# Lattice Semiconductor Corporation - LFECP6E-4FN256I Datasheet


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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.

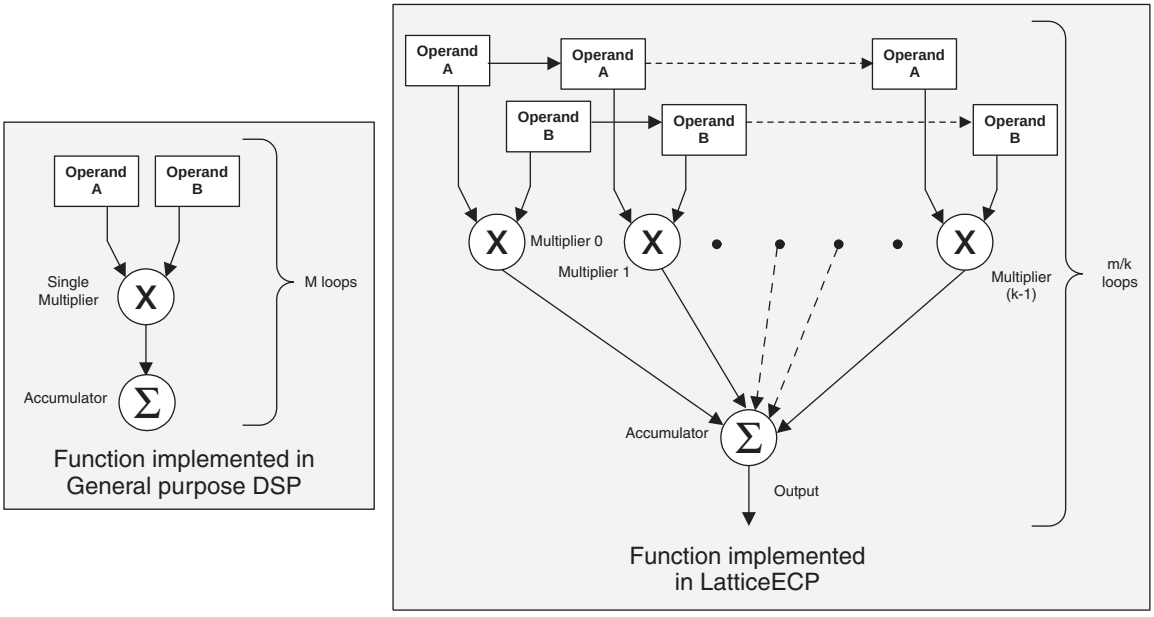
| Details | |
|---|---|
| Product Status | Obsolete |
| Number of LABs/CLBs | - |
| Number of Logic Elements/Cells | 6100 |
| Total RAM Bits | 94208 |
| Number of I/O | 195 |
| Number of Gates | - |
| Voltage - Supply | 1.14V ~ 1.26V |
| Mounting Type | Surface Mount |
| Operating Temperature | -40°C ~ 100°C (TJ) |
| Package / Case | 256-BGA |
| Supplier Device Package | 256-FPBGA (17x17) |
| Purchase URL | https://www.e-xfl.com/product-detail/lattice-semiconductor/lfecp6e-4fn256i |

decoders. These complex signal processing functions use similar building blocks such as multiply-adders and multiply-accumulators.

## sysDSP Block Approach Compared to General DSP

Conventional general-purpose DSP chips typically contain one to four (Multiply and Accumulate) MAC units with fixed data-width multipliers; this leads to limited parallelism and limited throughput. Their throughput is increased by higher clock speeds. The LatticeECP, on the other hand, has many DSP blocks that support different data-widths. This allows the designer to use highly parallel implementations of DSP functions. The designer can optimize the DSP performance vs. area by choosing an appropriate level of parallelism. Figure 2-18 compares the serial and the parallel implementations.

***Figure 2-18. Comparison of General DSP and LatticeECP-DSP Approaches***




## sysDSP Block Capabilities

The sysDSP block in the LatticeECP-DSP family supports four functional elements in three 9, 18 and 36 data path widths. The user selects a function element for a DSP block and then selects the width and type (signed/unsigned) of its operands. The operands in the LatticeECP-DSP family sysDSP Blocks can be either signed or unsigned but not mixed within a function element. Similarly, the operand widths cannot be mixed within a block.

The resources in each sysDSP block can be configured to support the following four elements:

- MULT (Multiply)
- MAC (Multiply, Accumulate)
- MULTADD (Multiply, Addition/Subtraction)
- MULTADDSUM (Multiply, Addition/Subtraction, Accumulate)

The number of elements available in each block depends on the width selected from the three available options x9, x18, and x36. A number of these elements are concatenated for highly parallel implementations of DSP functions. Table 2-1 shows the capabilities of the block.

*Figure 2-27. Input Register DDR Waveforms*

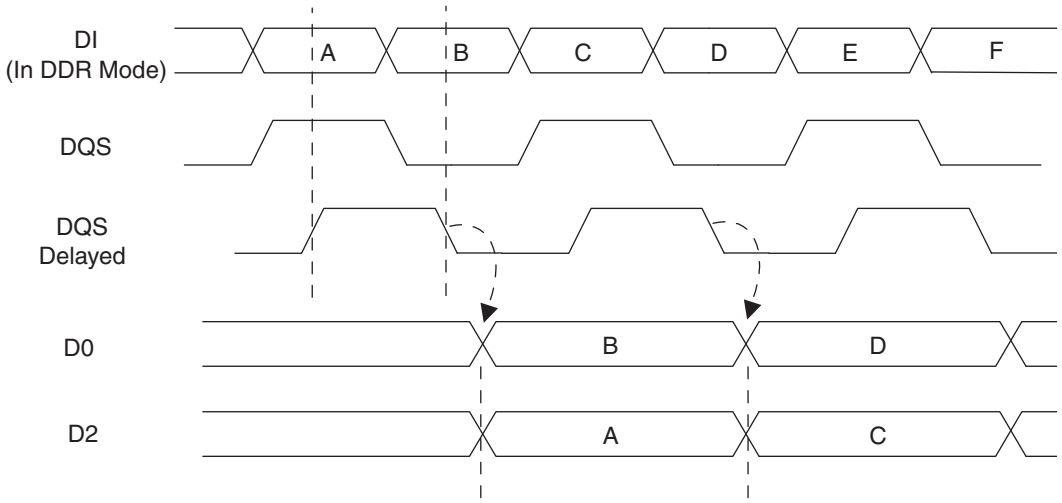
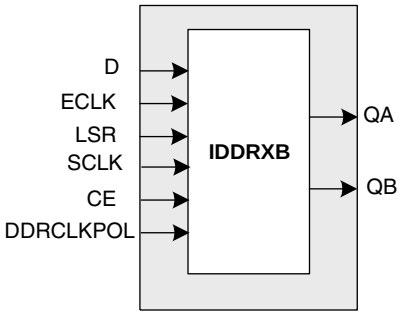



*Figure 2-28. INDDRXB Primitive*



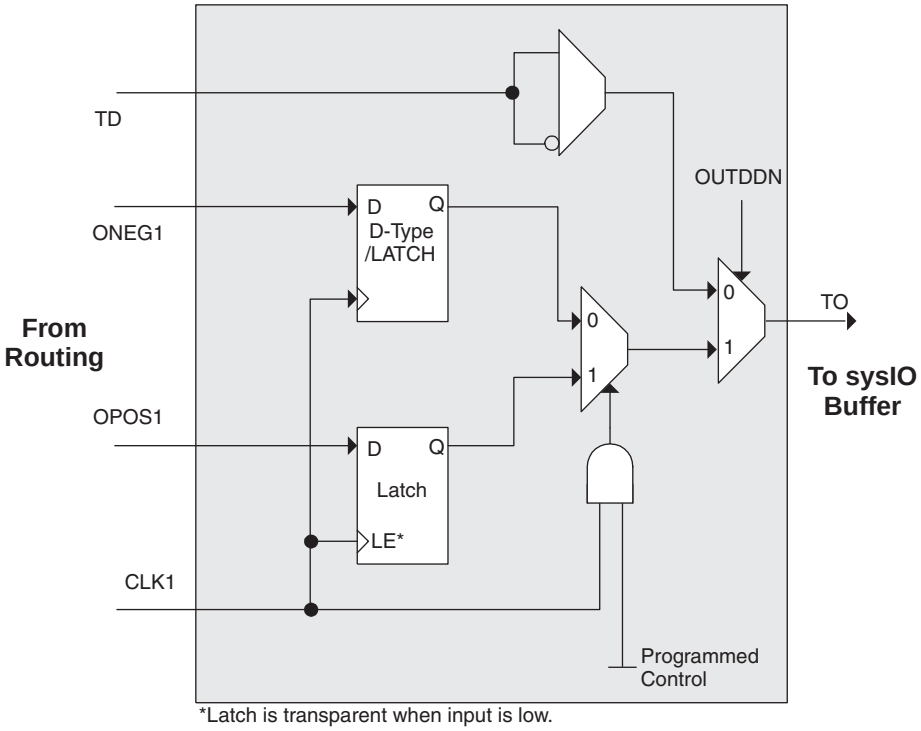

**Output Register Block**

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 block contains a register for SDR operation that is combined with an additional latch for DDR operation. Figure 2-29 shows the diagram of the Output Register Block.

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

Figure 2-30 shows the design tool DDR primitives. The SDR output register has reset and clock enable available. The additional register for DDR operation does not have reset or clock enable available.

*Figure 2-31. Tristate Register Block*




*Latch is transparent when input is low.

**Control Logic Block**

The control logic block allows the selection and modification of control signals for use in the PIO block. A clock is selected from one of the clock signals provided from the general purpose routing and a DQS signal provided from the programmable DQS pin. The clock can optionally be inverted.

The clock enable and local reset signals are selected from the routing and optionally inverted. The global tristate signal is passed through this block.

## DDR Memory Support

Implementing high performance DDR memory interfaces requires dedicated DDR register structures in the input (for read operations) and in the output (for write operations). As indicated in the PIO Logic section, the LatticeEC devices provide this capability. In addition to these registers, the LatticeEC devices contain two elements to simplify the design of input structures for read operations: the DQS delay block and polarity control logic.

### DLL Calibrated DQS Delay Block

Source Synchronous interfaces generally require the input clock to be adjusted in order to correctly capture data at the input register. For most interfaces a PLL is used for this adjustment. However in DDR memories the clock (referred to as DQS) is not free running so this approach cannot be used. The DQS Delay block provides the required clock alignment for DDR memory interfaces.

The DQS signal (selected PIOs only) feeds from the PAD through a DQS delay element to a dedicated DQS routing resource. The DQS signal also feeds polarity control logic, which controls the polarity of the clock to the sync registers in the input register blocks. Figures 2-32 and 2-33 show how the DQS transition signals are routed to the PIOs.

The temperature, voltage and process variations of the DQS delay block are compensated by a set of calibration (6-bit bus) signals from two DLLs on opposite sides of the device. Each DLL compensates DQS Delays in its half of the device as shown in Figure 2-33. The DLL loop is compensated for temperature, voltage and process variations by the system clock and feedback loop.

# DC Electrical Characteristics

**Over Recommended Operating Conditions**

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $I_{IL}$, $I_{IH}$[1] | Input or I/O Leakage | 0 ð $V_{IN}$ ð ($V_{CCIO}$ - 0.2V) | — | — | 10 | µA |
| $I_{IH}$[1, 3] | Input or I/O High Leakage | ($V_{CCIO}$ - 0.2V) ð $V_{IH}$ ð 3.6V | — | — | 40 | µA |
| $I_{PU}$ | I/O Active Pull-up Current | 0 ð $V_{IN}$ ð 0.7 $V_{CCIO}$ | -30 | — | -150 | µA |
| $I_{PD}$ | I/O Active Pull-down Current | $V_{IL}$ (MAX) ð $V_{IN}$ ð $V_{IH}$ (MAX) | 30 | — | 150 | µA |
| $I_{BHLS}$ | Bus Hold Low sustaining current | $V_{IN}$ = $V_{IL}$ (MAX) | 30 | — | — | µA |
| $I_{BHHS}$ | Bus Hold High sustaining current | $V_{IN}$ = 0.7$V_{CCIO}$ | -30 | — | — | µA |
| $I_{BHLO}$ | Bus Hold Low Overdrive current | 0 ð $V_{IN}$ ð $V_{IH}$ (MAX) | — | — | 150 | µA |
| $I_{BHLH}$ | Bus Hold High Overdrive current | 0 ð $V_{IN}$ ð $V_{IH}$ (MAX) | — | — | -150 | µA |
| $V_{BHT}$ | Bus Hold trip Points | 0 ð $V_{IN}$ ð $V_{IH}$ (MAX) | $V_{IL}$ (MAX) | — | $V_{IH}$ (MIN) | V |
| C1 | I/O Capacitance[2] | $V_{CCIO}$ = 3.3V, 2.5V, 1.8V, 1.5V, 1.2V, $V_{CC}$ = 1.2V, $V_{IO}$ = 0 to $V_{IH}$ (MAX) | — | 8 | — | pf |
| C2 | Dedicated Input Capacitance[2] | $V_{CCIO}$ = 3.3V, 2.5V, 1.8V, 1.5V, 1.2V, $V_{CC}$ = 1.2V, $V_{IO}$ = 0 to $V_{IH}$ (MAX) | — | 6 | — | pf |

1. Input or I/O leakage current is measured with the pin configured as an input or as an I/O with the output driver tri-stated. It is not measured with the output driver active. Bus maintenance circuits are disabled.
2. $T_A$ 25°C, f = 1.0MHz
3. For top and bottom general purpose I/O pins, when $V_{IH}$ is higher than $V_{CCIO}$, a transient current typically of 30ns in duration or less with a peak current of 6mA can occur on the high-to-low transition. For left and right I/O banks, $V_{IH}$ must be less than or equal to $V_{CCIO}$.

## Derating Timing Tables

Logic Timing provided in the following sections of the data sheet and the ispLEVER design tools are worst-case numbers in the operating range. Actual delays at nominal temperature and voltage for best-case process, can be much better than the values given in the tables. To calculate logic timing numbers at a particular temperature and voltage multiply the noted numbers with the derating factors provided below.

The junction temperature for the FPGA depends on the power dissipation by the device, the package thermal characteristics ($\Theta_{JA}$), and the ambient temperature, as calculated with the following equation:

$$T_{JMAX} = T_{AMAX} + (Power * \Theta_{JA})$$

The user must determine this temperature and then use it to determine the derating factor based on the following derating tables: $T_J$ °C.

***Table 3-5. Delay Derating Table for Internal Blocks***

| $T_J$ °C Commercial | $T_J$ °C Industrial | Power Supply Voltage | | |
|---|---|---|---|---|
| | | 1.14V | 1.2V | 1.26V |
| — | -40 | 0.82 | 0.77 | 0.71 |
| — | -25 | 0.82 | 0.76 | 0.71 |
| 0 | 20 | 0.89 | 0.83 | 0.78 |
| 25 | 45 | 0.93 | 0.87 | 0.81 |
| 85 | 105 | 1.00 | 0.94 | 0.89 |

# LFEC1, LFEC3, LFECP/EC6 Logic Signal Connections: 144 TQFP (Cont.)

| Pin Number | LFEC1 | | | | LFEC3 | | | | LFECP6/EC6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pin Function | Bank | LVDS | Dual Function | Pin Function | Bank | LVDS | Dual Function | Pin Function | Bank | LVDS | Dual Function |
| 50 | PB8B | 5 | C | VREF1_5 | PB16B | 5 | C | VREF1_5 | PB16B | 5 | C | VREF1_5 |
| 51 | PB9A | 5 | T | PCLKT5_0 | PB17A | 5 | T | PCLKT5_0 | PB17A | 5 | T | PCLKT5_0 |
| 52 | GND5 | 5 | | | GND5 | 5 | | | GND5 | 5 | | |
| 53 | PB9B | 5 | C | PCLKC5_0 | PB17B | 5 | C | PCLKC5_0 | PB17B | 5 | C | PCLKC5_0 |
| 54 | VCCAUX | - | | | VCCAUX | - | | | VCCAUX | - | | |
| 55 | VCCIO4 | 4 | | | VCCIO4 | 4 | | | VCCIO4 | 4 | | |
| 56 | PB10A | 4 | T | WRITEN | PB18A | 4 | T | WRITEN | PB18A | 4 | T | WRITEN |
| 57 | PB10B | 4 | C | CS1N | PB18B | 4 | C | CS1N | PB18B | 4 | C | CS1N |
| 58 | PB11A | 4 | T | VREF1_4 | PB19A | 4 | T | VREF1_4 | PB19A | 4 | T | VREF1_4 |
| 59 | PB11B | 4 | C | CSN | PB19B | 4 | C | CSN | PB19B | 4 | C | CSN |
| 60 | PB12A | 4 | T | VREF2_4 | PB20A | 4 | T | VREF2_4 | PB20A | 4 | T | VREF2_4 |
| 61 | PB12B | 4 | C | D0/SPID7 | PB20B | 4 | C | D0/SPID7 | PB20B | 4 | C | D0/SPID7 |
| 62 | PB13A | 4 | T | D2/SPID5 | PB21A | 4 | T | D2/SPID5 | PB21A | 4 | T | D2/SPID5 |
| 63 | GND4 | 4 | | | GND4 | 4 | | | GND4 | 4 | | |
| 64 | PB13B | 4 | C | D1/SPID6 | PB21B | 4 | C | D1/SPID6 | PB21B | 4 | C | D1/SPID6 |
| 65 | PB14A | 4 | T | BDQS14 | PB22A | 4 | T | BDQS22 | PB22A | 4 | T | BDQS22 |
| 66 | PB14B | 4 | C | D3/SPID4 | PB22B | 4 | C | D3/SPID4 | PB22B | 4 | C | D3/SPID4 |
| 67 | PB15A | 4 | T | | PB23A | 4 | T | | PB23A | 4 | T | |
| 68 | PB15B | 4 | C | D4/SPID3 | PB23B | 4 | C | D4/SPID3 | PB23B | 4 | C | D4/SPID3 |
| 69 | PB16B | 4 | | D5/SPID2 | PB24B | 4 | | D5/SPID2 | PB24B | 4 | | D5/SPID2 |
| 70 | PB17B | 4 | | D6/SPID1 | PB25B | 4 | | D6/SPID1 | PB25B | 4 | | D6/SPID1 |
| 71 | VCCIO4 | 4 | | | VCCIO4 | 4 | | | VCCIO4 | 4 | | |
| 72* | GND3<br>GND4 | - | | | GND3<br>GND4 | - | | | GND3<br>GND4 | - | | |
| 73 | VCCIO3 | 3 | | | VCCIO3 | 3 | | | VCCIO3 | 3 | | |
| 74 | PR14A | 3 | | VREF1_3 | PR18A | 3 | | VREF1_3 | PR27A | 3 | | VREF1_3 |
| 75 | PR12B | 3 | C | | PR16B | 3 | C | | PR25B | 3 | C | |
| 76 | PR12A | 3 | T | | PR16A | 3 | T | | PR25A | 3 | T | |
| 77 | PR11B | 3 | C | | PR15B | 3 | C | | PR24B | 3 | C | |
| 78 | PR11A | 3 | T | RDQS11 | PR15A | 3 | T | RDQS15 | PR24A | 3 | T | RDQS24 |
| 79 | PR10B | 3 | C | RLM0_PLLC_FB_A | PR14B | 3 | C | RLM0_PLLC_FB_A | PR23B | 3 | C | RLM0_PLLC_FB_A |
| 80 | GND3 | 3 | | | GND3 | 3 | | | GND3 | 3 | | |
| 81 | PR10A | 3 | T | RLM0_PLLT_FB_A | PR14A | 3 | T | RLM0_PLLT_FB_A | PR23A | 3 | T | RLM0_PLLT_FB_A |
| 82 | PR9B | 3 | C | RLM0_PLLC_IN_A | PR13B | 3 | C | RLM0_PLLC_IN_A | PR22B | 3 | C | RLM0_PLLC_IN_A |
| 83 | PR9A | 3 | T | RLM0_PLLT_IN_A | PR13A | 3 | T | RLM0_PLLT_IN_A | PR22A | 3 | T | RLM0_PLLT_IN_A |
| 84 | VCCIO3 | 3 | | | VCCIO3 | 3 | | | VCCIO3 | 3 | | |
| 85 | PR8B | 3 | C | DI/CSSPIN | PR12B | 3 | C | DI/CSSPIN | PR21B | 3 | C | DI/CSSPIN |
| 86 | PR8A | 3 | T | DOUT/CSON | PR12A | 3 | T | DOUT/CSON | PR21A | 3 | T | DOUT/CSON |
| 87 | PR7B | 3 | C | BUSY/SISPI | PR11B | 3 | C | BUSY/SISPI | PR20B | 3 | C | BUSY/SISPI |
| 88 | PR7A | 3 | T | D7/SPID0 | PR11A | 3 | T | D7/SPID0 | PR20A | 3 | T | D7/SPID0 |
| 89 | CFG2 | 3 | | | CFG2 | 3 | | | CFG2 | 3 | | |
| 90 | CFG1 | 3 | | | CFG1 | 3 | | | CFG1 | 3 | | |
| 91 | CFG0 | 3 | | | CFG0 | 3 | | | CFG0 | 3 | | |
| 92 | VCC | - | | | VCC | - | | | VCC | - | | |
| 93 | PROGRAMN | 3 | | | PROGRAMN | 3 | | | PROGRAMN | 3 | | |
| 94 | CCLK | 3 | | | CCLK | 3 | | | CCLK | 3 | | |
| 95 | INITN | 3 | | | INITN | 3 | | | INITN | 3 | | |
| 96 | GND | - | | | GND | - | | | GND | - | | |
| 97 | DONE | 3 | | | DONE | 3 | | | DONE | 3 | | |
| 98 | GND | - | | | GND | - | | | GND | - | | |

## LFECP/EC6, LFECP/EC10 Logic Signal Connections: 208 PQFP (Cont.)

| Pin Number | LFECP6/LFEC6 | | | | LFECP10/LFEC10 | | | |
|---|---|---|---|---|---|---|---|---|
| | 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 | | |

## LFECP/EC6, LFECP/EC10 Logic Signal Connections: 208 PQFP (Cont.)

| Pin Number | LFECP6/LFEC6 | | | | LFECP10/LFEC10 | | | |
|---|---|---|---|---|---|---|---|---|
| | Pin Function | Bank | LVDS | Dual Function | Pin Function | Bank | LVDS | Dual Function |
| 169 | PT21A | 1 | T | | PT29A | 1 | T | |
| 170 | PT20B | 1 | C | | PT28B | 1 | C | |
| 171 | PT20A | 1 | T | | PT28A | 1 | T | |
| 172 | PT19B | 1 | C | VREF2_1 | PT27B | 1 | C | VREF2_1 |
| 173 | PT19A | 1 | T | VREF1_1 | PT27A | 1 | T | VREF1_1 |
| 174 | PT18B | 1 | C | | PT26B | 1 | C | |
| 175 | PT18A | 1 | T | | PT26A | 1 | T | |
| 176 | VCCIO1 | 1 | | | VCCIO1 | 1 | | |
| 177 | VCCAUX | - | | | VCCAUX | - | | |
| 178 | PT17B | 0 | C | PCLKC0_0 | PT25B | 0 | C | PCLKC0_0 |
| 179 | GND0 | 0 | | | GND0 | 0 | | |
| 180 | PT17A | 0 | T | PCLKT0_0 | PT25A | 0 | T | PCLKT0_0 |
| 181 | PT16B | 0 | C | VREF1_0 | PT24B | 0 | C | VREF1_0 |
| 182 | PT16A | 0 | T | VREF2_0 | PT24A | 0 | T | VREF2_0 |
| 183 | PT15B | 0 | C | | PT23B | 0 | C | |
| 184 | PT15A | 0 | T | | PT23A | 0 | T | |
| 185 | PT14B | 0 | C | | PT22B | 0 | C | |
| 186 | PT14A | 0 | T | TDQS14 | PT22A | 0 | T | TDQS22 |
| 187 | VCCIO0 | 0 | | | VCCIO0 | 0 | | |
| 188 | PT13B | 0 | C | | PT21B | 0 | C | |
| 189 | GND0 | 0 | | | GND0 | 0 | | |
| 190 | PT13A | 0 | T | | PT21A | 0 | T | |
| 191 | PT12B | 0 | C | | PT20B | 0 | C | |
| 192 | PT12A | 0 | T | | PT20A | 0 | T | |
| 193 | PT11B | 0 | C | | PT19B | 0 | C | |
| 194 | PT11A | 0 | T | | PT19A | 0 | T | |
| 195 | PT10B | 0 | C | | PT18B | 0 | C | |
| 196 | PT10A | 0 | T | | PT18A | 0 | T | |
| 197 | VCCIO0 | 0 | | | VCCIO0 | 0 | | |
| 198 | PT6B | 0 | C | | PT6B | 0 | C | |
| 199 | PT6A | 0 | T | TDQS6 | PT6A | 0 | T | TDQS6 |
| 200 | PT5B | 0 | C | | PT5B | 0 | C | |
| 201 | PT5A | 0 | T | | PT5A | 0 | T | |
| 202 | PT4B | 0 | C | | PT4B | 0 | C | |
| 203 | PT4A | 0 | T | | PT4A | 0 | T | |
| 204 | PT3B | 0 | C | | PT3B | 0 | C | |
| 205 | PT3A | 0 | T | | PT3A | 0 | T | |
| 206 | PT2B | 0 | C | | PT2B | 0 | C | |
| 207 | PT2A | 0 | T | | PT2A | 0 | T | |
| 208 | VCCIO0 | 0 | | | VCCIO0 | 0 | | |

*Double bonded to the pin.

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

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

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

| Ball Number | LFECP10/LFEC10 | | | | LFECP15/LFEC15 | | | |
|---|---|---|---|---|---|---|---|---|
| | Ball Function | Bank | LVDS | Dual Function | Ball Function | Bank | LVDS | Dual Function |
| N7 | PB18B | 5 | C | | PB18B | 5 | C | |
| R7 | PB19A | 5 | T | | PB19A | 5 | T | |
| R8 | PB19B | 5 | C | | PB19B | 5 | C | |
| M7 | PB20A | 5 | T | | PB20A | 5 | T | |
| M8 | PB20B | 5 | C | | PB20B | 5 | C | |
| T8 | PB21A | 5 | T | | PB21A | 5 | T | |
| GND | GND5 | 5 | | | GND5 | 5 | | |
| T9 | PB21B | 5 | C | | PB21B | 5 | C | |
| P8 | PB22A | 5 | T | BDQS22 | PB22A | 5 | T | BDQS22 |
| N8 | PB22B | 5 | C | | PB22B | 5 | C | |
| R9 | PB23A | 5 | T | | PB23A | 5 | T | |
| R10 | PB23B | 5 | C | | PB23B | 5 | C | |
| P9 | PB24A | 5 | T | VREF2_5 | PB24A | 5 | T | VREF2_5 |
| N9 | PB24B | 5 | C | VREF1_5 | PB24B | 5 | C | VREF1_5 |
| T10 | PB25A | 5 | T | PCLKT5_0 | PB25A | 5 | T | PCLKT5_0 |
| GND | GND5 | 5 | | | GND5 | 5 | | |
| T11 | PB25B | 5 | C | PCLKC5_0 | PB25B | 5 | C | PCLKC5_0 |
| T12 | PB26A | 4 | T | WRITEN | PB26A | 4 | T | WRITEN |
| T13 | PB26B | 4 | C | CS1N | PB26B | 4 | C | CS1N |
| P10 | PB27A | 4 | T | VREF1_4 | PB27A | 4 | T | VREF1_4 |
| N10 | PB27B | 4 | C | CSN | PB27B | 4 | C | CSN |
| T14 | PB28A | 4 | T | VREF2_4 | PB28A | 4 | T | VREF2_4 |
| T15 | PB28B | 4 | C | D0/SPID7 | PB28B | 4 | C | D0/SPID7 |
| M10 | PB29A | 4 | T | D2/SPID5 | PB29A | 4 | T | D2/SPID5 |
| GND | GND4 | 4 | | | GND4 | 4 | | |
| M11 | PB29B | 4 | C | D1/SPID6 | PB29B | 4 | C | D1/SPID6 |
| R11 | PB30A | 4 | T | BDQS30 | PB30A | 4 | T | BDQS30 |
| P11 | PB30B | 4 | C | D3/SPID4 | PB30B | 4 | C | D3/SPID4 |
| R13 | PB31A | 4 | T | | PB31A | 4 | T | |
| R14 | PB31B | 4 | C | D4/SPID3 | PB31B | 4 | C | D4/SPID3 |
| P12 | PB32A | 4 | T | | PB32A | 4 | T | |
| P13 | PB32B | 4 | C | D5/SPID2 | PB32B | 4 | C | D5/SPID2 |
| N11 | PB33A | 4 | T | | PB33A | 4 | T | |
| GND | GND4 | 4 | | | GND4 | 4 | | |
| N12 | PB33B | 4 | C | D6/SPID1 | PB33B | 4 | C | D6/SPID1 |
| R12 | PB34A | 4 | | | PB34A | 4 | | |
| GND | GND4 | 4 | | | GND4 | 4 | | |
| GND | GND4 | 4 | | | GND4 | 4 | | |
| - | - | - | | | GND4 | 4 | | |
| - | - | - | | | GND4 | 4 | | |
| GND | GND3 | 3 | | | GND3 | 3 | | |
| N13 | PR36B | 3 | C | VREF2_3 | PR44B | 3 | C | VREF2_3 |
| N14 | PR36A | 3 | T | VREF1_3 | PR44A | 3 | T | VREF1_3 |

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

| LFECP6/LFEC6 | | | | | LFECP10/LFEC10 | | | | | LFECP/LFEC15 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ball Number | Ball Function | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function |
| W17 | NC | - | | | W17 | NC | - | | | W17 | PB46B | 4 | C | |
| AA20 | NC | - | | | AA20 | NC | - | | | AA20 | PB47A | 4 | T | |
| Y19 | NC | - | | | Y19 | NC | - | | | Y19 | PB47B | 4 | C | |
| Y18 | NC | - | | | Y18 | NC | - | | | Y18 | PB48A | 4 | T | |
| W18 | NC | - | | | W18 | NC | - | | | W18 | PB48B | 4 | C | |
| T17 | NC | - | | | T17 | NC | - | | | T17 | PB49A | 4 | T | |
| U17 | NC | - | | | U17 | NC | - | | | U17 | PB49B | 4 | C | |
| GND | GND4 | 4 | | | GND | GND4 | 4 | | | GND | GND4 | 4 | | |
| GND | GND3 | 3 | | | GND | GND3 | 3 | | | GND | GND3 | 3 | | |
| W20 | PR27B | 3 | C | VREF2_3 | W20 | PR36B | 3 | C | VREF2_3 | W20 | PR44B | 3 | C | VREF2_3 |
| Y20 | PR27A | 3 | T | VREF1_3 | Y20 | PR36A | 3 | T | VREF1_3 | Y20 | PR44A | 3 | T | VREF1_3 |
| AA21 | PR26B | 3 | C | | AA21 | PR35B | 3 | C | | AA21 | PR43B | 3 | C | |
| AB21 | PR26A | 3 | T | | AB21 | PR35A | 3 | T | | AB21 | PR43A | 3 | T | |
| W19 | PR25B | 3 | C | | W19 | PR34B | 3 | C | | W19 | PR42B | 3 | C | |
| V19 | PR25A | 3 | T | | V19 | PR34A | 3 | T | | V19 | PR42A | 3 | T | |
| Y21 | PR24B | 3 | C | | Y21 | PR33B | 3 | C | | Y21 | PR41B | 3 | C | |
| AA22 | PR24A | 3 | T | RDQS24 | AA22 | PR33A | 3 | T | RDQS33 | AA22 | PR41A | 3 | T | RDQS41 |
| V20 | PR23B | 3 | C | RLM0_PLLC_FB_A | V20 | PR32B | 3 | C | RLM0_PLLC_FB_A | V20 | PR40B | 3 | C | RLM0_PLLC_FB_A |
| GND | GND3 | 3 | | | GND | GND3 | 3 | | | GND | GND3 | 3 | | |
| U20 | PR23A | 3 | T | RLM0_PLLT_FB_A | U20 | PR32A | 3 | T | RLM0_PLLT_FB_A | U20 | PR40A | 3 | T | RLM0_PLLT_FB_A |
| W21 | PR22B | 3 | C | RLM0_PLLC_IN_A | W21 | PR31B | 3 | C | RLM0_PLLC_IN_A | W21 | PR39B | 3 | C | RLM0_PLLC_IN_A |
| Y22 | PR22A | 3 | T | RLM0_PLLT_IN_A | Y22 | PR31A | 3 | T | RLM0_PLLT_IN_A | Y22 | PR39A | 3 | T | RLM0_PLLT_IN_A |
| V21 | PR21B | 3 | C | DI/CSSPIN | V21 | PR30B | 3 | C | DI/CSSPIN | V21 | PR38B | 3 | C | DI/CSSPIN |
| W22 | PR21A | 3 | T | DOUT/CSON | W22 | PR30A | 3 | T | DOUT/CSON | W22 | PR38A | 3 | T | DOUT/CSON |
| U21 | PR20B | 3 | C | BUSY/SISPI | U21 | PR29B | 3 | C | BUSY/SISPI | U21 | PR37B | 3 | C | BUSY/SISPI |
| V22 | PR20A | 3 | T | D7/SPID0 | V22 | PR29A | 3 | T | D7/SPID0 | V22 | PR37A | 3 | T | D7/SPID0 |
| T19 | CFG2 | 3 | | | T19 | CFG2 | 3 | | | T19 | CFG2 | 3 | | |
| U19 | CFG1 | 3 | | | U19 | CFG1 | 3 | | | U19 | CFG1 | 3 | | |
| U18 | CFG0 | 3 | | | U18 | CFG0 | 3 | | | U18 | CFG0 | 3 | | |
| V18 | PROGRAMN | 3 | | | V18 | PROGRAMN | 3 | | | V18 | PROGRAMN | 3 | | |
| T20 | CCLK | 3 | | | T20 | CCLK | 3 | | | T20 | CCLK | 3 | | |
| T21 | INITN | 3 | | | T21 | INITN | 3 | | | T21 | INITN | 3 | | |
| R20 | DONE | 3 | | | R20 | DONE | 3 | | | R20 | DONE | 3 | | |
| T18 | NC | - | | | T18 | NC | - | | | T18 | NC | - | | |
| R17 | NC | - | | | R17 | NC | - | | | R17 | NC | - | | |
| R19 | NC | - | | | R19 | NC | - | | | R19 | NC | - | | |
| R18 | NC | - | | | R18 | NC | - | | | R18 | NC | - | | |
| U22 | NC | - | | | U22 | NC | - | | | U22 | PR35B | 3 | C | |
| GND | - | - | | | GND | - | - | | | GND | GND3 | 3 | | |
| T22 | NC | - | | | T22 | NC | - | | | T22 | PR35A | 3 | T | |
| R21 | NC | - | | | R21 | NC | - | | | R21 | PR34B | 3 | C | |
| R22 | NC | - | | | R22 | NC | - | | | R22 | PR34A | 3 | T | |
| P20 | NC | - | | | P20 | NC | - | | | P20 | PR33B | 3 | C | |
| N20 | NC | - | | | N20 | NC | - | | | N20 | PR33A | 3 | T | |
| P19 | NC | - | | | P19 | NC | - | | | P19 | PR32B | 3 | C | |
| P18 | NC | - | | | P18 | NC | - | | | P18 | PR32A | 3 | T | |
| P21 | PR18B | 3 | C | | P21 | PR27B | 3 | C | | P21 | PR31B | 3 | C | |
| GND | GND3 | 3 | | | GND | GND3 | 3 | | | GND | GND3 | 3 | | |
| P22 | PR18A | 3 | T | | P22 | PR27A | 3 | T | | P22 | PR31A | 3 | T | |
| N21 | PR17B | 3 | C | | N21 | PR26B | 3 | C | | N21 | PR30B | 3 | C | |

# LFECP/EC20 and LFECP/EC33 Logic Signal Connections: 484 fpBGA (Cont.)

| LFECP20/LFEC20 | | | | | LFECP/LFEC33 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ball Number | Ball Function | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function |
| AB1 | GND | - | | | AB1 | GND | - | | |
| AB22 | GND | - | | | AB22 | GND | - | | |
| H15 | GND | - | | | H15 | GND | - | | |
| H8 | GND | - | | | H8 | GND | - | | |
| J10 | GND | - | | | J10 | GND | - | | |
| J11 | GND | - | | | J11 | GND | - | | |
| J12 | GND | - | | | J12 | GND | - | | |
| J13 | GND | - | | | J13 | GND | - | | |
| J14 | GND | - | | | J14 | GND | - | | |
| J9 | GND | - | | | J9 | GND | - | | |
| K10 | GND | - | | | K10 | GND | - | | |
| K11 | GND | - | | | K11 | GND | - | | |
| K12 | GND | - | | | K12 | GND | - | | |
| K13 | GND | - | | | K13 | GND | - | | |
| K14 | GND | - | | | K14 | GND | - | | |
| K9 | GND | - | | | K9 | GND | - | | |
| L10 | GND | - | | | L10 | GND | - | | |
| L11 | GND | - | | | L11 | GND | - | | |
| L12 | GND | - | | | L12 | GND | - | | |
| L13 | GND | - | | | L13 | GND | - | | |
| L14 | GND | - | | | L14 | GND | - | | |
| L9 | GND | - | | | L9 | GND | - | | |
| M10 | GND | - | | | M10 | GND | - | | |
| M11 | GND | - | | | M11 | GND | - | | |
| M12 | GND | - | | | M12 | GND | - | | |
| M13 | GND | - | | | M13 | GND | - | | |
| M14 | GND | - | | | M14 | GND | - | | |
| M9 | GND | - | | | M9 | GND | - | | |
| N10 | GND | - | | | N10 | GND | - | | |
| N11 | GND | - | | | N11 | GND | - | | |
| N12 | GND | - | | | N12 | GND | - | | |
| N13 | GND | - | | | N13 | GND | - | | |
| N14 | GND | - | | | N14 | GND | - | | |
| N9 | GND | - | | | N9 | GND | - | | |
| P10 | GND | - | | | P10 | GND | - | | |
| P11 | GND | - | | | P11 | GND | - | | |
| P12 | GND | - | | | P12 | GND | - | | |
| P13 | GND | - | | | P13 | GND | - | | |
| P14 | GND | - | | | P14 | GND | - | | |
| P9 | GND | - | | | P9 | GND | - | | |
| R15 | GND | - | | | R15 | GND | - | | |
| R8 | GND | - | | | R8 | GND | - | | |
| J16 | VCC | - | | | J16 | VCC | - | | |
| J7 | VCC | - | | | J7 | VCC | - | | |

## 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 |
| P5 | PL32B | 6 | C | | P5 | PL44B | 6 | C | |
| P6 | PL33A | 6 | T | | P6 | PL45A | 6 | T | |
| R5 | PL33B | 6 | C | | R5 | PL45B | 6 | C | |
| U1 | PL34A | 6 | T | | U1 | PL46A | 6 | T | |
| U2 | PL34B | 6 | C | | U2 | PL46B | 6 | C | |
| T3 | PL35A | 6 | T | | T3 | PL47A | 6 | T | |
| GND | GND6 | 6 | | | GND | GND6 | 6 | | |
| T4 | PL35B | 6 | C | | T4 | PL47B | 6 | C | |
| R6 | PL36A | 6 | T | LDQS36 | R6 | PL48A | 6 | T | LDQS48 |
| T5 | PL36B | 6 | C | | T5 | PL48B | 6 | C | |
| T6 | PL37A | 6 | T | | T6 | PL49A | 6 | T | |
| U5 | PL37B | 6 | C | | U5 | PL49B | 6 | C | |
| U3 | PL38A | 6 | T | | U3 | PL50A | 6 | T | |
| U4 | PL38B | 6 | C | | U4 | PL50B | 6 | C | |
| V1 | PL39A | 6 | T | | V1 | PL51A | 6 | T | |
| GND | GND6 | 6 | | | GND | GND6 | 6 | | |
| V2 | PL39B | 6 | C | | V2 | PL51B | 6 | C | |
| U7 | TCK | 6 | | | U7 | TCK | 6 | | |
| V4 | TDI | 6 | | | V4 | TDI | 6 | | |
| V5 | TMS | 6 | | | V5 | TMS | 6 | | |
| V3 | TDO | 6 | | | V3 | TDO | 6 | | |
| U6 | VCCJ | 6 | | | U6 | VCCJ | 6 | | |
| W1 | PL41A | 6 | T | LLM0_PLLT_IN_A | W1 | PL53A | 6 | T | LLM0_PLLT_IN_A |
| W2 | PL41B | 6 | C | LLM0_PLLC_IN_A | W2 | PL53B | 6 | C | LLM0_PLLC_IN_A |
| V6 | PL42A | 6 | T | LLM0_PLLT_FB_A | V6 | PL54A | 6 | T | LLM0_PLLT_FB_A |
| W6 | PL42B | 6 | C | LLM0_PLLC_FB_A | W6 | PL54B | 6 | C | LLM0_PLLC_FB_A |
| Y1 | PL43A | 6 | T | | Y1 | PL55A | 6 | T | |
| Y2 | PL43B | 6 | C | | Y2 | PL55B | 6 | C | |
| W3 | PL44A | 6 | T | | W3 | PL56A | 6 | T | |
| GND | GND6 | 6 | | | GND | GND6 | 6 | | |
| W4 | PL44B | 6 | C | | W4 | PL56B | 6 | C | |
| AA1 | PL45A | 6 | T | LDQS45 | AA1 | PL57A | 6 | T | LDQS57 |
| AB1 | PL45B | 6 | C | | AB1 | PL57B | 6 | C | |
| Y4 | PL46A | 6 | T | | Y4 | PL58A | 6 | T | |
| Y3 | PL46B | 6 | C | | Y3 | PL58B | 6 | C | |
| AC1 | PL47A | 6 | T | | AC1 | PL59A | 6 | T | |
| AB2 | PL47B | 6 | C | | AB2 | PL59B | 6 | C | |
| AA2 | NC | - | | | AA2 | PL60A | 6 | T | |
| - | - | - | | | GND | GND6 | 6 | | |
| AA3 | NC | - | | | AA3 | PL60B | 6 | C | |
| W5 | NC | - | | | W5 | PL61A | 6 | T | |
| Y5 | NC | - | | | Y5 | PL61B | 6 | C | |

## 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 |
| AC13 | PB32B | 5 | C | VREF1_5 | AC13 | PB32B | 5 | C | VREF1_5 |
| AF14 | PB33A | 5 | T | PCLKT5_0 | AF14 | PB33A | 5 | T | PCLKT5_0 |
| GND | GND5 | 5 | | | GND | GND5 | 5 | | |
| AE14 | PB33B | 5 | C | PCLKC5_0 | AE14 | PB33B | 5 | C | PCLKC5_0 |
| AA13 | PB34A | 4 | T | WRITEN | AA13 | PB34A | 4 | T | WRITEN |
| AB13 | PB34B | 4 | C | CS1N | AB13 | PB34B | 4 | C | CS1N |
| AD14 | PB35A | 4 | T | VREF1_4 | AD14 | PB35A | 4 | T | VREF1_4 |
| AA14 | PB35B | 4 | C | CSN | AA14 | PB35B | 4 | C | CSN |
| AC14 | PB36A | 4 | T | VREF2_4 | AC14 | PB36A | 4 | T | VREF2_4 |
| AB14 | PB36B | 4 | C | D0/SPID7 | AB14 | PB36B | 4 | C | D0/SPID7 |
| AF15 | PB37A | 4 | T | D2/SPID5 | AF15 | PB37A | 4 | T | D2/SPID5 |
| GND | GND4 | 4 | | | GND | GND4 | 4 | | |
| AE15 | PB37B | 4 | C | D1/SPID6 | AE15 | PB37B | 4 | C | D1/SPID6 |
| AD15 | PB38A | 4 | T | BDQS38 | AD15 | PB38A | 4 | T | BDQS38 |
| AC15 | PB38B | 4 | C | D3/SPID4 | AC15 | PB38B | 4 | C | D3/SPID4 |
| AF16 | PB39A | 4 | T | | AF16 | PB39A | 4 | T | |
| Y14 | PB39B | 4 | C | D4/SPID3 | Y14 | PB39B | 4 | C | D4/SPID3 |
| AE16 | PB40A | 4 | T | | AE16 | PB40A | 4 | T | |
| AB15 | PB40B | 4 | C | D5/SPID2 | AB15 | PB40B | 4 | C | D5/SPID2 |
| AF17 | PB41A | 4 | T | | AF17 | PB41A | 4 | T | |
| GND | GND4 | 4 | | | GND | GND4 | 4 | | |
| AE17 | PB41B | 4 | C | D6/SPID1 | AE17 | PB41B | 4 | C | D6/SPID1 |
| Y15 | PB42A | 4 | T | | Y15 | PB42A | 4 | T | |
| AA15 | PB42B | 4 | C | | AA15 | PB42B | 4 | C | |
| AD17 | PB43A | 4 | T | | AD17 | PB43A | 4 | T | |
| Y16 | PB43B | 4 | C | | Y16 | PB43B | 4 | C | |
| AD18 | PB44A | 4 | T | | AD18 | PB44A | 4 | T | |
| AC16 | PB44B | 4 | C | | AC16 | PB44B | 4 | C | |
| AE18 | PB45A | 4 | T | | AE18 | PB45A | 4 | T | |
| GND | GND4 | 4 | | | GND | GND4 | 4 | | |
| AF18 | PB45B | 4 | C | | AF18 | PB45B | 4 | C | |
| AD16 | PB46A | 4 | T | BDQS46 | AD16 | PB46A | 4 | T | BDQS46 |
| AB16 | PB46B | 4 | C | | AB16 | PB46B | 4 | C | |
| AF19 | PB47A | 4 | T | | AF19 | PB47A | 4 | T | |
| AA16 | PB47B | 4 | C | | AA16 | PB47B | 4 | C | |
| AA17 | PB48A | 4 | T | | AA17 | PB48A | 4 | T | |
| Y17 | PB48B | 4 | C | | Y17 | PB48B | 4 | C | |
| AF21 | PB49A | 4 | T | | AF21 | PB49A | 4 | T | |
| GND | GND4 | 4 | | | GND | GND4 | 4 | | |
| AF20 | PB49B | 4 | C | | AF20 | PB49B | 4 | C | |
| AE21 | PB50A | 4 | T | | AE21 | PB50A | 4 | T | |
| AC17 | PB50B | 4 | C | | AC17 | PB50B | 4 | C | |

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

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

| LFEC20/LFECP20 | | | | | LFECP/EC33 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ball Number | Ball Function | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function |
| L24 | PR17A | 2 | T | | L24 | PR29A | 2 | T | |
| K25 | PR16B | 2 | C | | K25 | PR28B | 2 | C | |
| J25 | PR16A | 2 | T | | J25 | PR28A | 2 | T | |
| J26 | PR15B | 2 | C | | J26 | PR27B | 2 | C | |
| H26 | PR15A | 2 | T | | H26 | PR27A | 2 | T | |
| H25 | PR14B | 2 | C | | H25 | PR26B | 2 | C | |
| GND | GND2 | 2 | | | GND | GND2 | 2 | | |
| J24 | PR14A | 2 | T | | J24 | PR26A | 2 | T | |
| K21 | PR13B | 2 | C | | K21 | PR25B | 2 | C | |
| K22 | PR13A | 2 | T | | K22 | PR25A | 2 | T | |
| K20 | PR12B | 2 | C | | K20 | PR24B | 2 | C | |
| J20 | PR12A | 2 | T | | J20 | PR24A | 2 | T | |
| K23 | PR11B | 2 | C | | K23 | PR23B | 2 | C | |
| K24 | PR11A | 2 | T | | K24 | PR23A | 2 | T | RDQS23 |
| J21 | NC | - | | | J21 | PR22B | 2 | C | |
| - | - | - | | | GND | GND2 | 2 | | |
| J22 | NC | - | | | J22 | PR22A | 2 | T | |
| J23 | NC | - | | | J23 | PR21B | 2 | C | |
| H22 | NC | - | | | H22 | PR21A | 2 | T | |
| G26 | NC | - | | | G26 | PR20B | 2 | C | |
| F26 | NC | - | | | F26 | PR20A | 2 | T | |
| E26 | NC | - | | | E26 | PR19B | 2 | C | |
| E25 | NC | - | | | E25 | PR19A | 2 | T | |
| F25 | PR9B | 2 | C | RUM0_PLLC_FB_A | F25 | PR17B | 2 | C | RUM0_PLLC_FB_A |
| GND | GND2 | 2 | | | GND | GND2 | 2 | | |
| G25 | PR9A | 2 | T | RUM0_PLLT_FB_A | G25 | PR17A | 2 | T | RUM0_PLLT_FB_A |
| H23 | PR8B | 2 | C | RUM0_PLLC_IN_A | H23 | PR16B | 2 | C | RUM0_PLLC_IN_A |
| H24 | PR8A | 2 | T | RUM0_PLLT_IN_A | H24 | PR16A | 2 | T | RUM0_PLLT_IN_A |
| H21 | PR7B | 2 | C | | H21 | PR15B | 2 | C | |
| G21 | PR7A | 2 | T | | G21 | PR15A | 2 | T | |
| D26 | PR6B | 2 | C | | D26 | PR14B | 2 | C | |
| D25 | PR6A | 2 | T | RDQS6 | D25 | PR14A | 2 | T | RDQS14 |
| F21 | PR5B | 2 | C | | F21 | PR13B | 2 | C | |
| - | - | - | | | GND | GND2 | 2 | | |
| G22 | PR5A | 2 | T | | G22 | PR13A | 2 | T | |
| G24 | PR4B | 2 | C | | G24 | PR12B | 2 | C | |
| G23 | PR4A | 2 | T | | G23 | PR12A | 2 | T | |
| C26 | PR3B | 2 | C | | C26 | PR11B | 2 | C | |
| C25 | PR3A | 2 | T | | C25 | PR11A | 2 | T | |
| F24 | NC | - | | | F24 | PR9B | 2 | C | |
| - | - | - | | | GND | GND2 | 2 | | |
| F23 | NC | - | | | F23 | PR9A | 2 | T | |

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

| LFEC20/LFECP20 | | | | | LFECP/EC33 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ball Number | Ball Function | Bank | LVDS | Dual Function | Ball Number | Ball Function | Bank | LVDS | Dual Function |
| E24 | NC | - | | | E24 | PR8B | 2 | C | |
| D24 | NC | - | | | D24 | PR8A | 2 | T | |
| E22 | NC | - | | | E22 | PR7B | 2 | C | |
| F22 | NC | - | | | F22 | PR7A | 2 | T | |
| E21 | NC | - | | | E21 | PR6B | 2 | C | |
| D22 | NC | - | | | D22 | PR6A | 2 | T | RDQS6 |
| E23 | PR2B | 2 | C | VREF1_2 | E23 | PR2B | 2 | C | VREF1_2 |
| D23 | PR2A | 2 | T | VREF2_2 | D23 | PR2A | 2 | T | VREF2_2 |
| GND | GND2 | 2 | | | GND | GND2 | 2 | | |
| GND | GND1 | 1 | | | GND | GND1 | 1 | | |
| G20 | NC | - | | | G20 | PT65B | 1 | C | |
| F20 | NC | - | | | F20 | PT65A | 1 | T | |
| D21 | NC | - | | | D21 | PT64B | 1 | C | |
| C21 | NC | - | | | C21 | PT64A | 1 | T | |
| C23 | NC | - | | | C23 | PT63B | 1 | C | |
| C22 | NC | - | | | C22 | PT63A | 1 | T | |
| B23 | NC | - | | | B23 | PT62B | 1 | C | |
| C24 | NC | - | | | C24 | PT62A | 1 | T | TDQS62 |
| D20 | NC | - | | | D20 | PT61B | 1 | C | |
| - | - | - | | | GND | GND1 | 1 | | |
| E19 | NC | - | | | E19 | PT61A | 1 | T | |
| B25 | NC | - | | | B25 | PT60B | 1 | C | |
| B24 | NC | - | | | B24 | PT60A | 1 | T | |
| B26 | NC | - | | | B26 | PT59B | 1 | C | |
| A25 | NC | - | | | A25 | PT59A | 1 | T | |
| C20 | NC | - | | | C20 | PT58B | 1 | C | |
| C19 | NC | - | | | C19 | PT58A | 1 | T | |
| A24 | PT57B | 1 | C | | A24 | PT57B | 1 | C | |
| - | - | - | | | GND | GND1 | 1 | | |
| A23 | PT57A | 1 | T | | A23 | PT57A | 1 | T | |
| E18 | PT56B | 1 | C | | E18 | PT56B | 1 | C | |
| D19 | PT56A | 1 | T | | D19 | PT56A | 1 | T | |
| F19 | PT55B | 1 | C | | F19 | PT55B | 1 | C | |
| B22 | PT55A | 1 | T | | B22 | PT55A | 1 | T | |
| G19 | PT54B | 1 | C | | G19 | PT54B | 1 | C | |
| B21 | PT54A | 1 | T | TDQS54 | B21 | PT54A | 1 | T | TDQS54 |
| D18 | PT53B | 1 | C | | D18 | PT53B | 1 | C | |
| GND | GND1 | 1 | | | GND | GND1 | 1 | | |
| C18 | PT53A | 1 | T | | C18 | PT53A | 1 | T | |
| F18 | PT52B | 1 | C | | F18 | PT52B | 1 | C | |
| A22 | PT52A | 1 | T | | A22 | PT52A | 1 | T | |
| G18 | PT51B | 1 | C | | G18 | PT51B | 1 | C | |

**LatticeEC Commercial (Continued)**

| Part Number | I/Os | Grade | Package | Pins | Temp. | LUTs |
|---|---|---|---|---|---|---|
| LFEC10E-4F256C | 195 | -4 | fpBGA | 256 | COM | 10.2K |
| LFEC10E-5F256C | 195 | -5 | fpBGA | 256 | COM | 10.2K |
| LFEC10E-3Q208C | 147 | -3 | PQFP | 208 | COM | 10.2K |
| LFEC10E-4Q208C | 147 | -4 | PQFP | 208 | COM | 10.2K |
| LFEC10E-5Q208C | 147 | -5 | PQFP | 208 | COM | 10.2K |

| Part Number | I/Os | Grade | Package | Pins | Temp. | LUTs |
|---|---|---|---|---|---|---|
| LFEC15E-3F484C | 352 | -3 | fpBGA | 484 | COM | 15.3K |
| LFEC15E-4F484C | 352 | -4 | fpBGA | 484 | COM | 15.3K |
| LFEC15E-5F484C | 352 | -5 | fpBGA | 484 | COM | 15.3K |
| LFEC15E-3F256C | 195 | -3 | fpBGA | 256 | COM | 15.3K |
| LFEC15E-4F256C | 195 | -4 | fpBGA | 256 | COM | 15.3K |
| LFEC15E-5F256C | 195 | -5 | fpBGA | 256 | COM | 15.3K |

| Part Number | I/Os | Grade | Package | Pins | Temp. | LUTs |
|---|---|---|---|---|---|---|
| LFEC20E-3F672C | 400 | -3 | fpBGA | 672 | COM | 19.7K |
| LFEC20E-4F672C | 400 | -4 | fpBGA | 672 | COM | 19.7K |
| LFEC20E-5F672C | 400 | -5 | fpBGA | 672 | COM | 19.7K |
| LFEC20E-3F484C | 360 | -3 | fpBGA | 484 | COM | 19.7K |
| LFEC20E-4F484C | 360 | -4 | fpBGA | 484 | COM | 19.7K |
| LFEC20E-5F484C | 360 | -5 | fpBGA | 484 | COM | 19.7K |

| Part Number | I/Os | Grade | Package | Pins | Temp. | LUTs |
|---|---|---|---|---|---|---|
| LFEC33E-3F672C | 496 | -3 | fpBGA | 672 | COM | 32.8K |
| LFEC33E-4F672C | 496 | -4 | fpBGA | 672 | COM | 32.8K |
| LFEC33E-5F672C | 496 | -5 | fpBGA | 672 | COM | 32.8K |
| LFEC33E-3F484C | 360 | -3 | fpBGA | 484 | COM | 32.8K |
| LFEC33E-4F484C | 360 | -4 | fpBGA | 484 | COM | 32.8K |
| LFEC33E-5F484C | 360 | -5 | fpBGA | 484 | COM | 32.8K |

**LatticeECP Industrial (Continued)**

| Part Number | I/Os | Grade | Package | Pins/Balls | Temp. | LUTs |
|---|---|---|---|---|---|---|
| LFECP20E-3FN672I | 400 | -3 | Lead-Free fpBGA | 672 | IND | 19.7K |
| LFECP20E-4FN672I | 400 | -4 | Lead-Free fpBGA | 672 | IND | 19.7K |
| LFECP20E-3FN484I | 400 | -3 | Lead-Free fpBGA | 484 | IND | 19.7K |
| LFECP20E-4FN484I | 400 | -4 | Lead-Free fpBGA | 484 | IND | 19.7K |

| Part Number | I/Os | Grade | Package | Pins/Balls | Temp. | LUTs |
|---|---|---|---|---|---|---|
| LFECP33E-3FN672I | 496 | -3 | Lead-Free fpBGA | 672 | IND | 32.8K |
| LFECP33E-4FN672I | 496 | -4 | Lead-Free fpBGA | 672 | IND | 32.8K |
| LFECP33E-3FN484I | 360 | -3 | Lead-Free fpBGA | 484 | IND | 32.8K |
| LFECP33E-4FN484I | 360 | -4 | Lead-Free fpBGA | 484 | IND | 32.8K |