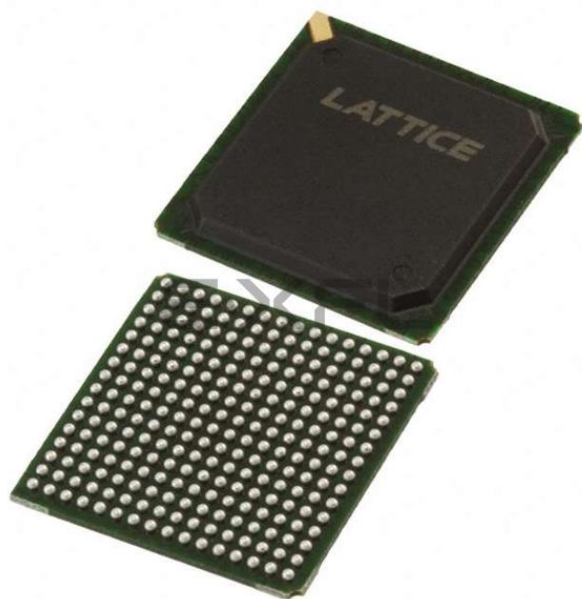




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### Understanding [Embedded - FPGAs \(Field Programmable Gate Array\)](#)

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.

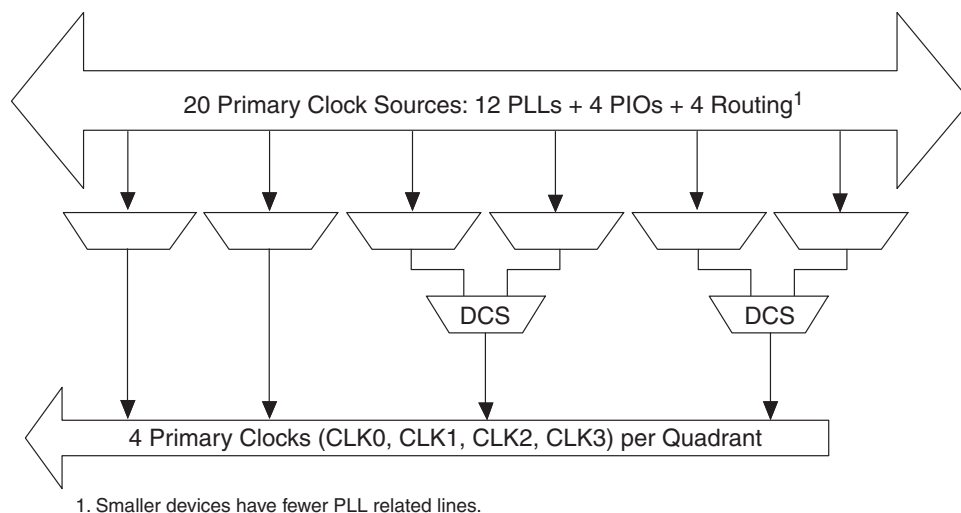
### Applications of Embedded - FPGAs

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

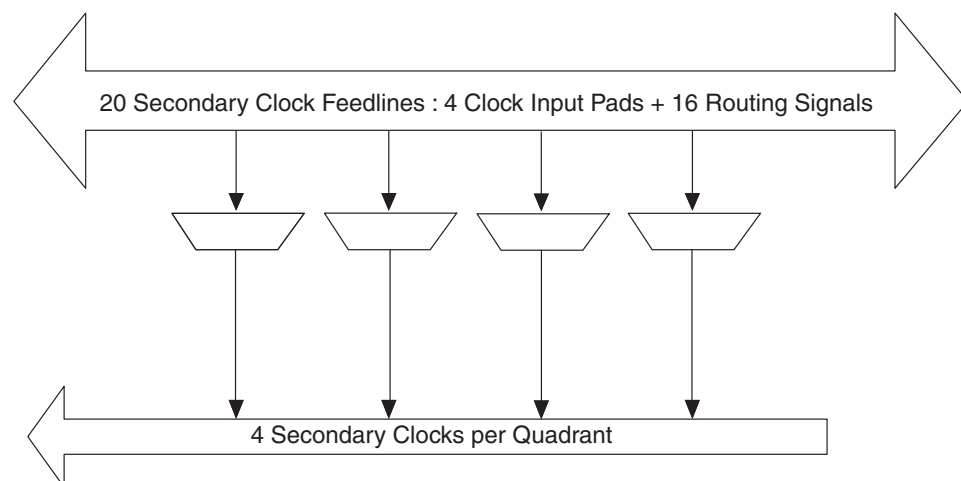
#### Details

|                                |                                                                                                                                                                 |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Status                 | Obsolete                                                                                                                                                        |
| Number of LABs/CLBs            | -                                                                                                                                                               |
| Number of Logic Elements/Cells | 3100                                                                                                                                                            |
| Total RAM Bits                 | 56320                                                                                                                                                           |
| Number of I/O                  | 160                                                                                                                                                             |
| Number of Gates                | -                                                                                                                                                               |
| Voltage - Supply               | 1.14V ~ 1.26V                                                                                                                                                   |
| Mounting Type                  | Surface Mount                                                                                                                                                   |
| Operating Temperature          | 0°C ~ 85°C (TJ)                                                                                                                                                 |
| Package / Case                 | 256-BGA                                                                                                                                                         |
| Supplier Device Package        | 256-FPBGA (17x17)                                                                                                                                               |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/lattice-semiconductor/lfec3e-3f256c">https://www.e-xfl.com/product-detail/lattice-semiconductor/lfec3e-3f256c</a> |

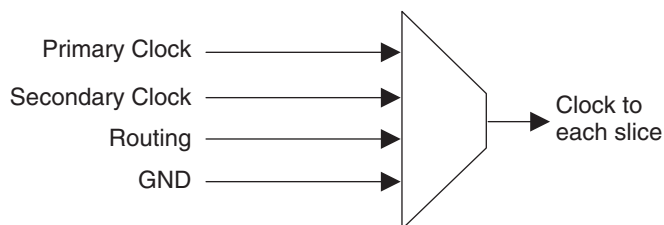
**Figure 2-8. Per Quadrant Primary Clock Selection**



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



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

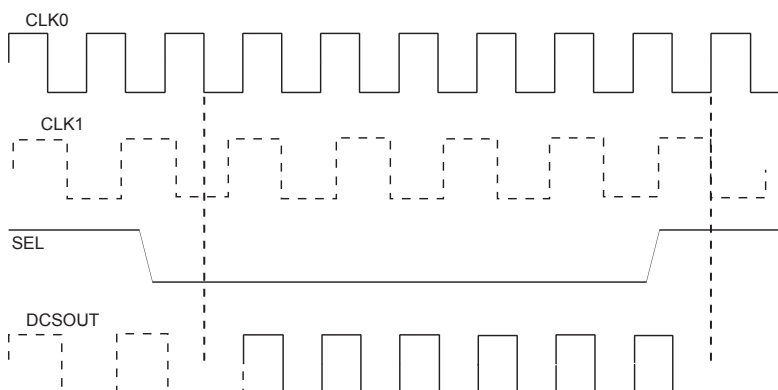


## sysCLOCK Phase Locked Loops (PLLs)

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       |

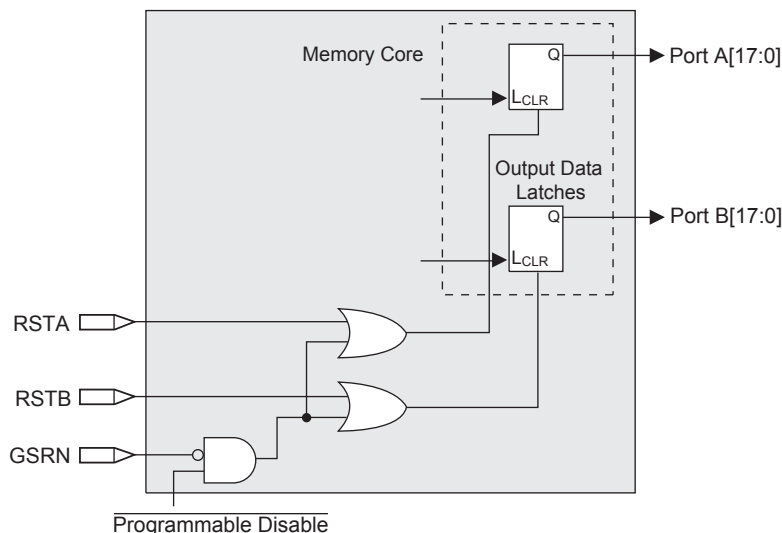
## Bus Size Matching

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 2-16. Memory Core Reset**

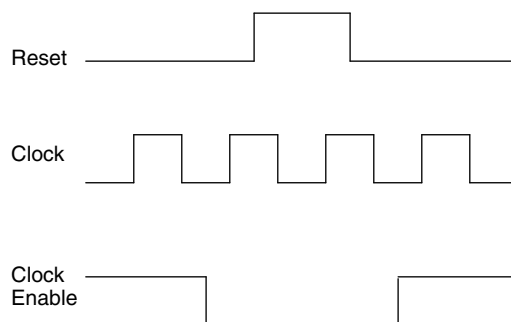


For further information about sysMEM EBR block, please see the the list of technical documentation at the end of this data sheet.

### EBR Asynchronous Reset

EBR asynchronous reset or GSR (if used) can only be applied if all clock enables are low for a clock cycle before the reset is applied and released a clock cycle after the reset is released, as shown in Figure 2-17. The GSR input to the EBR is always asynchronous.

**Figure 2-17. EBR Asynchronous Reset (Including GSR) Timing Diagram**



If all clock enables remain enabled, the EBR asynchronous reset or GSR may only be applied and released after the EBR read and write clock inputs are in a steady state condition for a minimum of  $1/f_{MAX}$  (EBR clock). The reset release must adhere to the EBR synchronous reset setup time before the next active read or write clock edge.

If an EBR is pre-loaded during configuration, the GSR input must be disabled or the release of the GSR during device Wake Up must occur before the release of the device I/Os becomes active.

These instructions apply to all EBR RAM and ROM implementations.

Note that there are no reset restrictions if the EBR synchronous reset is used and the EBR GSR input is disabled.

### sysDSP Block

The LatticeECP-DSP family provides a sysDSP block, making it ideally suited for low cost, high performance Digital Signal Processing (DSP) applications. Typical functions used in these applications are Finite Impulse Response (FIR) filters; Fast Fourier Transforms (FFT) functions, correlators, Reed-Solomon/Turbo/Convolution encoders and

## IPexpress™

The user can access the sysDSP block via the IPexpress configuration tool, included with the ispLEVER design tool suite. IPexpress has options to configure each DSP module (or group of modules) or through direct HDL instantiation. Additionally Lattice has partnered Mathworks to support instantiation in the Simulink tool, which is a Graphical Simulation Environment. Simulink works with ispLEVER and dramatically shortens the DSP design cycle in Lattice FPGAs.

## Optimized DSP Functions

Lattice provides a library of optimized DSP IP functions. Some of the IPs planned for LatticeECP DSP are: Bit Correlators, Fast Fourier Transform, Finite Impulse Response (FIR) Filter, Reed-Solomon Encoder/ Decoder, Turbo Encoder/Decoders and Convolutional Encoder/Decoder. Please contact Lattice to obtain the latest list of available DSP IPs.

## Resources Available in the LatticeECP Family

Table 2-9 shows the maximum number of multipliers for each member of the LatticeECP family. Table 2-10 shows the maximum available EBR RAM Blocks in each of the LatticeECP family. EBR blocks, together with Distributed RAM can be used to store variables locally for the fast DSP operations.

**Table 2-9. Number of DSP Blocks in LatticeECP Family**

| Device  | DSP Block | 9x9 Multiplier | 18x18 Multiplier | 36x36 Multiplier |
|---------|-----------|----------------|------------------|------------------|
| LFCEP6  | 4         | 32             | 16               | 4                |
| LFCEP10 | 5         | 40             | 20               | 5                |
| LFCEP15 | 6         | 48             | 24               | 6                |
| LFCEP20 | 7         | 56             | 28               | 7                |
| LFCEP33 | 8         | 64             | 32               | 8                |

**Table 2-10. Embedded SRAM in LatticeECP Family**

| Device  | EBR SRAM Block | Total EBR SRAM (Kbits) |
|---------|----------------|------------------------|
| LFCEP6  | 10             | 92                     |
| LFCEP10 | 30             | 276                    |
| LFCEP15 | 38             | 350                    |
| LFCEP20 | 46             | 424                    |
| LFCEP33 | 54             | 498                    |

## DSP Performance of the LatticeECP Family

Table 2-11 lists the maximum performance in millions of MAC operations per second (MMAC) for each member of the LatticeECP family.

**Table 2-11. DSP Block Performance of LatticeECP Family**

| Device  | DSP Block | DSP Performance MMAC |
|---------|-----------|----------------------|
| LFCEP6  | 4         | 3680                 |
| LFCEP10 | 5         | 4600                 |
| LFCEP15 | 6         | 5520                 |
| LFCEP20 | 7         | 6440                 |
| LFCEP33 | 8         | 7360                 |

**Table 2-14. Supported Output Standards**

| Output Standard                       | Drive                      | V <sub>CCIO</sub> (Nom.) |
|---------------------------------------|----------------------------|--------------------------|
| <b>Single-ended Interfaces</b>        |                            |                          |
| LVTTTL                                | 4mA, 8mA, 12mA, 16mA, 20mA | 3.3                      |
| LVC MOS33                             | 4mA, 8mA, 12mA 16mA, 20mA  | 3.3                      |
| LVC MOS25                             | 4mA, 8mA, 12mA, 16mA, 20mA | 2.5                      |
| LVC MOS18                             | 4mA, 8mA, 12mA, 16mA       | 1.8                      |
| LVC MOS15                             | 4mA, 8mA                   | 1.5                      |
| LVC MOS12                             | 2mA, 6mA                   | 1.2                      |
| LVC MOS33, Open Drain                 | 4mA, 8mA, 12mA 16mA, 20mA  | —                        |
| LVC MOS25, Open Drain                 | 4mA, 8mA, 12mA 16mA, 20mA  | —                        |
| LVC MOS18, Open Drain                 | 4mA, 8mA, 12mA 16mA        | —                        |
| LVC MOS15, Open Drain                 | 4mA, 8mA                   | —                        |
| LVC MOS12, Open Drain                 | 2mA, 6mA                   | —                        |
| PCI33                                 | N/A                        | 3.3                      |
| HSTL18 Class I, II, III               | N/A                        | 1.8                      |
| HSTL15 Class I, III                   | N/A                        | 1.5                      |
| SSTL3 Class I, II                     | N/A                        | 3.3                      |
| SSTL2 Class I, II                     | N/A                        | 2.5                      |
| SSTL18 Class I                        | N/A                        | 1.8                      |
| <b>Differential Interfaces</b>        |                            |                          |
| Differential SSTL3, Class I, II       | N/A                        | 3.3                      |
| Differential SSTL2, Class I, II       | N/A                        | 2.5                      |
| Differential SSTL18, Class I          | N/A                        | 1.8                      |
| Differential HSTL18, Class I, II, III | N/A                        | 1.8                      |
| Differential HSTL15, Class I, III     | N/A                        | 1.5                      |
| LVDS                                  | N/A                        | 2.5                      |
| BLVDS <sup>1</sup>                    | N/A                        | 2.5                      |
| LVPECL <sup>1</sup>                   | N/A                        | 3.3                      |
| RSDS <sup>1</sup>                     | N/A                        | 2.5                      |

1. Emulated with external resistors.

## Hot Socketing

The LatticeECP/EC devices have been carefully designed to ensure predictable behavior during power-up and power-down. Power supplies can be sequenced in any order. During power up and power-down sequences, the I/Os remain in tristate until the power supply voltage is high enough to ensure reliable operation. In addition, leakage into I/O pins is controlled within specified limits, this allows for easy integration with the rest of the system. These capabilities make the LatticeECP/EC ideal for many multiple power supply and hot-swap applications.

## Configuration and Testing

The following section describes the configuration and testing features of the LatticeECP/EC devices.

### IEEE 1149.1-Compliant Boundary Scan Testability

All LatticeECP/EC devices have boundary scan cells that are accessed through an IEEE 1149.1 compliant test access port (TAP). This allows functional testing of the circuit board, on which the device is mounted, through a serial scan path that can access all critical logic nodes. Internal registers are linked internally, allowing test data to

## Typical Building Block Function Performance

### Pin-to-Pin Performance (LVCMOS25 12mA Drive)

| Function               | -5 Timing | Units |
|------------------------|-----------|-------|
| <b>Basic Functions</b> |           |       |
| 16-bit decoder         | 5.5       | ns    |
| 32-bit decoder         | 6.9       | ns    |
| 64-bit decoder         | 7.1       | ns    |
| 4:1 MUX                | 4.3       | ns    |
| 8:1 MUX                | 4.7       | ns    |
| 16:1 MUX               | 5.0       | ns    |
| 32:1 MUX               | 5.5       | ns    |

### Register-to-Register Performance<sup>1</sup>

| Function                            | -5 Timing | Units |
|-------------------------------------|-----------|-------|
| <b>Basic Functions</b>              |           |       |
| 16 bit decoder                      | 410       | MHz   |
| 32 bit decoder                      | 283       | MHz   |
| 64 bit decoder                      | 272       | MHz   |
| 4:1 MUX                             | 613       | MHz   |
| 8:1 MUX                             | 565       | MHz   |
| 16:1 MUX                            | 526       | MHz   |
| 32:1 MUX                            | 442       | MHz   |
| 8-bit adder                         | 363       | MHz   |
| 16-bit adder                        | 353       | MHz   |
| 64-bit adder                        | 196       | MHz   |
| 16-bit counter                      | 414       | MHz   |
| 32-bit counter                      | 317       | MHz   |
| 64-bit counter                      | 216       | MHz   |
| 64-bit accumulator                  | 178       | MHz   |
| <b>Embedded Memory Functions</b>    |           |       |
| 256x36 Single Port RAM              | 280       | MHz   |
| 512x18 True-Dual Port RAM           | 280       | MHz   |
| <b>Distributed Memory Functions</b> |           |       |
| 16x2 Single Port RAM                | 460       | MHz   |
| 64x2 Single Port RAM                | 375       | MHz   |
| 128x4 Single Port RAM               | 294       | MHz   |
| 32x2 Pseudo-Dual Port RAM           | 392       | MHz   |
| 64x4 Pseudo-Dual Port RAM           | 332       | MHz   |
| <b>DSP Function<sup>2</sup></b>     |           |       |
| 9x9 Pipelined Multiply/Accumulate   | 242       | MHz   |
| 18x18 Pipelined Multiply/Accumulate | 238       | MHz   |
| 36x36 Pipelined Multiply            | 235       | MHz   |

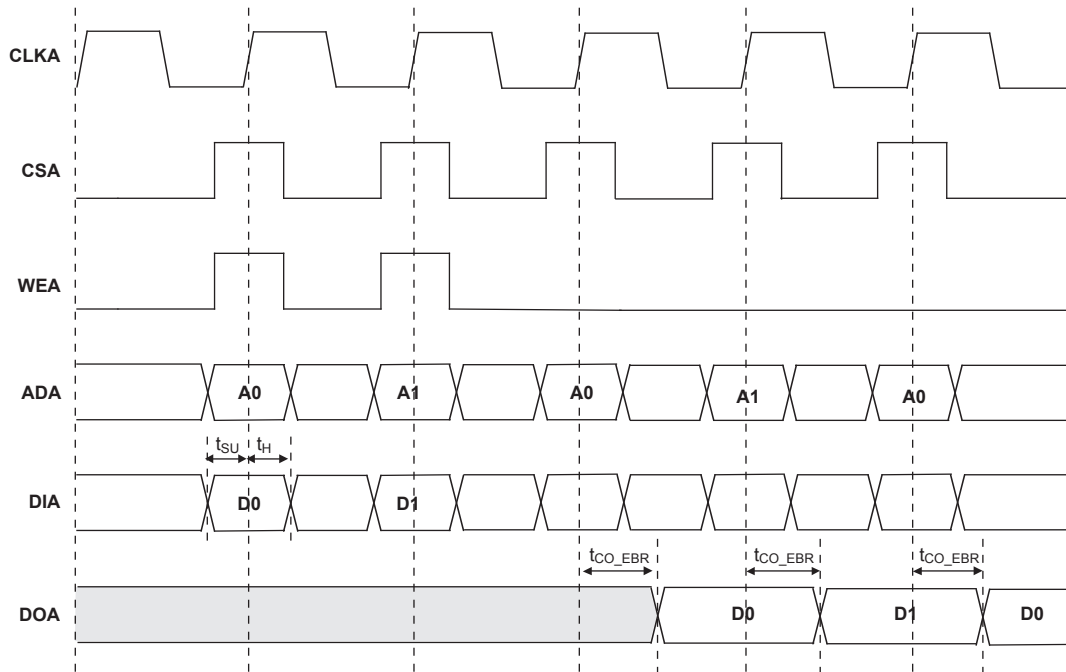
1. These timing numbers were generated using the ispLEVER design tool. Exact performance may vary with design and tool version. The tool uses internal parameters that have been characterized but are not tested on every device.

2. Applies to LatticeECP devices only.

Timing v.G 0.30

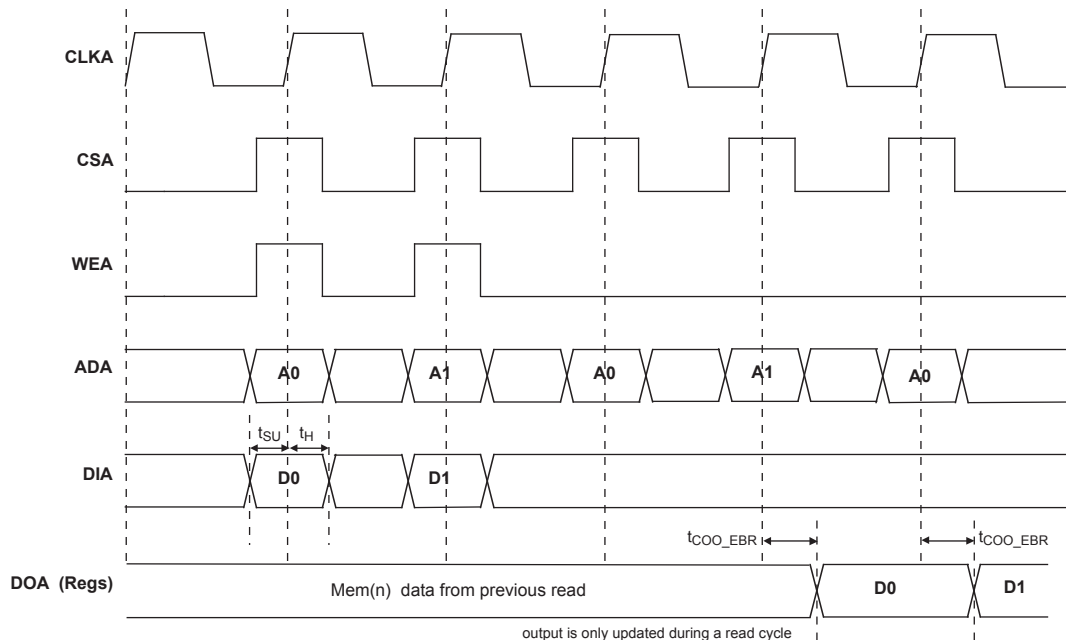
## EBR Memory Timing Diagrams

Figure 3-8. Read/Write Mode (Normal)



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 3-9. Read/Write Mode with Input and Output Registers





**LFEC1, LFEC3 Logic Signal Connections: 100 TQFP (Cont.)**

| Pin Number | LFEC1        |      |      |               | LFEC3        |      |      |               |
|------------|--------------|------|------|---------------|--------------|------|------|---------------|
|            | Pin Function | Bank | LVDS | Dual Function | Pin Function | Bank | LVDS | Dual Function |
| 82         | PT11B        | 1    | C    | VREF2_1       | PT19B        | 1    | C    | VREF2_1       |
| 83         | PT11A        | 1    | T    | VREF1_1       | PT19A        | 1    | T    | VREF1_1       |
| 84         | PT10B        | 1    | C    |               | PT18B        | 1    | C    |               |
| 85         | PT10A        | 1    | T    |               | PT18A        | 1    | T    |               |
| 86         | VCCIO1       | 1    |      |               | VCCIO1       | 1    |      |               |
| 87         | VCCAUX       | -    |      |               | VCCAUX       | -    |      |               |
| 88         | PT9B         | 0    | C    | PCLKC0_0      | PT17B        | 0    | C    | PCLKC0_0      |
| 89         | GND0         | 0    |      |               | GND0         | 0    |      |               |
| 90         | PT9A         | 0    | T    | PCLKT0_0      | PT17A        | 0    | T    | PCLKT0_0      |
| 91         | PT8B         | 0    | C    | VREF1_0       | PT16B        | 0    | C    | VREF1_0       |
| 92         | PT8A         | 0    | T    | VREF2_0       | PT16A        | 0    | T    | VREF2_0       |
| 93         | PT7B         | 0    |      |               | PT15B        | 0    |      |               |
| 94         | PT6B         | 0    | C    |               | PT14B        | 0    | C    |               |
| 95         | PT6A         | 0    | T    | TDQS6         | PT14A        | 0    | T    | TDQS14        |
| 96         | PT4B         | 0    | C    |               | PT12B        | 0    | C    |               |
| 97         | PT4A         | 0    | T    |               | PT12A        | 0    | T    |               |
| 98         | PT2B         | 0    | C    |               | PT10B        | 0    | C    |               |
| 99         | PT2A         | 0    | T    |               | PT10A        | 0    | T    |               |
| 100        | VCCIO0       | 0    |      |               | VCCIO0       | 0    |      |               |

\*Double bonded to the pin.

**LFEC1, LFEC3 Logic Signal Connections: 208 PQFP (Cont.)**

| Pin Number | LFEC1        |      |      |               | LFEC3        |      |      |               |
|------------|--------------|------|------|---------------|--------------|------|------|---------------|
|            | Pin Function | Bank | LVDS | Dual Function | Pin Function | Bank | LVDS | Dual Function |
| 127        | CFG0         | 3    |      |               | CFG0         | 3    |      |               |
| 128        | VCC          | -    |      |               | VCC          | -    |      |               |
| 129        | PROGRAMN     | 3    |      |               | PROGRAMN     | 3    |      |               |
| 130        | CCLK         | 3    |      |               | CCLK         | 3    |      |               |
| 131        | INITN        | 3    |      |               | INITN        | 3    |      |               |
| 132        | GND          | -    |      |               | GND          | -    |      |               |
| 133        | DONE         | 3    |      |               | DONE         | 3    |      |               |
| 134        | GND          | -    |      |               | GND          | -    |      |               |
| 135        | VCC          | -    |      |               | VCC          | -    |      |               |
| 136        | NC           | -    |      |               | VCCAUX       | -    |      |               |
| 137        | PR5B         | 2    | C    | PCLKC2_0      | PR9B         | 2    | C    | PCLKC2_0      |
| 138        | NC           | -    |      |               | GND2         | 2    |      |               |
| 139        | PR5A         | 2    | T    | PCLKT2_0      | PR9A         | 2    | T    | PCLKT2_0      |
| 140        | PR4B         | 2    | C    |               | PR8B         | 2    | C    |               |
| 141        | PR4A         | 2    | T    |               | PR8A         | 2    | T    |               |
| 142        | PR3B         | 2    | C    |               | PR7B         | 2    | C    |               |
| 143        | PR3A         | 2    | T    |               | PR7A         | 2    | T    |               |
| 144        | NC           | -    |      |               | PR6B         | 2    | C    |               |
| 145        | NC           | -    |      |               | VCCIO2       | 2    |      |               |
| 146        | NC           | -    |      |               | PR6A         | 2    | T    | RDQS6         |
| 147        | NC           | -    |      |               | PR5B         | 2    | C    |               |
| 148        | NC           | -    |      |               | PR5A         | 2    | T    |               |
| 149        | NC           | -    |      |               | PR4B         | 2    | C    |               |
| 150        | NC           | -    |      |               | PR4A         | 2    | T    |               |
| 151        | NC           | -    |      |               | NC           | -    |      |               |
| 152        | NC           | -    |      |               | NC           | -    |      |               |
| 153        | PR2B         | 2    | C    | VREF1_2       | PR2B         | 2    | C    | VREF1_2       |
| 154        | PR2A         | 2    | T    | VREF2_2       | PR2A         | 2    | T    | VREF2_2       |
| 155        | VCCIO2       | 2    |      |               | VCCIO2       | 2    |      |               |
| 156*       | GND1<br>GND2 | -    |      |               | GND1<br>GND2 | -    |      |               |
| 157        | VCCIO1       | 1    |      |               | VCCIO1       | 1    |      |               |
| 158        | NC           | -    |      |               | NC           | -    |      |               |
| 159        | PT17B        | 1    | C    |               | PT25B        | 1    | C    |               |
| 160        | PT17A        | 1    | T    |               | PT25A        | 1    | T    |               |
| 161        | PT16B        | 1    | C    |               | PT24B        | 1    | C    |               |
| 162        | PT16A        | 1    | T    |               | PT24A        | 1    | T    |               |
| 163        | PT15B        | 1    | C    |               | PT23B        | 1    | C    |               |
| 164        | PT15A        | 1    | T    |               | PT23A        | 1    | T    |               |
| 165        | PT14B        | 1    | C    |               | PT22B        | 1    | C    |               |
| 166        | PT14A        | 1    | T    | TDQS14        | PT22A        | 1    | T    | TDQS22        |
| 167        | PT13B        | 1    | C    |               | PT21B        | 1    | C    |               |
| 168        | GND1         | 1    |      |               | GND1         | 1    |      |               |

**LFEC6P/EC6, LFEC6P/EC10 Logic Signal Connections: 208 PQFP (Cont.)**

| Pin Number | LFEC6P/EC6   |      |      |                | LFEC6P/EC10  |      |      |                |
|------------|--------------|------|------|----------------|--------------|------|------|----------------|
|            | Pin Function | Bank | LVDS | Dual Function  | Pin Function | Bank | LVDS | Dual Function  |
| 85         | VCCIO4       | 4    |      |                | VCCIO4       | 4    |      |                |
| 86         | PB18A        | 4    | T    | WRITEN         | PB26A        | 4    | T    | WRITEN         |
| 87         | PB18B        | 4    | C    | CS1N           | PB26B        | 4    | C    | CS1N           |
| 88         | PB19A        | 4    | T    | VREF1_4        | PB27A        | 4    | T    | VREF1_4        |
| 89         | PB19B        | 4    | C    | CSN            | PB27B        | 4    | C    | CSN            |
| 90         | PB20A        | 4    | T    | VREF2_4        | PB28A        | 4    | T    | VREF2_4        |
| 91         | PB20B        | 4    | C    | D0/SPID7       | PB28B        | 4    | C    | D0/SPID7       |
| 92         | PB21A        | 4    | T    | D2/SPID5       | PB29A        | 4    | T    | D2/SPID5       |
| 93         | GND4         | 4    |      |                | GND4         | 4    |      |                |
| 94         | PB21B        | 4    | C    | D1/SPID6       | PB29B        | 4    | C    | D1/SPID6       |
| 95         | PB22A        | 4    | T    | BDQS22         | PB30A        | 4    | T    | BDQS30         |
| 96         | PB22B        | 4    | C    | D3/SPID4       | PB30B        | 4    | C    | D3/SPID4       |
| 97         | PB23A        | 4    | T    |                | PB31A        | 4    | T    |                |
| 98         | PB23B        | 4    | C    | D4/SPID3       | PB31B        | 4    | C    | D4/SPID3       |
| 99         | PB24A        | 4    | T    |                | PB32A        | 4    | T    |                |
| 100        | PB24B        | 4    | C    | D5/SPID2       | PB32B        | 4    | C    | D5/SPID2       |
| 101        | PB25A        | 4    | T    |                | PB33A        | 4    | T    |                |
| 102        | PB25B        | 4    | C    | D6/SPID1       | PB33B        | 4    | C    | D6/SPID1       |
| 103        | PB33A        | 4    |      |                | PB41A        | 4    |      |                |
| 104        | VCCIO4       | 4    |      |                | VCCIO4       | 4    |      |                |
| 105*       | GND3<br>GND4 | -    |      |                | GND3<br>GND4 | -    |      |                |
| 106        | VCCIO3       | 3    |      |                | VCCIO3       | 3    |      |                |
| 107        | PR27B        | 3    | C    | VREF2_3        | PR36B        | 3    | C    | VREF2_3        |
| 108        | PR27A        | 3    | T    | VREF1_3        | PR36A        | 3    | T    | VREF1_3        |
| 109        | PR26B        | 3    | C    |                | PR35B        | 3    | C    |                |
| 110        | PR26A        | 3    | T    |                | PR35A        | 3    | T    |                |
| 111        | PR25B        | 3    | C    |                | PR34B        | 3    | C    |                |
| 112        | PR25A        | 3    | T    |                | PR34A        | 3    | T    |                |
| 113        | PR24B        | 3    | C    |                | PR33B        | 3    | C    |                |
| 114        | PR24A        | 3    | T    | RDQS24         | PR33A        | 3    | T    | RDQS33         |
| 115        | PR23B        | 3    | C    | RLM0_PLLC_FB_A | PR32B        | 3    | C    | RLM0_PLLC_FB_A |
| 116        | GND3         | 3    |      |                | GND3         | 3    |      |                |
| 117        | PR23A        | 3    | T    | RLM0_PLLT_FB_A | PR32A        | 3    | T    | RLM0_PLLT_FB_A |
| 118        | PR22B        | 3    | C    | RLM0_PLLC_IN_A | PR31B        | 3    | C    | RLM0_PLLC_IN_A |
| 119        | PR22A        | 3    | T    | RLM0_PLLT_IN_A | PR31A        | 3    | T    | RLM0_PLLT_IN_A |
| 120        | VCCIO3       | 3    |      |                | VCCIO3       | 3    |      |                |
| 121        | PR21B        | 3    | C    | DI/CSSPIN      | PR30B        | 3    | C    | DI/CSSPIN      |
| 122        | PR21A        | 3    | T    | DOUT/CSON      | PR30A        | 3    | T    | DOUT/CSON      |
| 123        | PR20B        | 3    | C    | BUSY/SISPI     | PR29B        | 3    | C    | BUSY/SISPI     |
| 124        | PR20A        | 3    | T    | D7/SPID0       | PR29A        | 3    | T    | D7/SPID0       |
| 125        | CFG2         | 3    |      |                | CFG2         | 3    |      |                |
| 126        | CFG1         | 3    |      |                | CFG1         | 3    |      |                |

**LFEC3 and LFECP/EC6 Logic Signal Connections: 256 fpBGA**

| Ball Number | LFEC3         |      |      |               | LFECP6/LFEC6  |      |      |               |
|-------------|---------------|------|------|---------------|---------------|------|------|---------------|
|             | Ball Function | Bank | LVDS | Dual Function | Ball Function | Bank | LVDS | Dual Function |
| GND         | GND7          | 7    |      |               | GND7          | 7    |      |               |
| D4          | PL2A          | 7    | T    | VREF2_7       | PL2A          | 7    | T    | VREF2_7       |
| D3          | PL2B          | 7    | C    | VREF1_7       | PL2B          | 7    | C    | VREF1_7       |
| C3          | PL3A          | 7    | T    |               | PL3A          | 7    | T    |               |
| C2          | PL3B          | 7    | C    |               | PL3B          | 7    | C    |               |
| B1          | PL4A          | 7    | T    |               | PL4A          | 7    | T    |               |
| C1          | PL4B          | 7    | C    |               | PL4B          | 7    | C    |               |
| E3          | PL5A          | 7    | T    |               | PL5A          | 7    | T    |               |
| E4          | PL5B          | 7    | C    |               | PL5B          | 7    | C    |               |
| F4          | PL6A          | 7    | T    | LDQS6         | PL6A          | 7    | T    | LDQS6         |
| F5          | PL6B          | 7    | C    |               | PL6B          | 7    | C    |               |
| G4          | PL7A          | 7    | T    |               | PL7A          | 7    | T    |               |
| G3          | PL7B          | 7    | C    |               | PL7B          | 7    | C    |               |
| D2          | PL8A          | 7    | T    |               | PL8A          | 7    | T    |               |
| D1          | PL8B          | 7    | C    |               | PL8B          | 7    | C    |               |
| E1          | PL9A          | 7    | T    | PCLKT7_0      | PL9A          | 7    | T    | PCLKT7_0      |
| GND         | GND7          | 7    |      |               | GND7          | 7    |      |               |
| E2          | PL9B          | 7    | C    | PCLKC7_0      | PL9B          | 7    | C    | PCLKC7_0      |
| F3          | XRES          | 6    |      |               | XRES          | 6    |      |               |
| G5          | NC            | -    |      |               | PL11A         | 6    | T    |               |
| H5          | NC            | -    |      |               | PL11B         | 6    | C    |               |
| F2          | NC            | -    |      |               | PL12A         | 6    | T    |               |
| F1          | NC            | -    |      |               | PL12B         | 6    | C    |               |
| H4          | NC            | -    |      |               | PL13A         | 6    | T    |               |
| H3          | NC            | -    |      |               | PL13B         | 6    | C    |               |
| G2          | NC            | -    |      |               | PL14A         | 6    | T    |               |
| -           | -             | -    |      |               | GND6          | 6    |      |               |
| G1          | NC            | -    |      |               | PL14B         | 6    | C    |               |
| J4          | NC            | -    |      |               | PL15A         | 6    | T    | LDQS15        |
| J3          | NC            | -    |      |               | PL15B         | 6    | C    |               |
| J5          | NC            | -    |      |               | PL16A         | 6    | T    |               |
| K5          | NC            | -    |      |               | PL16B         | 6    | C    |               |
| H2          | NC            | -    |      |               | PL17A         | 6    | T    |               |
| H1          | NC            | -    |      |               | PL17B         | 6    | C    |               |
| J2          | NC            | -    |      |               | PL18A         | 6    | T    |               |
| -           | -             | -    |      |               | GND6          | 6    |      |               |
| J1          | NC            | -    |      |               | PL18B         | 6    | C    |               |
| K4          | TCK           | 6    |      |               | TCK           | 6    |      |               |
| K3          | TDI           | 6    |      |               | TDI           | 6    |      |               |
| L3          | TMS           | 6    |      |               | TMS           | 6    |      |               |
| L5          | TDO           | 6    |      |               | TDO           | 6    |      |               |
| L4          | VCCJ          | 6    |      |               | VCCJ          | 6    |      |               |

**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  |
| L3          | TMS            | 6    |      |                | TMS            | 6    |      |                |
| L5          | TDO            | 6    |      |                | TDO            | 6    |      |                |
| L4          | VCCJ           | 6    |      |                | VCCJ           | 6    |      |                |
| K2          | PL29A          | 6    | T    | LLM0_PLLT_IN_A | PL37A          | 6    | T    | LLM0_PLLT_IN_A |
| K1          | PL29B          | 6    | C    | LLM0_PLLC_IN_A | PL37B          | 6    | C    | LLM0_PLLC_IN_A |
| L2          | PL30A          | 6    | T    | LLM0_PLLT_FB_A | PL38A          | 6    | T    | LLM0_PLLT_FB_A |
| L1          | PL30B          | 6    | C    | LLM0_PLLC_FB_A | PL38B          | 6    | C    | LLM0_PLLC_FB_A |
| M2          | PL31A          | 6    | T    |                | PL39A          | 6    | T    |                |
| M1          | PL31B          | 6    | C    |                | PL39B          | 6    | C    |                |
| N1          | PL32A          | 6    | T    |                | PL40A          | 6    | T    |                |
| GND         | GND6           | 6    |      |                | GND6           | 6    |      |                |
| -           | -              | -    |      |                | GND6           | 6    |      |                |
| N2          | PL32B          | 6    | C    |                | PL40B          | 6    | C    |                |
| M4          | PL33A          | 6    | T    | LDQS33         | PL41A          | 6    | T    | LDQS41         |
| M3          | PL33B          | 6    | C    |                | PL41B          | 6    | C    |                |
| P1          | PL34A          | 6    | T    |                | PL42A          | 6    | T    |                |
| R1          | PL34B          | 6    | C    |                | PL42B          | 6    | C    |                |
| P2          | PL35A          | 6    | T    |                | PL43A          | 6    | T    |                |
| P3          | PL35B          | 6    | C    |                | PL43B          | 6    | C    |                |
| N3          | PL36A          | 6    | T    | VREF1_6        | PL44A          | 6    | T    | VREF1_6        |
| N4          | PL36B          | 6    | C    | VREF2_6        | PL44B          | 6    | C    | VREF2_6        |
| GND         | GND6           | 6    |      |                | GND6           | 6    |      |                |
| GND         | GND5           | 5    |      |                | GND5           | 5    |      |                |
| GND         | GND5           | 5    |      |                | GND5           | 5    |      |                |
| P4          | PB10A          | 5    | T    |                | PB10A          | 5    | T    |                |
| N5          | PB10B          | 5    | C    |                | PB10B          | 5    | C    |                |
| P5          | PB11A          | 5    | T    |                | PB11A          | 5    | T    |                |
| P6          | PB11B          | 5    | C    |                | PB11B          | 5    | C    |                |
| R4          | PB12A          | 5    | T    |                | PB12A          | 5    | T    |                |
| R3          | PB12B          | 5    | C    |                | PB12B          | 5    | C    |                |
| T2          | PB13A          | 5    | T    |                | PB13A          | 5    | T    |                |
| GND         | GND5           | 5    |      |                | GND5           | 5    |      |                |
| T3          | PB13B          | 5    | C    |                | PB13B          | 5    | C    |                |
| R5          | PB14A          | 5    | T    | BDQS14         | PB14A          | 5    | T    | BDQS14         |
| R6          | PB14B          | 5    | C    |                | PB14B          | 5    | C    |                |
| T4          | PB15A          | 5    | T    |                | PB15A          | 5    | T    |                |
| T5          | PB15B          | 5    | C    |                | PB15B          | 5    | C    |                |
| N6          | PB16A          | 5    | T    |                | PB16A          | 5    | T    |                |
| M6          | PB16B          | 5    | C    |                | PB16B          | 5    | C    |                |
| T6          | PB17A          | 5    | T    |                | PB17A          | 5    | T    |                |
| GND         | GND5           | 5    |      |                | GND5           | 5    |      |                |
| T7          | PB17B          | 5    | C    |                | PB17B          | 5    | C    |                |
| P7          | PB18A          | 5    | T    |                | PB18A          | 5    | T    |                |

## LFEC6P/EC6, LFEC6P/EC10, LFEC6P/EC15 Logic Signal Connections: 484 fpBGA (Cont.)

| LFEC6P/EC6  |               |      |      |                | LFEC6P/EC10 |               |      |      |                | LFEC6P/EC15 |               |      |      |                |
|-------------|---------------|------|------|----------------|-------------|---------------|------|------|----------------|-------------|---------------|------|------|----------------|
| Ball Number | Ball Function | Bank | LVDS | Dual Function  | Ball Number | Ball Function | Bank | LVDS | Dual Function  | Ball Number | Ball Function | Bank | LVDS | Dual Function  |
| M4          | PL13A         | 6    | T    |                | M4          | PL22A         | 6    | T    |                | M4          | PL26A         | 6    | T    |                |
| M5          | PL13B         | 6    | C    |                | M5          | PL22B         | 6    | C    |                | M5          | PL26B         | 6    | C    |                |
| M1          | PL14A         | 6    | T    |                | M1          | PL23A         | 6    | T    |                | M1          | PL27A         | 6    | T    |                |
| GND         | GND6          | 6    |      |                | GND         | GND6          | 6    |      |                | GND         | GND6          | 6    |      |                |
| M2          | PL14B         | 6    | C    |                | M2          | PL23B         | 6    | C    |                | M2          | PL27B         | 6    | C    |                |
| N3          | PL15A         | 6    | T    | LDQS15         | N3          | PL24A         | 6    | T    | LDQS24         | N3          | PL28A         | 6    | T    | LDQS28         |
| M3          | PL15B         | 6    | C    |                | M3          | PL24B         | 6    | C    |                | M3          | PL28B         | 6    | C    |                |
| N5          | PL16A         | 6    | T    |                | N5          | PL25A         | 6    | T    |                | N5          | PL29A         | 6    | T    |                |
| N4          | PL16B         | 6    | C    |                | N4          | PL25B         | 6    | C    |                | N4          | PL29B         | 6    | C    |                |
| N1          | PL17A         | 6    | T    |                | N1          | PL26A         | 6    | T    |                | N1          | PL30A         | 6    | T    |                |
| N2          | PL17B         | 6    | C    |                | N2          | PL26B         | 6    | C    |                | N2          | PL30B         | 6    | C    |                |
| P1          | PL18A         | 6    | T    |                | P1          | PL27A         | 6    | T    |                | P1          | PL31A         | 6    | T    |                |
| GND         | GND6          | 6    |      |                | GND         | GND6          | 6    |      |                | GND         | GND6          | 6    |      |                |
| P2          | PL18B         | 6    | C    |                | P2          | PL27B         | 6    | C    |                | P2          | PL31B         | 6    | C    |                |
| R6          | NC            | -    |      |                | R6          | NC            | -    |      |                | R6          | PL32A         | 6    | T    |                |
| P5          | NC            | -    |      |                | P5          | NC            | -    |      |                | P5          | PL32B         | 6    | C    |                |
| P3          | NC            | -    |      |                | P3          | NC            | -    |      |                | P3          | PL33A         | 6    | T    |                |
| P4          | NC            | -    |      |                | P4          | NC            | -    |      |                | P4          | PL33B         | 6    | C    |                |
| R1          | NC            | -    |      |                | R1          | NC            | -    |      |                | R1          | PL34A         | 6    | T    |                |
| R2          | NC            | -    |      |                | R2          | NC            | -    |      |                | R2          | PL34B         | 6    | C    |                |
| R5          | NC            | -    |      |                | R5          | NC            | -    |      |                | R5          | PL35A         | 6    | T    |                |
| GND         | -             | -    |      |                | -           | -             | -    |      |                | GND         | GND6          | 6    |      |                |
| R4          | NC            | -    |      |                | R4          | NC            | -    |      |                | R4          | PL35B         | 6    | C    |                |
| T1          | NC            | -    |      |                | T1          | NC            | -    |      |                | T1          | NC            | -    |      |                |
| T2          | NC            | -    |      |                | T2          | NC            | -    |      |                | T2          | NC            | -    |      |                |
| R3          | NC            | -    |      |                | R3          | NC            | -    |      |                | R3          | NC            | -    |      |                |
| T3          | NC            | -    |      |                | T3          | NC            | -    |      |                | T3          | NC            | -    |      |                |
| T5          | TCK           | 6    |      |                | T5          | TCK           | 6    |      |                | T5          | TCK           | 6    |      |                |
| U5          | TDI           | 6    |      |                | U5          | TDI           | 6    |      |                | U5          | TDI           | 6    |      |                |
| T4          | TMS           | 6    |      |                | T4          | TMS           | 6    |      |                | T4          | TMS           | 6    |      |                |
| U1          | TDO           | 6    |      |                | U1          | TDO           | 6    |      |                | U1          | TDO           | 6    |      |                |
| U2          | VCCJ          | 6    |      |                | U2          | VCCJ          | 6    |      |                | U2          | VCCJ          | 6    |      |                |
| V1          | PL20A         | 6    | T    | LLM0_PLLT_IN_A | V1          | PL29A         | 6    | T    | LLM0_PLLT_IN_A | V1          | PL37A         | 6    | T    | LLM0_PLLT_IN_A |
| V2          | PL20B         | 6    | C    | LLM0_PLLC_IN_A | V2          | PL29B         | 6    | C    | LLM0_PLLC_IN_A | V2          | PL37B         | 6    | C    | LLM0_PLLC_IN_A |
| U3          | PL21A         | 6    | T    | LLM0_PLLT_FB_A | U3          | PL30A         | 6    | T    | LLM0_PLLT_FB_A | U3          | PL38A         | 6    | T    | LLM0_PLLT_FB_A |
| V3          | PL21B         | 6    | C    | LLM0_PLLC_FB_A | V3          | PL30B         | 6    | C    | LLM0_PLLC_FB_A | V3          | PL38B         | 6    | C    | LLM0_PLLC_FB_A |
| U4          | PL22A         | 6    | T    |                | U4          | PL31A         | 6    | T    |                | U4          | PL39A         | 6    | T    |                |
| V5          | PL22B         | 6    | C    |                | V5          | PL31B         | 6    | C    |                | V5          | PL39B         | 6    | C    |                |
| W1          | PL23A         | 6    | T    |                | W1          | PL32A         | 6    | T    |                | W1          | PL40A         | 6    | T    |                |
| GND         | GND6          | 6    |      |                | GND         | GND6          | 6    |      |                | GND         | GND6          | 6    |      |                |
| W2          | PL23B         | 6    | C    |                | W2          | PL32B         | 6    | C    |                | W2          | PL40B         | 6    | C    |                |
| Y1          | PL24A         | 6    | T    | LDQS24         | Y1          | PL33A         | 6    | T    | LDQS33         | Y1          | PL41A         | 6    | T    | LDQS41         |
| Y2          | PL24B         | 6    | C    |                | Y2          | PL33B         | 6    | C    |                | Y2          | PL41B         | 6    | C    |                |
| AA1         | PL25A         | 6    | T    |                | AA1         | PL34A         | 6    | T    |                | AA1         | PL42A         | 6    | T    |                |
| AA2         | PL25B         | 6    | C    |                | AA2         | PL34B         | 6    | C    |                | AA2         | PL42B         | 6    | C    |                |
| W4          | PL26A         | 6    | T    |                | W4          | PL35A         | 6    | T    |                | W4          | PL43A         | 6    | T    |                |
| V4          | PL26B         | 6    | C    |                | V4          | PL35B         | 6    | C    |                | V4          | PL43B         | 6    | C    |                |
| W3          | PL27A         | 6    | T    | VREF1_6        | W3          | PL36A         | 6    | T    | VREF1_6        | W3          | PL44A         | 6    | T    | VREF1_6        |
| Y3          | PL27B         | 6    | C    | VREF2_6        | Y3          | PL36B         | 6    | C    | VREF2_6        | Y3          | PL44B         | 6    | C    | VREF2_6        |
| GND         | GND6          | 6    |      |                | GND         | GND6          | 6    |      |                | GND         | GND6          | 6    |      |                |

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

| LFECP20/LFEC20 |                  |      |          |               | LFECP/LFEC33 |               |      |          |               |
|----------------|------------------|------|----------|---------------|--------------|---------------|------|----------|---------------|
| Ball Number    | Ball Function    | Bank | LVD<br>S | Dual Function | Ball Number  | Ball Function | Bank | LVD<br>S | Dual Function |
| L7             | VCCIO7           | 7    |          |               | L7           | VCCIO7        | 7    |          |               |
| L8             | VCCIO7           | 7    |          |               | L8           | VCCIO7        | 7    |          |               |
| G15            | VCCAUX           | -    |          |               | G15          | VCCAUX        | -    |          |               |
| G16            | VCCAUX           | -    |          |               | G16          | VCCAUX        | -    |          |               |
| G7             | VCCAUX           | -    |          |               | G7           | VCCAUX        | -    |          |               |
| G8             | VCCAUX           | -    |          |               | G8           | VCCAUX        | -    |          |               |
| H16            | VCCAUX           | -    |          |               | H16          | VCCAUX        | -    |          |               |
| H7             | VCCAUX           | -    |          |               | H7           | VCCAUX        | -    |          |               |
| R16            | VCCAUX           | -    |          |               | R16          | VCCAUX        | -    |          |               |
| R7             | VCCAUX           | -    |          |               | R7           | VCCAUX        | -    |          |               |
| T15            | VCCAUX           | -    |          |               | T15          | VCCAUX        | -    |          |               |
| T16            | VCCAUX           | -    |          |               | T16          | VCCAUX        | -    |          |               |
| T7             | VCCAUX           | -    |          |               | T7           | VCCAUX        | -    |          |               |
| T8             | VCCAUX           | -    |          |               | T8           | VCCAUX        | -    |          |               |
| J6             | VCC <sup>1</sup> | -    |          |               | J6           | VCCPLL        | -    |          |               |
| J17            | VCC <sup>1</sup> | -    |          |               | J17          | VCCPLL        | -    |          |               |
| P6             | VCC <sup>1</sup> | -    |          |               | P6           | VCCPLL        | -    |          |               |
| P17            | VCC <sup>1</sup> | -    |          |               | P17          | VCCPLL        | -    |          |               |
| A2             | NC               | -    |          |               | A2           | NC            | -    |          |               |
| AB2            | NC               | -    |          |               | AB2          | NC            | -    |          |               |
| A21            | NC               | -    |          |               | A21          | NC            | -    |          |               |

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



**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 |
| K6             | PL13B         | 7    | C    |               | K6          | PL25B         | 7    | C    |               |
| F1             | PL14A         | 7    | T    |               | F1          | PL26A         | 7    | T    |               |
| GND            | GND7          | 7    |      |               | GND         | GND7          | 7    |      |               |
| G1             | PL14B         | 7    | C    |               | G1          | PL26B         | 7    | C    |               |
| H1             | PL15A         | 7    | T    |               | H1          | PL27A         | 7    | T    |               |
| J1             | PL15B         | 7    | C    |               | J1          | PL27B         | 7    | C    |               |
| K2             | PL16A         | 7    | T    |               | K2          | PL28A         | 7    | T    |               |
| K1             | PL16B         | 7    | C    |               | K1          | PL28B         | 7    | C    |               |
| K3             | PL17A         | 7    | T    |               | K3          | PL29A         | 7    | T    |               |
| L3             | PL17B         | 7    | C    |               | L3          | PL29B         | 7    | C    |               |
| L2             | PL18A         | 7    | T    |               | L2          | PL30A         | 7    | T    |               |
| GND            | GND7          | 7    |      |               | GND         | GND7          | 7    |      |               |
| L1             | PL18B         | 7    | C    |               | L1          | PL30B         | 7    | C    |               |
| M3             | PL19A         | 7    | T    | LDQS19        | M3          | PL31A         | 7    | T    | LDQS31        |
| M4             | PL19B         | 7    | C    |               | M4          | PL31B         | 7    | C    |               |
| M1             | PL20A         | 7    | T    |               | M1          | PL32A         | 7    | T    |               |
| M2             | PL20B         | 7    | C    |               | M2          | PL32B         | 7    | C    |               |
| L4             | PL21A         | 7    | T    |               | L4          | PL33A         | 7    | T    |               |
| L5             | PL21B         | 7    | C    |               | L5          | PL33B         | 7    | C    |               |
| N2             | PL22A         | 7    | T    | PCLKT7_0      | N2          | PL34A         | 7    | T    | PCLKT7_0      |
| GND            | GND7          | 7    |      |               | GND         | GND7          | 7    |      |               |
| N1             | PL22B         | 7    | C    | PCLKC7_0      | N1          | PL34B         | 7    | C    | PCLKC7_0      |
| N3             | XRES          | 6    |      |               | N3          | XRES          | 6    |      |               |
| P1             | PL24A         | 6    | T    |               | P1          | PL36A         | 6    | T    |               |
| P2             | PL24B         | 6    | C    |               | P2          | PL36B         | 6    | C    |               |
| L7             | PL25A         | 6    | T    |               | L7          | PL37A         | 6    | T    |               |
| L6             | PL25B         | 6    | C    |               | L6          | PL37B         | 6    | C    |               |
| N4             | PL26A         | 6    | T    |               | N4          | PL38A         | 6    | T    |               |
| N5             | PL26B         | 6    | C    |               | N5          | PL38B         | 6    | C    |               |
| R1             | PL27A         | 6    | T    |               | R1          | PL39A         | 6    | T    |               |
| GND            | GND6          | 6    |      |               | GND         | GND6          | 6    |      |               |
| R2             | PL27B         | 6    | C    |               | R2          | PL39B         | 6    | C    |               |
| P4             | PL28A         | 6    | T    | LDQS28        | P4          | PL40A         | 6    | T    | LDQS40        |
| P3             | PL28B         | 6    | C    |               | P3          | PL40B         | 6    | C    |               |
| M5             | PL29A         | 6    | T    |               | M5          | PL41A         | 6    | T    |               |
| M6             | PL29B         | 6    | C    |               | M6          | PL41B         | 6    | C    |               |
| T1             | PL30A         | 6    | T    |               | T1          | PL42A         | 6    | T    |               |
| T2             | PL30B         | 6    | C    |               | T2          | PL42B         | 6    | C    |               |
| R4             | PL31A         | 6    | T    |               | R4          | PL43A         | 6    | T    |               |
| GND            | GND6          | 6    |      |               | GND         | GND6          | 6    |      |               |
| R3             | PL31B         | 6    | C    |               | R3          | PL43B         | 6    | C    |               |
| N6             | PL32A         | 6    | T    |               | N6          | PL44A         | 6    | 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  |
| Y19            | NC            | -    |      |                | Y19         | PR65A         | 3    | T    | RDQS65         |
| AA23           | NC            | -    |      |                | AA23        | PR64B         | 3    | C    |                |
| -              | -             | -    |      |                | GND         | GND3          | 3    |      |                |
| AA22           | NC            | -    |      |                | AA22        | PR64A         | 3    | T    |                |
| AB23           | NC            | -    |      |                | AB23        | PR63B         | 3    | C    |                |
| AB24           | NC            | -    |      |                | AB24        | PR63A         | 3    | T    |                |
| Y21            | NC            | -    |      |                | Y21         | PR62B         | 3    | C    |                |
| AA21           | NC            | -    |      |                | AA21        | PR62A         | 3    | T    |                |
| Y23            | NC            | -    |      |                | Y23         | PR61B         | 3    | C    |                |
| Y22            | NC            | -    |      |                | Y22         | PR61A         | 3    | T    |                |
| AA24           | NC            | -    |      |                | AA24        | PR60B         | 3    | C    |                |
| -              | -             | -    |      |                | GND         | GND3          | 3    |      |                |
| Y24            | NC            | -    |      |                | Y24         | PR60A         | 3    | T    |                |
| AC25           | PR47B         | 3    | C    |                | AC25        | PR59B         | 3    | C    |                |
| AC26           | PR47A         | 3    | T    |                | AC26        | PR59A         | 3    | T    |                |
| AB25           | PR46B         | 3    | C    |                | AB25        | PR58B         | 3    | C    |                |
| AA25           | PR46A         | 3    | T    |                | AA25        | PR58A         | 3    | T    |                |
| AB26           | PR45B         | 3    | C    |                | AB26        | PR57B         | 3    | C    |                |
| AA26           | PR45A         | 3    | T    | RDQS45         | AA26        | PR57A         | 3    | T    | RDQS57         |
| W23            | PR44B         | 3    | C    | RLM0_PLLC_IN_A | W23         | PR56B         | 3    | C    | RLM0_PLLC_IN_A |
| GND            | GND3          | 3    |      |                | GND         | GND3          | 3    |      |                |
| W24            | PR44A         | 3    | T    | RLM0_PLLT_IN_A | W24         | PR56A         | 3    | T    | RLM0_PLLT_IN_A |
| W22            | PR43B         | 3    | C    | RLM0_PLLC_FB_A | W22         | PR55B         | 3    | C    | RLM0_PLLC_FB_A |
| W21            | PR43A         | 3    | T    | RLM0_PLLT_FB_A | W21         | PR55A         | 3    | T    | RLM0_PLLT_FB_A |
| Y25            | PR42B         | 3    | C    | DI/CSSPIN      | Y25         | PR54B         | 3    | C    | DI/CSSPIN      |
| Y26            | PR42A         | 3    | T    | DOUT/CSON      | Y26         | PR54A         | 3    | T    | DOUT/CSON      |
| W25            | PR41B         | 3    | C    | BUSY/SISPI     | W25         | PR53B         | 3    | C    | BUSY/SISPI     |
| W26            | PR41A         | 3    | T    | D7/SPID0       | W26         | PR53A         | 3    | T    | D7/SPID0       |
| V24            | CFG2          | 3    |      |                | V24         | CFG2          | 3    |      |                |
| V21            | CFG1          | 3    |      |                | V21         | CFG1          | 3    |      |                |
| V23            | CFG0          | 3    |      |                | V23         | CFG0          | 3    |      |                |
| V22            | PROGRAMN      | 3    |      |                | V22         | PROGRAMN      | 3    |      |                |
| V20            | CCLK          | 3    |      |                | V20         | CCLK          | 3    |      |                |
| V25            | INITN         | 3    |      |                | V25         | INITN         | 3    |      |                |
| U20            | DONE          | 3    |      |                | U20         | DONE          | 3    |      |                |
| V26            | PR39B         | 3    | C    |                | V26         | PR51B         | 3    | C    |                |
| GND            | GND3          | 3    |      |                | GND         | GND3          | 3    |      |                |
| U26            | PR39A         | 3    | T    |                | U26         | PR51A         | 3    | T    |                |
| U24            | PR38B         | 3    | C    |                | U24         | PR50B         | 3    | C    |                |
| U25            | PR38A         | 3    | T    |                | U25         | PR50A         | 3    | T    |                |
| U23            | PR37B         | 3    | C    |                | U23         | PR49B         | 3    | C    |                |
| U22            | PR37A         | 3    | T    |                | U22         | PR49A         | 3    | 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/LFEC20 |               |      |      |               | LFECP/EC33  |               |      |      |               |
|---------------|---------------|------|------|---------------|-------------|---------------|------|------|---------------|
| Ball Number   | Ball Function | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function |
| D13           | PT32B         | 0    | C    | VREF1_0       | D13         | PT32B         | 0    | C    | VREF1_0       |
| C13           | PT32A         | 0    | T    | VREF2_0       | C13         | PT32A         | 0    | T    | VREF2_0       |
| A13           | PT31B         | 0    | C    |               | A13         | PT31B         | 0    | C    |               |
| B13           | PT31A         | 0    | T    |               | B13         | PT31A         | 0    | T    |               |
| F13           | PT30B         | 0    | C    |               | F13         | PT30B         | 0    | C    |               |
| F12           | PT30A         | 0    | T    | TDQS30        | F12         | PT30A         | 0    | T    | TDQS30        |
| A12           | PT29B         | 0    | C    |               | A12         | PT29B         | 0    | C    |               |
| GND           | GND0          | 0    |      |               | GND         | GND0          | 0    |      |               |
| B12           | PT29A         | 0    | T    |               | B12         | PT29A         | 0    | T    |               |
| A11           | PT28B         | 0    | C    |               | A11         | PT28B         | 0    | C    |               |
| B11           | PT28A         | 0    | T    |               | B11         | PT28A         | 0    | T    |               |
| D12           | PT27B         | 0    | C    |               | D12         | PT27B         | 0    | C    |               |
| C12           | PT27A         | 0    | T    |               | C12         | PT27A         | 0    | T    |               |
| B10           | PT26B         | 0    | C    |               | B10         | PT26B         | 0    | C    |               |
| A10           | PT26A         | 0    | T    |               | A10         | PT26A         | 0    | T    |               |
| G12           | PT25B         | 0    | C    |               | G12         | PT25B         | 0    | C    |               |
| GND           | GND0          | 0    |      |               | GND         | GND0          | 0    |      |               |
| A9            | PT25A         | 0    | T    |               | A9          | PT25A         | 0    | T    |               |
| E12           | PT24B         | 0    | C    |               | E12         | PT24B         | 0    | C    |               |
| B9            | PT24A         | 0    | T    |               | B9          | PT24A         | 0    | T    |               |
| F11           | PT23B         | 0    | C    |               | F11         | PT23B         | 0    | C    |               |
| A8            | PT23A         | 0    | T    |               | A8          | PT23A         | 0    | T    |               |
| D11           | PT22B         | 0    | C    |               | D11         | PT22B         | 0    | C    |               |
| C11           | PT22A         | 0    | T    | TDQS22        | C11         | PT22A         | 0    | T    | TDQS22        |
| B8            | PT21B         | 0    | C    |               | B8          | PT21B         | 0    | C    |               |
| GND           | GND0          | 0    |      |               | GND         | GND0          | 0    |      |               |
| B7            | PT21A         | 0    | T    |               | B7          | PT21A         | 0    | T    |               |
| E11           | PT20B         | 0    | C    |               | E11         | PT20B         | 0    | C    |               |
| A7            | PT20A         | 0    | T    |               | A7          | PT20A         | 0    | T    |               |
| G11           | PT19B         | 0    | C    |               | G11         | PT19B         | 0    | C    |               |
| C7            | PT19A         | 0    | T    |               | C7          | PT19A         | 0    | T    |               |
| G10           | PT18B         | 0    | C    |               | G10         | PT18B         | 0    | C    |               |
| C6            | PT18A         | 0    | T    |               | C6          | PT18A         | 0    | T    |               |
| C10           | PT17B         | 0    | C    |               | C10         | PT17B         | 0    | C    |               |
| GND           | GND0          | 0    |      |               | GND         | GND0          | 0    |      |               |
| D10           | PT17A         | 0    | T    |               | D10         | PT17A         | 0    | T    |               |
| F10           | PT16B         | 0    | C    |               | F10         | PT16B         | 0    | C    |               |
| A6            | PT16A         | 0    | T    |               | A6          | PT16A         | 0    | T    |               |
| E10           | PT15B         | 0    | C    |               | E10         | PT15B         | 0    | C    |               |
| C9            | PT15A         | 0    | T    |               | C9          | PT15A         | 0    | T    |               |
| G9            | PT14B         | 0    | C    |               | G9          | PT14B         | 0    | C    |               |
| D9            | PT14A         | 0    | T    | TDQS14        | D9          | PT14A         | 0    | T    | TDQS14        |

**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 |
| A5             | PT13B         | 0    | C    |               | A5          | PT13B         | 0    | C    |               |
| GND            | GND0          | 0    |      |               | GND         | GND0          | 0    |      |               |
| A4             | PT13A         | 0    | T    |               | A4          | PT13A         | 0    | T    |               |
| F9             | PT12B         | 0    | C    |               | F9          | PT12B         | 0    | C    |               |
| B6             | PT12A         | 0    | T    |               | B6          | PT12A         | 0    | T    |               |
| E9             | PT11B         | 0    | C    |               | E9          | PT11B         | 0    | C    |               |
| C8             | PT11A         | 0    | T    |               | C8          | PT11A         | 0    | T    |               |
| G8             | PT10B         | 0    | C    |               | G8          | PT10B         | 0    | C    |               |
| B5             | PT10A         | 0    | T    |               | B5          | PT10A         | 0    | T    |               |
| A3             | PT9B          | 0    | C    |               | A3          | PT9B          | 0    | C    |               |
| GND            | GND0          | 0    |      |               | GND         | GND0          | 0    |      |               |
| A2             | PT9A          | 0    | T    |               | A2          | PT9A          | 0    | T    |               |
| F8             | PT8B          | 0    | C    |               | F8          | PT8B          | 0    | C    |               |
| B4             | PT8A          | 0    | T    |               | B4          | PT8A          | 0    | T    |               |
| E8             | PT7B          | 0    | C    |               | E8          | PT7B          | 0    | C    |               |
| B3             | PT7A          | 0    | T    |               | B3          | PT7A          | 0    | T    |               |
| D8             | PT6B          | 0    | C    |               | D8          | PT6B          | 0    | C    |               |
| G7             | PT6A          | 0    | T    | TDQS6         | G7          | PT6A          | 0    | T    | TDQS6         |
| C4             | PT5B          | 0    | C    |               | C4          | PT5B          | 0    | C    |               |
| C5             | PT5A          | 0    | T    |               | C5          | PT5A          | 0    | T    |               |
| E7             | PT4B          | 0    | C    |               | E7          | PT4B          | 0    | C    |               |
| D4             | PT4A          | 0    | T    |               | D4          | PT4A          | 0    | T    |               |
| F7             | PT3B          | 0    | C    |               | F7          | PT3B          | 0    | C    |               |
| D6             | PT3A          | 0    | T    |               | D6          | PT3A          | 0    | T    |               |
| D7             | PT2B          | 0    | C    |               | D7          | PT2B          | 0    | C    |               |
| E6             | PT2A          | 0    | T    |               | E6          | PT2A          | 0    | T    |               |
| GND            | GND0          | 0    |      |               | GND         | GND0          | 0    |      |               |
| K10            | GND           | -    |      |               | K10         | GND           | -    |      |               |
| K11            | GND           | -    |      |               | K11         | GND           | -    |      |               |
| K12            | GND           | -    |      |               | K12         | GND           | -    |      |               |
| K13            | GND           | -    |      |               | K13         | GND           | -    |      |               |
| K14            | GND           | -    |      |               | K14         | GND           | -    |      |               |
| K15            | GND           | -    |      |               | K15         | GND           | -    |      |               |
| K16            | GND           | -    |      |               | K16         | GND           | -    |      |               |
| L10            | GND           | -    |      |               | L10         | GND           | -    |      |               |
| L11            | GND           | -    |      |               | L11         | GND           | -    |      |               |
| L12            | GND           | -    |      |               | L12         | GND           | -    |      |               |
| L13            | GND           | -    |      |               | L13         | GND           | -    |      |               |
| L14            | GND           | -    |      |               | L14         | GND           | -    |      |               |
| L15            | GND           | -    |      |               | L15         | GND           | -    |      |               |
| L16            | GND           | -    |      |               | L16         | GND           | -    |      |               |
| L17            | GND           | -    |      |               | L17         | GND           | -    |      |               |