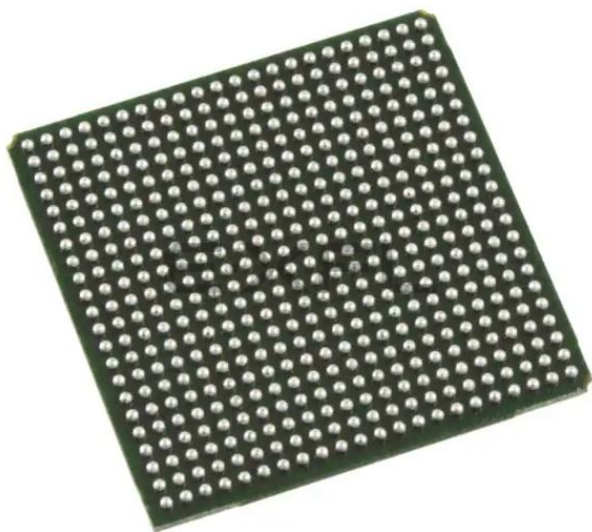




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### Understanding [Embedded - FPGAs \(Field Programmable Gate Array\)](#)

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            | 1500                                                                                                                                                                |
| Number of Logic Elements/Cells | 12000                                                                                                                                                               |
| Total RAM Bits                 | 226304                                                                                                                                                              |
| Number of I/O                  | 297                                                                                                                                                                 |
| Number of Gates                | -                                                                                                                                                                   |
| Voltage - Supply               | 1.14V ~ 1.26V                                                                                                                                                       |
| Mounting Type                  | Surface Mount                                                                                                                                                       |
| Operating Temperature          | 0°C ~ 85°C (TJ)                                                                                                                                                     |
| Package / Case                 | 484-BBGA                                                                                                                                                            |
| Supplier Device Package        | 484-FPBGA (23x23)                                                                                                                                                   |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/lattice-semiconductor/lfe2-12e-6f484c">https://www.e-xfl.com/product-detail/lattice-semiconductor/lfe2-12e-6f484c</a> |

**Table 1-2. LatticeECP2M (Including “S-Series”) Family Selection**

| Device                                        | ECP2M20 | ECP2M35 | ECP2M50 | ECP2M70  | ECP2M100 |
|-----------------------------------------------|---------|---------|---------|----------|----------|
| LUTs (K)                                      | 19      | 34      | 48      | 67       | 95       |
| sysMEM Blocks (18kb)                          | 66      | 114     | 225     | 246      | 288      |
| Embedded Memory (Kbits)                       | 1217    | 2101    | 4147    | 4534     | 5308     |
| Distributed Memory (Kbits)                    | 41      | 71      | 101     | 145      | 202      |
| sysDSP Blocks                                 | 6       | 8       | 22      | 24       | 42       |
| 18x18 Multipliers                             | 24      | 32      | 88      | 96       | 168      |
| GPLL+SPLL+DLL                                 | 2+6+2   | 2+6+2   | 2+6+2   | 2+6+2    | 2+6+2    |
| Maximum Available I/O                         | 304     | 410     | 410     | 436      | 520      |
| <b>Packages and SERDES / I/O Combinations</b> |         |         |         |          |          |
| 256-ball fpBGA (17 x 17 mm)                   | 4 / 140 | 4 / 140 |         |          |          |
| 484-ball fpBGA (23 x 23 mm)                   | 4 / 304 | 4 / 303 | 4 / 270 |          |          |
| 672-ball fpBGA (27 x 27 mm)                   |         | 4 / 410 | 8 / 372 |          |          |
| 900-ball fpBGA (31 x 31 mm)                   |         |         | 8 / 410 | 16 / 416 | 16 / 416 |
| 1152-ball fpBGA (35 x 35 mm)                  |         |         |         | 16 / 436 | 16 / 520 |

## Introduction

The LatticeECP2/M family of FPGA devices is optimized to deliver high performance features such as advanced DSP blocks, high speed SERDES (LatticeECP2M family only) and high speed source synchronous interfaces in an economical FPGA fabric. This combination was achieved through advances in device architecture and the use of 90nm technology.

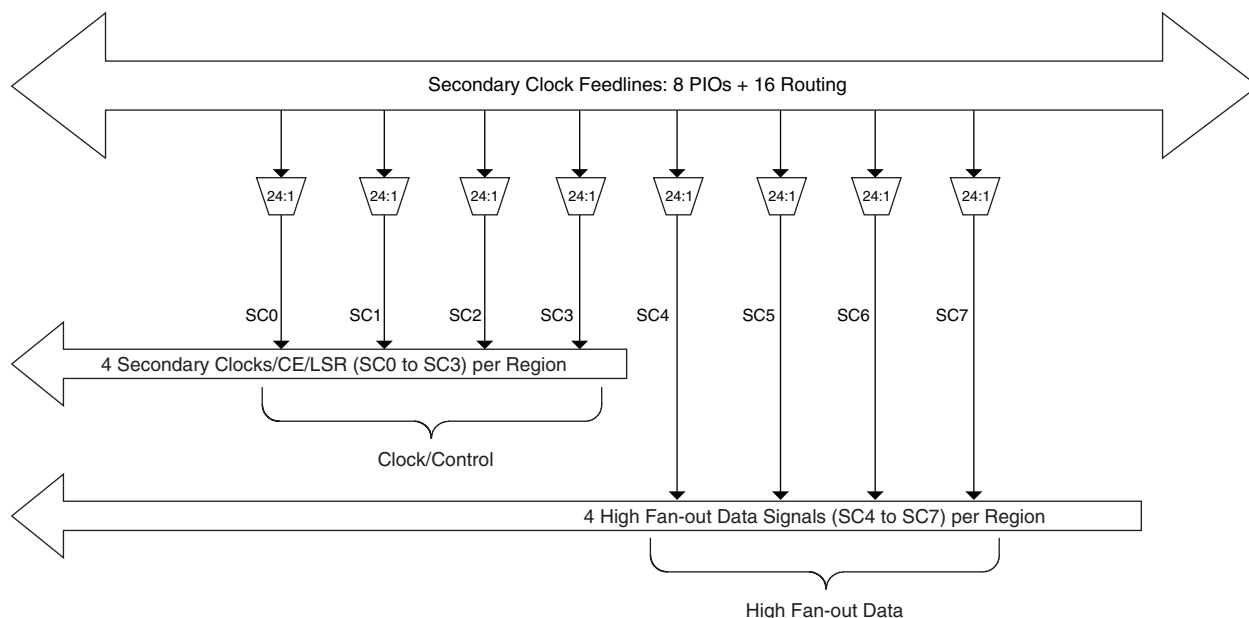
The LatticeECP2/M FPGA fabric is optimized with high performance and low cost in mind. The LatticeECP2/M devices include LUT-based logic, distributed and embedded memory, Phase Locked Loops (PLLs), Delay Locked Loops (DLLs), pre-engineered source synchronous I/O support, enhanced sysDSP blocks and advanced configuration support, including encryption (“S” versions only) and dual boot capabilities.

The LatticeECP2M device family features high speed SERDES with PCS. These high jitter tolerance and low transmission jitter SERDES with PCS blocks can be configured to support an array of popular data protocols including PCI Express, Ethernet (1GbE and SGMII), OBSAI and CPRI. Transmit Pre-emphasis and Receive Equalization settings make SERDES suitable for chip to chip and small form factor backplane applications.

Lattice Diamond® design software allows large complex designs to be efficiently implemented using the LatticeECP2/M FPGA family. Synthesis library support for LatticeECP2/M is available for popular logic synthesis tools. The Diamond software uses the synthesis tool output along with the constraints from its floor planning tools to place and route the design in the LatticeECP2/M device. The Diamond design tool extracts the timing from the routing and back-annotates it into the design for timing verification.

Lattice provides many pre-engineered IP (Intellectual Property) modules for the LatticeECP2/M family. By using these IP cores as standardized blocks, designers are free to concentrate on the unique aspects of their design, increasing their productivity.

**Figure 2-16. Secondary Clock Selection**

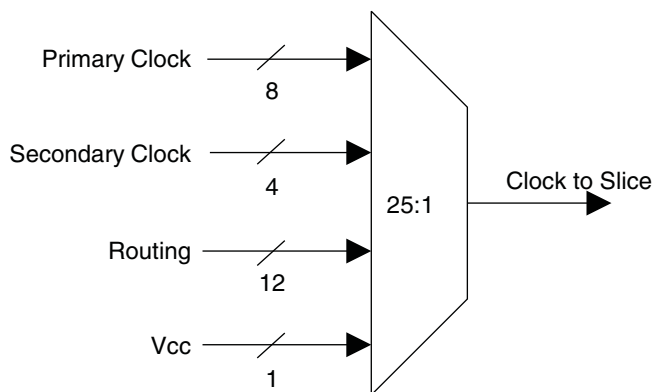


## Slice Clock Selection

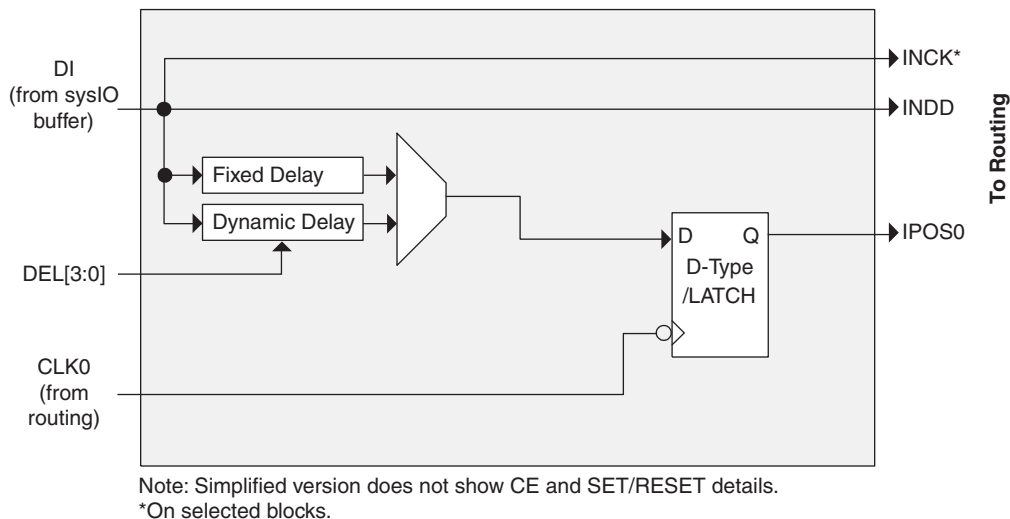
Figure 2-17 shows the clock selections and Figure 2-18 shows the control selections for Slice0 through Slice2. All the primary clocks and the four secondary clocks are routed to this clock selection mux. Other signals can be used as a clock input to the slices via routing. Slice controls are generated from the secondary clocks or other signals connected via routing.

If none of the signals are selected for both clock and control then the default value of the mux output is 1. Slice 3 does not have any registers; therefore it does not have the clock or control muxes.

**Figure 2-17. Slice0 through Slice2 Clock Selection**



**Figure 2-30. Input Register Block Top Edge**



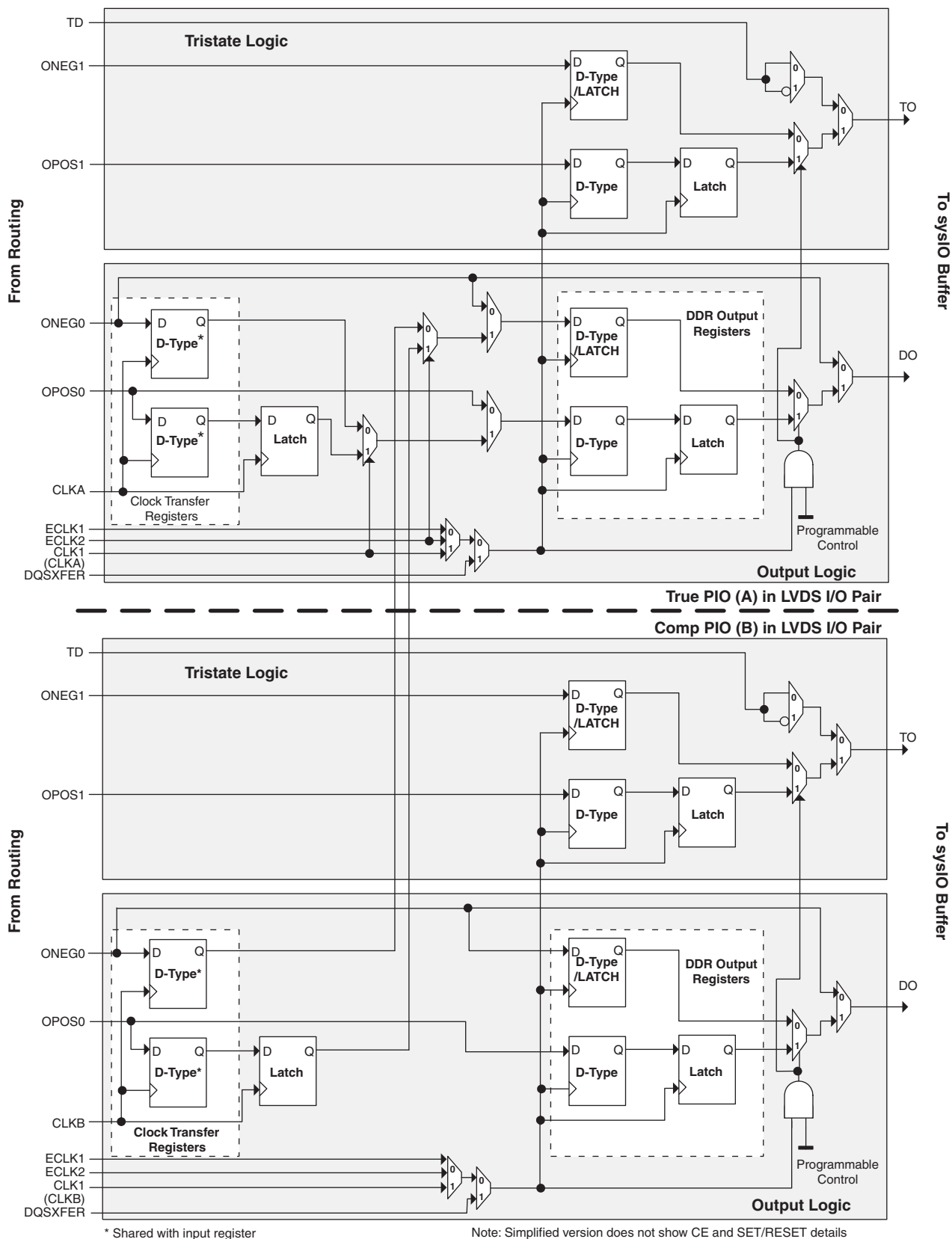
## Output Register Block

The output register block provides the ability to register signals from the core of the device before they are passed to the sysI/O buffers. The blocks on the PIOs on the left, right and bottom contain a register for SDR operation that is combined with an additional latch for DDR operation. Figure 2-31 shows the diagram of the Output Register Block for PIOs on the left, right and the bottom edges. Figure 2-32 shows the diagram of the Output Register Block for PIOs on the top edge of the device.

In SDR mode, ONEG0 feeds one of the flip-flops that then feeds the output. The flip-flop can be configured as a D-type or latch. In DDR mode, ONEG0 and OPOS0 are fed into registers on the positive edge of the clock. Then at the next clock cycle this registered OPOS0 is latched. A multiplexer running off the same clock selects the correct register for feeding to the output (D0).

By combining the output blocks of the complementary PIOs and sharing some registers from input blocks, a gearbox function can be implemented, that takes four data streams: ONEG0A, ONEG1A, ONEG1B and ONEG1B. Figure 2-32 shows the diagram using this gearbox function. For more information about this topic, please see information regarding additional documentation at the end of this data sheet.

**Figure 2-31. Output and Tristate Block for Left, Right and Bottom Edges**



## LatticeECP2/M Internal Switching Characteristics<sup>1</sup>

Over Recommended Operating Conditions

| Parameter                        | Description                                       | -7     |       | -6     |       | -5     |       | Units |
|----------------------------------|---------------------------------------------------|--------|-------|--------|-------|--------|-------|-------|
|                                  |                                                   | Min.   | Max.  | Min.   | Max.  | Min.   | Max.  |       |
| PFU/PFF Logic Mode Timing        |                                                   |        |       |        |       |        |       |       |
| t <sub>LUT4_PFU</sub>            | LUT4 delay (A to D inputs to F output)            | —      | 0.180 | —      | 0.198 | —      | 0.216 | ns    |
| t <sub>LUT6_PFU</sub>            | LUT6 delay (A to D inputs to OFX output)          | —      | 0.304 | —      | 0.331 | —      | 0.358 | ns    |
| t <sub>LSR_PFU</sub>             | Set/Reset to output of PFU (Asynchronous)         | —      | 0.600 | —      | 0.655 | —      | 0.711 | ns    |
| t <sub>SUM_PFU</sub>             | Clock to Mux (M0,M1) Input Setup Time             | 0.128  | —     | 0.129  | —     | 0.129  | —     | ns    |
| t <sub>HM_PFU</sub>              | Clock to Mux (M0,M1) Input Hold Time              | -0.051 | —     | -0.049 | —     | -0.046 | —     | ns    |
| t <sub>SUD_PFU</sub>             | Clock to D input setup time                       | 0.061  | —     | 0.071  | —     | 0.081  | —     | ns    |
| t <sub>HD_PFU</sub>              | Clock to D input hold time                        | 0.002  | —     | 0.003  | —     | 0.003  | —     | ns    |
| t <sub>CK2Q_PFU</sub>            | Clock to Q delay, (D-type Register Configuration) | —      | 0.285 | —      | 0.309 | —      | 0.333 | ns    |
| PFU Dual Port Memory Mode Timing |                                                   |        |       |        |       |        |       |       |
| t <sub>CORAM_PFU</sub>           | Clock to Output (F Port)                          | —      | 0.902 | —      | 1.083 | —      | 1.263 | ns    |
| t <sub>SUDATA_PFU</sub>          | Data Setup Time                                   | -0.172 | —     | -0.205 | —     | -0.238 | —     | ns    |
| t <sub>HDATA_PFU</sub>           | Data Hold Time                                    | 0.199  | —     | 0.235  | —     | 0.271  | —     | ns    |
| t <sub>SUADDR_PFU</sub>          | Address Setup Time                                | -0.245 | —     | -0.284 | —     | -0.323 | —     | ns    |
| t <sub>HADDR_PFU</sub>           | Address Hold Time                                 | 0.246  | —     | 0.285  | —     | 0.324  | —     | ns    |
| t <sub>SUWREN_PFU</sub>          | Write/Read Enable Setup Time                      | -0.122 | —     | -0.145 | —     | -0.168 | —     | ns    |
| t <sub>HWREN_PFU</sub>           | Write/Read Enable Hold Time                       | 0.132  | —     | 0.156  | —     | 0.180  | —     | ns    |
| PIC Timing                       |                                                   |        |       |        |       |        |       |       |
| PIO Input/Output Buffer Timing   |                                                   |        |       |        |       |        |       |       |
| t <sub>IN_PIO</sub>              | Input Buffer Delay (LVCMOS25)                     | —      | 0.613 | —      | 0.681 | —      | 0.749 | ns    |
| t <sub>OUT_PIO</sub>             | Output Buffer Delay (LVCMOS25)                    | —      | 1.115 | —      | 1.115 | —      | 1.343 | ns    |
| IOLOGIC Input/Output Timing      |                                                   |        |       |        |       |        |       |       |
| t <sub>SUI_PIO</sub>             | Input Register Setup Time (Data Before Clock)     | 0.596  | —     | 0.645  | —     | 0.694  | —     | ns    |
| t <sub>HI_PIO</sub>              | Input Register Hold Time (Data after Clock)       | -0.570 | —     | -0.614 | —     | -0.658 | —     | ns    |
| t <sub>COO_PIO</sub>             | Output Register Clock to Output Delay             | —      | 0.61  | —      | 0.66  | —      | 0.72  | ns    |
| t <sub>SUCE_PIO</sub>            | Input Register Clock Enable Setup Time            | 0.032  | —     | 0.037  | —     | 0.041  | —     | ns    |
| t <sub>HCE_PIO</sub>             | Input Register Clock Enable Hold Time             | -0.022 | —     | -0.025 | —     | -0.028 | —     | ns    |
| t <sub>SULSR_PIO</sub>           | Set/Reset Setup Time                              | 0.184  | —     | 0.201  | —     | 0.217  | —     | ns    |
| t <sub>HLSR_PIO</sub>            | Set/Reset Hold Time                               | -0.080 | —     | -0.086 | —     | -0.093 | —     | ns    |
| EBR Timing                       |                                                   |        |       |        |       |        |       |       |
| t <sub>CO_EBR</sub>              | Clock (Read) to output from Address or Data       | —      | 2.51  | —      | 2.75  | —      | 2.99  | ns    |
| t <sub>COO_EBR</sub>             | Clock (Write) to output from EBR output Register  | —      | 0.33  | —      | 0.36  | —      | 0.39  | ns    |
| t <sub>SUDATA_EBR</sub>          | Setup Data to EBR Memory                          | -0.157 | —     | -0.181 | —     | -0.205 | —     | ns    |
| t <sub>HDATA_EBR</sub>           | Hold Data to EBR Memory                           | 0.173  | —     | 0.195  | —     | 0.217  | —     | ns    |
| t <sub>SUADDR_EBR</sub>          | Setup Address to EBR Memory                       | -0.115 | —     | -0.130 | —     | -0.145 | —     | ns    |
| t <sub>HADDR_EBR</sub>           | Hold Address to EBR Memory                        | 0.138  | —     | 0.155  | —     | 0.172  | —     | ns    |
| t <sub>SUWREN_EBR</sub>          | Setup Write/Read Enable to PFU Memory             | -0.128 | —     | -0.149 | —     | -0.170 | —     | ns    |

## LatticeECP2 Power Supply and NC

| Signals          | 144 TQFP <sup>3</sup>                                  | 208 PQFP <sup>3</sup>                                                                            | 256 fpBGA <sup>4</sup>                                                                                | 484 fpBGA <sup>4</sup>                                                                                                                                                                                                                                                                                             |
|------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VCC              | 16, 22, 29, 48, 54, 83, 94, 102, 128, 135              | 12, 19, 28, 40, 74, 80, 97, 116, 129, 140, 146, 171, 188, 198                                    | <b>LFE2-6:</b> G7, G9, G10, H7, J10, K10, K8<br><b>LFE2-12/LFE2-20:</b> G7, G9, G10, H7, J10, K10, K8 | <b>LFE2-12/LFE2-20:</b> N6, N18, J10, J11, J12, J13, K14, K9, L14, L9, M14, M9, N14, N9, P10, P11, P12, P13<br><b>LFE2-35/LFE2-50:</b> J10, J11, J12, J13, K14, K9, L14, L9, M14, M9, N14, N9, P10, P11, P12, P13                                                                                                  |
| VCCIO0           | 139                                                    | 195, 206                                                                                         | C5, E7                                                                                                | G10, G9, H8, H9                                                                                                                                                                                                                                                                                                    |
| VCCIO1           | 117                                                    | 162, 170                                                                                         | C12, E10                                                                                              | G11, G12, G13, G14                                                                                                                                                                                                                                                                                                 |
| VCCIO2           | 106                                                    | 143, 148                                                                                         | E14, G12                                                                                              | H14, H15, J15, K16                                                                                                                                                                                                                                                                                                 |
| VCCIO3           | 89                                                     | 123, 135                                                                                         | K12, M14                                                                                              | L16, M16, N16, P16                                                                                                                                                                                                                                                                                                 |
| VCCIO4           | 64                                                     | 93, 100                                                                                          | M10, P12                                                                                              | R14, T12, T13, T14                                                                                                                                                                                                                                                                                                 |
| VCCIO5           | 42                                                     | 55, 63                                                                                           | M7, P5                                                                                                | R9, T10, T11, T9                                                                                                                                                                                                                                                                                                   |
| VCCIO6           | 31                                                     | 38, 44                                                                                           | K5, M3                                                                                                | N7, P7, P8, R8                                                                                                                                                                                                                                                                                                     |
| VCCIO7           | 9                                                      | 10, 14                                                                                           | E3, G5                                                                                                | J8, K7, L7, M7                                                                                                                                                                                                                                                                                                     |
| VCCIO8           | 85                                                     | 113, 118                                                                                         | T15                                                                                                   | P15, R15                                                                                                                                                                                                                                                                                                           |
| VCCJ             | 35                                                     | 51                                                                                               | K7                                                                                                    | T8                                                                                                                                                                                                                                                                                                                 |
| VCCAUX           | 6, 39, 90, 142                                         | 7, 30, 70, 86, 125, 151, 174, 190                                                                | G8, H10, J7, K9                                                                                       | G5, K5, R5, V7, V11, V8, V13, V15, M17, P17, E17, G18, D11, F13, C5, E6                                                                                                                                                                                                                                            |
| VCCPLL           | None                                                   | None                                                                                             | None                                                                                                  | <b>LFE2-12/LFE2-20:</b> None<br><b>LFE2-35:</b> N6, N18<br><b>LFE2-50:</b> N6, N18, K6, J16                                                                                                                                                                                                                        |
| GND <sup>1</sup> | 11, 21, 30, 47, 51, 61, 81, 95, 105, 120, 133, 138     | 5, 13, 17, 25, 32, 42, 60, 68, 77, 81, 89, 102, 115, 122, 139, 145, 159, 169, 175, 184, 192, 201 | A1, A16, B12, B5, C8, E15, E2, H14, H8, H9, J3, J8, J9, M15, M2, P9, R12, R5, T1, T16                 | A22, AA19, AA4, AB1, AB22, B19, B4, C14, C9, D2, D21, F17, F6, H10, H11, H12, H13, J14, J20, J3, J9, K10, K11, K12, K13, K15, K8, L10, L11, L12, L13, L15, L8, M10, M11, M12, M13, M15, M8, N10, N11, N12, N13, N15, N8, P14, P20, P3, P9, R10, R11, R12, R13, U17, U6, W2, W21, Y14, Y9, A1                       |
| NC <sup>2</sup>  | <b>LFE2-6:</b> 45, 46, 124, 127<br><b>LFE2-12:</b> 127 | None                                                                                             | <b>LFE2-6:</b> K6, R3, P4<br><b>LFE2-12/LFE2-20:</b> None                                             | <b>LFE2-12:</b> E3, F3, F1, H4, F2, H5, G1, G3, G2, G4, K6, N1, M2, N2, M1, N3, N5, N4, P5, N19, M19, J22, L22, H22, K22, J16, D22, F21, E21, E22, H19, G20, G19, F20, C21, C22, H6, J6, H3, H2, H17, H16, H20, H18<br><b>LFE2-20/LFE2-35:</b> K6, J16, H6, J6, H3, H2, H17, H16, H20, H18<br><b>LFE2-50:</b> None |

1. All grounds must be electrically connected at the board level. For fpBGA packages, the total number of GND balls is less than the actual number of GND logic connections from the die to the common package GND plane.
2. NC pins should not be connected to any active signals, VCC or GND.
3. Pin orientation follows the conventional order from the pin 1 marking of the top side view and counter-clockwise.
4. Pin orientation A1 starts from the upper left corner of the top side view with alphabetical order ascending vertically and numerical order ascending horizontally.

**LFE2-6E/SE and LFE2-12E/SE Logic Signal Connections: 256 fpBGA (Cont.)**

| LFE2-6E/SE  |                   |      |                |              | LFE2-12E/SE       |      |                |              |
|-------------|-------------------|------|----------------|--------------|-------------------|------|----------------|--------------|
| Ball Number | Ball/Pad Function | Bank | Dual Function  | Differential | Ball/Pad Function | Bank | Dual Function  | Differential |
| M8          | PB8B              | 5    | PCLKC5_0/BDQ6  | C            | PB26B             | 5    | PCLKC5_0/BDQ24 | C            |
| GND         | GNDIO5            | -    |                |              | GNDIO5            | -    |                |              |
| P7          | PB13A             | 4    | PCLKT4_0/BDQ15 | T            | PB31A             | 4    | PCLKT4_0/BDQ33 | T            |
| R8          | PB13B             | 4    | PCLKC4_0/BDQ15 | C            | PB31B             | 4    | PCLKC4_0/BDQ33 | C            |
| VCCIO       | VCCIO4            | 4    |                |              | VCCIO4            | 4    |                |              |
| T5          | PB14A             | 4    | BDQ15          | T            | PB32A             | 4    | BDQ33          | T            |
| T6          | PB14B             | 4    | BDQ15          | C            | PB32B             | 4    | BDQ33          | C            |
| T8          | PB15A             | 4    | BDQS15         | T            | PB33A             | 4    | BDQS33         | T            |
| GND         | GNDIO4            | -    |                |              | GNDIO4            | -    |                |              |
| R7          | PB16A             | 4    | BDQ15          | T            | PB34A             | 4    | BDQ33          | T            |
| T9          | PB15B             | 4    | BDQ15          | C            | PB33B             | 4    | BDQ33          | C            |
| T7          | PB16B             | 4    | BDQ15          | C            | PB34B             | 4    | BDQ33          | C            |
| L8          | PB17A             | 4    | BDQ15          | T            | PB35A             | 4    | BDQ33          | T            |
| VCCIO       | VCCIO4            | 4    |                |              | VCCIO4            | 4    |                |              |
| P8          | PB18A             | 4    | BDQ15          | T            | PB36A             | 4    | BDQ33          | T            |
| L9          | PB17B             | 4    | BDQ15          | C            | PB35B             | 4    | BDQ33          | C            |
| N8          | PB18B             | 4    | BDQ15          | C            | PB36B             | 4    | BDQ33          | C            |
| R9          | PB19A             | 4    | BDQ15          | T            | PB37A             | 4    | BDQ33          | T            |
| GND         | GNDIO4            | -    |                |              | GNDIO4            | -    |                |              |
| R10         | PB19B             | 4    | BDQ15          | C            | PB37B             | 4    | BDQ33          | C            |
| -           | -                 | -    |                |              | VCCIO             | 4    |                |              |
| -           | -                 | -    |                |              | GNDIO4            | 4    |                |              |
| N9          | PB20A             | 4    | BDQ24          | T            | PB47A             | 4    | BDQ51          | T            |
| T10         | PB21A             | 4    | BDQ24          | T            | PB48A             | 4    | BDQ51          | T            |
| M9          | PB20B             | 4    | BDQ24          | C            | PB47B             | 4    | BDQ51          | C            |
| R11         | PB21B             | 4    | BDQ24          | C            | PB48B             | 4    | BDQ51          | C            |
| P10         | PB22A             | 4    | BDQ24          | T            | PB49A             | 4    | BDQ51          | T            |
| N11         | PB23A             | 4    | BDQ24          | T            | PB50A             | 4    | BDQ51          | T            |
| VCCIO       | VCCIO4            | 4    |                |              | VCCIO4            | 4    |                |              |
| N10         | PB22B             | 4    | BDQ24          | C            | PB49B             | 4    | BDQ51          | C            |
| P11         | PB23B             | 4    | BDQ24          | C            | PB50B             | 4    | BDQ51          | C            |
| T11         | PB24A             | 4    | BDQS24         | T            | PB51A             | 4    | BDQS51         | T            |
| GND         | GNDIO4            | -    |                |              | GNDIO4            | -    |                |              |
| M11         | PB25A             | 4    | BDQ24          | T            | PB52A             | 4    | BDQ51          | T            |
| T12         | PB24B             | 4    | BDQ24          | C            | PB51B             | 4    | BDQ51          | C            |
| L11         | PB25B             | 4    | BDQ24          | C            | PB52B             | 4    | BDQ51          | C            |
| T13         | PB26A             | 4    | BDQ24          | T            | PB53A             | 4    | BDQ51          | T            |
| R13         | PB27A             | 4    | BDQ24          | T            | PB54A             | 4    | BDQ51          | T            |
| VCCIO       | VCCIO4            | 4    |                |              | VCCIO4            | 4    |                |              |
| T14         | PB26B             | 4    | BDQ24          | C            | PB53B             | 4    | BDQ51          | C            |
| P13         | PB27B             | 4    | BDQ24          | C            | PB54B             | 4    | BDQ51          | C            |
| GND         | GNDIO4            | -    |                |              | GNDIO4            | -    |                |              |
| N12         | PB28A             | 4    | VREF2_4/BDQ24  | T            | PB55A             | 4    | VREF2_4/BDQ51  | T            |
| M12         | PB28B             | 4    | VREF1_4/BDQ24  | C            | PB55B             | 4    | VREF1_4/BDQ51  | C            |
| R15         | CFG2              | 8    |                |              | CFG2              | 8    |                |              |

**LFE2-20E/SE Logic Signal Connections: 256 fpBGA**

| LFE2-20E/SE |             |                   |      |                         |              |
|-------------|-------------|-------------------|------|-------------------------|--------------|
| Ball Number | Ball Number | Ball/Pad Function | Bank | Dual Function           | Differential |
| C3          | C3          | PL2A              | 7    | VREF2_7                 | T (LVDS)*    |
| C2          | C2          | PL2B              | 7    | VREF1_7                 | C (LVDS)*    |
| VCCIO       | VCCIO       | VCCIO7            | 7    |                         |              |
| -           | GND         | GNDIO7            | 7    |                         |              |
| D3          | D3          | PL7A              | 7    | LDQ8                    | T            |
| D4          | D4          | PL6A              | 7    | LDQ8                    | T (LVDS)*    |
| D2          | D2          | PL7B              | 7    | LDQ8                    | C            |
| GND         | GND         | GNDIO7            | -    |                         |              |
| E4          | E4          | PL6B              | 7    | LDQ8                    | C (LVDS)*    |
| B1          | B1          | PL13A             | 7    | LDQ16                   | T            |
| C1          | C1          | PL13B             | 7    | LDQ16                   | C            |
| F5          | F5          | PL15A             | 7    | LDQ16                   | T            |
| VCCIO       | VCC         | VCCIO             | 7    |                         |              |
| F4          | F4          | PL14A             | 7    | LDQ16                   | T (LVDS)*    |
| G6          | G6          | PL15B             | 7    | LDQ16                   | C            |
| G4          | G4          | PL14B             | 7    | LDQ16                   | C (LVDS)*    |
| D1          | D1          | PL16A             | 7    | LDQS16                  | T (LVDS)*    |
| GND         | GND         | GNDIO7            | -    |                         |              |
| E1          | E1          | PL16B             | 7    | LDQ16                   | C (LVDS)*    |
| F3          | F3          | PL17A             | 7    | LDQ16                   | T            |
| G3          | G3          | PL17B             | 7    | LDQ16                   | C            |
| VCCIO       | VCCIO       | VCCIO7            | 7    |                         |              |
| F2          | F2          | PL18A             | 7    | LDQ16                   | T (LVDS)*    |
| F1          | F1          | PL18B             | 7    | LDQ16                   | C (LVDS)*    |
| GND         | GND         | GNDIO7            | -    |                         |              |
| G2          | G2          | PL19A             | 7    | PCLKT7_0/LDQ16          | T            |
| G1          | G1          | PL19B             | 7    | PCLKC7_0/LDQ16          | C            |
| H6          | H6          | PL21A             | 6    | PCLKT6_0/LDQ25          | T (LVDS)*    |
| VCCIO       | VCCIO       | VCCIO6            | 6    |                         |              |
| H5          | H5          | PL21B             | 6    | PCLKC6_0/LDQ25          | C (LVDS)*    |
| H4          | H4          | PL22A             | 6    | VREF2_6/LDQ25           | T            |
| GND         | GND         | GNDIO6            | -    |                         |              |
| H3          | H3          | PL22B             | 6    | VREF1_6/LDQ25           | C            |
| H2          | H2          | PL27A             | 6    | LLM0_GDLLT_IN_A**/LDQ25 | T (LVDS)*    |
| H1          | H1          | PL27B             | 6    | LLM0_GDLLC_IN_A**/LDQ25 | C (LVDS)*    |
| G10         | G10         | VCC               | -    |                         |              |
| J4          | J4          | PL28A             | 6    | LLM0_GDLLT_FB_A/LDQ25   | T            |
| J5          | J5          | PL28B             | 6    | LLM0_GDLLC_FB_A/LDQ25   | C            |
| J6          | J6          | LLM0_PLLCAP       | 6    |                         |              |
| K4          | K4          | PL30A             | 6    | LLM0_GPLLT_IN_A**/LDQ34 | T (LVDS)*    |
| GND         | GND         | GNDIO6            | -    |                         |              |

## LFE2-35E/SE and LFE2-50E/SE Logic Signal Connections: 484 fpBGA (Cont.)

| LFE2-35E/SE |                   |      |               |              | LFE2-50E/SE       |      |               |              |
|-------------|-------------------|------|---------------|--------------|-------------------|------|---------------|--------------|
| Ball Number | Ball/Pad Function | Bank | Dual Function | Differential | Ball/Pad Function | Bank | Dual Function | Differential |
| U3          | PL55A             | 6    | LDQ56         | T            | PL74A             | 6    | LDQ75         | T            |
| U4          | PL55B             | 6    | LDQ56         | C            | PL74B             | 6    | LDQ75         | C            |
| GNDIO       | GNDIO6            | -    |               |              | GNDIO6            | -    |               |              |
| Y1          | PL56A             | 6    | LDQS56        | T (LVDS)*    | PL75A             | 6    | LDQS75        | T (LVDS)*    |
| W1          | PL56B             | 6    | LDQ56         | C (LVDS)*    | PL75B             | 6    | LDQ75         | C (LVDS)*    |
| R7          | PL57A             | 6    | LDQ56         | T            | PL76A             | 6    | LDQ75         | T            |
| VCCIO       | VCCIO6            | 6    |               |              | VCCIO             | 6    |               |              |
| T7          | PL57B             | 6    | LDQ56         | C            | PL76B             | 6    | LDQ75         | C            |
| V4          | PL58A             | 6    | LDQ56         | T (LVDS)*    | PL77A             | 6    | LDQ75         | T (LVDS)*    |
| V3          | PL58B             | 6    | LDQ56         | C (LVDS)*    | PL77B             | 6    | LDQ75         | C (LVDS)*    |
| AA2         | PL59A             | 6    | LDQ56         | T            | PL78A             | 6    | LDQ75         | T            |
| GNDIO       | GNDIO6            | -    |               |              | GNDIO6            | -    |               |              |
| AA1         | PL59B             | 6    | LDQ56         | C            | PL78B             | 6    | LDQ75         | C            |
| U7          | TCK               | -    |               |              | TCK               | -    |               |              |
| U5          | TDI               | -    |               |              | TDI               | -    |               |              |
| V5          | TMS               | -    |               |              | TMS               | -    |               |              |
| V6          | TDO               | -    |               |              | TDO               | -    |               |              |
| T8          | VCCJ              | -    |               |              | VCCJ              | -    |               |              |
| Y3          | PB2A              | 5    | VREF2_5/BDQ6  | T            | PB2A              | 5    | VREF2_5/BDQ6  | T            |
| Y2          | PB2B              | 5    | VREF1_5/BDQ6  | C            | PB2B              | 5    | VREF1_5/BDQ6  | C            |
| W4          | PB3A              | 5    | BDQ6          | T            | PB3A              | 5    | BDQ6          | T            |
| W3          | PB3B              | 5    | BDQ6          | C            | PB3B              | 5    | BDQ6          | C            |
| W5          | PB4A              | 5    | BDQ6          | T            | PB4A              | 5    | BDQ6          | T            |
| W6          | PB4B              | 5    | BDQ6          | C            | PB4B              | 5    | BDQ6          | C            |
| VCCIO       | VCCIO5            | 5    |               |              | VCCIO             | 5    |               |              |
| AB3         | PB5A              | 5    | BDQ6          | T            | PB5A              | 5    | BDQ6          | T            |
| AB2         | PB5B              | 5    | BDQ6          | C            | PB5B              | 5    | BDQ6          | C            |
| GNDIO       | GNDIO5            | -    |               |              | GNDIO5            | -    |               |              |
| Y4          | PB6A              | 5    | BDQS6         | T            | PB6A              | 5    | BDQS6         | T            |
| AA3         | PB6B              | 5    | BDQ6          | C            | PB6B              | 5    | BDQ6          | C            |
| AB5         | PB7A              | 5    | BDQ6          | T            | PB7A              | 5    | BDQ6          | T            |
| AB4         | PB7B              | 5    | BDQ6          | C            | PB7B              | 5    | BDQ6          | C            |
| AA5         | PB8A              | 5    | BDQ6          | T            | PB8A              | 5    | BDQ6          | T            |
| Y5          | PB8B              | 5    | BDQ6          | C            | PB8B              | 5    | BDQ6          | C            |
| VCCIO       | VCCIO5            | 5    |               |              | VCCIO             | 5    |               |              |
| AB6         | PB9A              | 5    | BDQ6          | T            | PB9A              | 5    | BDQ6          | T            |
| AA6         | PB9B              | 5    | BDQ6          | C            | PB9B              | 5    | BDQ6          | C            |
| GNDIO       | GNDIO5            | -    |               |              | GNDIO5            | -    |               |              |
| VCCIO       | VCCIO5            | 5    |               |              | VCCIO             | 5    |               |              |
| W7          | PB20A             | 5    | BDQ24         | T            | PB29A             | 5    | BDQ33         | T            |
| W8          | PB20B             | 5    | BDQ24         | C            | PB29B             | 5    | BDQ33         | C            |
| Y6          | PB21A             | 5    | BDQ24         | T            | PB30A             | 5    | BDQ33         | T            |
| Y7          | PB21B             | 5    | BDQ24         | C            | PB30B             | 5    | BDQ33         | C            |
| AA7         | PB22A             | 5    | BDQ24         | T            | PB31A             | 5    | BDQ33         | T            |
| VCCIO       | VCCIO5            | 5    |               |              | VCCIO             | 5    |               |              |
| AB7         | PB22B             | 5    | BDQ24         | C            | PB31B             | 5    | BDQ33         | C            |

## LFE2-35E/SE and LFE2-50E/SE Logic Signal Connections: 484 fpBGA (Cont.)

| LFE2-35E/SE |                   |      |               |              | LFE2-50E/SE       |      |               |              |
|-------------|-------------------|------|---------------|--------------|-------------------|------|---------------|--------------|
| Ball Number | Ball/Pad Function | Bank | Dual Function | Differential | Ball/Pad Function | Bank | Dual Function | Differential |
| N16         | VCCIO3            | 3    |               |              | VCCIO3            | 3    |               |              |
| P16         | VCCIO3            | 3    |               |              | VCCIO3            | 3    |               |              |
| R14         | VCCIO4            | 4    |               |              | VCCIO4            | 4    |               |              |
| T12         | VCCIO4            | 4    |               |              | VCCIO4            | 4    |               |              |
| T13         | VCCIO4            | 4    |               |              | VCCIO4            | 4    |               |              |
| T14         | VCCIO4            | 4    |               |              | VCCIO4            | 4    |               |              |
| R9          | VCCIO5            | 5    |               |              | VCCIO5            | 5    |               |              |
| T10         | VCCIO5            | 5    |               |              | VCCIO5            | 5    |               |              |
| T11         | VCCIO5            | 5    |               |              | VCCIO5            | 5    |               |              |
| T9          | VCCIO5            | 5    |               |              | VCCIO5            | 5    |               |              |
| N7          | VCCIO6            | 6    |               |              | VCCIO6            | 6    |               |              |
| P7          | VCCIO6            | 6    |               |              | VCCIO6            | 6    |               |              |
| P8          | VCCIO6            | 6    |               |              | VCCIO6            | 6    |               |              |
| R8          | VCCIO6            | 6    |               |              | VCCIO6            | 6    |               |              |
| J8          | VCCIO7            | 7    |               |              | VCCIO7            | 7    |               |              |
| K7          | VCCIO7            | 7    |               |              | VCCIO7            | 7    |               |              |
| L7          | VCCIO7            | 7    |               |              | VCCIO7            | 7    |               |              |
| M7          | VCCIO7            | 7    |               |              | VCCIO7            | 7    |               |              |
| P15         | VCCIO8            | 8    |               |              | VCCIO8            | 8    |               |              |
| R15         | VCCIO8            | 8    |               |              | VCCIO8            | 8    |               |              |
| A22         | GND               | -    |               |              | GND               | -    |               |              |
| AA19        | GND               | -    |               |              | GND               | -    |               |              |
| AA4         | GND               | -    |               |              | GND               | -    |               |              |
| AB1         | GND               | -    |               |              | GND               | -    |               |              |
| AB22        | GND               | -    |               |              | GND               | -    |               |              |
| B19         | GND               | -    |               |              | GND               | -    |               |              |
| B4          | GND               | -    |               |              | GND               | -    |               |              |
| C14         | GND               | -    |               |              | GND               | -    |               |              |
| C9          | GND               | -    |               |              | GND               | -    |               |              |
| D2          | GND               | -    |               |              | GND               | -    |               |              |
| D21         | GND               | -    |               |              | GND               | -    |               |              |
| F17         | GND               | -    |               |              | GND               | -    |               |              |
| F6          | GND               | -    |               |              | GND               | -    |               |              |
| H10         | GND               | -    |               |              | GND               | -    |               |              |
| H11         | GND               | -    |               |              | GND               | -    |               |              |
| H12         | GND               | -    |               |              | GND               | -    |               |              |
| H13         | GND               | -    |               |              | GND               | -    |               |              |
| J14         | GND               | -    |               |              | GND               | -    |               |              |
| J20         | GND               | -    |               |              | GND               | -    |               |              |
| J3          | GND               | -    |               |              | GND               | -    |               |              |
| J9          | GND               | -    |               |              | GND               | -    |               |              |
| K10         | GND               | -    |               |              | GND               | -    |               |              |
| K11         | GND               | -    |               |              | GND               | -    |               |              |
| K12         | GND               | -    |               |              | GND               | -    |               |              |
| K13         | GND               | -    |               |              | GND               | -    |               |              |
| K15         | GND               | -    |               |              | GND               | -    |               |              |

## LFE2-50E/SE and LFE2-70E/SE Logic Signal Connections: 672 fpBGA (Cont.)

| LFE2-50E/SE |                   |      |               |              | LFE2-70E/SE       |      |               |              |  |
|-------------|-------------------|------|---------------|--------------|-------------------|------|---------------|--------------|--|
| Ball Number | Ball/Pad Function | Bank | Dual Function | Differential | Ball/Pad Function | Bank | Dual Function | Differential |  |
| W5          | PL71B             | 6    | LDQ75         | C (LVDS)*    | PL84B             | 6    | LDQ88         | C (LVDS)*    |  |
| AC1         | PL72A             | 6    | LDQ75         | T            | PL85A             | 6    | LDQ88         | T            |  |
| AD1         | PL72B             | 6    | LDQ75         | C            | PL85B             | 6    | LDQ88         | C            |  |
| VCCIO       | VCCIO6            | 6    |               |              | VCCIO6            | 6    |               |              |  |
| Y6          | PL73A             | 6    | LDQ75         | T (LVDS)*    | PL86A             | 6    | LDQ88         | T (LVDS)*    |  |
| Y5          | PL73B             | 6    | LDQ75         | C (LVDS)*    | PL86B             | 6    | LDQ88         | C (LVDS)*    |  |
| AE2         | PL74A             | 6    | LDQ75         | T            | PL87A             | 6    | LDQ88         | T            |  |
| AD2         | PL74B             | 6    | LDQ75         | C            | PL87B             | 6    | LDQ88         | C            |  |
| GND         | GNDIO6            | -    |               |              | GNDIO6            | -    |               |              |  |
| AB3         | PL75A             | 6    | LDQS75        | T (LVDS)*    | PL88A             | 6    | LDQS88        | T (LVDS)*    |  |
| AB2         | PL75B             | 6    | LDQ75         | C (LVDS)*    | PL88B             | 6    | LDQ88         | C (LVDS)*    |  |
| W7          | PL76A             | 6    | LDQ75         | T            | PL89A             | 6    | LDQ88         | T            |  |
| VCCIO       | VCCIO6            | 6    |               |              | VCCIO6            | 6    |               |              |  |
| W8          | PL76B             | 6    | LDQ75         | C            | PL89B             | 6    | LDQ88         | C            |  |
| Y7          | PL77A             | 6    | LDQ75         | T (LVDS)*    | PL90A             | 6    | LDQ88         | T (LVDS)*    |  |
| Y8          | PL77B             | 6    | LDQ75         | C (LVDS)*    | PL90B             | 6    | LDQ88         | C (LVDS)*    |  |
| AC2         | PL78A             | 6    | LDQ75         | T            | PL91A             | 6    | LDQ88         | T            |  |
| GND         | GNDIO6            | -    |               |              | GNDIO6            | -    |               |              |  |
| AD3         | PL78B             | 6    | LDQ75         | C            | PL91B             | 6    | LDQ88         | C            |  |
| AC3         | TCK               | -    |               |              | TCK               | -    |               |              |  |
| AA8         | TDI               | -    |               |              | TDI               | -    |               |              |  |
| AB4         | TMS               | -    |               |              | TMS               | -    |               |              |  |
| AA5         | TDO               | -    |               |              | TDO               | -    |               |              |  |
| AB5         | VCCJ              | -    |               |              | VCCJ              | -    |               |              |  |
| AE3         | PB2A              | 5    | VREF2_5/BDQ6  | T            | PB2A              | 5    | VREF2_5/BDQ6  | T            |  |
| AF3         | PB2B              | 5    | VREF1_5/BDQ6  | C            | PB2B              | 5    | VREF1_5/BDQ6  | C            |  |
| AC4         | PB3A              | 5    | BDQ6          | T            | PB3A              | 5    | BDQ6          | T            |  |
| AD4         | PB3B              | 5    | BDQ6          | C            | PB3B              | 5    | BDQ6          | C            |  |
| AE4         | PB4A              | 5    | BDQ6          | T            | PB4A              | 5    | BDQ6          | T            |  |
| AF4         | PB4B              | 5    | BDQ6          | C            | PB4B              | 5    | BDQ6          | C            |  |
| VCCIO       | VCCIO5            | 5    |               |              | VCCIO5            | 5    |               |              |  |
| V9          | PB5A              | 5    | BDQ6          | T            | PB5A              | 5    | BDQ6          | T            |  |
| W9          | PB5B              | 5    | BDQ6          | C            | PB5B              | 5    | BDQ6          | C            |  |
| GND         | GNDIO5            | -    |               |              | GNDIO5            | -    |               |              |  |
| AA6         | PB6A              | 5    | BDQS6         | T            | PB6A              | 5    | BDQS6         | T            |  |
| AB6         | PB6B              | 5    | BDQ6          | C            | PB6B              | 5    | BDQ6          | C            |  |
| AC5         | PB7A              | 5    | BDQ6          | T            | PB7A              | 5    | BDQ6          | T            |  |
| AD5         | PB7B              | 5    | BDQ6          | C            | PB7B              | 5    | BDQ6          | C            |  |
| AA7         | PB8A              | 5    | BDQ6          | T            | PB8A              | 5    | BDQ6          | T            |  |
| AB7         | PB8B              | 5    | BDQ6          | C            | PB8B              | 5    | BDQ6          | C            |  |
| VCCIO       | VCCIO5            | 5    |               |              | VCCIO5            | 5    |               |              |  |
| AE5         | PB9A              | 5    | BDQ6          | T            | PB9A              | 5    | BDQ6          | T            |  |
| AF5         | PB9B              | 5    | BDQ6          | C            | PB9B              | 5    | BDQ6          | C            |  |
| AC7         | PB10A             | 5    | BDQ6          | T            | PB10A             | 5    | BDQ6          | T            |  |
| AD7         | PB10B             | 5    | BDQ6          | C            | PB10B             | 5    | BDQ6          | C            |  |
| VCCIO       | VCCIO5            | 5    |               |              | VCCIO5            | 5    |               |              |  |

**LFE2-70E/SE Logic Signal Connections: 900 fpBGA**

| LFE2-70E/SE |                   |      |                       |              |
|-------------|-------------------|------|-----------------------|--------------|
| Ball Number | Ball/Pad Function | Bank | Dual Function         | Differential |
| VCCIO       | VCCIO7            | 7    |                       |              |
| F4          | PL2A              | 7    | VREF2_7               | T (LVDS)*    |
| F3          | PL2B              | 7    | VREF1_7               | C (LVDS)*    |
| H4          | PL3A              | 7    |                       | T            |
| G5          | PL3B              | 7    |                       | C            |
| GND         | GNDIO7            | -    |                       |              |
| D2          | PL4A              | 7    |                       | T (LVDS)*    |
| D1          | PL4B              | 7    |                       | C (LVDS)*    |
| E2          | PL5A              | 7    |                       | T            |
| VCCIO       | VCCIO7            | 7    |                       |              |
| E1          | PL5B              | 7    |                       | C            |
| GND         | GNDIO7            | -    |                       |              |
| VCCIO       | VCCIO7            | 7    |                       |              |
| F1          | PL14A             | 7    | LUM1_SPLLT_IN_A/LDQ12 | T (LVDS)*    |
| F2          | PL14B             | 7    | LUM1_SPLLC_IN_A/LDQ12 | C (LVDS)*    |
| G1          | PL15A             | 7    | LUM1_SPLLT_FB_A/LDQ12 | T            |
| G2          | PL15B             | 7    | LUM1_SPLLC_FB_A/LDQ12 | C            |
| GND         | GNDIO7            | -    |                       |              |
| H8          | PL18A             | 7    | LDQ21                 | T            |
| H6          | PL18B             | 7    | LDQ21                 | C            |
| VCCIO       | VCCIO7            | 7    |                       |              |
| G4          | PL19A             | 7    | LDQ21                 | T (LVDS)*    |
| G3          | PL19B             | 7    | LDQ21                 | C (LVDS)*    |
| H7          | PL20A             | 7    | LDQ21                 | T            |
| H5          | PL20B             | 7    | LDQ21                 | C            |
| GND         | GNDIO7            | -    |                       |              |
| H2          | PL21A             | 7    | LDQS21                | T (LVDS)*    |
| H1          | PL21B             | 7    | LDQ21                 | C (LVDS)*    |
| J6          | PL22A             | 7    | LDQ21                 | T            |
| VCCIO       | VCCIO7            | 7    |                       |              |
| J8          | PL22B             | 7    | LDQ21                 | C            |
| J2          | PL23A             | 7    | LDQ21                 | T (LVDS)*    |
| J1          | PL23B             | 7    | LDQ21                 | C (LVDS)*    |
| J5          | PL24A             | 7    | LDQ21                 | T            |
| GND         | GNDIO7            | -    |                       |              |
| J7          | PL24B             | 7    | LDQ21                 | C            |
| J4          | PL25A             | 7    | LDQ29                 | T (LVDS)*    |
| J3          | PL25B             | 7    | LDQ29                 | C (LVDS)*    |
| K6          | PL26A             | 7    | LDQ29                 | T            |
| K8          | PL26B             | 7    | LDQ29                 | C            |
| VCCIO       | VCCIO7            | 7    |                       |              |
| K2          | PL27A             | 7    | LDQ29                 | T (LVDS)*    |

**LFE2-70E/SE Logic Signal Connections: 900 fpBGA (Cont.)**

| LFE2-70E/SE |                   |      |                       |              |
|-------------|-------------------|------|-----------------------|--------------|
| Ball Number | Ball/Pad Function | Bank | Dual Function         | Differential |
| K28         | PR25A             | 2    | RDQ29                 | T (LVDS)*    |
| J24         | PR24B             | 2    | RDQ21                 | C            |
| J26         | PR24A             | 2    | RDQ21                 | T            |
| GND         | GNDIO2            | -    |                       |              |
| K29         | PR23B             | 2    | RDQ21                 | C (LVDS)*    |
| K30         | PR23A             | 2    | RDQ21                 | T (LVDS)*    |
| J23         | PR22B             | 2    | RDQ21                 | C            |
| J25         | PR22A             | 2    | RDQ21                 | T            |
| VCCIO       | VCCIO2            | 99   |                       |              |
| J27         | PR21B             | 2    | RDQ21                 | C (LVDS)*    |
| J28         | PR21A             | 2    | RDQS21                | T (LVDS)*    |
| H26         | PR20B             | 2    | RDQ21                 | C            |
| GND         | GNDIO2            | -    |                       |              |
| H24         | PR20A             | 2    | RDQ21                 | T            |
| J29         | PR19B             | 2    | RDQ21                 | C (LVDS)*    |
| J30         | PR19A             | 2    | RDQ21                 | T (LVDS)*    |
| H25         | PR18B             | 2    | RDQ21                 | C            |
| VCCIO       | VCCIO2            | 2    |                       |              |
| H23         | PR18A             | 2    | RDQ21                 | T            |
| G27         | PR15B             | 2    | RUM1_SPLLC_FB_A/RDQ12 | C            |
| GND         | GNDIO2            | -    |                       |              |
| H27         | PR15A             | 2    | RUM1_SPLLT_FB_A/RDQ12 | T            |
| G29         | PR14B             | 2    | RUM1_SPLLC_IN_A/RDQ12 | C (LVDS)*    |
| G28         | PR14A             | 2    | RUM1_SPLLT_IN_A/RDQ12 | T (LVDS)*    |
| VCCIO       | VCCIO2            | 2    |                       |              |
| GND         | GNDIO2            | -    |                       |              |
| G26         | PR6B              | 2    |                       | C (LVDS)*    |
| G25         | PR6A              | 2    |                       | T (LVDS)*    |
| G30         | PR5B              | 2    |                       | C            |
| F30         | PR5A              | 2    |                       | T            |
| VCCIO       | VCCIO2            | 2    |                       |              |
| F26         | PR4B              | 2    |                       | C (LVDS)*    |
| F27         | PR4A              | 2    |                       | T (LVDS)*    |
| F29         | PR3B              | 2    |                       | C            |
| GND         | GNDIO2            | -    |                       |              |
| F28         | PR3A              | 2    |                       | T            |
| H29         | PR2B              | 2    | VREF2_2               | C (LVDS)*    |
| H30         | PR2A              | 2    | VREF1_2               | T (LVDS)*    |
| VCCIO       | VCCIO2            | 2    |                       |              |
| B26         | PT100B            | 1    | VREF2_1               | C            |
| A26         | PT100A            | 1    | VREF1_1               | T            |
| GND         | GNDIO1            | -    |                       |              |
| C25         | PT99B             | 1    |                       | C            |

**LFE2-70E/SE Logic Signal Connections: 900 fpBGA (Cont.)**

| LFE2-70E/SE |                   |      |               |              |
|-------------|-------------------|------|---------------|--------------|
| Ball Number | Ball/Pad Function | Bank | Dual Function | Differential |
| AG4         | NC                | -    |               |              |
| AG8         | NC                | -    |               |              |
| AH1         | NC                | -    |               |              |
| AH16        | NC                | -    |               |              |
| AH2         | NC                | -    |               |              |
| AH26        | NC                | -    |               |              |
| AH27        | NC                | -    |               |              |
| AH29        | NC                | -    |               |              |
| AH30        | NC                | -    |               |              |
| AH4         | NC                | -    |               |              |
| AJ1         | NC                | -    |               |              |
| AJ2         | NC                | -    |               |              |
| AJ27        | NC                | -    |               |              |
| AJ28        | NC                | -    |               |              |
| AJ29        | NC                | -    |               |              |
| AJ3         | NC                | -    |               |              |
| AJ30        | NC                | -    |               |              |
| AK2         | NC                | -    |               |              |
| AK27        | NC                | -    |               |              |
| AK28        | NC                | -    |               |              |
| AK29        | NC                | -    |               |              |
| AK3         | NC                | -    |               |              |
| B1          | NC                | -    |               |              |
| B2          | NC                | -    |               |              |
| B3          | NC                | -    |               |              |
| B30         | NC                | -    |               |              |
| B4          | NC                | -    |               |              |
| B5          | NC                | -    |               |              |
| C1          | NC                | -    |               |              |
| C2          | NC                | -    |               |              |
| C29         | NC                | -    |               |              |
| C30         | NC                | -    |               |              |
| C4          | NC                | -    |               |              |
| D13         | NC                | -    |               |              |
| D18         | NC                | -    |               |              |
| D23         | NC                | -    |               |              |
| D28         | NC                | -    |               |              |
| D29         | NC                | -    |               |              |
| D3          | NC                | -    |               |              |
| D30         | NC                | -    |               |              |
| D4          | NC                | -    |               |              |
| E25         | NC                | -    |               |              |
| E26         | NC                | -    |               |              |

**LFE2M100E/SE Logic Signal Connections: 900 fpBGA (Cont.)**

| LFE2M100E/SE |                   |      |                       |              |
|--------------|-------------------|------|-----------------------|--------------|
| Ball Number  | Ball/Pad Function | Bank | Dual Function         | Differential |
| J2           | PL34B             | 7    | LDQ32                 | C (LVDS)*    |
| H1           | PL35A             | 7    | LDQ32                 | T            |
| GNDIO        | GNDIO7            | -    |                       |              |
| J1           | PL35B             | 7    | LDQ32                 | C            |
| GNDIO        | GNDIO7            | -    |                       |              |
| L5           | PL41A             | 7    | LDQ45                 | T (LVDS)*    |
| L4           | PL41B             | 7    | LDQ45                 | C (LVDS)*    |
| N9           | PL42A             | 7    | LDQ45                 | T            |
| N7           | PL42B             | 7    | LDQ45                 | C            |
| K2           | PL43A             | 7    | LDQ45                 | T (LVDS)*    |
| K1           | PL43B             | 7    | LDQ45                 | C (LVDS)*    |
| P9           | PL44A             | 7    | LDQ45                 | T            |
| P7           | PL44B             | 7    | LDQ45                 | C            |
| GNDIO        | GNDIO7            | -    |                       |              |
| M6           | PL45A             | 7    | LDQS45                | T (LVDS)*    |
| M5           | PL45B             | 7    | LDQ45                 | C (LVDS)*    |
| N5           | PL46A             | 7    | LDQ45                 | T            |
| N6           | PL46B             | 7    | LDQ45                 | C            |
| M4           | PL47A             | 7    | LDQ45                 | T (LVDS)*    |
| M3           | PL47B             | 7    | LDQ45                 | C (LVDS)*    |
| P6           | PL48A             | 7    | LDQ45                 | T            |
| GNDIO        | GNDIO7            | -    |                       |              |
| P8           | PL48B             | 7    | LDQ45                 | C            |
| L3           | PL50A             | 7    | LUM3_SPLLT_IN_A/LDQ54 | T (LVDS)*    |
| L2           | PL50B             | 7    | LUM3_SPLLC_IN_A/LDQ54 | C (LVDS)*    |
| P5           | PL51A             | 7    | LUM3_SPLLT_FB_A/LDQ54 | T            |
| P4           | PL51B             | 7    | LUM3_SPLLC_FB_A/LDQ54 | C            |
| L1           | PL52A             | 7    | LDQ54                 | T (LVDS)*    |
| M2           | PL52B             | 7    | LDQ54                 | C (LVDS)*    |
| R5           | PL53A             | 7    | LDQ54                 | T            |
| R4           | PL53B             | 7    | LDQ54                 | C            |
| GNDIO        | GNDIO7            | -    |                       |              |
| M1           | PL54A             | 7    | LDQS54                | T (LVDS)*    |
| N2           | PL54B             | 7    | LDQ54                 | C (LVDS)*    |
| R8           | PL55A             | 7    | LDQ54                 | T            |
| T9           | PL55B             | 7    | LDQ54                 | C            |
| P3           | PL56A             | 7    | LDQ54                 | T (LVDS)*    |
| P2           | PL56B             | 7    | LDQ54                 | C (LVDS)*    |
| N1           | PL57A             | 7    | PCLKT7_0/LDQ54        | T            |
| GNDIO        | GNDIO7            | -    |                       |              |
| P1           | PL57B             | 7    | PCLKC7_0/LDQ54        | C            |
| T5           | PL59A             | 6    | PCLKT6_0/LDQ63        | T (LVDS)*    |
| T4           | PL59B             | 6    | PCLKC6_0/LDQ63        | C (LVDS)*    |

**LFE2M100E/SE Logic Signal Connections: 900 fpBGA (Cont.)**

| LFE2M100E/SE |                   |      |                |              |
|--------------|-------------------|------|----------------|--------------|
| Ball Number  | Ball/Pad Function | Bank | Dual Function  | Differential |
| AG2          | PB34A             | 5    | BDQ33          | T            |
| AG3          | PB34B             | 5    | BDQ33          | C            |
| AD13         | PB35A             | 5    | BDQ33          | T            |
| VCCIO        | VCCIO5            | 5    |                |              |
| AC13         | PB35B             | 5    | BDQ33          | C            |
| AE14         | PB36A             | 5    | BDQ33          | T            |
| AC14         | PB36B             | 5    | BDQ33          | C            |
| AF3          | PB37A             | 5    | BDQ33          | T            |
| GNDIO        | GNDIO5            | -    |                |              |
| AF4          | PB37B             | 5    | BDQ33          | C            |
| -            | -                 | -    |                |              |
| AG4          | PB38A             | 5    | BDQ42          | T            |
| AG5          | PB38B             | 5    | BDQ42          | C            |
| GNDIO        | GNDIO5            | -    |                |              |
| -            | -                 | -    |                |              |
| AD11         | PB48A             | 5    | BDQ51          | T            |
| AF13         | PB48B             | 5    | BDQ51          | C            |
| AF12         | PB49A             | 5    | BDQ51          | T            |
| VCCIO        | VCCIO5            | 5    |                |              |
| AD14         | PB49B             | 5    | BDQ51          | C            |
| AG8          | PB50A             | 5    | BDQ51          | T            |
| AF8          | PB50B             | 5    | BDQ51          | C            |
| AE15         | PB51A             | 5    | BDQS51****     | T            |
| GNDIO        | GNDIO5            | -    |                |              |
| -            | -                 | -    |                |              |
| AC15         | PB51B             | 5    | BDQ51          | C            |
| VCCIO        | VCCIO5            | 5    |                |              |
| GNDIO        | GNDIO5            | -    |                |              |
| AD15         | PB56A             | 5    | BDQ60          | T            |
| AF15         | PB56B             | 5    | BDQ60          | C            |
| AG10         | PB57A             | 5    | BDQ60          | T            |
| AG9          | PB57B             | 5    | BDQ60          | C            |
| AH14         | PB58A             | 5    | BDQ60          | T            |
| AG12         | PB58B             | 5    | BDQ60          | C            |
| VCCIO        | VCCIO5            | 5    |                |              |
| AG15         | PB59A             | 5    | BDQ60          | T            |
| AG13         | PB59B             | 5    | BDQ60          | C            |
| GNDIO        | GNDIO5            | -    |                |              |
| AF16         | PB60A             | 5    | BDQS60         | T            |
| AH15         | PB60B             | 5    | BDQ60          | C            |
| AC16         | PB61A             | 5    | VREF2_5/BDQ60  | T            |
| AE16         | PB61B             | 5    | VREF1_5/BDQ60  | C            |
| AG11         | PB62A             | 5    | PCLKT5_0/BDQ60 | T            |

**LFE2M100E/SE Logic Signal Connections: 900 fpBGA (Cont.)**

| LFE2M100E/SE |                   |      |               |              |
|--------------|-------------------|------|---------------|--------------|
| Ball Number  | Ball/Pad Function | Bank | Dual Function | Differential |
| M23          | GND               | -    |               |              |
| M8           | GND               | -    |               |              |
| N14          | GND               | -    |               |              |
| N15          | GND               | -    |               |              |
| N16          | GND               | -    |               |              |
| N17          | GND               | -    |               |              |
| N27          | GND               | -    |               |              |
| N4           | GND               | -    |               |              |
| P11          | GND               | -    |               |              |
| P13          | GND               | -    |               |              |
| P14          | GND               | -    |               |              |
| P15          | GND               | -    |               |              |
| P16          | GND               | -    |               |              |
| P17          | GND               | -    |               |              |
| P18          | GND               | -    |               |              |
| P20          | GND               | -    |               |              |
| R10          | GND               | -    |               |              |
| R11          | GND               | -    |               |              |
| R13          | GND               | -    |               |              |
| R14          | GND               | -    |               |              |
| R15          | GND               | -    |               |              |
| R16          | GND               | -    |               |              |
| R17          | GND               | -    |               |              |
| R18          | GND               | -    |               |              |
| R20          | GND               | -    |               |              |
| R21          | GND               | -    |               |              |
| R24          | GND               | -    |               |              |
| R7           | GND               | -    |               |              |
| T10          | GND               | -    |               |              |
| T11          | GND               | -    |               |              |
| T13          | GND               | -    |               |              |
| T14          | GND               | -    |               |              |
| T15          | GND               | -    |               |              |
| T16          | GND               | -    |               |              |
| T17          | GND               | -    |               |              |
| T18          | GND               | -    |               |              |
| T20          | GND               | -    |               |              |
| T21          | GND               | -    |               |              |
| T24          | GND               | -    |               |              |
| T7           | GND               | -    |               |              |
| U11          | GND               | -    |               |              |
| U13          | GND               | -    |               |              |
| U14          | GND               | -    |               |              |

## LFE2M70E/SE and LFE2M100E/SE Logic Signal Connections: 1152 fpBGA (Cont.)

| LFE2M70E/SE |                   |      |               | LFE2M100E/SE |                   |      |               |              |
|-------------|-------------------|------|---------------|--------------|-------------------|------|---------------|--------------|
| Ball Number | Ball/Pad Function | Bank | Dual Function | Differential | Ball/Pad Function | Bank | Dual Function | Differential |
| K11         | NC                | -    |               |              | NC                | -    |               |              |
| K12         | NC                | -    |               |              | NC                | -    |               |              |
| K13         | NC                | -    |               |              | NC                | -    |               |              |
| K23         | NC                | -    |               |              | NC                | -    |               |              |
| K24         | NC                | -    |               |              | NC                | -    |               |              |
| K25         | NC                | -    |               |              | NC                | -    |               |              |
| K26         | NC                | -    |               |              | NC                | -    |               |              |
| L11         | NC                | -    |               |              | NC                | -    |               |              |
| L12         | NC                | -    |               |              | NC                | -    |               |              |
| L13         | NC                | -    |               |              | NC                | -    |               |              |
| L14         | NC                | -    |               |              | NC                | -    |               |              |
| L21         | NC                | -    |               |              | NC                | -    |               |              |
| L22         | NC                | -    |               |              | NC                | -    |               |              |
| L23         | NC                | -    |               |              | NC                | -    |               |              |
| L24         | NC                | -    |               |              | NC                | -    |               |              |
| L25         | NC                | -    |               |              | NC                | -    |               |              |
| L26         | NC                | -    |               |              | NC                | -    |               |              |
| M11         | NC                | -    |               |              | NC                | -    |               |              |
| M24         | NC                | -    |               |              | NC                | -    |               |              |
| M25         | NC                | -    |               |              | NC                | -    |               |              |
| M6          | NC                | -    |               |              | NC                | -    |               |              |
| M8          | NC                | -    |               |              | NC                | -    |               |              |
| N10         | NC                | -    |               |              | NC                | -    |               |              |
| N11         | NC                | -    |               |              | NC                | -    |               |              |
| P10         | NC                | -    |               |              | NC                | -    |               |              |
| P25         | NC                | -    |               |              | NC                | -    |               |              |
| P26         | NC                | -    |               |              | NC                | -    |               |              |
| R9          | NC                | -    |               |              | NC                | -    |               |              |
| T11         | NC                | -    |               |              | NC                | -    |               |              |
| U11         | NC                | -    |               |              | NC                | -    |               |              |
| W11         | NC                | -    |               |              | NC                | -    |               |              |
| Y10         | NC                | -    |               |              | NC                | -    |               |              |
| Y11         | NC                | -    |               |              | NC                | -    |               |              |
| R15         | VCCPLL            | -    |               |              | VCCPLL            | -    |               |              |
| R20         | VCCPLL            | -    |               |              | VCCPLL            | -    |               |              |
| Y15         | VCCPLL            | -    |               |              | VCCPLL            | -    |               |              |
| Y20         | VCCPLL            | -    |               |              | VCCPLL            | -    |               |              |

\* Supports true LVDS. Other differential signals must be emulated with external resistors.

\*\* These dedicated input pins can be used for GPLLs or GDLLs within the respective quadrant.

\*\*\* For density migration, board design must take into account that these sysCONFIG pins are dual function for the lower density devices (ECP2M20 and ECP2M35). They can be either sysCONFIG pins or general purpose I/Os. These pins are dedicated pins for the higher density devices (ECP2M50, ECP2M70, and ECP2M100).

\*\*\*\*Due to packaging bond out option, this DQS does not have all the necessary DQ pins bonded out for a full 8-bit data width.

Note: VCCIO and GND pads are used to determine the average DC current drawn by I/Os between GND/VCCIO connections, or between the last GND/VCCIO in an I/O bank and the end of an I/O bank. The substrate pads listed in the Pin Table do not necessarily have a one to one connection with a package ball or pin.

**LatticeECP2 S-Series Devices, Lead-Free Packaging**
**Commercial**

| Part Number      | I/Os | Voltage | Grade | Package         | Pins | Temp. | LUTs (K) |
|------------------|------|---------|-------|-----------------|------|-------|----------|
| LFE2-6SE-5TN144C | 90   | 1.2V    | -5    | Lead-Free TQFP  | 144  | Com   | 6        |
| LFE2-6SE-6TN144C | 90   | 1.2V    | -6    | Lead-Free TQFP  | 144  | Com   | 6        |
| LFE2-6SE-7TN144C | 90   | 1.2V    | -7    | Lead-Free TQFP  | 144  | Com   | 6        |
| LFE2-6SE-5FN256C | 190  | 1.2V    | -5    | Lead-Free fpBGA | 256  | Com   | 6        |
| LFE2-6SE-6FN256C | 190  | 1.2V    | -6    | Lead-Free fpBGA | 256  | Com   | 6        |
| LFE2-6SE-7FN256C | 190  | 1.2V    | -7    | Lead-Free fpBGA | 256  | Com   | 6        |

| Part Number       | I/Os | Voltage | Grade | Package         | Pins | Temp. | LUTs (K) |
|-------------------|------|---------|-------|-----------------|------|-------|----------|
| LFE2-12SE-5TN144C | 93   | 1.2V    | -5    | Lead-Free TQFP  | 144  | Com   | 12       |
| LFE2-12SE-6TN144C | 93   | 1.2V    | -6    | Lead-Free TQFP  | 144  | Com   | 12       |
| LFE2-12SE-7TN144C | 93   | 1.2V    | -7    | Lead-Free TQFP  | 144  | Com   | 12       |
| LFE2-12SE-5QN208C | 131  | 1.2V    | -5    | Lead-Free PQFP  | 208  | Com   | 12       |
| LFE2-12SE-6QN208C | 131  | 1.2V    | -6    | Lead-Free PQFP  | 208  | Com   | 12       |
| LFE2-12SE-7QN208C | 131  | 1.2V    | -7    | Lead-Free PQFP  | 208  | Com   | 12       |
| LFE2-12SE-5FN256C | 193  | 1.2V    | -5    | Lead-Free fpBGA | 256  | Com   | 12       |
| LFE2-12SE-6FN256C | 193  | 1.2V    | -6    | Lead-Free fpBGA | 256  | Com   | 12       |
| LFE2-12SE-7FN256C | 193  | 1.2V    | -7    | Lead-Free fpBGA | 256  | Com   | 12       |
| LFE2-12SE-5FN484C | 297  | 1.2V    | -5    | Lead-Free fpBGA | 484  | Com   | 12       |
| LFE2-12SE-6FN484C | 297  | 1.2V    | -6    | Lead-Free fpBGA | 484  | Com   | 12       |
| LFE2-12SE-7FN484C | 297  | 1.2V    | -7    | Lead-Free fpBGA | 484  | Com   | 12       |

| Part Number       | I/Os | Voltage | Grade | Package         | Pins | Temp. | LUTs (K) |
|-------------------|------|---------|-------|-----------------|------|-------|----------|
| LFE2-20SE-5QN208C | 131  | 1.2V    | -5    | Lead-Free PQFP  | 208  | Com   | 20       |
| LFE2-20SE-6QN208C | 131  | 1.2V    | -6    | Lead-Free PQFP  | 208  | Com   | 20       |
| LFE2-20SE-7QN208C | 131  | 1.2V    | -7    | Lead-Free PQFP  | 208  | Com   | 20       |
| LFE2-20SE-5FN256C | 193  | 1.2V    | -5    | Lead-Free fpBGA | 256  | Com   | 20       |
| LFE2-20SE-6FN256C | 193  | 1.2V    | -6    | Lead-Free fpBGA | 256  | Com   | 20       |
| LFE2-20SE-7FN256C | 193  | 1.2V    | -7    | Lead-Free fpBGA | 256  | Com   | 20       |
| LFE2-20SE-5FN484C | 331  | 1.2V    | -5    | Lead-Free fpBGA | 484  | Com   | 20       |
| LFE2-20SE-6FN484C | 331  | 1.2V    | -6    | Lead-Free fpBGA | 484  | Com   | 20       |
| LFE2-20SE-7FN484C | 331  | 1.2V    | -7    | Lead-Free fpBGA | 484  | Com   | 20       |
| LFE2-20SE-5FN672C | 402  | 1.2V    | -5    | Lead-Free fpBGA | 672  | Com   | 20       |
| LFE2-20SE-6FN672C | 402  | 1.2V    | -6    | Lead-Free fpBGA | 672  | Com   | 20       |
| LFE2-20SE-7FN672C | 402  | 1.2V    | -7    | Lead-Free fpBGA | 672  | Com   | 20       |

## For Further Information

A variety of technical notes for the LatticeECP2/M family are available on the Lattice web site at [www.latticesemi.com](http://www.latticesemi.com).

- TN1102, [LatticeECP2/M sysIO Usage Guide](#)
- TN1103, [LatticeECP2/M sysCLOCK PLL Design and Usage Guide](#)
- TN1104, [LatticeECP2/M Memory Usage Guide](#)
- TN1105, [LatticeECP2/M High-Speed I/O Interface](#)
- TN1106, [Power Estimation and Management for LatticeECP2/M Devices](#)
- TN1107, [LatticeECP2/M sysDSP Usage Guide](#)
- TN1108, [LatticeECP2/M sysCONFIG Usage Guide](#)
- TN1109, [LatticeECP2/M Configuration Encryption Usage Guide](#)
- TN1113, [LatticeECP2/M Soft Error Detection \(SED\) Usage Guide](#)
- TN1124, [LatticeECP2M SERDES/PCS Usage Guide](#)
- TN1162, [LatticeECP2/M Hardware Checklist](#)

For further information about interface standards refer to the following web sites:

- JEDEC Standards (LVTTTL, LVCMOS, SSTL, HSTL): [www.jedec.org](http://www.jedec.org)
- PCI: [www.pcisig.com](http://www.pcisig.com)