |       |                | GND           | GND3          | 3    |       |                |
| U20           | PR44A         | 3    | T     | RLM0_PLLT_IN_A | U20           | PR56A         | 3    | T     | RLM0_PLLT_IN_A |
| W21           | PR43B         | 3    | C     | RLM0_PLLC_FB_A | W21           | PR55B         | 3    | C     | RLM0_PLLC_FB_A |
| Y22           | PR43A         | 3    | T     | RLM0_PLLT_FB_A | Y22           | PR55A         | 3    | T     | RLM0_PLLT_FB_A |
| V21           | PR42B         | 3    | C     | DI/CSSPIN      | V21           | PR54B         | 3    | C     | DI/CSSPIN      |
| W22           | PR42A         | 3    | T     | DOUT/CSON      | W22           | PR54A         | 3    | T     | DOUT/CSON      |
| U21           | PR41B         | 3    | C     | BUSY/SISPI     | U21           | PR53B         | 3    | C     | BUSY/SISPI     |
| V22           | PR41A         | 3    | T     | D7/SPID0       | V22           | PR53A         | 3    | T     | D7/SPID0       |
| T19           | CFG2          | 3    |       |                | T19           | CFG2          | 3    |       |                |
| U19           | CFG1          | 3    |       |                | U19           | CFG1          | 3    |       |                |
| U18           | CFG0          | 3    |       |                | U18           | CFG0          | 3    |       |                |
| V18           | PROGRAMN      | 3    |       |                | V18           | PROGRAMN      | 3    |       |                |
| T20           | CCLK          | 3    |       |                | T20           | CCLK          | 3    |       |                |
| T21           | INITN         | 3    |       |                | T21           | INITN         | 3    |       |                |
| R20           | DONE          | 3    |       |                | R20           | DONE          | 3    |       |                |
| GND           | GND3          | 3    |       |                | GND           | GND3          | 3    |       |                |
| T18           | PR37B         | 3    | C     |                | T18           | PR49B         | 3    | C     |                |
| R17           | PR37A         | 3    | T     |                | R17           | PR49A         | 3    | T     |                |
| R19           | PR36B         | 3    | C     |                | R19           | PR48B         | 3    | C     |                |
| R18           | PR36A         | 3    | T     | RDQS36         | R18           | PR48A         | 3    | T     | RDQS48         |
| U22           | PR35B         | 3    | C     |                | U22           | PR47B         | 3    | C     |                |
| GND           | GND3          | 3    |       |                | GND           | GND3          | 3    |       |                |
| T22           | PR35A         | 3    | T     |                | T22           | PR47A         | 3    | T     |                |
| R21           | PR34B         | 3    | C     |                | R21           | PR46B         | 3    | C     |                |
| R22           | PR34A         | 3    | T     |                | R22           | PR46A         | 3    | T     |                |
| P20           | PR33B         | 3    | C     |                | P20           | PR45B         | 3    | C     |                |
| N20           | PR33A         | 3    | T     |                | N20           | PR45A         | 3    | T     |                |
| P19           | PR32B         | 3    | C     |                | P19           | PR44B         | 3    | C     |                |
| P18           | PR32A         | 3    | T     |                | P18           | PR44A         | 3    | T     |                |
| P21           | PR31B         | 3    | C     |                | P21           | PR43B         | 3    | C     |                |
| GND           | GND3          | 3    |       |                | GND           | GND3          | 3    |       |                |
| P22           | PR31A         | 3    | T     |                | P22           | PR43A         | 3    | T     |                |
| N21           | PR30B         | 3    | C     |                | N21           | PR42B         | 3    | C     |                |

**LFECP/EC20, LFECP/EC33 Logic Signal Connections: 672 fpBGA**

| LFEC20/LFEC20 |               |      |      |                | LFECP/EC33  |               |      |      |                |
|---------------|---------------|------|------|----------------|-------------|---------------|------|------|----------------|
| Ball Number   | Ball Function | Bank | LVDS | Dual Function  | Ball Number | Ball Function | Bank | LVDS | Dual Function  |
| GND           | GND7          | 7    |      |                | GND         | GND7          | 7    |      |                |
| E3            | PL2A          | 7    | T    | VREF2_7        | E3          | PL2A          | 7    | T    | VREF2_7        |
| E4            | PL2B          | 7    | C    | VREF1_7        | E4          | PL2B          | 7    | C    | VREF1_7        |
| E5            | NC            | -    |      |                | E5          | PL6A          | 7    | T    | LDQS6          |
| D5            | NC            | -    |      |                | D5          | PL6B          | 7    | C    |                |
| F4            | NC            | -    |      |                | F4          | PL7A          | 7    | T    |                |
| F5            | NC            | -    |      |                | F5          | PL7B          | 7    | C    |                |
| C3            | NC            | -    |      |                | C3          | PL8A          | 7    | T    |                |
| D3            | NC            | -    |      |                | D3          | PL8B          | 7    | C    |                |
| C2            | NC            | -    |      |                | C2          | PL9A          | 7    | T    |                |
| -             | -             | -    |      |                | GND         | GND7          | 7    |      |                |
| B2            | NC            | -    |      |                | B2          | PL9B          | 7    | C    |                |
| B1            | PL3A          | 7    | T    |                | B1          | PL10A         | 7    | T    |                |
| C1            | PL3B          | 7    | C    |                | C1          | PL10B         | 7    | C    |                |
| F3            | PL4A          | 7    | T    |                | F3          | PL11A         | 7    | T    |                |
| G3            | PL4B          | 7    | C    |                | G3          | PL11B         | 7    | C    |                |
| D2            | PL5A          | 7    | T    |                | D2          | PL12A         | 7    | T    |                |
| E2            | PL5B          | 7    | C    |                | E2          | PL12B         | 7    | C    |                |
| -             | -             | -    |      |                | GND         | GND7          | 7    |      |                |
| D1            | PL6A          | 7    | T    | LDQS6          | D1          | PL14A         | 7    | T    | LDQS14         |
| E1            | PL6B          | 7    | C    |                | E1          | PL14B         | 7    | C    |                |
| F2            | PL7A          | 7    | T    |                | F2          | PL15A         | 7    | T    |                |
| G2            | PL7B          | 7    | C    |                | G2          | PL15B         | 7    | C    |                |
| F6            | PL8A          | 7    | T    | LUM0_PLLT_IN_A | F6          | PL16A         | 7    | T    | LUM0_PLLT_IN_A |
| G6            | PL8B          | 7    | C    | LUM0_PLLC_IN_A | G6          | PL16B         | 7    | C    | LUM0_PLLC_IN_A |
| H4            | PL9A          | 7    | T    | LUM0_PLLT_FB_A | H4          | PL17A         | 7    | T    | LUM0_PLLT_FB_A |
| GND           | GND7          | 7    |      |                | GND         | GND7          | 7    |      |                |
| G4            | PL9B          | 7    | C    | LUM0_PLLC_FB_A | G4          | PL17B         | 7    | C    | LUM0_PLLC_FB_A |
| H6            | NC            | -    |      |                | H6          | PL19A         | 7    | T    |                |
| J7            | NC            | -    |      |                | J7          | PL19B         | 7    | C    |                |
| G5            | NC            | -    |      |                | G5          | PL20A         | 7    | T    |                |
| H5            | NC            | -    |      |                | H5          | PL20B         | 7    | C    |                |
| H3            | NC            | -    |      |                | H3          | PL21A         | 7    | T    |                |
| J3            | NC            | -    |      |                | J3          | PL21B         | 7    | C    |                |
| H2            | NC            | -    |      |                | H2          | PL22A         | 7    | T    |                |
| -             | -             | -    |      |                | GND         | GND7          | 7    |      |                |
| J2            | NC            | -    |      |                | J2          | PL22B         | 7    | C    |                |
| J4            | PL11A         | 7    | T    |                | J4          | PL23A         | 7    | T    | LDQS23         |
| J5            | PL11B         | 7    | C    |                | J5          | PL23B         | 7    | C    |                |
| K4            | PL12A         | 7    | T    |                | K4          | PL24A         | 7    | T    |                |
| K5            | PL12B         | 7    | C    |                | K5          | PL24B         | 7    | C    |                |
| J6            | PL13A         | 7    | T    |                | J6          | PL25A         | 7    | T    |                |

**LFECP/EC20, LFECP/EC33 Logic Signal Connections: 672 fpBGA (Cont.)**

| LFEC20/LFECP20 |               |      |      |               | LFECP/EC33  |               |      |      |               |
|----------------|---------------|------|------|---------------|-------------|---------------|------|------|---------------|
| Ball Number    | Ball Function | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function |
| U21            | PR36B         | 3    | C    |               | U21         | PR48B         | 3    | C    |               |
| T21            | PR36A         | 3    | T    | RDQS36        | T21         | PR48A         | 3    | T    | RDQS48        |
| T25            | PR35B         | 3    | C    |               | T25         | PR47B         | 3    | C    |               |
| GND            | GND3          | 3    |      |               | GND         | GND3          | 3    |      |               |
| T26            | PR35A         | 3    | T    |               | T26         | PR47A         | 3    | T    |               |
| T22            | PR34B         | 3    | C    |               | T22         | PR46B         | 3    | C    |               |
| T23            | PR34A         | 3    | T    |               | T23         | PR46A         | 3    | T    |               |
| T24            | PR33B         | 3    | C    |               | T24         | PR45B         | 3    | C    |               |
| R23            | PR33A         | 3    | T    |               | R23         | PR45A         | 3    | T    |               |
| R25            | PR32B         | 3    | C    |               | R25         | PR44B         | 3    | C    |               |
| R24            | PR32A         | 3    | T    |               | R24         | PR44A         | 3    | T    |               |
| R26            | PR31B         | 3    | C    |               | R26         | PR43B         | 3    | C    |               |
| GND            | GND3          | 3    |      |               | GND         | GND3          | 3    |      |               |
| P26            | PR31A         | 3    | T    |               | P26         | PR43A         | 3    | T    |               |
| R21            | PR30B         | 3    | C    |               | R21         | PR42B         | 3    | C    |               |
| R22            | PR30A         | 3    | T    |               | R22         | PR42A         | 3    | T    |               |
| P25            | PR29B         | 3    | C    |               | P25         | PR41B         | 3    | C    |               |
| P24            | PR29A         | 3    | T    |               | P24         | PR41A         | 3    | T    |               |
| P23            | PR28B         | 3    | C    |               | P23         | PR40B         | 3    | C    |               |
| P22            | PR28A         | 3    | T    | RDQS28        | P22         | PR40A         | 3    | T    | RDQS40        |
| N26            | PR27B         | 3    | C    |               | N26         | PR39B         | 3    | C    |               |
| GND            | GND3          | 3    |      |               | GND         | GND3          | 3    |      |               |
| M26            | PR27A         | 3    | T    |               | M26         | PR39A         | 3    | T    |               |
| N21            | PR26B         | 3    | C    |               | N21         | PR38B         | 3    | C    |               |
| P21            | PR26A         | 3    | T    |               | P21         | PR38A         | 3    | T    |               |
| N23            | PR25B         | 3    | C    |               | N23         | PR37B         | 3    | C    |               |
| N22            | PR25A         | 3    | T    |               | N22         | PR37A         | 3    | T    |               |
| N25            | PR24B         | 3    | C    |               | N25         | PR36B         | 3    | C    |               |
| N24            | PR24A         | 3    | T    |               | N24         | PR36A         | 3    | T    |               |
| L26            | PR22B         | 2    | C    | PCLKC2_0      | L26         | PR34B         | 2    | C    | PCLKC2_0      |
| GND            | GND2          | 2    |      |               | GND         | GND2          | 2    |      |               |
| K26            | PR22A         | 2    | T    | PCLKT2_0      | K26         | PR34A         | 2    | T    | PCLKT2_0      |
| M22            | PR21B         | 2    | C    |               | M22         | PR33B         | 2    | C    |               |
| M23            | PR21A         | 2    | T    |               | M23         | PR33A         | 2    | T    |               |
| M25            | PR20B         | 2    | C    |               | M25         | PR32B         | 2    | C    |               |
| M24            | PR20A         | 2    | T    |               | M24         | PR32A         | 2    | T    |               |
| M21            | PR19B         | 2    | C    |               | M21         | PR31B         | 2    | C    |               |
| L21            | PR19A         | 2    | T    | RDQS19        | L21         | PR31A         | 2    | T    | RDQS31        |
| L22            | PR18B         | 2    | C    |               | L22         | PR30B         | 2    | C    |               |
| GND            | GND2          | 2    |      |               | GND         | GND2          | 2    |      |               |
| L23            | PR18A         | 2    | T    |               | L23         | PR30A         | 2    | T    |               |
| L25            | PR17B         | 2    | C    |               | L25         | PR29B         | 2    | C    |               |



**LFECP/EC20, LFECP/EC33 Logic Signal Connections: 672 fpBGA (Cont.)**

| LFEC20/LFEC20 |               |      |      |                | LFECP/EC33  |               |      |      |                |
|---------------|---------------|------|------|----------------|-------------|---------------|------|------|----------------|
| Ball Number   | Ball Function | Bank | LVDS | Dual Function  | Ball Number | Ball Function | Bank | LVDS | Dual Function  |
| L24           | PR17A         | 2    | T    |                | L24         | PR29A         | 2    | T    |                |
| K25           | PR16B         | 2    | C    |                | K25         | PR28B         | 2    | C    |                |
| J25           | PR16A         | 2    | T    |                | J25         | PR28A         | 2    | T    |                |
| J26           | PR15B         | 2    | C    |                | J26         | PR27B         | 2    | C    |                |
| H26           | PR15A         | 2    | T    |                | H26         | PR27A         | 2    | T    |                |
| H25           | PR14B         | 2    | C    |                | H25         | PR26B         | 2    | C    |                |
| GND           | GND2          | 2    |      |                | GND         | GND2          | 2    |      |                |
| J24           | PR14A         | 2    | T    |                | J24         | PR26A         | 2    | T    |                |
| K21           | PR13B         | 2    | C    |                | K21         | PR25B         | 2    | C    |                |
| K22           | PR13A         | 2    | T    |                | K22         | PR25A         | 2    | T    |                |
| K20           | PR12B         | 2    | C    |                | K20         | PR24B         | 2    | C    |                |
| J20           | PR12A         | 2    | T    |                | J20         | PR24A         | 2    | T    |                |
| K23           | PR11B         | 2    | C    |                | K23         | PR23B         | 2    | C    |                |
| K24           | PR11A         | 2    | T    |                | K24         | PR23A         | 2    | T    | RDQS23         |
| J21           | NC            | -    |      |                | J21         | PR22B         | 2    | C    |                |
| -             | -             | -    |      |                | GND         | GND2          | 2    |      |                |
| J22           | NC            | -    |      |                | J22         | PR22A         | 2    | T    |                |
| J23           | NC            | -    |      |                | J23         | PR21B         | 2    | C    |                |
| H22           | NC            | -    |      |                | H22         | PR21A         | 2    | T    |                |
| G26           | NC            | -    |      |                | G26         | PR20B         | 2    | C    |                |
| F26           | NC            | -    |      |                | F26         | PR20A         | 2    | T    |                |
| E26           | NC            | -    |      |                | E26         | PR19B         | 2    | C    |                |
| E25           | NC            | -    |      |                | E25         | PR19A         | 2    | T    |                |
| F25           | PR9B          | 2    | C    | RUM0_PLLC_FB_A | F25         | PR17B         | 2    | C    | RUM0_PLLC_FB_A |
| GND           | GND2          | 2    |      |                | GND         | GND2          | 2    |      |                |
| G25           | PR9A          | 2    | T    | RUM0_PLLT_FB_A | G25         | PR17A         | 2    | T    | RUM0_PLLT_FB_A |
| H23           | PR8B          | 2    | C    | RUM0_PLLC_IN_A | H23         | PR16B         | 2    | C    | RUM0_PLLC_IN_A |
| H24           | PR8A          | 2    | T    | RUM0_PLLT_IN_A | H24         | PR16A         | 2    | T    | RUM0_PLLT_IN_A |
| H21           | PR7B          | 2    | C    |                | H21         | PR15B         | 2    | C    |                |
| G21           | PR7A          | 2    | T    |                | G21         | PR15A         | 2    | T    |                |
| D26           | PR6B          | 2    | C    |                | D26         | PR14B         | 2    | C    |                |
| D25           | PR6A          | 2    | T    | RDQS6          | D25         | PR14A         | 2    | T    | RDQS14         |
| F21           | PR5B          | 2    | C    |                | F21         | PR13B         | 2    | C    |                |
| -             | -             | -    |      |                | GND         | GND2          | 2    |      |                |
| G22           | PR5A          | 2    | T    |                | G22         | PR13A         | 2    | T    |                |
| G24           | PR4B          | 2    | C    |                | G24         | PR12B         | 2    | C    |                |
| G23           | PR4A          | 2    | T    |                | G23         | PR12A         | 2    | T    |                |
| C26           | PR3B          | 2    | C    |                | C26         | PR11B         | 2    | C    |                |
| C25           | PR3A          | 2    | T    |                | C25         | PR11A         | 2    | T    |                |
| F24           | NC            | -    |      |                | F24         | PR9B          | 2    | C    |                |
| -             | -             | -    |      |                | GND         | GND2          | 2    |      |                |
| F23           | NC            | -    |      |                | F23         | PR9A          | 2    | T    |                |

**LFECP/EC20, LFECP/EC33 Logic Signal Connections: 672 fpBGA (Cont.)**

| LFEC20/LFECP20 |               |      |      |               | LFECP/EC33  |               |      |      |               |
|----------------|---------------|------|------|---------------|-------------|---------------|------|------|---------------|
| Ball Number    | Ball Function | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function |
| A21            | PT51A         | 1    | T    |               | A21         | PT51A         | 1    | T    |               |
| E17            | PT50B         | 1    | C    |               | E17         | PT50B         | 1    | C    |               |
| B17            | PT50A         | 1    | T    |               | B17         | PT50A         | 1    | T    |               |
| C17            | PT49B         | 1    | C    |               | C17         | PT49B         | 1    | C    |               |
| GND            | GND1          | 1    |      |               | GND         | GND1          | 1    |      |               |
| D17            | PT49A         | 1    | T    |               | D17         | PT49A         | 1    | T    |               |
| F17            | PT48B         | 1    | C    |               | F17         | PT48B         | 1    | C    |               |
| E20            | PT48A         | 1    | T    |               | E20         | PT48A         | 1    | T    |               |
| G17            | PT47B         | 1    | C    |               | G17         | PT47B         | 1    | C    |               |
| B20            | PT47A         | 1    | T    |               | B20         | PT47A         | 1    | T    |               |
| E16            | PT46B         | 1    | C    |               | E16         | PT46B         | 1    | C    |               |
| A20            | PT46A         | 1    | T    | TDQS46        | A20         | PT46A         | 1    | T    | TDQS46        |
| A19            | PT45B         | 1    | C    |               | A19         | PT45B         | 1    | C    |               |
| GND            | GND1          | 1    |      |               | GND         | GND1          | 1    |      |               |
| B19            | PT45A         | 1    | T    |               | B19         | PT45A         | 1    | T    |               |
| D16            | PT44B         | 1    | C    |               | D16         | PT44B         | 1    | C    |               |
| C16            | PT44A         | 1    | T    |               | C16         | PT44A         | 1    | T    |               |
| F16            | PT43B         | 1    | C    |               | F16         | PT43B         | 1    | C    |               |
| A18            | PT43A         | 1    | T    |               | A18         | PT43A         | 1    | T    |               |
| G16            | PT42B         | 1    | C    |               | G16         | PT42B         | 1    | C    |               |
| B18            | PT42A         | 1    | T    |               | B18         | PT42A         | 1    | T    |               |
| A17            | PT41B         | 1    | C    |               | A17         | PT41B         | 1    | C    |               |
| GND            | GND1          | 1    |      |               | GND         | GND1          | 1    |      |               |
| A16            | PT41A         | 1    | T    |               | A16         | PT41A         | 1    | T    |               |
| D15            | PT40B         | 1    | C    |               | D15         | PT40B         | 1    | C    |               |
| B16            | PT40A         | 1    | T    |               | B16         | PT40A         | 1    | T    |               |
| E15            | PT39B         | 1    | C    |               | E15         | PT39B         | 1    | C    |               |
| C15            | PT39A         | 1    | T    |               | C15         | PT39A         | 1    | T    |               |
| F15            | PT38B         | 1    | C    |               | F15         | PT38B         | 1    | C    |               |
| G15            | PT38A         | 1    | T    | TDQS38        | G15         | PT38A         | 1    | T    | TDQS38        |
| B15            | PT37B         | 1    | C    |               | B15         | PT37B         | 1    | C    |               |
| GND            | GND1          | 1    |      |               | GND         | GND1          | 1    |      |               |
| A15            | PT37A         | 1    | T    |               | A15         | PT37A         | 1    | T    |               |
| E14            | PT36B         | 1    | C    |               | E14         | PT36B         | 1    | C    |               |
| G14            | PT36A         | 1    | T    |               | G14         | PT36A         | 1    | T    |               |
| D14            | PT35B         | 1    | C    | VREF2_1       | D14         | PT35B         | 1    | C    | VREF2_1       |
| E13            | PT35A         | 1    | T    | VREF1_1       | E13         | PT35A         | 1    | T    | VREF1_1       |
| F14            | PT34B         | 1    | C    |               | F14         | PT34B         | 1    | C    |               |
| C14            | PT34A         | 1    | T    |               | C14         | PT34A         | 1    | T    |               |
| B14            | PT33B         | 0    | C    | PCLKC0_0      | B14         | PT33B         | 0    | C    | PCLKC0_0      |
| GND            | GND0          | 0    |      |               | GND         | GND0          | 0    |      |               |
| A14            | PT33A         | 0    | T    | PCLKT0_0      | A14         | PT33A         | 0    | T    | PCLKT0_0      |

**LFECP/EC20, LFECP/EC33 Logic Signal Connections: 672 fpBGA (Cont.)**

| LFEC20/LFECP20 |               |      |      |               | LFECP/EC33  |               |      |      |               |
|----------------|---------------|------|------|---------------|-------------|---------------|------|------|---------------|
| Ball Number    | Ball Function | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function |
| M10            | GND           | -    |      |               | M10         | GND           | -    |      |               |
| M11            | GND           | -    |      |               | M11         | GND           | -    |      |               |
| M12            | GND           | -    |      |               | M12         | GND           | -    |      |               |
| M13            | GND           | -    |      |               | M13         | GND           | -    |      |               |
| M14            | GND           | -    |      |               | M14         | GND           | -    |      |               |
| M15            | GND           | -    |      |               | M15         | GND           | -    |      |               |
| M16            | GND           | -    |      |               | M16         | GND           | -    |      |               |
| M17            | GND           | -    |      |               | M17         | GND           | -    |      |               |
| N10            | GND           | -    |      |               | N10         | GND           | -    |      |               |
| N11            | GND           | -    |      |               | N11         | GND           | -    |      |               |
| N12            | GND           | -    |      |               | N12         | GND           | -    |      |               |
| N13            | GND           | -    |      |               | N13         | GND           | -    |      |               |
| N14            | GND           | -    |      |               | N14         | GND           | -    |      |               |
| N15            | GND           | -    |      |               | N15         | GND           | -    |      |               |
| N16            | GND           | -    |      |               | N16         | GND           | -    |      |               |
| N17            | GND           | -    |      |               | N17         | GND           | -    |      |               |
| P10            | GND           | -    |      |               | P10         | GND           | -    |      |               |
| P11            | GND           | -    |      |               | P11         | GND           | -    |      |               |
| P12            | GND           | -    |      |               | P12         | GND           | -    |      |               |
| P13            | GND           | -    |      |               | P13         | GND           | -    |      |               |
| P14            | GND           | -    |      |               | P14         | GND           | -    |      |               |
| P15            | GND           | -    |      |               | P15         | GND           | -    |      |               |
| P16            | GND           | -    |      |               | P16         | GND           | -    |      |               |
| P17            | GND           | -    |      |               | P17         | GND           | -    |      |               |
| R10            | GND           | -    |      |               | R10         | GND           | -    |      |               |
| R11            | GND           | -    |      |               | R11         | GND           | -    |      |               |
| R12            | GND           | -    |      |               | R12         | GND           | -    |      |               |
| R13            | GND           | -    |      |               | R13         | GND           | -    |      |               |
| R14            | GND           | -    |      |               | R14         | GND           | -    |      |               |
| R15            | GND           | -    |      |               | R15         | GND           | -    |      |               |
| R16            | GND           | -    |      |               | R16         | GND           | -    |      |               |
| R17            | GND           | -    |      |               | R17         | GND           | -    |      |               |
| T10            | GND           | -    |      |               | T10         | GND           | -    |      |               |
| T11            | GND           | -    |      |               | T11         | GND           | -    |      |               |
| T12            | GND           | -    |      |               | T12         | GND           | -    |      |               |
| T13            | GND           | -    |      |               | T13         | GND           | -    |      |               |
| T14            | GND           | -    |      |               | T14         | GND           | -    |      |               |
| T15            | GND           | -    |      |               | T15         | GND           | -    |      |               |
| T16            | GND           | -    |      |               | T16         | GND           | -    |      |               |
| T17            | GND           | -    |      |               | T17         | GND           | -    |      |               |
| U10            | GND           | -    |      |               | U10         | GND           | -    |      |               |
| U11            | GND           | -    |      |               | U11         | GND           | -    |      |               |

**LFECP/EC20, LFECP/EC33 Logic Signal Connections: 672 fpBGA (Cont.)**

| LFEC20/LFECP20 |                  |      |      |               | LFECP/EC33  |               |      |      |               |
|----------------|------------------|------|------|---------------|-------------|---------------|------|------|---------------|
| Ball Number    | Ball Function    | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function |
| H7             | VCCAUX           | -    |      |               | H7          | VCCAUX        | -    |      |               |
| J19            | VCCAUX           | -    |      |               | J19         | VCCAUX        | -    |      |               |
| J8             | VCCAUX           | -    |      |               | J8          | VCCAUX        | -    |      |               |
| K7             | VCCAUX           | -    |      |               | K7          | VCCAUX        | -    |      |               |
| L20            | VCCAUX           | -    |      |               | L20         | VCCAUX        | -    |      |               |
| M20            | VCCAUX           | -    |      |               | M20         | VCCAUX        | -    |      |               |
| M7             | VCCAUX           | -    |      |               | M7          | VCCAUX        | -    |      |               |
| N20            | VCCAUX           | -    |      |               | N20         | VCCAUX        | -    |      |               |
| P20            | VCCAUX           | -    |      |               | P20         | VCCAUX        | -    |      |               |
| P7             | VCCAUX           | -    |      |               | P7          | VCCAUX        | -    |      |               |
| T20            | VCCAUX           | -    |      |               | T20         | VCCAUX        | -    |      |               |
| T7             | VCCAUX           | -    |      |               | T7          | VCCAUX        | -    |      |               |
| T8             | VCCAUX           | -    |      |               | T8          | VCCAUX        | -    |      |               |
| V19            | VCCAUX           | -    |      |               | V19         | VCCAUX        | -    |      |               |
| V7             | VCCAUX           | -    |      |               | V7          | VCCAUX        | -    |      |               |
| W20            | VCCAUX           | -    |      |               | W20         | VCCAUX        | -    |      |               |
| Y13            | VCCAUX           | -    |      |               | Y13         | VCCAUX        | -    |      |               |
| Y7             | VCCAUX           | -    |      |               | Y7          | VCCAUX        | -    |      |               |
| K19            | VCC <sup>1</sup> | -    |      |               | K19         | VCCPLL        | -    |      |               |
| L8             | VCC <sup>1</sup> | -    |      |               | L8          | VCCPLL        | -    |      |               |
| U19            | VCC <sup>1</sup> | -    |      |               | U19         | VCCPLL        | -    |      |               |
| U8             | VCC <sup>1</sup> | -    |      |               | U8          | VCCPLL        | -    |      |               |

 1. Tied to V<sub>CCPLL</sub>.

**LatticeEC Industrial (Continued)**

| Part Number     | I/Os | Grade | Package         | Pins/Balls | Temp. | LUTs  |
|-----------------|------|-------|-----------------|------------|-------|-------|
| LFEC15E-3FN484I | 352  | -3    | Lead-Free fpBGA | 484        | IND   | 15.3K |
| LFEC15E-4FN484I | 352  | -4    | Lead-Free fpBGA | 484        | IND   | 15.3K |
| LFEC15E-3FN256I | 195  | -3    | Lead-Free fpBGA | 256        | IND   | 15.3K |
| LFEC15E-4FN256I | 195  | -4    | Lead-Free fpBGA | 256        | IND   | 15.3K |

| Part Number     | I/Os | Grade | Package         | Pins/Balls | Temp. | LUTs  |
|-----------------|------|-------|-----------------|------------|-------|-------|
| LFEC20E-3FN672I | 400  | -3    | Lead-Free fpBGA | 672        | IND   | 19.7K |
| LFEC20E-4FN672I | 400  | -4    | Lead-Free fpBGA | 672        | IND   | 19.7K |
| LFEC20E-3FN484I | 400  | -3    | Lead-Free fpBGA | 484        | IND   | 19.7K |
| LFEC20E-4FN484I | 400  | -4    | Lead-Free fpBGA | 484        | IND   | 19.7K |

| Part Number     | I/Os | Grade | Package         | Pins/Balls | Temp. | LUTs  |
|-----------------|------|-------|-----------------|------------|-------|-------|
| LFEC33E-3FN672I | 496  | -3    | Lead-Free fpBGA | 672        | IND   | 32.8K |
| LFEC33E-4FN672I | 496  | -4    | Lead-Free fpBGA | 672        | IND   | 32.8K |
| LFEC33E-3FN484I | 360  | -3    | Lead-Free fpBGA | 484        | IND   | 32.8K |
| LFEC33E-4FN484I | 360  | -4    | Lead-Free fpBGA | 484        | IND   | 32.8K |

**LatticeECP Industrial**

| Part Number    | I/Os | Grade | Package         | Pins/Balls | Temp. | LUTs |
|----------------|------|-------|-----------------|------------|-------|------|
| LFEC6E-3FN484I | 224  | -3    | Lead-Free fpBGA | 484        | IND   | 6.1K |
| LFEC6E-4FN484I | 224  | -4    | Lead-Free fpBGA | 484        | IND   | 6.1K |
| LFEC6E-3FN256I | 195  | -3    | Lead-Free fpBGA | 256        | IND   | 6.1K |
| LFEC6E-4FN256I | 195  | -4    | Lead-Free fpBGA | 256        | IND   | 6.1K |
| LFEC6E-3QN208I | 147  | -3    | Lead-Free PQFP  | 208        | IND   | 6.1K |
| LFEC6E-4QN208I | 147  | -4    | Lead-Free PQFP  | 208        | IND   | 6.1K |
| LFEC6E-3TN144I | 97   | -3    | Lead-Free TQFP  | 144        | IND   | 6.1K |
| LFEC6E-4TN144I | 97   | -4    | Lead-Free TQFP  | 144        | IND   | 6.1K |

| Part Number     | I/Os | Grade | Package         | Pins/Balls | Temp. | LUTs  |
|-----------------|------|-------|-----------------|------------|-------|-------|
| LFEC10E-3FN484I | 288  | -3    | Lead-Free fpBGA | 484        | IND   | 10.2K |
| LFEC10E-4FN484I | 288  | -4    | Lead-Free fpBGA | 484        | IND   | 10.2K |
| LFEC10E-3FN256I | 195  | -3    | Lead-Free fpBGA | 256        | IND   | 10.2K |
| LFEC10E-4FN256I | 195  | -4    | Lead-Free fpBGA | 256        | IND   | 10.2K |
| LFEC10E-3QN208I | 147  | -3    | Lead-Free PQFP  | 208        | IND   | 10.2K |
| LFEC10E-4QN208I | 147  | -4    | Lead-Free PQFP  | 208        | IND   | 10.2K |

| Part Number     | I/Os | Grade | Package         | Pins/Balls | Temp. | LUTs  |
|-----------------|------|-------|-----------------|------------|-------|-------|
| LFEC15E-3FN484I | 352  | -3    | Lead-Free fpBGA | 484        | IND   | 15.3K |
| LFEC15E-4FN484I | 352  | -4    | Lead-Free fpBGA | 484        | IND   | 15.3K |
| LFEC15E-3FN256I | 195  | -3    | Lead-Free fpBGA | 256        | IND   | 15.3K |
| LFEC15E-4FN256I | 195  | -4    | Lead-Free fpBGA | 256        | IND   | 15.3K |