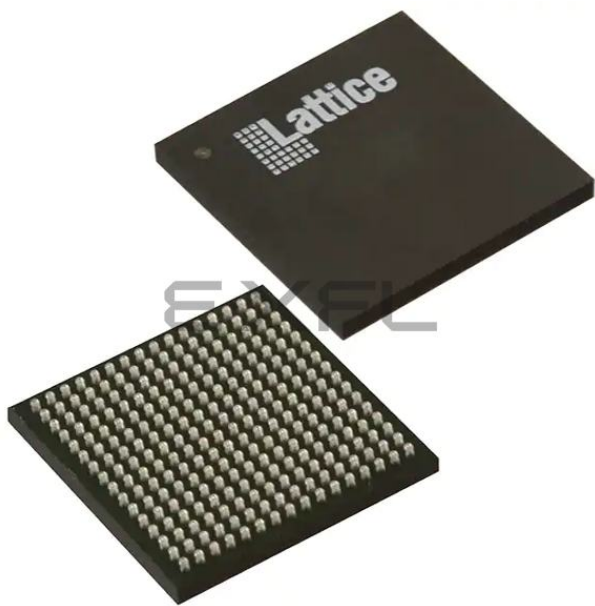




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## Understanding [Embedded - FPGAs \(Field Programmable Gate Array\)](#)

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            | 285                                                                                                                                                                     |
| Number of Logic Elements/Cells | 2280                                                                                                                                                                    |
| Total RAM Bits                 | 28262                                                                                                                                                                   |
| Number of I/O                  | 211                                                                                                                                                                     |
| Number of Gates                | -                                                                                                                                                                       |
| Voltage - Supply               | 1.71V ~ 3.465V                                                                                                                                                          |
| Mounting Type                  | Surface Mount                                                                                                                                                           |
| Operating Temperature          | -40°C ~ 100°C (TJ)                                                                                                                                                      |
| Package / Case                 | 256-LFBGA, CSPBGA                                                                                                                                                       |
| Supplier Device Package        | 256-CABGA (14x14)                                                                                                                                                       |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/lattice-semiconductor/lcmxo2280c-3b256i">https://www.e-xfl.com/product-detail/lattice-semiconductor/lcmxo2280c-3b256i</a> |

## Architecture Overview

The MachXO family architecture contains an array of logic blocks surrounded by Programmable I/O (PIO). Some devices in this family have sysCLOCK PLLs and blocks of sysMEM™ Embedded Block RAM (EBRs). Figures 2-1, 2-2, and 2-3 show the block diagrams of the various family members.

The logic blocks are arranged in a two-dimensional grid with rows and columns. The EBR blocks are arranged in a column to the left of the logic array. The PIO cells are located at the periphery of the device, arranged into Banks. The PIOs utilize a flexible I/O buffer referred to as a sysIO interface that supports operation with a variety of interface standards. The blocks are connected with many vertical and horizontal routing channel resources. The place and route software tool automatically allocates these routing resources.

There are two kinds of logic blocks, the Programmable Functional Unit (PFU) and the Programmable Functional unit without RAM (PFF). The PFU contains the building blocks for logic, arithmetic, RAM, ROM, and register functions. The PFF block contains building blocks for logic, arithmetic, ROM, and register functions. Both the PFU and PFF blocks are optimized for flexibility, allowing complex designs to be implemented quickly and effectively. Logic blocks are arranged in a two-dimensional array. Only one type of block is used per row.

In the MachXO family, the number of sysIO Banks varies by device. There are different types of I/O Buffers on different Banks. See the details in later sections of this document. The sysMEM EBRs are large, dedicated fast memory blocks; these blocks are found only in the larger devices. These blocks can be configured as RAM, ROM or FIFO. FIFO support includes dedicated FIFO pointer and flag “hard” control logic to minimize LUT use.

The MachXO registers in PFU and sysI/O can be configured to be SET or RESET. After power up and device is configured, the device enters into user mode with these registers SET/RESET according to the configuration setting, allowing device entering to a known state for predictable system function.

The MachXO architecture provides up to two sysCLOCK™ Phase Locked Loop (PLL) blocks on larger devices. These blocks are located at either end of the memory blocks. The PLLs have multiply, divide, and phase shifting capabilities that are used to manage the frequency and phase relationships of the clocks.

Every device in the family has a JTAG Port that supports programming and configuration of the device as well as access to the user logic. The MachXO devices are available for operation from 3.3V, 2.5V, 1.8V, and 1.2V power supplies, providing easy integration into the overall system.

## sysCLOCK Phase Locked Loops (PLLs)

The MachXO1200 and MachXO2280 provide PLL support. The source of the PLL input divider can come from an external pin or from internal routing. There are four sources of feedback signals to the feedback divider: from CLKINTFB (internal feedback port), from the global clock nets, from the output of the post scalar divider, and from the routing (or from an external pin). There is a PLL\_LOCK signal to indicate that the PLL has locked on to the input clock signal. Figure 2-10 shows the sysCLOCK PLL diagram.

The setup and hold times of the device can be improved by programming a delay in the feedback or input path of the PLL which will advance or delay the output clock with reference to the input clock. This delay can be either programmed during configuration or can be adjusted dynamically. In dynamic mode, the PLL may lose lock after adjustment and not relock until the  $t_{LOCK}$  parameter has been satisfied. Additionally, the phase and duty cycle block allows the user to adjust the phase and duty cycle of the CLKOS output.

The sysCLOCK PLLs provide the ability to synthesize clock frequencies. Each PLL has four dividers associated with it: input clock divider, feedback divider, post scalar divider, and secondary clock divider. The input clock divider is used to divide the input clock signal, while the feedback divider is used to multiply the input clock signal. The post scalar divider allows the VCO to operate at higher frequencies than the clock output, thereby increasing the frequency range. The secondary divider is used to derive lower frequency outputs.

**Figure 2-10. PLL Diagram**

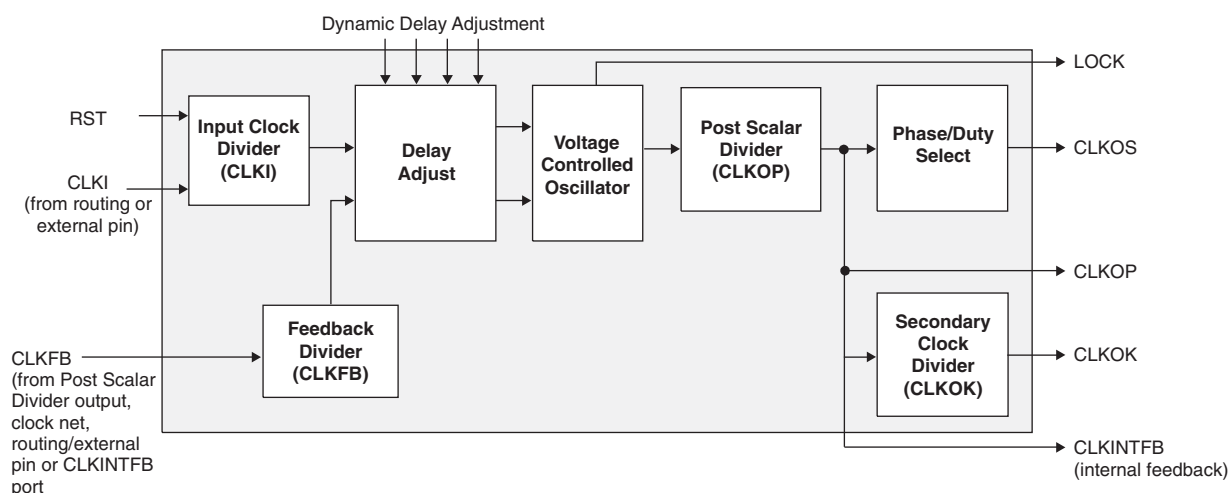
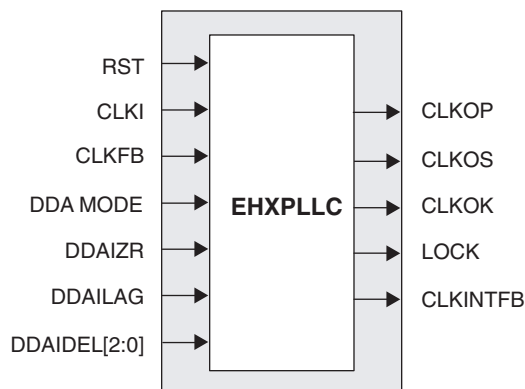


Figure 2-11 shows the available macros for the PLL. Table 2-5 provides signal description of the PLL Block.

**Figure 2-11. PLL Primitive**



**Table 2-5. PLL Signal Descriptions**

| Signal       | I/O | Description                                                                                                 |
|--------------|-----|-------------------------------------------------------------------------------------------------------------|
| CLKI         | I   | Clock input from external pin or routing                                                                    |
| CLKFB        | I   | PLL feedback input from PLL output, clock net, routing/external pin or internal feedback from CLKINTFB port |
| RST          | I   | "1" to reset the input clock divider                                                                        |
| CLKOS        | O   | PLL output clock to clock tree (phase shifted/duty cycle changed)                                           |
| CLKOP        | O   | PLL output clock to clock tree (No phase shift)                                                             |
| CLKOK        | O   | PLL output to clock tree through secondary clock divider                                                    |
| LOCK         | O   | "1" indicates PLL LOCK to CLKI                                                                              |
| CLKINTFB     | O   | Internal feedback source, CLKOP divider output before CLOCKTREE                                             |
| DDAMODE      | I   | Dynamic Delay Enable. "1": Pin control (dynamic), "0": Fuse Control (static)                                |
| DDAIZR       | I   | Dynamic Delay Zero. "1": delay = 0, "0": delay = on                                                         |
| DDAILAG      | I   | Dynamic Delay Lag/Lead. "1": Lag, "0": Lead                                                                 |
| DDAIDEL[2:0] | I   | Dynamic Delay Input                                                                                         |

For more information on the PLL, please see details of additional technical documentation at the end of this data sheet.

## sysMEM Memory

The MachXO1200 and MachXO2280 devices contain sysMEM Embedded Block RAMs (EBRs). The EBR consists of a 9-Kbit RAM, with dedicated input and output registers.

### sysMEM Memory Block

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

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

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

**Table 2-10. Supported Output Standards**

| Output Standard                | Drive                | V <sub>CCIO</sub> (Typ.) |
|--------------------------------|----------------------|--------------------------|
| <b>Single-ended Interfaces</b> |                      |                          |
| LVTTTL                         | 4mA, 8mA, 12mA, 16mA | 3.3                      |
| LVC MOS33                      | 4mA, 8mA, 12mA, 14mA | 3.3                      |
| LVC MOS25                      | 4mA, 8mA, 12mA, 14mA | 2.5                      |
| LVC MOS18                      | 4mA, 8mA, 12mA, 14mA | 1.8                      |
| LVC MOS15                      | 4mA, 8mA             | 1.5                      |
| LVC MOS12                      | 2mA, 6mA             | 1.2                      |
| LVC MOS33, Open Drain          | 4mA, 8mA, 12mA, 14mA | —                        |
| LVC MOS25, Open Drain          | 4mA, 8mA, 12mA, 14mA | —                        |
| LVC MOS18, Open Drain          | 4mA, 8mA, 12mA, 14mA | —                        |
| LVC MOS15, Open Drain          | 4mA, 8mA             | —                        |
| LVC MOS12, Open Drain          | 2mA, 6mA             | —                        |
| PCI33 <sup>3</sup>             | N/A                  | 3.3                      |
| <b>Differential Interfaces</b> |                      |                          |
| LVDS <sup>1, 2</sup>           | N/A                  | 2.5                      |
| BLVDS, RSDS <sup>2</sup>       | N/A                  | 2.5                      |
| LVPECL <sup>2</sup>            | N/A                  | 3.3                      |

1. MachXO1200 and MachXO2280 devices have dedicated LVDS buffers.

2. These interfaces can be emulated with external resistors in all devices.

3. Top Banks of MachXO1200 and MachXO2280 devices only.

## sysIO Buffer Banks

The number of Banks vary between the devices of this family. Eight Banks surround the two larger devices, the MachXO1200 and MachXO2280 (two Banks per side). The MachXO640 has four Banks (one Bank per side). The smallest member of this family, the MachXO256, has only two Banks.

Each sysIO buffer Bank is capable of supporting multiple I/O standards. Each Bank has its own I/O supply voltage (V<sub>CCIO</sub>) which allows it to be completely independent from the other Banks. Figure 2-18, Figure 2-18, Figure 2-20 and Figure 2-21 shows the sysIO Banks and their associated supplies for all devices.

Figure 2-18. MachXO2280 Banks

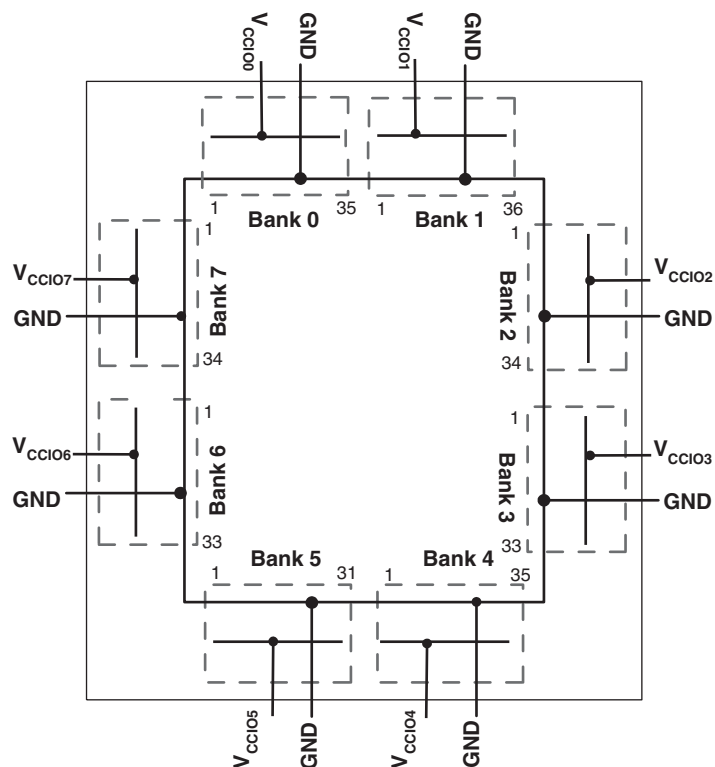
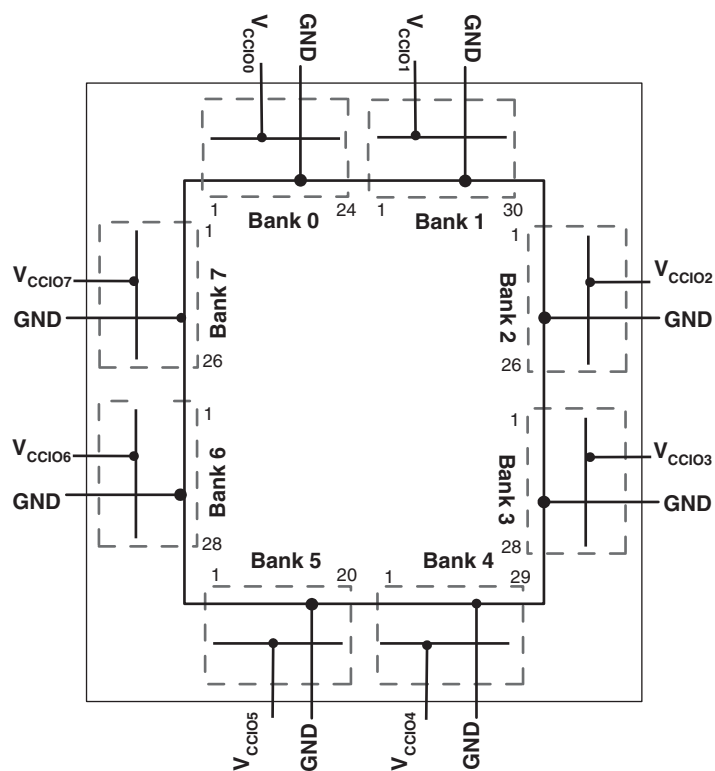


Figure 2-19. MachXO1200 Banks



the system. These capabilities make the MachXO ideal for many multiple power supply and hot-swap applications.

## Sleep Mode

The MachXO “C” devices ( $V_{CC} = 1.8/2.5/3.3V$ ) have a sleep mode that allows standby current to be reduced dramatically during periods of system inactivity. Entry and exit to Sleep mode is controlled by the SLEEPN pin.

During Sleep mode, the logic is non-operational, registers and EBR contents are not maintained, and I/Os are tri-stated. Do not enter Sleep mode during device programming or configuration operation. In Sleep mode, power supplies are in their normal operating range, eliminating the need for external switching of power supplies. Table 2-11 compares the characteristics of Normal, Off and Sleep modes.

**Table 2-11. Characteristics of Normal, Off and Sleep Modes**

| Characteristic                  | Normal        | Off             | Sleep           |
|---------------------------------|---------------|-----------------|-----------------|
| SLEEPN Pin                      | High          | —               | Low             |
| Static Icc                      | Typical <10mA | 0               | Typical <100uA  |
| I/O Leakage                     | <10μA         | <1mA            | <10μA           |
| Power Supplies VCC/VCCIO/VCCAUX | Normal Range  | 0               | Normal Range    |
| Logic Operation                 | User Defined  | Non Operational | Non operational |
| I/O Operation                   | User Defined  | Tri-state       | Tri-state       |
| JTAG and Programming circuitry  | Operational   | Non-operational | Non-operational |
| EBR Contents and Registers      | Maintained    | Non-maintained  | Non-maintained  |

## SLEEPN Pin Characteristics

The SLEEPN pin behaves as an LVCMOS input with the voltage standard appropriate to the VCC supply for the device. This pin also has a weak pull-up, along with a Schmidt trigger and glitch filter to prevent false triggering. An external pull-up to VCC is recommended when Sleep Mode is not used to ensure the device stays in normal operation mode. Typically, the device enters sleep mode several hundred nanoseconds after SLEEPN is held at a valid low and restarts normal operation as specified in the Sleep Mode Timing table. The AC and DC specifications portion of this data sheet shows a detailed timing diagram.

## Oscillator

Every MachXO device has an internal CMOS oscillator. The oscillator can be routed as an input clock to the clock tree or to general routing resources. The oscillator frequency can be divided by internal logic. There is a dedicated programming bit to enable/disable the oscillator. The oscillator frequency ranges from 18MHz to 26MHz.

## Configuration and Testing

The following section describes the configuration and testing features of the MachXO family of devices.

### IEEE 1149.1-Compliant Boundary Scan Testability

All MachXO devices have boundary scan cells that are accessed through an IEEE 1149.1 compliant test access port (TAP). This allows functional testing of the circuit board, on which the device is mounted, through a serial scan path that can access all critical logic nodes. Internal registers are linked internally, allowing test data to 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 shares its power supply with one of the VCCIO Banks (MachXO256:  $V_{CCIO1}$ ; MachXO640:  $V_{CCIO2}$ ; MachXO1200 and MachXO2280:  $V_{CCIO5}$ ) 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 MachXO devices contain a test access port that can be used for device configuration and programming.

The non-volatile memory in the MachXO can be configured in two different modes:

- In IEEE 1532 mode via the IEEE 1149.1 port. In this mode, the device is off-line and I/Os are controlled by BSCAN registers.
- In background mode via the IEEE 1149.1 port. This allows the device to remain operational in user mode while reprogramming takes place.

The SRAM configuration memory can be configured in three different ways:

- At power-up via the on-chip non-volatile memory.
- After a refresh command is issued via the IEEE 1149.1 port.
- In IEEE 1532 mode via the IEEE 1149.1 port.

Figure 2-22 provides a pictorial representation of the different programming modes available in the MachXO devices. On power-up, the SRAM is ready to be configured with IEEE 1149.1 serial TAP port using IEEE 1532 protocols.

### Leave Alone I/O

When using IEEE 1532 mode for non-volatile memory programming, SRAM configuration, or issuing a refresh command, users may specify I/Os as high, low, tristated or held at current value. This provides excellent flexibility for implementing systems where reconfiguration or reprogramming occurs on-the-fly.

### TransFR (Transparent Field Reconfiguration)

TransFR (TFR) is a unique Lattice technology that allows users to update their logic in the field without interrupting system operation using a single ispVM command. See TN1087, [Minimizing System Interruption During Configuration Using TransFR Technology](#) for details.

### Security

The MachXO devices contain security bits that, when set, prevent the readback of the SRAM configuration and non-volatile memory spaces. Once set, the only way to clear the security bits is to erase the memory space.

For more information on device configuration, please see details of additional technical documentation at the end of this data sheet.

### sysCLOCK PLL Timing

#### Over Recommended Operating Conditions

| Parameter                       | Descriptions                          | Conditions                                                          | Min.  | Max.   | Units |
|---------------------------------|---------------------------------------|---------------------------------------------------------------------|-------|--------|-------|
| f <sub>IN</sub>                 | Input Clock Frequency (CLKI, CLKFB)   |                                                                     | 25    | 420    | MHz   |
|                                 |                                       | Input Divider (M) = 1;<br>Feedback Divider (N) <= 4 <sup>5, 6</sup> | 18    | 25     | MHz   |
| f <sub>OUT</sub>                | Output Clock Frequency (CLKOP, CLKOS) |                                                                     | 25    | 420    | MHz   |
| f <sub>OUT2</sub>               | K-Divider Output Frequency (CLKOK)    |                                                                     | 0.195 | 210    | MHz   |
| f <sub>VCO</sub>                | PLL VCO Frequency                     |                                                                     | 420   | 840    | MHz   |
| f <sub>PFD</sub>                | Phase Detector Input Frequency        |                                                                     | 25    | —      | MHz   |
|                                 |                                       | Input Divider (M) = 1;<br>Feedback Divider (N) <= 4 <sup>5, 6</sup> | 18    | 25     | MHz   |
| AC Characteristics              |                                       |                                                                     |       |        |       |
| t <sub>DT</sub>                 | Output Clock Duty Cycle               | Default duty cycle selected <sup>3</sup>                            | 45    | 55     | %     |
| t <sub>PH</sub> <sup>4</sup>    | Output Phase Accuracy                 |                                                                     | —     | 0.05   | UI    |
| t <sub>OPJIT</sub> <sup>1</sup> | Output Clock Period Jitter            | f <sub>OUT</sub> >= 100 MHz                                         | —     | +/-120 | ps    |
|                                 |                                       | f <sub>OUT</sub> < 100 MHz                                          | —     | 0.02   | UIPP  |
| t <sub>SK</sub>                 | Input Clock to Output Clock Skew      | Divider ratio = integer                                             | —     | +/-200 | ps    |
| t <sub>W</sub>                  | Output Clock Pulse Width              | At 90% or 10% <sup>3</sup>                                          | 1     | —      | ns    |
| t <sub>LOCK</sub> <sup>2</sup>  | PLL Lock-in Time                      |                                                                     | —     | 150    | μs    |
| t <sub>PA</sub>                 | Programmable Delay Unit               |                                                                     | 100   | 450    | ps    |
| t <sub>IPJIT</sub>              | Input Clock Period Jitter             | f <sub>OUT</sub> ≥ 100 MHz                                          | —     | +/-200 | ps    |
|                                 |                                       | f <sub>OUT</sub> < 100 MHz                                          | —     | 0.02   | UI    |
| t <sub>FBKDLY</sub>             | External Feedback Delay               |                                                                     | —     | 10     | ns    |
| t <sub>HI</sub>                 | Input Clock High Time                 | 90% to 90%                                                          | 0.5   | —      | ns    |
| t <sub>LO</sub>                 | Input Clock Low Time                  | 10% to 10%                                                          | 0.5   | —      | ns    |
| t <sub>RST</sub>                | RST Pulse Width                       |                                                                     | 10    | —      | ns    |

1. Jitter sample is taken over 10,000 samples of the primary PLL output with a clean reference clock.

2. Output clock is valid after  $t_{LOCK}$  for PLL reset and dynamic delay adjustment.

3. Using LVDS output buffers.

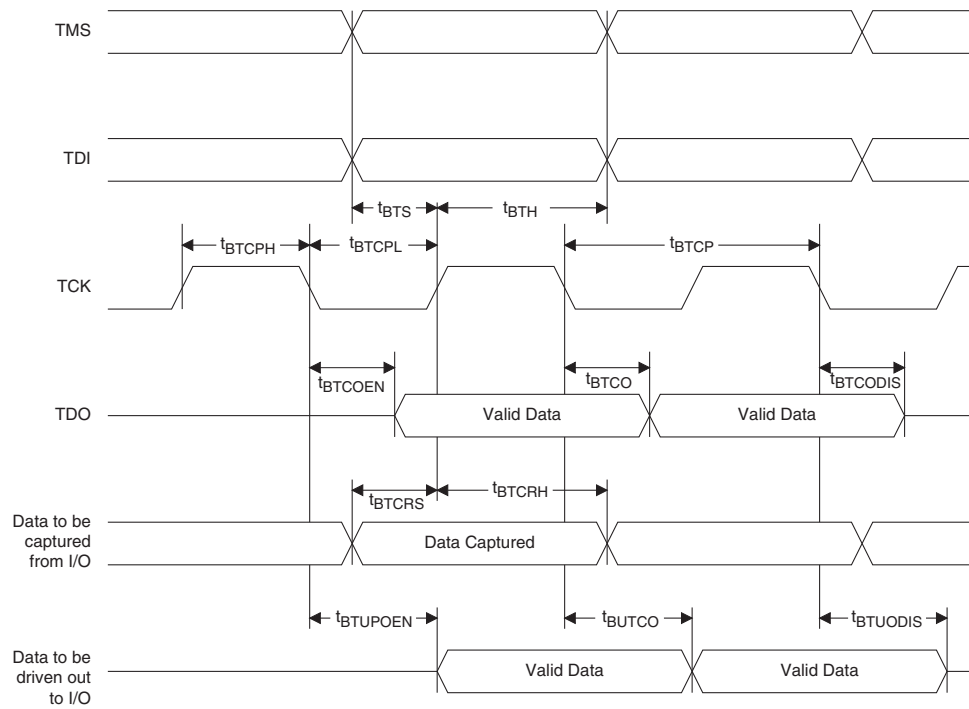
4. CLKOS as compared to CLKOP output.

5. When using an input frequency less than 25 MHz the output frequency must be less than or equal to 4 times the input frequency.

6. The on-chip oscillator can be used to provide reference clock input to the PLL provided the output frequency restriction for clock inputs below 25 MHz are followed.

Rev. A 0.19

**Figure 3-5. JTAG Port Timing Waveforms**



**LCMX0256 and LCMX0640 Logic Signal Connections: 100 TQFP**

| Pin Number | LCMX0256      |      |               |              | LCMX0640      |      |               |              |
|------------|---------------|------|---------------|--------------|---------------|------|---------------|--------------|
|            | Ball Function | Bank | Dual Function | Differential | Ball Function | Bank | Dual Function | Differential |
| 1          | PL2A          | 1    |               | T            | PL2A          | 3    |               | T            |
| 2          | PL2B          | 1    |               | C            | PL2C          | 3    |               | T            |
| 3          | PL3A          | 1    |               | T            | PL2B          | 3    |               | C            |
| 4          | PL3B          | 1    |               | C            | PL2D          | 3    |               | C            |
| 5          | PL3C          | 1    |               | T            | PL3A          | 3    |               | T            |
| 6          | PL3D          | 1    |               | C            | PL3B          | 3    |               | C            |
| 7          | PL4A          | 1    |               | T            | PL3C          | 3    |               | T            |
| 8          | PL4B          | 1    |               | C            | PL3D          | 3    |               | C            |
| 9          | PL5A          | 1    |               | T            | PL4A          | 3    |               |              |
| 10         | VCCIO1        | 1    |               |              | VCCIO3        | 3    |               |              |
| 11         | PL5B          | 1    |               | C            | PL4C          | 3    |               | T            |
| 12         | GNDIO1        | 1    |               |              | GNDIO3        | 3    |               |              |
| 13         | PL5C          | 1    |               | T            | PL4D          | 3    |               | C            |
| 14         | PL5D          | 1    | GSRN          | C            | PL5B          | 3    | GSRN          |              |
| 15         | PL6A          | 1    |               | T            | PL7B          | 3    |               |              |
| 16         | PL6B          | 1    | TSALL         | C            | PL8C          | 3    | TSALL         | T            |
| 17         | PL7A          | 1    |               | T            | PL8D          | 3    |               | C            |
| 18         | PL7B          | 1    |               | C            | PL9A          | 3    |               |              |
| 19         | PL7C          | 1    |               | T            | PL9C          | 3    |               |              |
| 20         | PL7D          | 1    |               | C            | PL10A         | 3    |               |              |
| 21         | PL8A          | 1    |               | T            | PL10C         | 3    |               |              |
| 22         | PL8B          | 1    |               | C            | PL11A         | 3    |               |              |
| 23         | PL9A          | 1    |               | T            | PL11C         | 3    |               |              |
| 24         | VCCIO1        | 1    |               |              | VCCIO3        | 3    |               |              |
| 25         | GNDIO1        | 1    |               |              | GNDIO3        | 3    |               |              |
| 26         | TMS           | 1    | TMS           |              | TMS           | 2    | TMS           |              |
| 27         | PL9B          | 1    |               | C            | PB2C          | 2    |               |              |
| 28         | TCK           | 1    | TCK           |              | TCK           | 2    | TCK           |              |
| 29         | PB2A          | 1    |               | T            | VCCIO2        | 2    |               |              |
| 30         | PB2B          | 1    |               | C            | GNDIO2        | 2    |               |              |
| 31         | TDO           | 1    | TDO           |              | TDO           | 2    | TDO           |              |
| 32         | PB2C          | 1    |               | T            | PB4C          | 2    |               |              |
| 33         | TDI           | 1    | TDI           |              | TDI           | 2    | TDI           |              |
| 34         | PB2D          | 1    |               | C            | PB4E          | 2    |               |              |
| 35         | VCC           | -    |               |              | VCC           | -    |               |              |
| 36         | PB3A          | 1    | PCLK1_1**     | T            | PB5B          | 2    | PCLK2_1**     |              |
| 37         | PB3B          | 1    |               | C            | PB5D          | 2    |               |              |
| 38         | PB3C          | 1    | PCLK1_0**     | T            | PB6B          | 2    | PCLK2_0**     |              |
| 39         | PB3D          | 1    |               | C            | PB6C          | 2    |               |              |
| 40         | GND           | -    |               |              | GND           | -    |               |              |
| 41         | VCCIO1        | 1    |               |              | VCCIO2        | 2    |               |              |
| 42         | GNDIO1        | 1    |               |              | GNDIO2        | 2    |               |              |

**LCMX0256 and LCMX0640 Logic Signal Connections: 100 csBGA (Cont.)**

| LCMX0256    |               |      |               |              | LCMX0640    |               |      |               |              |
|-------------|---------------|------|---------------|--------------|-------------|---------------|------|---------------|--------------|
| Ball Number | Ball Function | Bank | Dual Function | Differential | Ball Number | Ball Function | Bank | Dual Function | Differential |
| P13         | PB5A          | 1    |               |              | P13         | PB9C          | 2    |               | T            |
| M12*        | SLEEPN        | -    | SLEEPN        |              | M12*        | SLEEPN        | -    | SLEEPN        |              |
| P14         | PB5C          | 1    |               | T            | P14         | PB9D          | 2    |               | C            |
| N13         | PB5D          | 1    |               | C            | N13         | PB9F          | 2    |               |              |
| N14         | PR9B          | 0    |               | C            | N14         | PR11D         | 1    |               | C            |
| M14         | PR9A          | 0    |               | T            | M14         | PR11B         | 1    |               | C            |
| L13         | PR8B          | 0    |               | C            | L13         | PR11C         | 1    |               | T            |
| L14         | PR8A          | 0    |               | T            | L14         | PR11A         | 1    |               | T            |
| M13         | PR7D          | 0    |               | C            | M13         | PR10D         | 1    |               | C            |
| K14         | PR7C          | 0    |               | T            | K14         | PR10C         | 1    |               | T            |
| K13         | PR7B          | 0    |               | C            | K13         | PR10B         | 1    |               | C            |
| J14         | PR7A          | 0    |               | T            | J14         | PR10A         | 1    |               | T            |
| J13         | PR6B          | 0    |               | C            | J13         | PR9D          | 1    |               |              |
| H13         | PR6A          | 0    |               | T            | H13         | PR9B          | 1    |               |              |
| G14         | GNDIO0        | 0    |               |              | G14         | GNDIO1        | 1    |               |              |
| G13         | PR5D          | 0    |               | C            | G13         | PR7B          | 1    |               |              |
| F14         | PR5C          | 0    |               | T            | F14         | PR6C          | 1    |               |              |
| F13         | PR5B          | 0    |               | C            | F13         | PR6B          | 1    |               |              |
| E14         | PR5A          | 0    |               | T            | E14         | PR5D          | 1    |               |              |
| E13         | PR4B          | 0    |               | C            | E13         | PR5B          | 1    |               |              |
| D14         | PR4A          | 0    |               | T            | D14         | PR4D          | 1    |               |              |
| D13         | PR3D          | 0    |               | C            | D13         | PR4B          | 1    |               |              |
| C14         | PR3C          | 0    |               | T            | C14         | PR3D          | 1    |               |              |
| C13         | PR3B          | 0    |               | C            | C13         | PR3B          | 1    |               |              |
| B14         | PR3A          | 0    |               | T            | B14         | PR2D          | 1    |               |              |
| C12         | PR2B          | 0    |               | C            | C12         | PR2B          | 1    |               |              |
| B13         | GNDIO0        | 0    |               |              | B13         | GNDIO1        | 1    |               |              |
| A13         | PR2A          | 0    |               | T            | A13         | PT9F          | 0    |               | C            |
| A12         | PT5C          | 0    |               |              | A12         | PT9E          | 0    |               | T            |
| B11         | PT5B          | 0    |               | C            | B11         | PT9C          | 0    |               |              |
| A11         | PT5A          | 0    |               | T            | A11         | PT9A          | 0    |               |              |
| B12         | PT4F          | 0    |               | C            | B12         | VCCIO0        | 0    |               |              |
| A10         | PT4E          | 0    |               | T            | A10         | GNDIO0        | 0    |               |              |
| B10         | PT4D          | 0    |               | C            | B10         | PT7E          | 0    |               |              |
| A9          | PT4C          | 0    |               | T            | A9          | PT7A          | 0    |               |              |
| A8          | PT4B          | 0    | PCLK0_1**     | C            | A8          | PT6B          | 0    | PCLK0_1**     |              |
| B8          | PT4A          | 0    | PCLK0_0**     | T            | B8          | PT5B          | 0    | PCLK0_0**     | C            |
| A7          | PT3D          | 0    |               | C            | A7          | PT5A          | 0    |               | T            |
| B7          | VCCAUX        | -    |               |              | B7          | VCCAUX        | -    |               |              |
| A6          | PT3C          | 0    |               | T            | A6          | PT4F          | 0    |               |              |
| B6          | VCC           | -    |               |              | B6          | VCC           | -    |               |              |
| A5          | PT3B          | 0    |               | C            | A5          | PT3F          | 0    |               |              |

## LCMX0640, LCMX01200 and LCMX02280 Logic Signal Connections: 132 csBGA (Cont.)

| LCMX0640 |               |      |               |              | LCMX01200 |               |      |               |              | LCMX02280 |               |      |               |              |
|----------|---------------|------|---------------|--------------|-----------|---------------|------|---------------|--------------|-----------|---------------|------|---------------|--------------|
| Ball #   | Ball Function | Bank | Dual Function | Differential | Ball #    | Ball Function | Bank | Dual Function | Differential | Ball #    | Ball Function | Bank | Dual Function | Differential |
| M9       | PB7B          | 2    |               | C            | M9        | PB9B          | 4    |               | C            | M9        | PB12B         | 4    |               | C            |
| N10      | PB7E          | 2    |               | T            | N10       | PB9C          | 4    |               | T            | N10       | PB12C         | 4    |               | T            |
| P10      | PB7F          | 2    |               | C            | P10       | PB9D          | 4    |               | C            | P10       | PB12D         | 4    |               | C            |
| N11      | GNDIO2        | 2    |               |              | N11       | GNDIO4        | 4    |               |              | N11       | GNDIO4        | 4    |               |              |
| P11      | PB8C          | 2    |               | T            | P11       | PB10A         | 4    |               | T            | P11       | PB13C         | 4    |               | T            |
| M11      | PB8D          | 2    |               | C            | M11       | PB10B         | 4    |               | C            | M11       | PB13D         | 4    |               | C            |
| P12      | PB9C          | 2    |               | T            | P12       | PB10C         | 4    |               |              | P12       | PB15B         | 4    |               |              |
| P13      | PB9D          | 2    |               | C            | P13       | PB11C         | 4    |               | T            | P13       | PB16C         | 4    |               | T            |
| N12**    | SLEEPN        | -    | SLEEPN        |              | N12**     | SLEEPN        | -    | SLEEPN        |              | N12**     | SLEEPN        | -    | SLEEPN        |              |
| P14      | PB9F          | 2    |               |              | P14       | PB11D         | 4    |               | C            | P14       | PB16D         | 4    |               | C            |
| N14      | PR11D         | 1    |               | C            | N14       | PR16B         | 3    |               | C            | N14       | PR19B         | 3    |               | C            |
| M14      | PR11C         | 1    |               | T            | M14       | PR15B         | 3    |               | C*           | M14       | PR18B         | 3    |               | C*           |
| N13      | PR11B         | 1    |               | C            | N13       | PR16A         | 3    |               | T            | N13       | PR19A         | 3    |               | T            |
| M12      | PR11A         | 1    |               | T            | M12       | PR15A         | 3    |               | T*           | M12       | PR18A         | 3    |               | T*           |
| M13      | PR10B         | 1    |               | C            | M13       | PR14B         | 3    |               | C*           | M13       | PR17B         | 3    |               | C*           |
| L14      | PR10A         | 1    |               | T            | L14       | PR14A         | 3    |               | T*           | L14       | PR17A         | 3    |               | T*           |
| L13      | GNDIO1        | 1    |               |              | L13       | GNDIO3        | 3    |               |              | L13       | GNDIO3        | 3    |               |              |
| K14      | PR8D          | 1    |               | C            | K14       | PR12B         | 3    |               | C*           | K14       | PR15B         | 3    |               | C*           |
| K13      | PR8C          | 1    |               | T            | K13       | PR12A         | 3    |               | T*           | K13       | PR15A         | 3    |               | T*           |
| K12      | PR8B          | 1    |               | C            | K12       | PR11B         | 3    |               | C*           | K12       | PR14B         | 3    |               | C*           |
| J13      | PR8A          | 1    |               | T            | J13       | PR11A         | 3    |               | T*           | J13       | PR14A         | 3    |               | T*           |
| J12      | PR7C          | 1    |               |              | J12       | PR10B         | 3    |               | C*           | J12       | PR13B         | 3    |               | C*           |
| H14      | PR7B          | 1    |               | C            | H14       | PR10A         | 3    |               | T*           | H14       | PR13A         | 3    |               | T*           |
| H13      | PR7A          | 1    |               | T            | H13       | PR9B          | 3    |               | C*           | H13       | PR11B         | 3    |               | C*           |
| H12      | PR6D          | 1    |               | C            | H12       | PR9A          | 3    |               | T*           | H12       | PR11A         | 3    |               | T*           |
| G13      | PR6C          | 1    |               | T            | G13       | PR8B          | 2    |               | C*           | G13       | PR10B         | 2    |               | C*           |
| G14      | PR6B          | 1    |               |              | G14       | PR8A          | 2    |               | T*           | G14       | PR10A         | 2    |               | T*           |
| G12      | VCC           | -    |               |              | G12       | VCC           | -    |               |              | G12       | VCC           | -    |               |              |
| F14      | PR5D          | 1    |               | C            | F14       | PR6C          | 2    |               |              | F14       | PR8C          | 2    |               |              |
| F13      | PR5C          | 1    |               | T            | F13       | PR6B          | 2    |               | C*           | F13       | PR8B          | 2    |               | C*           |
| F12      | PR4D          | 1    |               | C            | F12       | PR6A          | 2    |               | T*           | F12       | PR8A          | 2    |               | T*           |
| E13      | PR4C          | 1    |               | T            | E13       | PR5B          | 2    |               | C*           | E13       | PR7B          | 2    |               | C*           |
| E14      | PR4B          | 1    |               |              | E14       | PR5A          | 2    |               | T*           | E14       | PR7A          | 2    |               | T*           |
| D13      | GNDIO1        | 1    |               |              | D13       | GNDIO2        | 2    |               |              | D13       | GNDIO2        | 2    |               |              |
| D14      | PR3D          | 1    |               | C            | D14       | PR4B          | 2    |               | C*           | D14       | PR5B          | 2    |               | C*           |
| D12      | PR3C          | 1    |               | T            | D12       | PR4A          | 2    |               | T*           | D12       | PR5A          | 2    |               | T*           |
| C14      | PR2D          | 1    |               | C            | C14       | PR3D          | 2    |               | C            | C14       | PR4D          | 2    |               | C            |
| B14      | PR2C          | 1    |               | T            | B14       | PR2B          | 2    |               | C            | B14       | PR3B          | 2    |               | C*           |
| C13      | PR2B          | 1    |               | C            | C13       | PR3C          | 2    |               | T            | C13       | PR4C          | 2    |               | T            |
| A14      | PR2A          | 1    |               | T            | A14       | PR2A          | 2    |               | T            | A14       | PR3A          | 2    |               | T*           |
| A13      | PT9F          | 0    |               | C            | A13       | PT11D         | 1    |               | C            | A13       | PT16D         | 1    |               | C            |
| A12      | PT9E          | 0    |               | T            | A12       | PT11B         | 1    |               | C            | A12       | PT16B         | 1    |               | C            |
| B13      | PT9D          | 0    |               | C            | B13       | PT11C         | 1    |               | T            | B13       | PT16C         | 1    |               | T            |
| B12      | PT9C          | 0    |               | T            | B12       | PT10F         | 1    |               |              | B12       | PT15D         | 1    |               |              |
| C12      | PT9B          | 0    |               | C            | C12       | PT11A         | 1    |               | T            | C12       | PT16A         | 1    |               | T            |
| A11      | PT9A          | 0    |               | T            | A11       | PT10D         | 1    |               | C            | A11       | PT14B         | 1    |               | C            |
| C11      | PT8C          | 0    |               |              | C11       | PT10C         | 1    |               | T            | C11       | PT14A         | 1    |               | T            |
| A10      | GNDIO0        | 0    |               |              | A10       | GNDIO1        | 1    |               |              | A10       | GNDIO1        | 1    |               |              |
| B10      | PT7F          | 0    |               | C            | B10       | PT9F          | 1    |               | C            | B10       | PT12F         | 1    |               | C            |
| C10      | PT7E          | 0    |               | T            | C10       | PT9E          | 1    |               | T            | C10       | PT12E         | 1    |               | T            |

**LCMX02280 Logic Signal Connections: 324 ftBGA (Cont.)**

| LCMX02280   |               |      |                |              |
|-------------|---------------|------|----------------|--------------|
| Ball Number | Ball Function | Bank | Dual Function  | Differential |
| G2          | PL11A         | 6    |                | T*           |
| H2          | PL11B         | 6    |                | C*           |
| L3          | PL11C         | 6    |                | T            |
| L5          | PL11D         | 6    |                | C            |
| H1          | PL12A         | 6    |                | T*           |
| VCCIO6      | VCCIO6        | 6    |                |              |
| GND         | GNDIO6        | 6    |                |              |
| J2          | PL12B         | 6    |                | C*           |
| L4          | PL12C         | 6    |                | T            |
| L6          | PL12D         | 6    |                | C            |
| K2          | PL13A         | 6    |                | T*           |
| K1          | PL13B         | 6    |                | C*           |
| J1          | PL13C         | 6    |                | T            |
| VCC         | VCC           | -    |                |              |
| L2          | PL13D         | 6    |                | C            |
| M5          | PL14D         | 6    |                | C            |
| M3          | PL14C         | 6    | TSALL          | T            |
| L1          | PL14B         | 6    |                | C*           |
| M2          | PL14A         | 6    |                | T*           |
| M1          | PL15A         | 6    |                | T*           |
| N1          | PL15B         | 6    |                | C*           |
| M6          | PL15C         | 6    |                | T            |
| M4          | PL15D         | 6    |                | C            |
| VCCIO6      | VCCIO6        | 6    |                |              |
| GND         | GNDIO6        | 6    |                |              |
| P1          | PL16A         | 6    |                | T*           |
| P2          | PL16B         | 6    |                | C*           |
| N3          | PL16C         | 6    |                | T            |
| N4          | PL16D         | 6    |                | C            |
| GND         | GND           | -    |                |              |
| T1          | PL17A         | 6    | LLM0_PLLT_FB_A | T*           |
| R1          | PL17B         | 6    | LLM0_PLLC_FB_A | C*           |
| P3          | PL17C         | 6    |                | T            |
| N5          | PL17D         | 6    |                | C            |
| R3          | PL18A         | 6    | LLM0_PLLT_IN_A | T*           |
| R2          | PL18B         | 6    | LLM0_PLLC_IN_A | C*           |
| P4          | PL19A         | 6    |                | T            |
| N6          | PL19B         | 6    |                | C            |
| U1          | PL20A         | 6    |                | T            |
| VCCIO6      | VCCIO6        | 6    |                |              |
| GND         | GNDIO6        | 6    |                |              |
| GND         | GNDIO5        | 5    |                |              |
| VCCIO5      | VCCIO5        | 5    |                |              |

**LCMX02280 Logic Signal Connections: 324 ftBGA (Cont.)**

| LCMX02280   |               |      |               |              |
|-------------|---------------|------|---------------|--------------|
| Ball Number | Ball Function | Bank | Dual Function | Differential |
| T2          | PL20B         | 6    |               | C            |
| P6          | TMS           | 5    | TMS           |              |
| V1          | PB2A          | 5    |               | T            |
| U2          | PB2B          | 5    |               | C            |
| T3          | PB2C          | 5    |               | T            |
| N7          | TCK           | 5    | TCK           |              |
| R4          | PB2D          | 5    |               | C            |
| R5          | PB3A          | 5    |               | T            |
| T4          | PB3B          | 5    |               | C            |
| VCC         | VCC           | -    |               |              |
| R6          | PB3C          | 5    |               | T            |
| P7          | PB3D          | 5    |               | C            |
| U3          | PB4A          | 5    |               | T            |
| T5          | PB4B          | 5    |               | C            |
| V2          | PB4C          | 5    |               | T            |
| N8          | TDO           | 5    | TDO           |              |
| V3          | PB4D          | 5    |               | C            |
| T6          | PB5A          | 5    |               | T            |
| GND         | GNDIO5        | 5    |               |              |
| VCCIO5      | VCCIO5        | 5    |               |              |
| U4          | PB5B          | 5    |               | C            |
| P8          | PB5C          | 5    |               | T            |
| T7          | PB5D          | 5    |               | C            |
| V4          | TDI           | 5    | TDI           |              |
| R8          | PB6A          | 5    |               | T            |
| N9          | PB6B          | 5    |               | C            |
| U5          | PB6C          | 5    |               | T            |
| V5          | PB6D          | 5    |               | C            |
| U6          | PB7A          | 5    |               | T            |
| VCC         | VCC           | -    |               |              |
| V6          | PB7B          | 5    |               | C            |
| P9          | PB7C          | 5    |               | T            |
| T8          | PB7D          | 5    |               | C            |
| U7          | PB8A          | 5    |               | T            |
| V7          | PB8B          | 5    |               | C            |
| M10         | VCCAUX        | -    |               |              |
| U8          | PB8C          | 5    |               | T            |
| V8          | PB8D          | 5    |               | C            |
| VCCIO5      | VCCIO5        | 5    |               |              |
| GND         | GNDIO5        | 5    |               |              |
| T9          | PB8E          | 5    |               | T            |
| U9          | PB8F          | 5    |               | C            |
| V9          | PB9A          | 4    |               | T            |

**LCMX02280 Logic Signal Connections: 324 ftBGA (Cont.)**

| LCMX02280   |               |      |               |              |
|-------------|---------------|------|---------------|--------------|
| Ball Number | Ball Function | Bank | Dual Function | Differential |
| V10         | PB9B          | 4    |               | C            |
| N10         | PB9C          | 4    |               | T            |
| R10         | PB9D          | 4    |               | C            |
| P10         | PB10F         | 4    | PCLK4_1***    | C            |
| T10         | PB10E         | 4    |               | T            |
| U10         | PB10D         | 4    |               | C            |
| V11         | PB10C         | 4    |               | T            |
| U11         | PB10B         | 4    | PCLK4_0***    | C            |
| VCCIO4      | VCCIO4        | 4    |               |              |
| GND         | GNDIO4        | 4    |               |              |
| T11         | PB10A         | 4    |               | T            |
| U12         | PB11A         | 4    |               | T            |
| R11         | PB11B         | 4    |               | C            |
| GND         | GND           | -    |               |              |
| T12         | PB11C         | 4    |               | T            |
| P11         | PB11D         | 4    |               | C            |
| V12         | PB12A         | 4    |               | T            |
| V13         | PB12B         | 4    |               | C            |
| R12         | PB12C         | 4    |               | T            |
| N11         | PB12D         | 4    |               | C            |
| U13         | PB12E         | 4    |               | T            |
| VCCIO4      | VCCIO4        | 4    |               |              |
| GND         | GNDIO4        | 4    |               |              |
| V14         | PB12F         | 4    |               | C            |
| T13         | PB13A         | 4    |               | T            |
| P12         | PB13B         | 4    |               | C            |
| R13         | PB13C         | 4    |               | T            |
| N12         | PB13D         | 4    |               | C            |
| V15         | PB14A         | 4    |               | T            |
| U14         | PB14B         | 4    |               | C            |
| V16         | PB14C         | 4    |               | T            |
| GND         | GND           | -    |               |              |
| T14         | PB14D         | 4    |               | C            |
| U15         | PB15A         | 4    |               | T            |
| V17         | PB15B         | 4    |               | C            |
| P13**       | SLEEPN        | -    | SLEEPN        |              |
| T15         | PB15D         | 4    |               |              |
| U16         | PB16A         | 4    |               | T            |
| V18         | PB16B         | 4    |               | C            |
| N13         | PB16C         | 4    |               | T            |
| R14         | PB16D         | 4    |               | C            |
| VCCIO4      | VCCIO4        | 4    |               |              |
| GND         | GNDIO4        | 4    |               |              |

**LCMX02280 Logic Signal Connections: 324 ftBGA (Cont.)**

| LCMX02280   |               |      |               |              |
|-------------|---------------|------|---------------|--------------|
| Ball Number | Ball Function | Bank | Dual Function | Differential |
| GND         | GNDIO3        | 3    |               |              |
| VCCIO3      | VCCIO3        | 3    |               |              |
| P15         | PR20B         | 3    |               | C            |
| N14         | PR20A         | 3    |               | T            |
| N15         | PR19B         | 3    |               | C            |
| M13         | PR19A         | 3    |               | T            |
| R15         | PR18B         | 3    |               | C*           |
| T16         | PR18A         | 3    |               | T*           |
| N16         | PR17D         | 3    |               | C            |
| M14         | PR17C         | 3    |               | T            |
| U17         | PR17B         | 3    |               | C*           |
| VCC         | VCC           | -    |               |              |
| U18         | PR17A         | 3    |               | T*           |
| R17         | PR16D         | 3    |               | C            |
| R16         | PR16C         | 3    |               | T            |
| P16         | PR16B         | 3    |               | C*           |
| VCCIO3      | VCCIO3        | 3    |               |              |
| GND         | GNDIO3        | 3    |               |              |
| P17         | PR16A         | 3    |               | T*           |
| L13         | PR15D         | 3    |               | C            |
| M15         | PR15C         | 3    |               | T            |
| T17         | PR15B         | 3    |               | C*           |
| T18         | PR15A         | 3    |               | T*           |
| L14         | PR14D         | 3    |               | C            |
| L15         | PR14C         | 3    |               | T            |
| R18         | PR14B         | 3    |               | C*           |
| P18         | PR14A         | 3    |               | T*           |
| GND         | GND           | -    |               |              |
| K15         | PR13D         | 3    |               | C            |
| K13         | PR13C         | 3    |               | T            |
| N17         | PR13B         | 3    |               | C*           |
| N18         | PR13A         | 3    |               | T*           |
| K16         | PR12D         | 3    |               | C            |
| K14         | PR12C         | 3    |               | T            |
| M16         | PR12B         | 3    |               | C*           |
| L16         | PR12A         | 3    |               | T*           |
| GND         | GNDIO3        | 3    |               |              |
| VCCIO3      | VCCIO3        | 3    |               |              |
| J16         | PR11D         | 3    |               | C            |
| J14         | PR11C         | 3    |               | T            |
| M17         | PR11B         | 3    |               | C*           |
| L17         | PR11A         | 3    |               | T*           |
| J15         | PR10D         | 2    |               | C            |

**LCMX02280 Logic Signal Connections: 324 ftBGA (Cont.)**

| LCMX02280   |               |      |               |              |
|-------------|---------------|------|---------------|--------------|
| Ball Number | Ball Function | Bank | Dual Function | Differential |
| A10         | PT8E          | 0    |               | T            |
| VCCIO0      | VCCIO0        | 0    |               |              |
| GND         | GNDIO0        | 0    |               |              |
| A9          | PT8D          | 0    |               | C            |
| C9          | PT8C          | 0    |               | T            |
| B9          | PT8B          | 0    |               | C            |
| F9          | VCCAUX        | -    |               |              |
| A8          | PT8A          | 0    |               | T            |
| B8          | PT7D          | 0    |               | C            |
| C8          | PT7C          | 0    |               | T            |
| VCC         | VCC           | -    |               |              |
| A7          | PT7B          | 0    |               | C            |
| B7          | PT7A          | 0    |               | T            |
| A6          | PT6A          | 0    |               | T            |
| B6          | PT6B          | 0    |               | C            |
| D8          | PT6C          | 0    |               | T            |
| F8          | PT6D          | 0    |               | C            |
| C7          | PT6E          | 0    |               | T            |
| E8          | PT6F          | 0    |               | C            |
| D7          | PT5D          | 0    |               | C            |
| VCCIO0      | VCCIO0        | 0    |               |              |
| GND         | GNDIO0        | 0    |               |              |
| E7          | PT5C          | 0    |               | T            |
| A5          | PT5B          | 0    |               | C            |
| C6          | PT5A          | 0    |               | T            |
| B5          | PT4A          | 0    |               | T            |
| A4          | PT4B          | 0    |               | C            |
| D6          | PT4C          | 0    |               | T            |
| F7          | PT4D          | 0    |               | C            |
| B4          | PT4E          | 0    |               | T            |
| GND         | GND           | -    |               |              |
| C5          | PT4F          | 0    |               | C            |
| F6          | PT3D          | 0    |               | C            |
| E5          | PT3C          | 0    |               | T            |
| E6          | PT3B          | 0    |               | C            |
| D5          | PT3A          | 0    |               | T            |
| A3          | PT2D          | 0    |               | C            |
| C4          | PT2C          | 0    |               | T            |
| A2          | PT2B          | 0    |               | C            |
| B2          | PT2A          | 0    |               | T            |
| VCCIO0      | VCCIO0        | 0    |               |              |
| GND         | GNDIO0        | 0    |               |              |
| E14         | GND           | -    |               |              |

| Part Number        | LUTs | Supply Voltage | I/Os | Grade | Package | Pins | Temp. |
|--------------------|------|----------------|------|-------|---------|------|-------|
| LCMXO1200E-3T100C  | 1200 | 1.2V           | 73   | -3    | TQFP    | 100  | COM   |
| LCMXO1200E-4T100C  | 1200 | 1.2V           | 73   | -4    | TQFP    | 100  | COM   |
| LCMXO1200E-5T100C  | 1200 | 1.2V           | 73   | -5    | TQFP    | 100  | COM   |
| LCMXO1200E-3T144C  | 1200 | 1.2V           | 113  | -3    | TQFP    | 144  | COM   |
| LCMXO1200E-4T144C  | 1200 | 1.2V           | 113  | -4    | TQFP    | 144  | COM   |
| LCMXO1200E-5T144C  | 1200 | 1.2V           | 113  | -5    | TQFP    | 144  | COM   |
| LCMXO1200E-3M132C  | 1200 | 1.2V           | 101  | -3    | csBGA   | 132  | COM   |
| LCMXO1200E-4M132C  | 1200 | 1.2V           | 101  | -4    | csBGA   | 132  | COM   |
| LCMXO1200E-5M132C  | 1200 | 1.2V           | 101  | -5    | csBGA   | 132  | COM   |
| LCMXO1200E-3B256C  | 1200 | 1.2V           | 211  | -3    | caBGA   | 256  | COM   |
| LCMXO1200E-4B256C  | 1200 | 1.2V           | 211  | -4    | caBGA   | 256  | COM   |
| LCMXO1200E-5B256C  | 1200 | 1.2V           | 211  | -5    | caBGA   | 256  | COM   |
| LCMXO1200E-3FT256C | 1200 | 1.2V           | 211  | -3    | ftBGA   | 256  | COM   |
| LCMXO1200E-4FT256C | 1200 | 1.2V           | 211  | -4    | ftBGA   | 256  | COM   |
| LCMXO1200E-5FT256C | 1200 | 1.2V           | 211  | -5    | ftBGA   | 256  | COM   |

| Part Number        | LUTs | Supply Voltage | I/Os | Grade | Package | Pins | Temp. |
|--------------------|------|----------------|------|-------|---------|------|-------|
| LCMXO2280E-3T100C  | 2280 | 1.2V           | 73   | -3    | TQFP    | 100  | COM   |
| LCMXO2280E-4T100C  | 2280 | 1.2V           | 73   | -4    | TQFP    | 100  | COM   |
| LCMXO2280E-5T100C  | 2280 | 1.2V           | 73   | -5    | TQFP    | 100  | COM   |
| LCMXO2280E-3T144C  | 2280 | 1.2V           | 113  | -3    | TQFP    | 144  | COM   |
| LCMXO2280E-4T144C  | 2280 | 1.2V           | 113  | -4    | TQFP    | 144  | COM   |
| LCMXO2280E-5T144C  | 2280 | 1.2V           | 113  | -5    | TQFP    | 144  | COM   |
| LCMXO2280E-3M132C  | 2280 | 1.2V           | 101  | -3    | csBGA   | 132  | COM   |
| LCMXO2280E-4M132C  | 2280 | 1.2V           | 101  | -4    | csBGA   | 132  | COM   |
| LCMXO2280E-5M132C  | 2280 | 1.2V           | 101  | -5    | csBGA   | 132  | COM   |
| LCMXO2280E-3B256C  | 2280 | 1.2V           | 211  | -3    | caBGA   | 256  | COM   |
| LCMXO2280E-4B256C  | 2280 | 1.2V           | 211  | -4    | caBGA   | 256  | COM   |
| LCMXO2280E-5B256C  | 2280 | 1.2V           | 211  | -5    | caBGA   | 256  | COM   |
| LCMXO2280E-3FT256C | 2280 | 1.2V           | 211  | -3    | ftBGA   | 256  | COM   |
| LCMXO2280E-4FT256C | 2280 | 1.2V           | 211  | -4    | ftBGA   | 256  | COM   |
| LCMXO2280E-5FT256C | 2280 | 1.2V           | 211  | -5    | ftBGA   | 256  | COM   |
| LCMXO2280E-3FT324C | 2280 | 1.2V           | 271  | -3    | ftBGA   | 324  | COM   |
| LCMXO2280E-4FT324C | 2280 | 1.2V           | 271  | -4    | ftBGA   | 324  | COM   |
| LCMXO2280E-5FT324C | 2280 | 1.2V           | 271  | -5    | ftBGA   | 324  | COM   |

| Part Number         | LUTs | Supply Voltage | I/Os | Grade | Package         | Pins | Temp. |
|---------------------|------|----------------|------|-------|-----------------|------|-------|
| LCMXO2280C-3TN100C  | 2280 | 1.8V/2.5V/3.3V | 73   | -3    | Lead-Free TQFP  | 100  | COM   |
| LCMXO2280C-4TN100C  | 2280 | 1.8V/2.5V/3.3V | 73   | -4    | Lead-Free TQFP  | 100  | COM   |
| LCMXO2280C-5TN100C  | 2280 | 1.8V/2.5V/3.3V | 73   | -5    | Lead-Free TQFP  | 100  | COM   |
| LCMXO2280C-3TN144C  | 2280 | 1.8V/2.5V/3.3V | 113  | -3    | Lead-Free TQFP  | 144  | COM   |
| LCMXO2280C-4TN144C  | 2280 | 1.8V/2.5V/3.3V | 113  | -4    | Lead-Free TQFP  | 144  | COM   |
| LCMXO2280C-5TN144C  | 2280 | 1.8V/2.5V/3.3V | 113  | -5    | Lead-Free TQFP  | 144  | COM   |
| LCMXO2280C-3MN132C  | 2280 | 1.8V/2.5V/3.3V | 101  | -3    | Lead-Free csBGA | 132  | COM   |
| LCMXO2280C-4MN132C  | 2280 | 1.8V/2.5V/3.3V | 101  | -4    | Lead-Free csBGA | 132  | COM   |
| LCMXO2280C-5MN132C  | 2280 | 1.8V/2.5V/3.3V | 101  | -5    | Lead-Free csBGA | 132  | COM   |
| LCMXO2280C-3BN256C  | 2280 | 1.8V/2.5V/3.3V | 211  | -3    | Lead-Free caBGA | 256  | COM   |
| LCMXO2280C-4BN256C  | 2280 | 1.8V/2.5V/3.3V | 211  | -4    | Lead-Free caBGA | 256  | COM   |
| LCMXO2280C-5BN256C  | 2280 | 1.8V/2.5V/3.3V | 211  | -5    | Lead-Free caBGA | 256  | COM   |
| LCMXO2280C-3FTN256C | 2280 | 1.8V/2.5V/3.3V | 211  | -3    | Lead-Free ftBGA | 256  | COM   |
| LCMXO2280C-4FTN256C | 2280 | 1.8V/2.5V/3.3V | 211  | -4    | Lead-Free ftBGA | 256  | COM   |
| LCMXO2280C-5FTN256C | 2280 | 1.8V/2.5V/3.3V | 211  | -5    | Lead-Free ftBGA | 256  | COM   |
| LCMXO2280C-3FTN324C | 2280 | 1.8V/2.5V/3.3V | 271  | -3    | Lead-Free ftBGA | 324  | COM   |
| LCMXO2280C-4FTN324C | 2280 | 1.8V/2.5V/3.3V | 271  | -4    | Lead-Free ftBGA | 324  | COM   |
| LCMXO2280C-5FTN324C | 2280 | 1.8V/2.5V/3.3V | 271  | -5    | Lead-Free ftBGA | 324  | COM   |

| Part Number       | LUTs | Supply Voltage | I/Os | Grade | Package         | Pins | Temp. |
|-------------------|------|----------------|------|-------|-----------------|------|-------|
| LCMXO256E-3TN100C | 256  | 1.2V           | 78   | -3    | Lead-Free TQFP  | 100  | COM   |
| LCMXO256E-4TN100C | 256  | 1.2V           | 78   | -4    | Lead-Free TQFP  | 100  | COM   |
| LCMXO256E-5TN100C | 256  | 1.2V           | 78   | -5    | Lead-Free TQFP  | 100  | COM   |
| LCMXO256E-3MN100C | 256  | 1.2V           | 78   | -3    | Lead-Free csBGA | 100  | COM   |
| LCMXO256E-4MN100C | 256  | 1.2V           | 78   | -4    | Lead-Free csBGA | 100  | COM   |
| LCMXO256E-5MN100C | 256  | 1.2V           | 78   | -5    | Lead-Free csBGA | 100  | COM   |

| Part Number        | LUTs | Supply Voltage | I/Os | Grade | Package         | Pins | Temp. |
|--------------------|------|----------------|------|-------|-----------------|------|-------|
| LCMXO640E-3TN100C  | 640  | 1.2V           | 74   | -3    | Lead-Free TQFP  | 100  | COM   |
| LCMXO640E-4TN100C  | 640  | 1.2V           | 74   | -4    | Lead-Free TQFP  | 100  | COM   |
| LCMXO640E-5TN100C  | 640  | 1.2V           | 74   | -5    | Lead-Free TQFP  | 100  | COM   |
| LCMXO640E-3MN100C  | 640  | 1.2V           | 74   | -3    | Lead-Free csBGA | 100  | COM   |
| LCMXO640E-4MN100C  | 640  | 1.2V           | 74   | -4    | Lead-Free csBGA | 100  | COM   |
| LCMXO640E-5MN100C  | 640  | 1.2V           | 74   | -5    | Lead-Free csBGA | 100  | COM   |
| LCMXO640E-3TN144C  | 640  | 1.2V           | 113  | -3    | Lead-Free TQFP  | 144  | COM   |
| LCMXO640E-4TN144C  | 640  | 1.2V           | 113  | -4    | Lead-Free TQFP  | 144  | COM   |
| LCMXO640E-5TN144C  | 640  | 1.2V           | 113  | -5    | Lead-Free TQFP  | 144  | COM   |
| LCMXO640E-3MN132C  | 640  | 1.2V           | 101  | -3    | Lead-Free csBGA | 132  | COM   |
| LCMXO640E-4MN132C  | 640  | 1.2V           | 101  | -4    | Lead-Free csBGA | 132  | COM   |
| LCMXO640E-5MN132C  | 640  | 1.2V           | 101  | -5    | Lead-Free csBGA | 132  | COM   |
| LCMXO640E-3BN256C  | 640  | 1.2V           | 159  | -3    | Lead-Free caBGA | 256  | COM   |
| LCMXO640E-4BN256C  | 640  | 1.2V           | 159  | -4    | Lead-Free caBGA | 256  | COM   |
| LCMXO640E-5BN256C  | 640  | 1.2V           | 159  | -5    | Lead-Free caBGA | 256  | COM   |
| LCMXO640E-3FTN256C | 640  | 1.2V           | 159  | -3    | Lead-Free ftBGA | 256  | COM   |
| LCMXO640E-4FTN256C | 640  | 1.2V           | 159  | -4    | Lead-Free ftBGA | 256  | COM   |
| LCMXO640E-5FTN256C | 640  | 1.2V           | 159  | -5    | Lead-Free ftBGA | 256  | COM   |

| Part Number         | LUTs | Supply Voltage | I/Os | Grade | Package         | Pins | Temp. |
|---------------------|------|----------------|------|-------|-----------------|------|-------|
| LCMXO1200E-3TN100C  | 1200 | 1.2V           | 73   | -3    | Lead-Free TQFP  | 100  | COM   |
| LCMXO1200E-4TN100C  | 1200 | 1.2V           | 73   | -4    | Lead-Free TQFP  | 100  | COM   |
| LCMXO1200E-5TN100C  | 1200 | 1.2V           | 73   | -5    | Lead-Free TQFP  | 100  | COM   |
| LCMXO1200E-3TN144C  | 1200 | 1.2V           | 113  | -3    | Lead-Free TQFP  | 144  | COM   |
| LCMXO1200E-4TN144C  | 1200 | 1.2V           | 113  | -4    | Lead-Free TQFP  | 144  | COM   |
| LCMXO1200E-5TN144C  | 1200 | 1.2V           | 113  | -5    | Lead-Free TQFP  | 144  | COM   |
| LCMXO1200E-3MN132C  | 1200 | 1.2V           | 101  | -3    | Lead-Free csBGA | 132  | COM   |
| LCMXO1200E-4MN132C  | 1200 | 1.2V           | 101  | -4    | Lead-Free csBGA | 132  | COM   |
| LCMXO1200E-5MN132C  | 1200 | 1.2V           | 101  | -5    | Lead-Free csBGA | 132  | COM   |
| LCMXO1200E-3BN256C  | 1200 | 1.2V           | 211  | -3    | Lead-Free caBGA | 256  | COM   |
| LCMXO1200E-4BN256C  | 1200 | 1.2V           | 211  | -4    | Lead-Free caBGA | 256  | COM   |
| LCMXO1200E-5BN256C  | 1200 | 1.2V           | 211  | -5    | Lead-Free caBGA | 256  | COM   |
| LCMXO1200E-3FTN256C | 1200 | 1.2V           | 211  | -3    | Lead-Free ftBGA | 256  | COM   |
| LCMXO1200E-4FTN256C | 1200 | 1.2V           | 211  | -4    | Lead-Free ftBGA | 256  | COM   |
| LCMXO1200E-5FTN256C | 1200 | 1.2V           | 211  | -5    | Lead-Free ftBGA | 256  | COM   |

| Part Number         | LUTs | Supply Voltage | I/Os | Grade | Package         | Pins | Temp. |
|---------------------|------|----------------|------|-------|-----------------|------|-------|
| LCMXO2280E-3TN100C  | 2280 | 1.2V           | 73   | -3    | Lead-Free TQFP  | 100  | COM   |
| LCMXO2280E-4TN100C  | 2280 | 1.2V           | 73   | -4    | Lead-Free TQFP  | 100  | COM   |
| LCMXO2280E-5TN100C  | 2280 | 1.2V           | 73   | -5    | Lead-Free TQFP  | 100  | COM   |
| LCMXO2280E-3TN144C  | 2280 | 1.2V           | 113  | -3    | Lead-Free TQFP  | 144  | COM   |
| LCMXO2280E-4TN144C  | 2280 | 1.2V           | 113  | -4    | Lead-Free TQFP  | 144  | COM   |
| LCMXO2280E-5TN144C  | 2280 | 1.2V           | 113  | -5    | Lead-Free TQFP  | 144  | COM   |
| LCMXO2280E-3MN132C  | 2280 | 1.2V           | 101  | -3    | Lead-Free csBGA | 132  | COM   |
| LCMXO2280E-4MN132C  | 2280 | 1.2V           | 101  | -4    | Lead-Free csBGA | 132  | COM   |
| LCMXO2280E-5MN132C  | 2280 | 1.2V           | 101  | -5    | Lead-Free csBGA | 132  | COM   |
| LCMXO2280E-3BN256C  | 2280 | 1.2V           | 211  | -3    | Lead-Free caBGA | 256  | COM   |
| LCMXO2280E-4BN256C  | 2280 | 1.2V           | 211  | -4    | Lead-Free caBGA | 256  | COM   |
| LCMXO2280E-5BN256C  | 2280 | 1.2V           | 211  | -5    | Lead-Free caBGA | 256  | COM   |
| LCMXO2280E-3FTN256C | 2280 | 1.2V           | 211  | -3    | Lead-Free ftBGA | 256  | COM   |
| LCMXO2280E-4FTN256C | 2280 | 1.2V           | 211  | -4    | Lead-Free ftBGA | 256  | COM   |
| LCMXO2280E-5FTN256C | 2280 | 1.2V           | 211  | -5    | Lead-Free ftBGA | 256  | COM   |
| LCMXO2280E-3FTN324C | 2280 | 1.2V           | 271  | -3    | Lead-Free ftBGA | 324  | COM   |
| LCMXO2280E-4FTN324C | 2280 | 1.2V           | 271  | -4    | Lead-Free ftBGA | 324  | COM   |
| LCMXO2280E-5FTN324C | 2280 | 1.2V           | 271  | -5    | Lead-Free ftBGA | 324  | COM   |