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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.

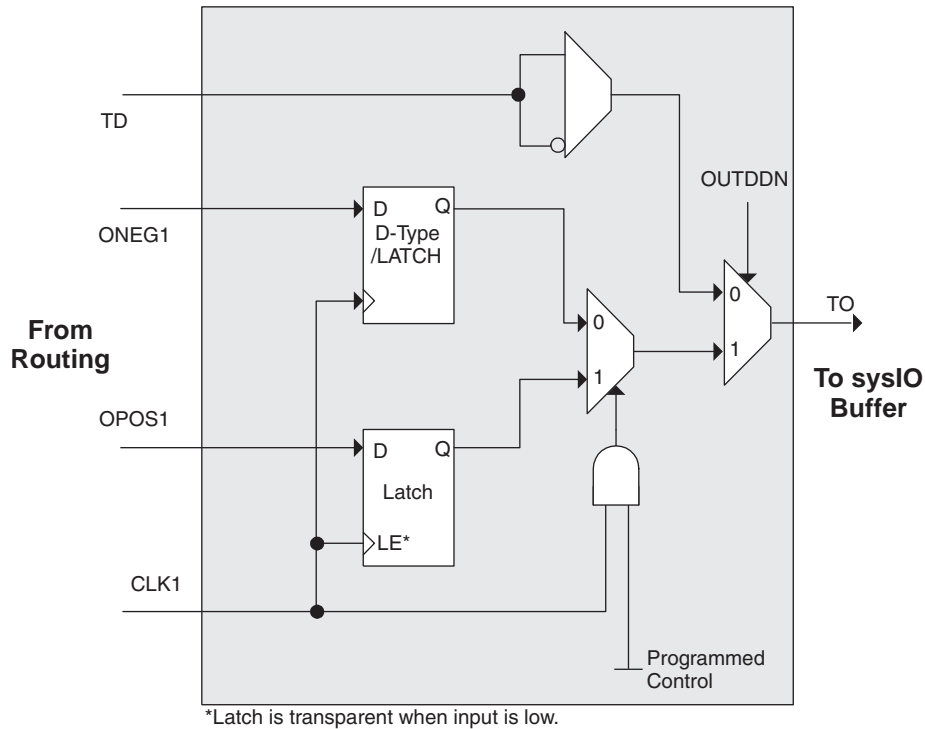
## Applications of Embedded - FPGAs

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	97
Number of Gates	-
Voltage - Supply	1.14V ~ 1.26V
Mounting Type	Surface Mount
Operating Temperature	0°C ~ 85°C (TJ)
Package / Case	144-LQFP
Supplier Device Package	144-TQFP (20x20)
Purchase URL	<a href="https://www.e-xfl.com/product-detail/lattice-semiconductor/lfecp6e-4tn144c">https://www.e-xfl.com/product-detail/lattice-semiconductor/lfecp6e-4tn144c</a>

Figure 2-31. Tristate Register Block



### 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.

be shifted in and loaded directly onto test nodes, or test data to be captured and shifted out for verification. The test access port consists of dedicated I/Os: TDI, TDO, TCK and TMS. The test access port has its own supply voltage  $V_{CCJ}$  and can operate with LVCMOS3.3, 2.5, 1.8, 1.5 and 1.2 standards.

For more details on boundary scan test, please see information regarding additional technical documentation at the end of this data sheet.

## Device Configuration

All LatticeECP/EC devices contain two possible ports that can be used for device configuration. The test access port (TAP), which supports bit-wide configuration, and the sysCONFIG port that supports both byte-wide and serial configuration.

The TAP supports both the IEEE Std. 1149.1 Boundary Scan specification and the IEEE Std. 1532 In-System Configuration specification. The sysCONFIG port is a 20-pin interface with six of the I/Os used as dedicated pins and the rest being dual-use pins (please refer to TN1053 for more information about using the dual-use pins as general purpose I/O). There are four configuration options for LatticeECP/EC devices:

1. Industry standard SPI memories.
2. Industry standard byte wide flash and ispMACH 4000 for control/addressing.
3. Configuration from system microprocessor via the configuration bus or TAP.
4. Industry standard FPGA board memory.

On power-up, the FPGA SRAM is ready to be configured with the sysCONFIG port active. The IEEE 1149.1 serial mode can be activated any time after power-up by sending the appropriate command through the TAP port. Once a configuration port is selected, that port is locked and another configuration port cannot be activated until the next power-up sequence.

For more information about device configuration, please see the list of technical documentation at the end of this data sheet.

## Internal Logic Analyzer Capability (ispTRACY)

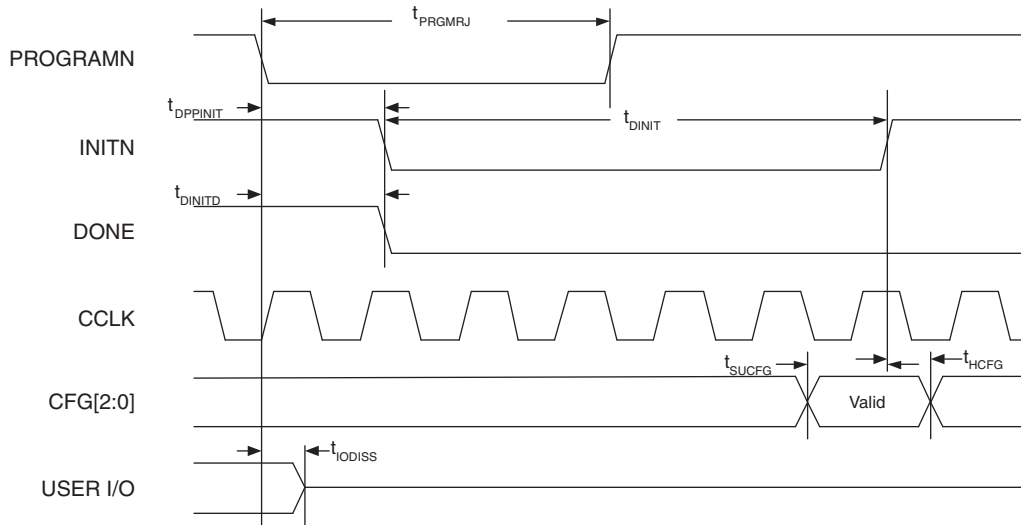
All LatticeECP/EC devices support an internal logic analyzer diagnostic feature. The diagnostic features provide capabilities similar to an external logic analyzer, such as programmable event and trigger condition and deep trace memory. This feature is enabled by Lattice's ispTRACY. The ispTRACY utility is added into the user design at compile time.

For more information about ispTRACY, please see information regarding additional technical documentation at the end of this data sheet.

## External Resistor

LatticeECP/EC devices require a single external, 10K ohm +/- 1% value between the XRES pin and ground. Device configuration will not be completed if this resistor is missing. There is no boundary scan register on the external resistor pad.

Figure 3-17. Configuration from PROGRAMN Timing



1. The CFG pins are normally static (hard wired)

Figure 3-18. Wake-Up Timing

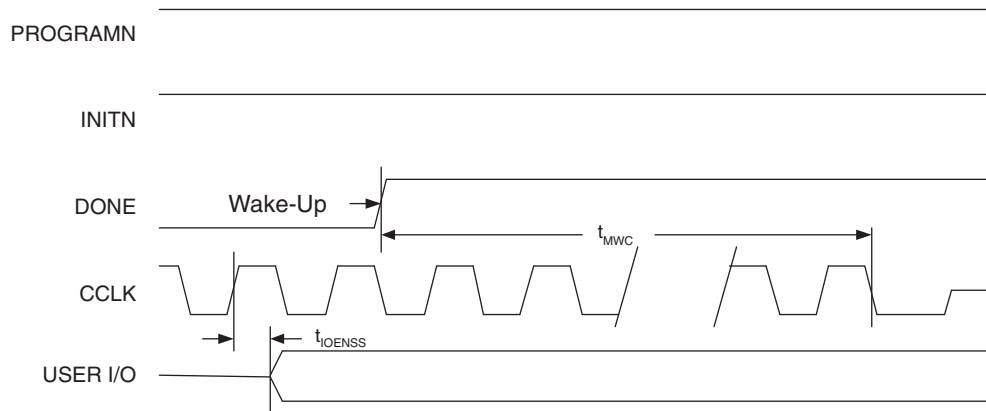
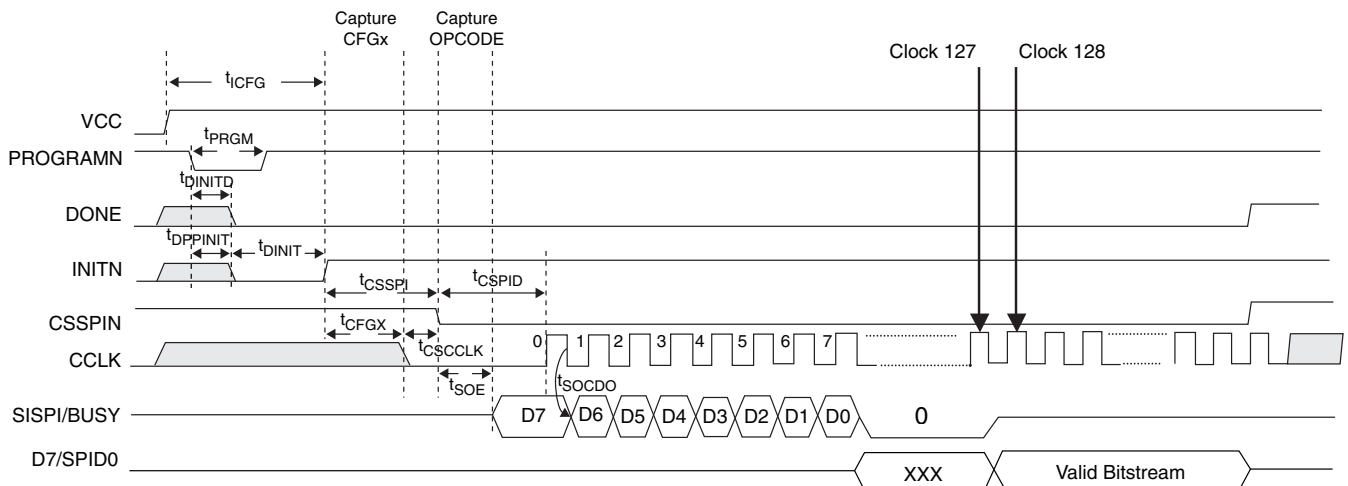


Figure 3-19. sysCONFIG SPI Port Sequence



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

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

**LFEC1, LFEC3, LFEC6/EC6 Logic Signal Connections: 144 TQFP**

Pin Number	LFEC1				LFEC3				LFEC6/EC6			
	Pin Function	Bank	LVD S	Dual Function	Pin Function	Bank	LVD S	Dual Function	Pin Function	Bank	LVD S	Dual Function
1	VCCIO7	7			VCCIO7	7			VCCIO7	7		
2	PL2A	7	T	VREF2_7	PL2A	7	T	VREF2_7	PL2A	7	T	VREF2_7
3	PL2B	7	C	VREF1_7	PL2B	7	C	VREF1_7	PL2B	7	C	VREF1_7
4	PL3A	7	T		PL7A	7	T		PL7A	7	T	
5	PL3B	7	C		PL7B	7	C		PL7B	7	C	
6	PL4A	7	T		PL8A	7	T		PL8A	7	T	
7	PL4B	7	C		PL8B	7	C		PL8B	7	C	
8	PL5A	7	T	PCLKT7_0	PL9A	7	T	PCLKT7_0	PL9A	7	T	PCLKT7_0
9	PL5B	7	C	PCLKC7_0	PL9B	7	C	PCLKC7_0	PL9B	7	C	PCLKC7_0
10	XRES	6			XRES	6			XRES	6		
11	NC	-			NC	-			VCC	-		
12	NC	-			NC	-			GND	-		
13	VCC	-			VCC	-			VCC	-		
14	TCK	6			TCK	6			TCK	6		
15	GND	-			GND	-			GND	-		
16	TDI	6			TDI	6			TDI	6		
17	TMS	6			TMS	6			TMS	6		
18	TDO	6			TDO	6			TDO	6		
19	VCCJ	6			VCCJ	6			VCCJ	6		
20	PL7A	6	T	LLM0_PLLT_IN_A	PL11A	6	T	LLM0_PLLT_IN_A	PL20A	6	T	LLM0_PLLT_IN_A
21	PL7B	6	C	LLM0_PLLC_IN_A	PL11B	6	C	LLM0_PLLC_IN_A	PL20B	6	C	LLM0_PLLC_IN_A
22	PL8A	6	T	LLM0_PLLT_FB_A	PL12A	6	T	LLM0_PLLT_FB_A	PL21A	6	T	LLM0_PLLT_FB_A
23	PL8B	6	C	LLM0_PLLC_FB_A	PL12B	6	C	LLM0_PLLC_FB_A	PL21B	6	C	LLM0_PLLC_FB_A
24	VCCIO6	6			VCCIO6	6			VCCIO6	6		
25	PL9A	6	T		PL13A	6	T		PL22A	6	T	
26	PL9B	6	C		PL13B	6	C		PL22B	6	C	
27	PL10A	6	T		PL14A	6	T		PL23A	6	T	
28	GND6	6			GND6	6			GND6	6		
29	PL10B	6	C		PL14B	6	C		PL23B	6	C	
30	PL11A	6	T	LDQS11	PL15A	6	T	LDQS15	PL24A	6	T	LDQS24
31	PL11B	6	C		PL15B	6	C		PL24B	6	C	
32	PL12A	6	T		PL16A	6	T		PL25A	6	T	
33	PL12B	6	C		PL16B	6	C		PL25B	6	C	
34	PL14A	6	T	VREF1_6	PL18A	6	T	VREF1_6	PL27A	6	T	VREF1_6
35	PL14B	6	C	VREF2_6	PL18B	6	C	VREF2_6	PL27B	6	C	VREF2_6
36	VCCIO6	6			VCCIO6	6			VCCIO6	6		
37*	GND5 GND6	-			GND5 GND6	-			GND5 GND6	-		
38	VCCIO5	5			VCCIO5	5			VCCIO5	5		
39	PB2A	5	T		PB10A	5	T		PB10A	5	T	
40	PB2B	5	C		PB10B	5	C		PB10B	5	C	
41	PB3A	5	T		PB11A	5	T		PB11A	5	T	
42	PB3B	5	C		PB11B	5	C		PB11B	5	C	
43	PB5B	5			PB13B	5			PB13B	5		
44	VCCIO5	5			VCCIO5	5			VCCIO5	5		
45	PB6A	5	T	BDQS6	PB14A	5	T	BDQS14	PB14A	5	T	BDQS14
46	PB6B	5	C		PB14B	5	C		PB14B	5	C	
47	PB7A	5	T		PB15A	5	T		PB15A	5	T	
48	PB7B	5	C		PB15B	5	C		PB15B	5	C	
49	PB8A	5	T	VREF2_5	PB16A	5	T	VREF2_5	PB16A	5	T	VREF2_5

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

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

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

Pin Number	LFEC1				LFEC3			
	Pin Function	Bank	LVDS	Dual Function	Pin Function	Bank	LVDS	Dual Function
169	PT13A	1	T		PT21A	1	T	
170	PT12B	1	C		PT20B	1	C	
171	PT12A	1	T		PT20A	1	T	
172	PT11B	1	C	VREF2_1	PT19B	1	C	VREF2_1
173	PT11A	1	T	VREF1_1	PT19A	1	T	VREF1_1
174	PT10B	1	C		PT18B	1	C	
175	PT10A	1	T		PT18A	1	T	
176	VCCIO1	1			VCCIO1	1		
177	VCCAUX	-			VCCAUX	-		
178	PT9B	0	C	PCLKC0_0	PT17B	0	C	PCLKC0_0
179	GND0	0			GND0	0		
180	PT9A	0	T	PCLKT0_0	PT17A	0	T	PCLKT0_0
181	PT8B	0	C	VREF1_0	PT16B	0	C	VREF1_0
182	PT8A	0	T	VREF2_0	PT16A	0	T	VREF2_0
183	PT7B	0	C		PT15B	0	C	
184	PT7A	0	T		PT15A	0	T	
185	PT6B	0	C		PT14B	0	C	
186	PT6A	0	T	TDQS6	PT14A	0	T	TDQS14
187	VCCIO0	0			VCCIO0	0		
188	PT5B	0	C		PT13B	0	C	
189	NC	-			GND0	0		
190	PT5A	0	T		PT13A	0	T	
191	PT4B	0	C		PT12B	0	C	
192	PT4A	0	T		PT12A	0	T	
193	PT3B	0	C		PT11B	0	C	
194	PT3A	0	T		PT11A	0	T	
195	PT2B	0	C		PT10B	0	C	
196	PT2A	0	T		PT10A	0	T	
197	NC	-			VCCIO0	0		
198	NC	-			PT6B	0	C	
199	NC	-			PT6A	0	T	TDQS6
200	NC	-			PT5B	0	C	
201	NC	-			PT5A	0	T	
202	NC	-			PT4B	0	C	
203	NC	-			PT4A	0	T	
204	NC	-			PT3B	0	C	
205	NC	-			PT3A	0	T	
206	NC	-			PT2B	0	C	
207	NC	-			PT2A	0	T	
208	VCCIO0	0			VCCIO0	0		

\* Double bonded to the pin.



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

Pin Number	LFCEP6/LFCEC6				LFCEP10/LFCEC10			
	Pin Function	Bank	LVDS	Dual Function	Pin Function	Bank	LVDS	Dual Function
127	CFG0	3			CFG0	3		
128	VCC	-			VCC	-		
129	PROGRAMN	3			PROGRAMN	3		
130	CCLK	3			CCLK	3		
131	INITN	3			INITN	3		
132	GND	-			GND	-		
133	DONE	3			DONE	3		
134	GND	-			GND	-		
135	VCC	-			VCC	-		
136	VCCAUX	-			VCCAUX	-		
137	PR9B	2	C	PCLKC2_0	PR18B	2	C	PCLKC2_0
138	GND2	2			GND2	2		
139	PR9A	2	T	PCLKT2_0	PR18A	2	T	PCLKT2_0
140	PR8B	2	C		PR17B	2	C	
141	PR8A	2	T		PR17A	2	T	
142	PR7B	2	C		PR16B	2	C	
143	PR7A	2	T		PR16A	2	T	
144	PR6B	2	C		PR15B	2	C	
145	VCCIO2	2			VCCIO2	2		
146	PR6A	2	T	RDQS6	PR15A	2	T	RDQS15
147	PR5B	2	C		PR14B	2	C	
148	PR5A	2	T		PR14A	2	T	
149	PR4B	2	C		PR13B	2	C	
150	PR4A	2	T		PR13A	2	T	
151	NC	-			GND	-		
152	NC	-			VCC	-		
153	PR2B	2	C	VREF1_2	PR2B	2	C	VREF1_2
154	PR2A	2	T	VREF2_2	PR2A	2	T	VREF2_2
155	VCCIO2	2			VCCIO2	2		
156*	GND1 GND2	-			GND1 GND2	-		
157	VCCIO1	1			VCCIO1	1		
158	PT33A	1			PT41A	1		
159	PT25B	1	C		PT33B	1	C	
160	PT25A	1	T		PT33A	1	T	
161	PT24B	1	C		PT32B	1	C	
162	PT24A	1	T		PT32A	1	T	
163	PT23B	1	C		PT31B	1	C	
164	PT23A	1	T		PT31A	1	T	
165	PT22B	1	C		PT30B	1	C	
166	PT22A	1	T	TDQS22	PT30A	1	T	TDQS30
167	PT21B	1	C		PT29B	1	C	
168	GND1	1			GND1	1		

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

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

LFECP6/LFEC6					LFECP10/LFEC10					LFECP/EC15				
Ball Number	Ball Function	Bank	LVDS	Dual Function	Ball Number	Ball Function	Bank	LVDS	Dual Function	Ball Number	Ball Function	Bank	LVDS	Dual Function
V12	PB16B	5	C	VREF1_5	V12	PB24B	5	C	VREF1_5	V12	PB24B	5	C	VREF1_5
AB10	PB17A	5	T	PCLKT5_0	AB10	PB25A	5	T	PCLKT5_0	AB10	PB25A	5	T	PCLKT5_0
GND	GND5	5			GND	GND5	5			GND	GND5	5		
AB11	PB17B	5	C	PCLKC5_0	AB11	PB25B	5	C	PCLKC5_0	AB11	PB25B	5	C	PCLKC5_0
Y12	PB18A	4	T	WRITEN	Y12	PB26A	4	T	WRITEN	Y12	PB26A	4	T	WRITEN
U11	PB18B	4	C	CS1N	U11	PB26B	4	C	CS1N	U11	PB26B	4	C	CS1N
W12	PB19A	4	T	VREF1_4	W12	PB27A	4	T	VREF1_4	W12	PB27A	4	T	VREF1_4
U12	PB19B	4	C	CSN	U12	PB27B	4	C	CSN	U12	PB27B	4	C	CSN
W13	PB20A	4	T	VREF2_4	W13	PB28A	4	T	VREF2_4	W13	PB28A	4	T	VREF2_4
U13	PB20B	4	C	D0/SPID7	U13	PB28B	4	C	D0/SPID7	U13	PB28B	4	C	D0/SPID7
AA12	PB21A	4	T	D2/SPID5	AA12	PB29A	4	T	D2/SPID5	AA12	PB29A	4	T	D2/SPID5
GND	GND4	4			GND	GND4	4			GND	GND4	4		
AB12	PB21B	4	C	D1/SPID6	AB12	PB29B	4	C	D1/SPID6	AB12	PB29B	4	C	D1/SPID6
T13	PB22A	4	T	BDQS22	T13	PB30A	4	T	BDQS30	T13	PB30A	4	T	BDQS30
V13	PB22B	4	C	D3/SPID4	V13	PB30B	4	C	D3/SPID4	V13	PB30B	4	C	D3/SPID4
W14	PB23A	4	T		W14	PB31A	4	T		W14	PB31A	4	T	
U14	PB23B	4	C	D4/SPID3	U14	PB31B	4	C	D4/SPID3	U14	PB31B	4	C	D4/SPID3
Y13	PB24A	4	T		Y13	PB32A	4	T		Y13	PB32A	4	T	
V14	PB24B	4	C	D5/SPID2	V14	PB32B	4	C	D5/SPID2	V14	PB32B	4	C	D5/SPID2
AA13	PB25A	4	T		AA13	PB33A	4	T		AA13	PB33A	4	T	
GND	GND4	4			GND	GND4	4			GND	GND4	4		
AB13	PB25B	4	C	D6/SPID1	AB13	PB33B	4	C	D6/SPID1	AB13	PB33B	4	C	D6/SPID1
AA14	PB26A	4	T		AA14	PB34A	4	T		AA14	PB34A	4	T	
Y14	PB26B	4	C		Y14	PB34B	4	C		Y14	PB34B	4	C	
Y15	PB27A	4	T		Y15	PB35A	4	T		Y15	PB35A	4	T	
W15	PB27B	4	C		W15	PB35B	4	C		W15	PB35B	4	C	
V15	PB28A	4	T		V15	PB36A	4	T		V15	PB36A	4	T	
T14	PB28B	4	C		T14	PB36B	4	C		T14	PB36B	4	C	
AB14	PB29A	4	T		AB14	PB37A	4	T		AB14	PB37A	4	T	
GND	GND4	4			GND	GND4	4			GND	GND4	4		
AB15	PB29B	4	C		AB15	PB37B	4	C		AB15	PB37B	4	C	
AB16	PB30A	4	T	BDQS30	AB16	PB38A	4	T	BDQS38	AB16	PB38A	4	T	BDQS38
AA15	PB30B	4	C		AA15	PB38B	4	C		AA15	PB38B	4	C	
AB17	PB31A	4	T		AB17	PB39A	4	T		AB17	PB39A	4	T	
AA16	PB31B	4	C		AA16	PB39B	4	C		AA16	PB39B	4	C	
AB18	PB32A	4	T		AB18	PB40A	4	T		AB18	PB40A	4	T	
AA17	PB32B	4	C		AA17	PB40B	4	C		AA17	PB40B	4	C	
AB19	PB33A	4	T		AB19	PB41A	4	T		AB19	PB41A	4	T	
GND	-	-			GND	-	-			GND	GND4	4		
AA18	PB33B	4	C		AA18	PB41B	4	C		AA18	PB41B	4	C	
W16	NC	-			W16	NC	-			W16	PB42A	4	T	
U15	NC	-			U15	NC	-			U15	PB42B	4	C	
V16	NC	-			V16	NC	-			V16	PB43A	4	T	
U16	NC	-			U16	NC	-			U16	PB43B	4	C	
Y17	NC	-			Y17	NC	-			Y17	PB44A	4	T	
V17	NC	-			V17	NC	-			V17	PB44B	4	C	
AB20	NC	-			AB20	NC	-			AB20	PB45A	4	T	
GND	-	-			GND	-	-			GND	GND4	4		
AA19	NC	-			AA19	NC	-			AA19	PB45B	4	C	
Y16	NC	-			Y16	NC	-			Y16	PB46A	4	T	BDQS46

**LFECF/EC6, LFECF/EC10, LFECF/EC15 Logic Signal Connections:  
 484 fpBGA (Cont.)**

LFECF/EC6					LFECF/EC10					LFECF/EC15				
Ball Number	Ball Function	Bank	LVDS	Dual Function	Ball Number	Ball Function	Bank	LVDS	Dual Function	Ball Number	Ball Function	Bank	LVDS	Dual Function
N22	PR17A	3	T		N22	PR26A	3	T		N22	PR30A	3	T	
N19	PR16B	3	C		N19	PR25B	3	C		N19	PR29B	3	C	
N18	PR16A	3	T		N18	PR25A	3	T		N18	PR29A	3	T	
M21	PR15B	3	C		M21	PR24B	3	C		M21	PR28B	3	C	
L20	PR15A	3	T	RDQS15	L20	PR24A	3	T	RDQS24	L20	PR28A	3	T	RDQS28
L21	PR14B	3	C		L21	PR23B	3	C		L21	PR27B	3	C	
GND	GND3	3			GND	GND3	3			GND	GND3	3		
M20	PR14A	3	T		M20	PR23A	3	T		M20	PR27A	3	T	
M18	PR13B	3	C		M18	PR22B	3	C		M18	PR26B	3	C	
M19	PR13A	3	T		M19	PR22A	3	T		M19	PR26A	3	T	
M22	PR12B	3	C		M22	PR21B	3	C		M22	PR25B	3	C	
L22	PR12A	3	T		L22	PR21A	3	T		L22	PR25A	3	T	
K22	PR11B	3	C		K22	PR20B	3	C		K22	PR24B	3	C	
K21	PR11A	3	T		K21	PR20A	3	T		K21	PR24A	3	T	
J22	PR9B	2	C	PCLKC2_0	J22	PR18B	2	C	PCLKC2_0	J22	PR22B	2	C	PCLKC2_0
GND	GND2	2			GND	GND2	2			GND	GND2	2		
J21	PR9A	2	T	PCLKT2_0	J21	PR18A	2	T	PCLKT2_0	J21	PR22A	2	T	PCLKT2_0
H22	PR8B	2	C		H22	PR17B	2	C		H22	PR21B	2	C	
H21	PR8A	2	T		H21	PR17A	2	T		H21	PR21A	2	T	
L19	PR7B	2	C		L19	PR16B	2	C		L19	PR20B	2	C	
L18	PR7A	2	T		L18	PR16A	2	T		L18	PR20A	2	T	
K20	PR6B	2	C		K20	PR15B	2	C		K20	PR19B	2	C	
J20	PR6A	2	T	RDQS6	J20	PR15A	2	T	RDQS15	J20	PR19A	2	T	RDQS19
K19	PR5B	2	C		K19	PR14B	2	C		K19	PR18B	2	C	
GND	-	-			GND	GND2	2			GND	GND2	2		
K18	PR5A	2	T		K18	PR14A	2	T		K18	PR18A	2	T	
G22	PR4B	2	C		G22	PR13B	2	C		G22	PR17B	2	C	
F22	PR4A	2	T		F22	PR13A	2	T		F22	PR17A	2	T	
F21	PR3B	2	C		F21	PR12B	2	C		F21	PR16B	2	C	
E22	PR3A	2	T		E22	PR12A	2	T		E22	PR16A	2	T	
E21	NC	-			E21	PR11B	2	C		E21	PR15B	2	C	
D22	NC	-			D22	PR11A	2	T		D22	PR15A	2	T	
G21	NC	-			G21	NC	-			G21	PR14B	2	C	
G20	NC	-			G20	NC	-			GND	GND2	2		
GND	-	-			-	-	-			G20	PR14A	2	T	
J18	NC	-			J18	NC	-			J18	PR13B	2	C	
H19	NC	-			H19	NC	-			H19	PR13A	2	T	
J19	NC	-			J19	NC	-			J19	PR12B	2	C	
H20	NC	-			H20	NC	-			H20	PR12A	2	T	
H17	NC	-			H17	NC	-			H17	PR11B	2	C	
H18	NC	-			H18	NC	-			H18	PR11A	2	T	
D21	NC	-			D21	PR9B	2	C	RUM0_PLLC_FB_A	D21	PR9B	2	C	RUM0_PLLC_FB_A
GND	-	-			GND	GND2	2			GND	GND2	2		
C22	NC	-			C22	PR9A	2	T	RUM0_PLLT_FB_A	C22	PR9A	2	T	RUM0_PLLT_FB_A
G19	NC	-			G19	PR8B	2	C	RUM0_PLLC_IN_A	G19	PR8B	2	C	RUM0_PLLC_IN_A
G18	NC	-			G18	PR8A	2	T	RUM0_PLLT_IN_A	G18	PR8A	2	T	RUM0_PLLT_IN_A
F20	NC	-			F20	PR7B	2	C		F20	PR7B	2	C	
F19	NC	-			F19	PR7A	2	T		F19	PR7A	2	T	
E20	NC	-			E20	PR6B	2	C		E20	PR6B	2	C	
D20	NC	-			D20	PR6A	2	T	RDQS6	D20	PR6A	2	T	RDQS6

**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
C21	NC	-			C21	PR5B	2	C		C21	PR5B	2	C	
C20	NC	-			C20	PR5A	2	T		C20	PR5A	2	T	
F18	NC	-			F18	PR4B	2	C		F18	PR4B	2	C	
E18	NC	-			E18	PR4A	2	T		E18	PR4A	2	T	
B22	NC	-			B22	PR3B	2	C		B22	PR3B	2	C	
B21	NC	-			B21	PR3A	2	T		B21	PR3A	2	T	
E19	PR2B	2	C	VREF1_2	E19	PR2B	2	C	VREF1_2	E19	PR2B	2	C	VREF1_2
D19	PR2A	2	T	VREF2_2	D19	PR2A	2	T	VREF2_2	D19	PR2A	2	T	VREF2_2
GND	GND2	2			GND	GND2	2			GND	GND2	2		
GND	GND1	1			GND	GND1	1			GND	GND1	1		
G17	NC	-			G17	NC	-			G17	PT49B	1	C	
F17	NC	-			F17	NC	-			F17	PT49A	1	T	
D18	NC	-			D18	NC	-			D18	PT48B	1	C	
C18	NC	-			C18	NC	-			C18	PT48A	1	T	
C19	NC	-			C19	NC	-			C19	PT47B	1	C	
B20	NC	-			B20	NC	-			B20	PT47A	1	T	
D17	NC	-			D17	NC	-			D17	PT46B	1	C	
C16	NC	-			C16	NC	-			C16	PT46A	1	T	TDQS46
B19	NC	-			B19	NC	-			B19	PT45B	1	C	
GND	-	-			GND	-	-			GND	GND1	1		
A20	NC	-			A20	NC	-			A20	PT45A	1	T	
E17	NC	-			E17	NC	-			E17	PT44B	1	C	
C17	NC	-			C17	NC	-			C17	PT44A	1	T	
F16	NC	-			F16	NC	-			F16	PT43B	1	C	
E16	NC	-			E16	NC	-			E16	PT43A	1	T	
F15	NC	-			F15	NC	-			F15	PT42B	1	C	
D16	NC	-			D16	NC	-			D16	PT42A	1	T	
B18	PT33B	1	C		B18	PT41B	1	C		B18	PT41B	1	C	
GND	-	-			GND	-	-			GND	GND1	1		
A19	PT33A	1	T		A19	PT41A	1	T		A19	PT41A	1	T	
B17	PT32B	1	C		B17	PT40B	1	C		B17	PT40B	1	C	
A18	PT32A	1	T		A18	PT40A	1	T		A18	PT40A	1	T	
B16	PT31B	1	C		B16	PT39B	1	C		B16	PT39B	1	C	
A17	PT31A	1	T		A17	PT39A	1	T		A17	PT39A	1	T	
B15	PT30B	1	C		B15	PT38B	1	C		B15	PT38B	1	C	
A16	PT30A	1	T	TDQS30	A16	PT38A	1	T	TDQS38	A16	PT38A	1	T	TDQS38
A15	PT29B	1	C		A15	PT37B	1	C		A15	PT37B	1	C	
GND	GND1	1			GND	GND1	1			GND	GND1	1		
A14	PT29A	1	T		A14	PT37A	1	T		A14	PT37A	1	T	
G14	PT28B	1	C		G14	PT36B	1	C		G14	PT36B	1	C	
E15	PT28A	1	T		E15	PT36A	1	T		E15	PT36A	1	T	
D15	PT27B	1	C		D15	PT35B	1	C		D15	PT35B	1	C	
C15	PT27A	1	T		C15	PT35A	1	T		C15	PT35A	1	T	
C14	PT26B	1	C		C14	PT34B	1	C		C14	PT34B	1	C	
B14	PT26A	1	T		B14	PT34A	1	T		B14	PT34A	1	T	
A13	PT25B	1	C		A13	PT33B	1	C		A13	PT33B	1	C	
GND	GND1	1			GND	GND1	1			GND	GND1	1		
B13	PT25A	1	T		B13	PT33A	1	T		B13	PT33A	1	T	
E14	PT24B	1	C		E14	PT32B	1	C		E14	PT32B	1	C	
C13	PT24A	1	T		C13	PT32A	1	T		C13	PT32A	1	T	

**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
F14	PT23B	1	C		F14	PT31B	1	C		F14	PT31B	1	C	
D14	PT23A	1	T		D14	PT31A	1	T		D14	PT31A	1	T	
E13	PT22B	1	C		E13	PT30B	1	C		E13	PT30B	1	C	
G13	PT22A	1	T	TDQS22	G13	PT30A	1	T	TDQS30	G13	PT30A	1	T	TDQS30
A12	PT21B	1	C		A12	PT29B	1	C		A12	PT29B	1	C	
GND	GND1	1			GND	GND1	1			GND	GND1	1		
B12	PT21A	1	T		B12	PT29A	1	T		B12	PT29A	1	T	
F13	PT20B	1	C		F13	PT28B	1	C		F13	PT28B	1	C	
D13	PT20A	1	T		D13	PT28A	1	T		D13	PT28A	1	T	
F12	PT19B	1	C	VREF2_1	F12	PT27B	1	C	VREF2_1	F12	PT27B	1	C	VREF2_1
D12	PT19A	1	T	VREF1_1	D12	PT27A	1	T	VREF1_1	D12	PT27A	1	T	VREF1_1
F11	PT18B	1	C		F11	PT26B	1	C		F11	PT26B	1	C	
C12	PT18A	1	T		C12	PT26A	1	T		C12	PT26A	1	T	
A11	PT17B	0	C	PCLKC0_0	A11	PT25B	0	C	PCLKC0_0	A11	PT25B	0	C	PCLKC0_0
GND	GND0	0			GND	GND0	0			GND	GND0	0		
A10	PT17A	0	T	PCLKT0_0	A10	PT25A	0	T	PCLKT0_0	A10	PT25A	0	T	PCLKT0_0
E12	PT16B	0	C	VREF1_0	E12	PT24B	0	C	VREF1_0	E12	PT24B	0	C	VREF1_0
E11	PT16A	0	T	VREF2_0	E11	PT24A	0	T	VREF2_0	E11	PT24A	0	T	VREF2_0
B11	PT15B	0	C		B11	PT23B	0	C		B11	PT23B	0	C	
C11	PT15A	0	T		C11	PT23A	0	T		C11	PT23A	0	T	
B9	PT14B	0	C		B9	PT22B	0	C		B9	PT22B	0	C	
B10	PT14A	0	T	TDQS14	B10	PT22A	0	T	TDQS22	B10	PT22A	0	T	TDQS22
A9	PT13B	0	C		A9	PT21B	0	C		A9	PT21B	0	C	
GND	GND0	0			GND	GND0	0			GND	GND0	0		
A8	PT13A	0	T		A8	PT21A	0	T		A8	PT21A	0	T	
D11	PT12B	0	C		D11	PT20B	0	C		D11	PT20B	0	C	
C10	PT12A	0	T		C10	PT20A	0	T		C10	PT20A	0	T	
A7	PT11B	0	C		A7	PT19B	0	C		A7	PT19B	0	C	
A6	PT11A	0	T		A6	PT19A	0	T		A6	PT19A	0	T	
B7	PT10B	0	C		B7	PT18B	0	C		B7	PT18B	0	C	
B8	PT10A	0	T		B8	PT18A	0	T		B8	PT18A	0	T	
A5	PT9B	0	C		A5	PT17B	0	C		A5	PT17B	0	C	
GND	GND0	0			GND	GND0	0			GND	GND0	0		
B6	PT9A	0	T		B6	PT17A	0	T		B6	PT17A	0	T	
G10	PT8B	0	C		G10	PT16B	0	C		G10	PT16B	0	C	
E10	PT8A	0	T		E10	PT16A	0	T		E10	PT16A	0	T	
F10	PT7B	0	C		F10	PT15B	0	C		F10	PT15B	0	C	
D10	PT7A	0	T		D10	PT15A	0	T		D10	PT15A	0	T	
G9	PT6B	0	C		G9	PT14B	0	C		G9	PT14B	0	C	
E9	PT6A	0	T	TDQS6	E9	PT14A	0	T	TDQS14	E9	PT14A	0	T	TDQS14
C9	PT5B	0	C		C9	PT13B	0	C		C9	PT13B	0	C	
GND	-	-			GND	GND0	0			GND	GND0	0		
C8	PT5A	0	T		C8	PT13A	0	T		C8	PT13A	0	T	
F9	PT4B	0	C		F9	PT12B	0	C		F9	PT12B	0	C	
D9	PT4A	0	T		D9	PT12A	0	T		D9	PT12A	0	T	
F8	PT3B	0	C		F8	PT11B	0	C		F8	PT11B	0	C	
D7	PT3A	0	T		D7	PT11A	0	T		D7	PT11A	0	T	
D8	PT2B	0	C		D8	PT10B	0	C		D8	PT10B	0	C	
C7	PT2A	0	T		C7	PT10A	0	T		C7	PT10A	0	T	
GND	GND0	0			GND	GND0	0			GND	GND0	0		

**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
A4	NC	-			A4	PT9B	0	C		A4	PT9B	0	C	
B4	NC	-			B4	PT9A	0	T		B4	PT9A	0	T	
C4	NC	-			C4	PT8B	0	C		C4	PT8B	0	C	
C5	NC	-			C5	PT8A	0	T		C5	PT8A	0	T	
D6	NC	-			D6	PT7B	0	C		D6	PT7B	0	C	
B5	NC	-			B5	PT7A	0	T		B5	PT7A	0	T	
E6	NC	-			E6	PT6B	0	C		E6	PT6B	0	C	
C6	NC	-			C6	PT6A	0	T	TDQS6	C6	PT6A	0	T	TDQS6
A3	NC	-			A3	PT5B	0	C		A3	PT5B	0	C	
B3	NC	-			B3	PT5A	0	T		B3	PT5A	0	T	
F6	NC	-			F6	PT4B	0	C		F6	PT4B	0	C	
D5	NC	-			D5	PT4A	0	T		D5	PT4A	0	T	
F7	NC	-			F7	PT3B	0	C		F7	PT3B	0	C	
E8	NC	-			E8	PT3A	0	T		E8	PT3A	0	T	
G6	NC	-			G6	PT2B	0	C		G6	PT2B	0	C	
E7	NC	-			E7	PT2A	0	T		E7	PT2A	0	T	
GND	-	-			GND	GND0	0			GND	GND0	0		
A1	GND	-			A1	GND	-			A1	GND	-		
A22	GND	-			A22	GND	-			A22	GND	-		
AB1	GND	-			AB1	GND	-			AB1	GND	-		
AB22	GND	-			AB22	GND	-			AB22	GND	-		
H15	GND	-			H15	GND	-			H15	GND	-		
H8	GND	-			H8	GND	-			H8	GND	-		
J10	GND	-			J10	GND	-			J10	GND	-		
J11	GND	-			J11	GND	-			J11	GND	-		
J12	GND	-			J12	GND	-			J12	GND	-		
J13	GND	-			J13	GND	-			J13	GND	-		
J14	GND	-			J14	GND	-			J14	GND	-		
J9	GND	-			J9	GND	-			J9	GND	-		
K10	GND	-			K10	GND	-			K10	GND	-		
K11	GND	-			K11	GND	-			K11	GND	-		
K12	GND	-			K12	GND	-			K12	GND	-		
K13	GND	-			K13	GND	-			K13	GND	-		
K14	GND	-			K14	GND	-			K14	GND	-		
K9	GND	-			K9	GND	-			K9	GND	-		
L10	GND	-			L10	GND	-			L10	GND	-		
L11	GND	-			L11	GND	-			L11	GND	-		
L12	GND	-			L12	GND	-			L12	GND	-		
L13	GND	-			L13	GND	-			L13	GND	-		
L14	GND	-			L14	GND	-			L14	GND	-		
L9	GND	-			L9	GND	-			L9	GND	-		
M10	GND	-			M10	GND	-			M10	GND	-		
M11	GND	-			M11	GND	-			M11	GND	-		
M12	GND	-			M12	GND	-			M12	GND	-		
M13	GND	-			M13	GND	-			M13	GND	-		
M14	GND	-			M14	GND	-			M14	GND	-		
M9	GND	-			M9	GND	-			M9	GND	-		
N10	GND	-			N10	GND	-			N10	GND	-		
N11	GND	-			N11	GND	-			N11	GND	-		
N12	GND	-			N12	GND	-			N12	GND	-		



**LFCEP/EC20 and LFCEP/EC33 Logic Signal Connections: 484 fpBGA**

LFCEP20/LFCEP20					LFCEP/LFCEP33				
Ball Number	Ball Function	Bank	LVD S	Dual Function	Ball Number	Ball Function	Bank	LVD S	Dual Function
GND	GND7	7			GND	GND7	7		
D4	PL2A	7	T	VREF2_7	D4	PL2A	7	T	VREF2_7
E4	PL2B	7	C	VREF1_7	E4	PL2B	7	C	VREF1_7
GND	-	-			GND	GND7	7		
C3	PL3A	7	T		C3	PL10A	7	T	
B2	PL3B	7	C		B2	PL10B	7	C	
E5	PL4A	7	T		E5	PL11A	7	T	
F5	PL4B	7	C		F5	PL11B	7	C	
D3	PL5A	7	T		D3	PL12A	7	T	
C2	PL5B	7	C		C2	PL12B	7	C	
GND	-	-			GND	GND7	7		
F4	PL6A	7	T	LDQS6	F4	PL14A	7	T	LDQS14
G4	PL6B	7	C		G4	PL14B	7	C	
E3	PL7A	7	T		E3	PL15A	7	T	
D2	PL7B	7	C		D2	PL15B	7	C	
B1	PL8A	7	T	LUM0_PLLT_IN_A	B1	PL16A	7	T	LUM0_PLLT_IN_A
C1	PL8B	7	C	LUM0_PLLC_IN_A	C1	PL16B	7	C	LUM0_PLLC_IN_A
F3	PL9A	7	T	LUM0_PLLT_FB_A	F3	PL17A	7	T	LUM0_PLLT_FB_A
GND	GND7	7			GND	GND7	7		
E2	PL9B	7	C	LUM0_PLLC_FB_A	E2	PL17B	7	C	LUM0_PLLC_FB_A
GND	-	-			GND	GND7	7		
G5	PL11A	7	T		G5	PL23A	7	T	LDQS23
H6	PL11B	7	C		H6	PL23B	7	C	
G3	PL12A	7	T		G3	PL24A	7	T	
H4	PL12B	7	C		H4	PL24B	7	C	
J5	PL13A	7	T		J5	PL25A	7	T	
H5	PL13B	7	C		H5	PL25B	7	C	
F2	PL14A	7	T		F2	PL26A	7	T	
GND	GND7	7			GND	GND7	7		
F1	PL14B	7	C		F1	PL26B	7	C	
E1	PL15A	7	T		E1	PL27A	7	T	
D1	PL15B	7	C		D1	PL27B	7	C	
H3	PL16A	7	T		H3	PL28A	7	T	
G2	PL16B	7	C		G2	PL28B	7	C	
H2	PL17A	7	T		H2	PL29A	7	T	
G1	PL17B	7	C		G1	PL29B	7	C	
J4	PL18A	7	T		J4	PL30A	7	T	
GND	GND7	7			GND	GND7	7		
J3	PL18B	7	C		J3	PL30B	7	C	
J2	PL19A	7	T	LDQS19	J2	PL31A	7	T	LDQS31
H1	PL19B	7	C		H1	PL31B	7	C	
K4	PL20A	7	T		K4	PL32A	7	T	
K5	PL20B	7	C		K5	PL32B	7	C	

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

LFECP20/LFEC20					LFECP/LFEC33				
Ball Number	Ball Function	Bank	LVD S	Dual Function	Ball Number	Ball Function	Bank	LVD S	Dual Function
N22	PR30A	3	T		N22	PR42A	3	T	
N19	PR29B	3	C		N19	PR41B	3	C	
N18	PR29A	3	T		N18	PR41A	3	T	
M21	PR28B	3	C		M21	PR40B	3	C	
L20	PR28A	3	T	RDQS28	L20	PR40A	3	T	RDQS40
L21	PR27B	3	C		L21	PR39B	3	C	
GND	GND3	3			GND	GND3	3		
M20	PR27A	3	T		M20	PR39A	3	T	
M18	PR26B	3	C		M18	PR38B	3	C	
M19	PR26A	3	T		M19	PR38A	3	T	
M22	PR25B	3	C		M22	PR37B	3	C	
L22	PR25A	3	T		L22	PR37A	3	T	
K22	PR24B	3	C		K22	PR36B	3	C	
K21	PR24A	3	T		K21	PR36A	3	T	
J22	PR22B	2	C	PCLKC2_0	J22	PR34B	2	C	PCLKC2_0
GND	GND2	2			GND	GND2	2		
J21	PR22A	2	T	PCLKT2_0	J21	PR34A	2	T	PCLKT2_0
H22	PR21B	2	C		H22	PR33B	2	C	
H21	PR21A	2	T		H21	PR33A	2	T	
L19	PR20B	2	C		L19	PR32B	2	C	
L18	PR20A	2	T		L18	PR32A	2	T	
K20	PR19B	2	C		K20	PR31B	2	C	
J20	PR19A	2	T	RDQS19	J20	PR31A	2	T	RDQS31
K19	PR18B	2	C		K19	PR30B	2	C	
GND	GND2	2			GND	GND2	2		
K18	PR18A	2	T		K18	PR30A	2	T	
G22	PR17B	2	C		G22	PR29B	2	C	
F22	PR17A	2	T		F22	PR29A	2	T	
F21	PR16B	2	C		F21	PR28B	2	C	
E22	PR16A	2	T		E22	PR28A	2	T	
E21	PR15B	2	C		E21	PR27B	2	C	
D22	PR15A	2	T		D22	PR27A	2	T	
G21	PR14B	2	C		G21	PR26B	2	C	
G20	PR14A	2	T		G20	PR26A	2	T	
GND	GND2	2			GND	GND2	2		
J18	PR13B	2	C		J18	PR25B	2	C	
H19	PR13A	2	T		H19	PR25A	2	T	
J19	PR12B	2	C		J19	PR24B	2	C	
H20	PR12A	2	T		H20	PR24A	2	T	
H17	PR11B	2	C		H17	PR23B	2	C	
H18	PR11A	2	T		H18	PR23A	2	T	RDQS23
D21	PR9B	2	C	RUM0_PLLC_FB_A	D21	PR17B	2	C	RUM0_PLLC_FB_A
GND	GND2	2			GND	GND2	2		
GND	-	-			GND	GND2	2		

**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	

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

LFCEP/EC20					LFCEP/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/Balls	Temp.	LUTs
LFEC10E-4FN256C	195	-4	Lead-Free fpBGA	256	COM	10.2K
LFEC10E-5FN256C	195	-5	Lead-Free fpBGA	256	COM	10.2K
LFEC10E-3QN208C	147	-3	Lead-Free PQFP	208	COM	10.2K
LFEC10E-4QN208C	147	-4	Lead-Free PQFP	208	COM	10.2K
LFEC10E-5QN208C	147	-5	Lead-Free PQFP	208	COM	10.2K

Part Number	I/Os	Grade	Package	Pins/Balls	Temp.	LUTs
LFEC15E-3FN484C	352	-3	Lead-Free fpBGA	484	COM	15.3K
LFEC15E-4FN484C	352	-4	Lead-Free fpBGA	484	COM	15.3K
LFEC15E-5FN484C	352	-5	Lead-Free fpBGA	484	COM	15.3K
LFEC15E-3FN256C	195	-3	Lead-Free fpBGA	256	COM	15.3K
LFEC15E-4FN256C	195	-4	Lead-Free fpBGA	256	COM	15.3K
LFEC15E-5FN256C	195	-5	Lead-Free fpBGA	256	COM	15.3K

Part Number	I/Os	Grade	Package	Pins/Balls	Temp.	LUTs
LFEC20E-3FN672C	400	-3	Lead-Free fpBGA	672	COM	19.7K
LFEC20E-4FN672C	400	-4	Lead-Free fpBGA	672	COM	19.7K
LFEC20E-5FN672C	400	-5	Lead-Free fpBGA	672	COM	19.7K
LFEC20E-3FN484C	360	-3	Lead-Free fpBGA	484	COM	19.7K
LFEC20E-4FN484C	360	-4	Lead-Free fpBGA	484	COM	19.7K
LFEC20E-5FN484C	360	-5	Lead-Free fpBGA	484	COM	19.7K

Part Number	I/Os	Grade	Package	Pins/Balls	Temp.	LUTs
LFEC33E-3FN672C	496	-3	Lead-Free fpBGA	672	COM	32.8K
LFEC33E-4FN672C	496	-4	Lead-Free fpBGA	672	COM	32.8K
LFEC33E-5FN672C	496	-5	Lead-Free fpBGA	672	COM	32.8K
LFEC33E-3FN484C	360	-3	Lead-Free fpBGA	484	COM	32.8K
LFEC33E-4FN484C	360	-4	Lead-Free fpBGA	484	COM	32.8K
LFEC33E-5FN484C	360	-5	Lead-Free fpBGA	484	COM	32.8K