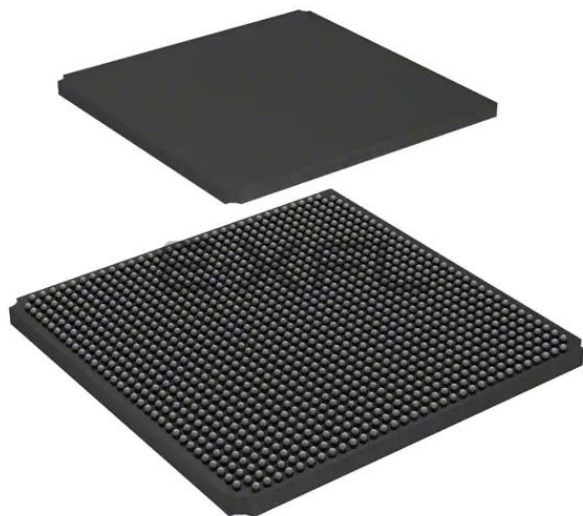




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## Understanding [Embedded - FPGAs \(Field Programmable Gate Array\)](#)

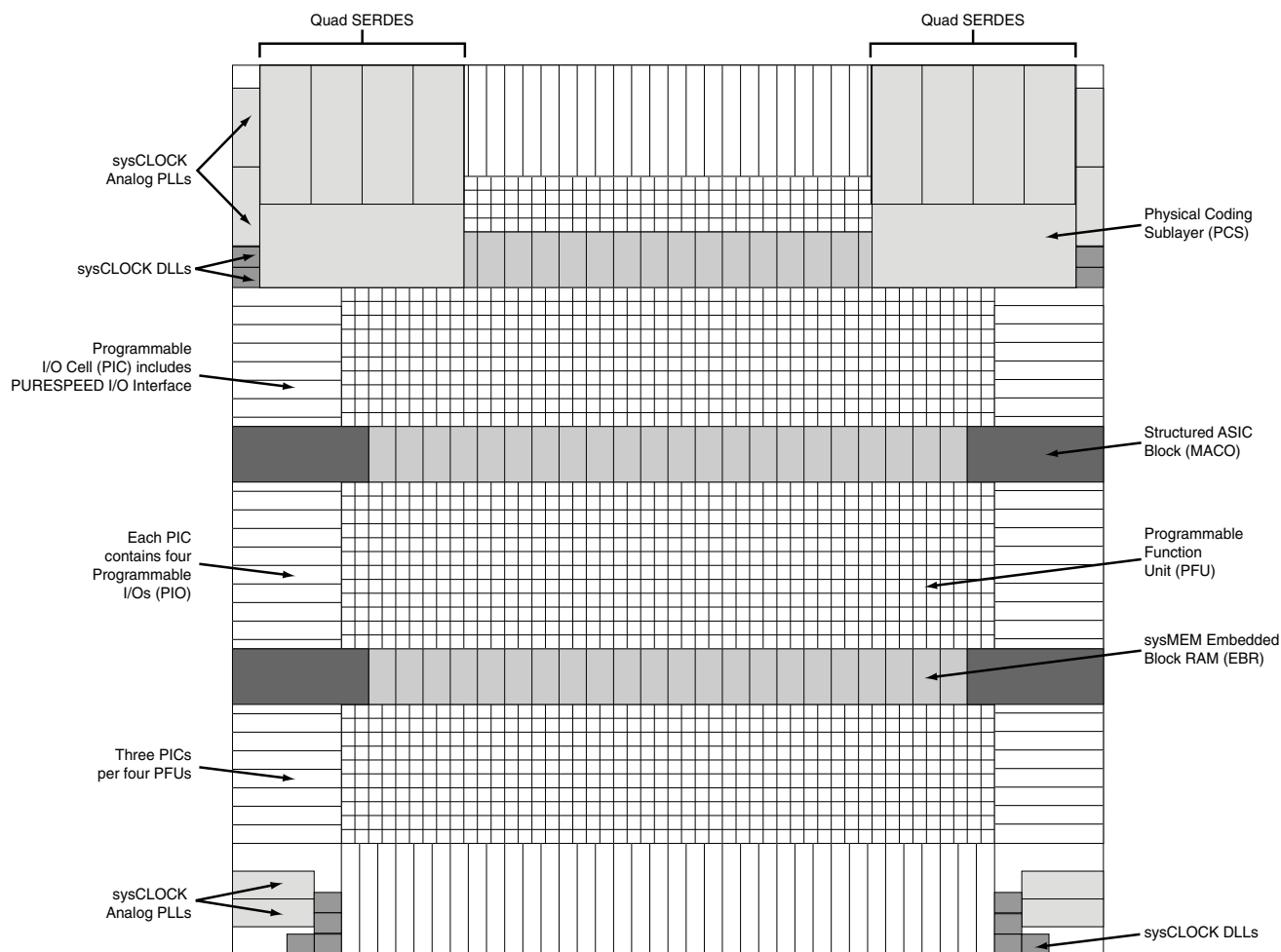
Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling 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            | 20000                                                                                                                                                                         |
| Number of Logic Elements/Cells | 80000                                                                                                                                                                         |
| Total RAM Bits                 | 5816320                                                                                                                                                                       |
| Number of I/O                  | 660                                                                                                                                                                           |
| Number of Gates                | -                                                                                                                                                                             |
| Voltage - Supply               | 0.95V ~ 1.26V                                                                                                                                                                 |
| Mounting Type                  | Surface Mount                                                                                                                                                                 |
| Operating Temperature          | 0°C ~ 85°C (TJ)                                                                                                                                                               |
| Package / Case                 | 1152-BBGA                                                                                                                                                                     |
| Supplier Device Package        | 1152-FPBGA (35x35)                                                                                                                                                            |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/lattice-semiconductor/lfsc3ga80e-7ffn1152c">https://www.e-xfl.com/product-detail/lattice-semiconductor/lfsc3ga80e-7ffn1152c</a> |

**Figure 2-1. Simplified Block Diagram (Top Level)**

**Table 2-5. sysMEM Block Configurations**

| Memory Mode      | Configurations                                                              |
|------------------|-----------------------------------------------------------------------------|
| Single Port      | 16,384 x 1<br>8,192 x 2<br>4,096 x 4<br>2,048 x 9<br>1,024 x 18<br>512 x 36 |
| True Dual Port   | 16,384 x 1<br>8,192 x 2<br>4,096 x 4<br>2,048 x 9<br>1,024 x 18             |
| Pseudo Dual Port | 16,384 x 1<br>8,192 x 2<br>4,096 x 4<br>2,048 x 9<br>1,024 x 18<br>512 x 36 |
| FIFO             | 16,384 x 1<br>8,192 x 2<br>4,096 x 4<br>2,048 x 9<br>1,024 x 18<br>512 x 36 |

## Bus Size Matching

All of the multi-port memory modes support different widths on each of the ports. The RAM bits are mapped LSB word 0 to MSB word 0, LSB word 1 to MSB word 1 and so on. Although the word size and number of words for each port varies, this mapping scheme applies to each port.

## RAM Initialization and ROM Operation

If desired, the contents of the RAM can be pre-loaded during device configuration. By preloading the RAM block during the chip configuration cycle and disabling the write controls, the sysMEM block can also be utilized as a ROM.

## Single, Dual and Pseudo-Dual Port Modes

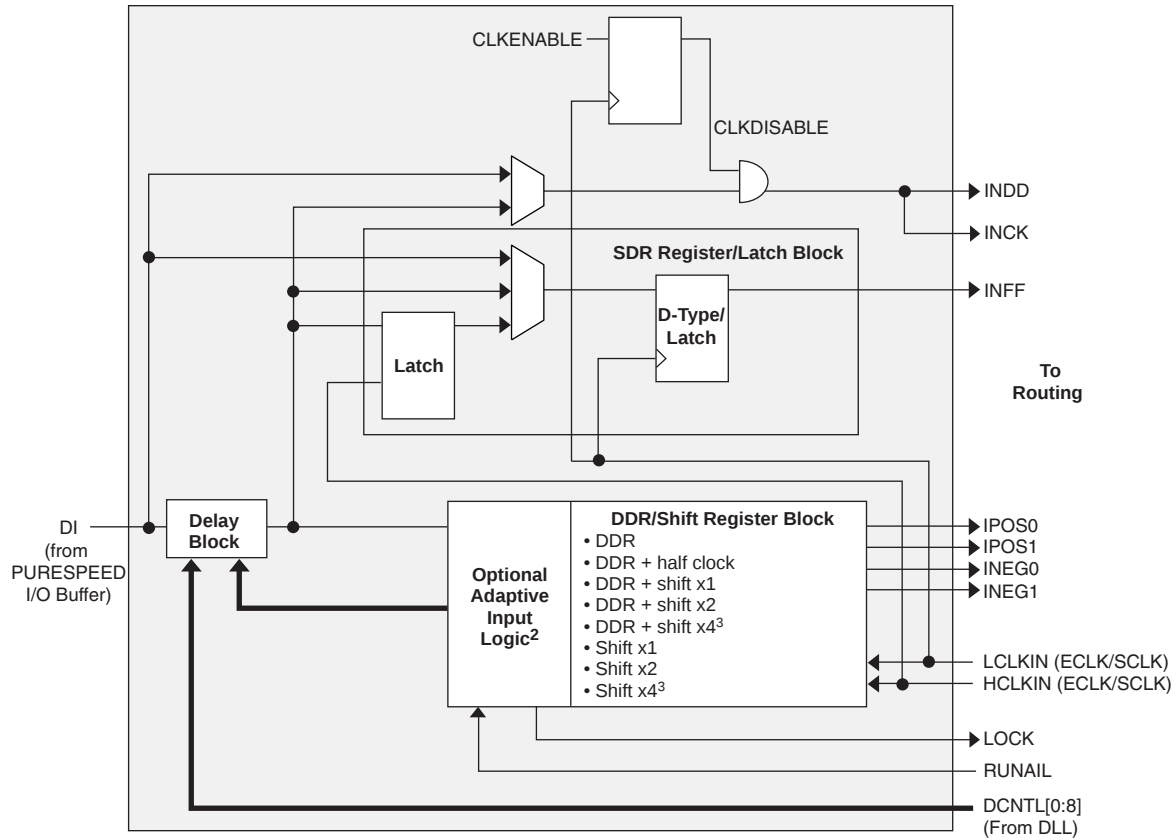
In all the sysMEM RAM modes the input data and address for the ports are registered at the input of the memory array. The output data of the memory is optionally registered at the output. A clock is required even in asynchronous read mode.

The EBR memory supports two forms of write behavior for dual port operation:

1. **Normal** — data on the output appears only during a read cycle. During a write cycle, the data (at the current address) does not appear on the output.
2. **Write Through** — a copy of the input data appears at the output of the same port.

## FIFO Configuration

The FIFO has a write port with Data-in, WCE, WE and WCLK signals. There is a separate read port with Data-out, RCE, RE and RCLK signals. The FIFO internally generates Almost Full, Full, Almost Empty, and Empty Flags. The Full and Almost Full flags are registered with WCLK. The Empty and Almost Empty flags are registered with RCLK.

Figure 2-20. Input Register Block<sup>1</sup>

1. UPDATE, Set and Reset not shown for clarity

2. Adaptive input logic is only available in selected PIO

3. By four shift modes utilize DDR/shift register block from paired PIO.

4. CLKDISABLE is used to block the transitions on the DQS pin during post-amble. Its main use is to disable DQS (typically found in DDR memory interfaces) or other clock signals. It can also be used to disable any/all input signals to save power.

**Table 2-9. Supported Input Standards**

| Input Standard                          | V <sub>REF</sub> (Nom.) | V <sub>CCIO</sub> <sup>1</sup> (Nom.) | On-chip Termination                                                                                                                                |
|-----------------------------------------|-------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Single Ended Interfaces</b>          |                         |                                       |                                                                                                                                                    |
| LVTTL33 <sup>3</sup>                    | —                       | 3.3                                   | None                                                                                                                                               |
| LVC MOS 33, 25, 18, 15, 12 <sup>3</sup> | —                       | 3.3/2.5/1.8/1.5/1.2                   | None                                                                                                                                               |
| PCI33, PCIX33, AGP1X33 <sup>3</sup>     | —                       | 3.3                                   | None                                                                                                                                               |
| PCIX15                                  | 0.75                    | 1.5 <sup>2</sup>                      | None / V <sub>CCIO</sub> / 2: 50, 60/ V <sub>TT</sub> : 60, 75, 120, 210                                                                           |
| AGP2X33                                 | 1.32                    | —                                     | None                                                                                                                                               |
| HSTL18_I, II                            | 0.9                     | 1.8 <sup>2</sup>                      | None / V <sub>CCIO</sub> / 2: 50, 60/ V <sub>TT</sub> : 60, 75, 120, 210                                                                           |
| HSTL18_III, IV                          | 1.08                    | 1.8 <sup>2</sup>                      | None / V <sub>CCIO</sub> : 50                                                                                                                      |
| HSTL15_I, II                            | 0.75                    | 1.5 <sup>2</sup>                      | None / V <sub>CCIO</sub> / 2: 50, 60/ V <sub>TT</sub> : 60, 75, 120, 210                                                                           |
| HSTL15_III, IV                          | 0.9                     | 1.5 <sup>2</sup>                      | None / V <sub>CCIO</sub> : 50                                                                                                                      |
| SSTL33_I, II                            | 1.5                     | 3.3                                   | None                                                                                                                                               |
| SSTL25_I, II                            | 1.25                    | 2.5 <sup>2</sup>                      | None / V <sub>CCIO</sub> / 2: 50, 60/ V <sub>TT</sub> : 60, 75, 120, 210                                                                           |
| SSTL18_I, II                            | 0.9                     | 1.8 <sup>2</sup>                      | None / V <sub>CCIO</sub> / 2: 50, 60/ V <sub>TT</sub> : 60, 75, 120, 210                                                                           |
| GTL+, GTL                               | 1.0 / 0.8               | 1.5 / 1.2 <sup>2</sup>                | None / V <sub>CCIO</sub> : 50                                                                                                                      |
| <b>Differential Interfaces</b>          |                         |                                       |                                                                                                                                                    |
| SSTL18D_I, II                           | —                       | 1.8 <sup>2</sup>                      | None / Diff: 120, 150, 220, 420/ Diff to V <sub>CMT</sub> : 120, 150, 220, 420 / V <sub>CCIO</sub> / 2: 50, 60/ V <sub>TT</sub> : 60, 75, 120, 210 |
| SSTL25D_I, II                           | —                       | 2.5 <sup>2</sup>                      | None / Diff: 120, 150, 220, 420/ Diff to V <sub>CMT</sub> : 120, 150, 220, 420 / V <sub>CCIO</sub> / 2: 50, 60/ V <sub>TT</sub> : 60, 75, 120, 210 |
| SSTL33D_I, II                           | —                       | 3.3                                   | None                                                                                                                                               |
| HSTL15D_I, II                           | —                       | 1.5 <sup>2</sup>                      | None / Diff: 120, 150, 220, 420/ Diff to V <sub>CMT</sub> : 120, 150, 220, 420 / V <sub>CCIO</sub> / 2: 50, 60/ V <sub>TT</sub> : 60, 75, 120, 210 |
| HSTL18D_I, II                           | —                       | 1.8 <sup>2</sup>                      | None / Diff: 120, 150, 220, 420/ Diff to V <sub>CMT</sub> : 120, 150, 220, 420 / V <sub>CCIO</sub> / 2: 50, 60/ V <sub>TT</sub> : 60, 75, 120, 210 |
| LVDS                                    | —                       | —                                     | None / Diff: 120, 150, 220, 240/ Diff to V <sub>CMT</sub> : 120, 150, 220, 240                                                                     |
| Mini-LVDS                               | —                       | —                                     | None / Diff: 120, 150 / Diff to V <sub>CMT</sub> : 120, 150                                                                                        |
| BLVDS25                                 | —                       | —                                     | None                                                                                                                                               |
| MLVDS25                                 | —                       | —                                     | None                                                                                                                                               |
| RSDS                                    | —                       | —                                     | None / Diff: 120, 150, 220, 240/ Diff to V <sub>CMT</sub> : 120, 150, 220, 240                                                                     |
| LVPECL33                                | —                       | ≤2.5                                  | None / Diff: 120, 150, 220, 240/ Diff to V <sub>CMT</sub> : 120, 150, 220, 240                                                                     |

1. When not specified V<sub>CCIO</sub> can be set anywhere in the valid operating range.

2. V<sub>CCIO</sub> needed for on-chip termination to V<sub>CCIO</sub>/2 or V<sub>CCIO</sub> only. V<sub>CCIO</sub> is not specified for off-chip termination or V<sub>TT</sub> termination.

3. All ratioed input buffers and dedicated pin input buffers include hysteresis with a typical value of 50mV.

VDDAX25 needs to be connected independent of the use of the SERDES. This supply is used to control the SERDES CML I/O regardless of the SERDES being used in the design.

## Supported Source Synchronous Interfaces

The LatticeSC devices contain a variety of hardware, such as delay elements, DDR registers and PLLs, to simplify the implementation of Source Synchronous interfaces. Table 2-11 lists Source Synchronous and DDR/QDR standards supported in the LatticeSC. For additional detail refer to technical information at the end of the data sheet.

**Table 2-11. Source Synchronous Standards Table<sup>1</sup>**

| Source Synchronous Standard   | Clocking   | Speeds (MHz) | Data Rate (Mbps) |
|-------------------------------|------------|--------------|------------------|
| RapidIO                       | DDR        | 500          | 1000             |
| SPI4.2 (POS-PHY4)/NPSI        | DDR        | 500          | 1000             |
| SFI4/XSBI                     | DDR<br>SDR | 334<br>667   | 667              |
| XGMII                         | DDR        | 156.25       | 312              |
| CSIX                          | SDR        | 250          | 250              |
| QDRII/QDRII+ memory interface | DDR        | 300          | 600              |
| DDR memory interface          | DDR        | 240          | 480              |
| DDRII memory interface        | DDR        | 333          | 667              |
| RLDRAM memory interface       | DDR        | 400          | 800              |

1. Memory width is dependent on the system design and limited by the number of I/Os in the device.

## flexiPCS™ (Physical Coding Sublayer Block)

### flexiPCS Functionality

The LatticeSC family combines a high-performance FPGA fabric, high-performance I/Os and large embedded RAM in a single industry leading architecture. LatticeSC devices also feature up to 32 channels of embedded SERDES with associated Physical Coding Sublayer (PCS) logic. The flexiPCS logic can be configured to support numerous industry standard high-speed data transfer protocols.

Each channel of flexiPCS logic contains dedicated transmit and receive SERDES for high-speed, full-duplex serial data transfers at data rates up to 3.8 Gbps. The PCS logic in each channel can be configured to support an array of popular data protocols including SONET (STS-12/STS-12c, STS-48/STS-48c, and TFI-5 support of 10 Gbps or above), Gigabit Ethernet (compliant to the IEEE 100BASE-X specification), 1.02 or 2.04 Gbps Fibre Channel, PCI-Express, and Serial RapidIO. In addition, the protocol based logic can be fully or partially bypassed in a number of configurations to allow users flexibility in designing their own high-speed data interface.

Protocols requiring data rates above 3.8 Gbps can be accommodated by dedicating either one pair or all four channels in one flexiPCS quad block to one data link. One quad can support full-duplex serial data transfers at data rates up to 15.2 Gbps. A single flexiPCS quad can be configured to support 10Gb Ethernet (with a fully compliant XAUI interface), 10Gb Fibre Channel, and x4 PCI-Express and 4x RapidIO.

The flexiPCS also provides bypass modes that allow a direct 8-bit or 10-bit interface from the SERDES to the FPGA logic which can also be geared to run at 1/2 speed for a 16-bit or 20-bit interface to the FPGA logic. Each SERDES pin can be DC coupled independently and can allow for both high-speed and low-speed operation down to DC rates on the same SERDES pin, as required by some Serial Digital Video applications.

The ispLEVER design tools from Lattice support all modes of the flexiPCS. Most modes are dedicated to applications associated with a specific industry standard data protocol. Other more general purpose modes allow a user to define their own operation. With ispLEVER, the user can define the mode for each quad in a design. Nine modes are currently supported by the ispLEVER design flow:

Switching Test Conditions

Figure 3-15 shows the output test load that is used for AC testing. The specific values for resistance, capacitance, voltage, and other test conditions are shown in Table 3-4.

Figure 3-15. Output Test Load, LVTTTL and LVCMOS Standards

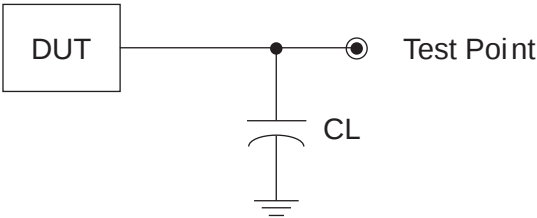


Table 3-4. Test Fixture Required Components, Non-Terminated Interfaces

| Test Condition                                    | C <sub>L</sub> | Timing Ref.                       | V <sub>T</sub>  |
|---------------------------------------------------|----------------|-----------------------------------|-----------------|
| LVTTTL and other LVCMOS settings (L -> H, H -> L) | 30pF           | LVCMOS 3.3 = 1.5V                 | —               |
|                                                   |                | LVCMOS 2.5 = V <sub>CCIO</sub> /2 | —               |
|                                                   |                | LVCMOS 1.8 = V <sub>CCIO</sub> /2 | —               |
|                                                   |                | LVCMOS 1.5 = V <sub>CCIO</sub> /2 | —               |
|                                                   |                | LVCMOS 1.2 = V <sub>CCIO</sub> /2 | —               |
| LVCMOS 2.5 I/O (Z -> H)                           | 30pF           | V <sub>CCIO</sub> /2              | V <sub>OL</sub> |
| LVCMOS 2.5 I/O (Z -> L)                           |                | V <sub>CCIO</sub> /2              | V <sub>OH</sub> |
| LVCMOS 2.5 I/O (H -> Z)                           |                | V <sub>OH</sub> - 0.15            | V <sub>OL</sub> |
| LVCMOS 2.5 I/O (L -> Z)                           |                | V <sub>OL</sub> + 0.15            | V <sub>OH</sub> |

Note: Output test conditions for all other interfaces are determined by the respective standards.

**Pin Information Summary (Cont.)**

| Pin Type                                         |                  | 1152 fcBGA |          |           | 1704 fcBGA |           |
|--------------------------------------------------|------------------|------------|----------|-----------|------------|-----------|
|                                                  |                  | LFSC/M40   | LFSC/M80 | LFSC/M115 | LFSC/M80   | LFSC/M115 |
| Single Ended User I/O                            |                  | 604        | 660      | 660       | 904        | 942       |
| Differential Pair User I/O                       |                  | 302        | 330      | 330       | 452        | 470       |
| LVDS Output Pairs                                |                  | 78         | 102      | 102       | 114        | 132       |
| Configuration                                    | Dedicated        | 11         | 11       | 11        | 11         | 11        |
|                                                  | Muxes/MPI sysBus | 72         | 72       | 72        | 72         | 72        |
| JTAG (excluding VCCJ)                            |                  | 4          | 4        | 4         | 4          | 4         |
| Dedicated Pins                                   |                  | 4          | 4        | 4         | 4          | 4         |
| VCC                                              |                  | 44         | 44       | 44        | 76         | 76        |
| VCC12                                            |                  | 52         | 52       | 52        | 88         | 88        |
| VCCAUX                                           |                  | 38         | 38       | 38        | 52         | 52        |
| VCCIO                                            | Bank 1           | 10         | 10       | 10        | 10         | 10        |
|                                                  | Bank 2           | 9          | 9        | 9         | 12         | 12        |
|                                                  | Bank 3           | 12         | 12       | 12        | 14         | 14        |
|                                                  | Bank 4           | 12         | 12       | 12        | 14         | 14        |
|                                                  | Bank 5           | 12         | 12       | 12        | 14         | 14        |
|                                                  | Bank 6           | 12         | 12       | 12        | 14         | 14        |
|                                                  | Bank 7           | 9          | 9        | 9         | 12         | 12        |
| VTT                                              | Bank 2           | 3          | 3        | 3         | 4          | 4         |
|                                                  | Bank 3           | 3          | 3        | 3         | 4          | 4         |
|                                                  | Bank 4           | 3          | 3        | 3         | 5          | 5         |
|                                                  | Bank 5           | 3          | 3        | 3         | 5          | 5         |
|                                                  | Bank 6           | 3          | 3        | 3         | 4          | 4         |
|                                                  | Bank 7           | 3          | 3        | 3         | 4          | 4         |
| GND                                              |                  | 130        | 130      | 130       | 184        | 184       |
| NC                                               |                  | 62         | 6        | 6         | 52         | 14        |
| Single Ended User /<br>Differential I/O per Bank | Bank 1           | 80/40      | 80/40    | 80/40     | 80/40      | 80/40     |
|                                                  | Bank 2           | 60/30      | 76/38    | 76/38     | 96/48      | 103/51    |
|                                                  | Bank 3           | 96/48      | 108/54   | 108/54    | 132/66     | 144/72    |
|                                                  | Bank 4           | 106/53     | 106/53   | 106/53    | 184/92     | 184/92    |
|                                                  | Bank 5           | 106/53     | 106/53   | 106/53    | 184/92     | 184/92    |
|                                                  | Bank 6           | 96/48      | 108/54   | 108/54    | 132/66     | 144/72    |
|                                                  | Bank 7           | 60/30      | 76/38    | 76/38     | 96/48      | 103/51    |
| LVDS Output Pairs Per Bank                       | Bank 2           | 15         | 21       | 21        | 24         | 27        |
|                                                  | Bank 3           | 24         | 30       | 30        | 33         | 39        |
|                                                  | Bank 6           | 24         | 30       | 30        | 33         | 39        |
|                                                  | Bank 7           | 15         | 21       | 21        | 24         | 27        |
| VCCJ                                             |                  | 1          | 1        | 1         | 1          | 1         |
| SERDES (signal + power supply)                   |                  | 108        | 108      | 108       | 212        | 212       |
| Total                                            |                  | 1152       | 1152     | 1152      | 1704       | 1704      |

**LFSC/M15, LFSC/M25 Logic Signal Connections: 900 fpBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M15      |            |                             | LFSC/M25      |            |                             |
|-------------|---------------|------------|-----------------------------|---------------|------------|-----------------------------|
|             | Ball Function | VCCIO Bank | Dual Function               | Ball Function | VCCIO Bank | Dual Function               |
| AH29        | PB48B         | 4          | LRC_DLLC_IN_C/LRC_DLLC_FB_D | PB68B         | 4          | LRC_DLLC_IN_C/LRC_DLLC_FB_D |
| AE26        | PB48C         | 4          |                             | PB68C         | 4          |                             |
| AD25        | PB48D         | 4          |                             | PB68D         | 4          |                             |
| AJ30        | PB49A         | 4          | LRC_PLLT_IN_A/LRC_PLLT_FB_B | PB69A         | 4          | LRC_PLLT_IN_A/LRC_PLLT_FB_B |
| AH30        | PB49B         | 4          | LRC_PLLC_IN_A/LRC_PLLC_FB_B | PB69B         | 4          | LRC_PLLC_IN_A/LRC_PLLC_FB_B |
| AG28        | PB49C         | 4          | LRC_DLLT_IN_D/LRC_DLLT_FB_C | PB69C         | 4          | LRC_DLLT_IN_D/LRC_DLLT_FB_C |
| AG29        | PB49D         | 4          | LRC_DLLC_IN_D/LRC_DLLC_FB_C | PB69D         | 4          | LRC_DLLC_IN_D/LRC_DLLC_FB_C |
| AF26        | VCC12         | -          |                             | VCC12         | -          |                             |
| AD27        | PROBE_VCC     | -          |                             | PROBE_VCC     | -          |                             |
| AG27        | VCC12         | -          |                             | VCC12         | -          |                             |
| AE28        | PROBE_GND     | -          |                             | PROBE_GND     | -          |                             |
| AC25        | PR45D         | 3          | LRC_PLLC_IN_B/LRC_PLLC_FB_A | PR57D         | 3          | LRC_PLLC_IN_B/LRC_PLLC_FB_A |
| AD26        | PR45C         | 3          | LRC_PLLT_IN_B/LRC_PLLT_FB_A | PR57C         | 3          | LRC_PLLT_IN_B/LRC_PLLT_FB_A |
| AF28        | PR45B         | 3          | LRC_DLLC_IN_F/LRC_DLLC_FB_E | PR57B         | 3          | LRC_DLLC_IN_F/LRC_DLLC_FB_E |
| AF29        | PR45A         | 3          | LRC_DLLT_IN_F/LRC_DLLT_FB_E | PR57A         | 3          | LRC_DLLT_IN_F/LRC_DLLT_FB_E |
| AC26        | PR44D         | 3          | LRC_DLLC_IN_E/LRC_DLLC_FB_F | PR55D         | 3          | LRC_DLLC_IN_E/LRC_DLLC_FB_F |
| AB26        | PR44C         | 3          | LRC_DLLT_IN_E/LRC_DLLT_FB_F | PR55C         | 3          | LRC_DLLT_IN_E/LRC_DLLT_FB_F |
| AG30        | PR44B         | 3          |                             | PR55B         | 3          |                             |
| AF30        | PR44A         | 3          |                             | PR55A         | 3          |                             |
| AC28        | PR43B         | 3          |                             | PR52B         | 3          |                             |
| AB28        | PR43A         | 3          |                             | PR52A         | 3          |                             |
| AB27        | PR41D         | 3          | VREF2_3                     | PR51D         | 3          | VREF2_3                     |
| AE30        | PR41B         | 3          |                             | PR51B         | 3          |                             |
| AD30        | PR41A         | 3          |                             | PR51A         | 3          |                             |
| AB25        | PR40B         | 3          |                             | PR49B         | 3          |                             |
| AA25        | PR40A         | 3          |                             | PR49A         | 3          |                             |
| AA30        | PR39B         | 3          |                             | PR48B         | 3          |                             |
| Y30         | PR39A         | 3          |                             | PR48A         | 3          |                             |
| W29         | PR37B         | 3          |                             | PR44B         | 3          |                             |
| V29         | PR37A         | 3          |                             | PR44A         | 3          |                             |
| U30         | PR36B         | 3          |                             | PR43B         | 3          |                             |
| T30         | PR36A         | 3          |                             | PR43A         | 3          |                             |
| V25         | PR35D         | 3          | DIFFR_3                     | PR42D         | 3          | DIFFR_3                     |
| W28         | PR35B         | 3          |                             | PR42B         | 3          |                             |
| V28         | PR35A         | 3          |                             | PR42A         | 3          |                             |
| R30         | PR33B         | 3          |                             | PR38B         | 3          |                             |
| P30         | PR33A         | 3          |                             | PR38A         | 3          |                             |
| N30         | PR32B         | 3          |                             | PR35B         | 3          |                             |
| M29         | PR32A         | 3          |                             | PR35A         | 3          |                             |
| U26         | PR31D         | 3          |                             | PR34D         | 3          |                             |
| T26         | PR31C         | 3          | VREF1_3                     | PR34C         | 3          | VREF1_3                     |
| U28         | PR31B         | 3          |                             | PR34B         | 3          |                             |
| T28         | PR31A         | 3          |                             | PR34A         | 3          |                             |
| M30         | PR28D         | 3          | PCLKC3_2                    | PR31D         | 3          | PCLKC3_2                    |
| L29         | PR28C         | 3          | PCLKT3_2                    | PR31C         | 3          | PCLKT3_2                    |

**LFSC/M15, LFSC/M25 Logic Signal Connections: 900 fpBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M15      |            |               | LFSC/M25      |            |               |
|-------------|---------------|------------|---------------|---------------|------------|---------------|
|             | Ball Function | VCCIO Bank | Dual Function | Ball Function | VCCIO Bank | Dual Function |
| W24         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC17        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC18        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC19        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AD17        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AD18        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AD19        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC12        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC13        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC14        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AD12        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AD13        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AD14        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| U7          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| U8          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| V7          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| V8          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| W7          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| W8          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| M7          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| M8          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| N7          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| N8          | VCCAUX        | -          |               | VCCAUX        | -          |               |
| H10         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| H21         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| H22         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| H9          | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J11         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J12         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J13         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J14         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J15         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J16         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J17         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J18         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J19         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J20         | VCCIO1        | -          |               | VCCIO1        | -          |               |
| J23         | VCCIO2        | -          |               | VCCIO2        | -          |               |
| J24         | VCCIO2        | -          |               | VCCIO2        | -          |               |
| K23         | VCCIO2        | -          |               | VCCIO2        | -          |               |
| K24         | VCCIO2        | -          |               | VCCIO2        | -          |               |
| L22         | VCCIO2        | -          |               | VCCIO2        | -          |               |
| L23         | VCCIO2        | -          |               | VCCIO2        | -          |               |
| M22         | VCCIO2        | -          |               | VCCIO2        | -          |               |
| N22         | VCCIO2        | -          |               | VCCIO2        | -          |               |

**LFSC/M25, LFSC/M40 Logic Signal Connections: 1020 fcBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M25      |            |               | LFSC/M40      |            |               |
|-------------|---------------|------------|---------------|---------------|------------|---------------|
|             | Ball Function | VCCIO Bank | Dual Function | Ball Function | VCCIO Bank | Dual Function |
| Y6          | PR42D         | 3          | DIFFR_3       | PR51D         | 3          | DIFFR_3       |
| W6          | PR42C         | 3          |               | PR51C         | 3          |               |
| Y2          | PR42B         | 3          |               | PR51B         | 3          |               |
| W2          | PR42A         | 3          |               | PR51A         | 3          |               |
| W7          | PR40D         | 3          |               | PR49D         | 3          |               |
| V8          | PR40C         | 3          |               | PR49C         | 3          |               |
| W4          | PR40B         | 3          |               | PR49B         | 3          |               |
| W3          | PR40A         | 3          |               | PR49A         | 3          |               |
| V5          | PR39D         | 3          |               | PR48D         | 3          |               |
| U6          | PR39C         | 3          |               | PR48C         | 3          |               |
| V3          | PR39B         | 3          |               | PR48B         | 3          |               |
| V4          | PR39A         | 3          |               | PR48A         | 3          |               |
| V10         | PR38D         | 3          |               | PR47D         | 3          |               |
| V9          | PR38C         | 3          |               | PR47C         | 3          |               |
| V2          | PR38B         | 3          |               | PR47B         | 3          |               |
| V1          | PR38A         | 3          |               | PR47A         | 3          |               |
| U8          | PR36D         | 3          |               | PR45D         | 3          |               |
| U7          | PR36C         | 3          |               | PR45C         | 3          |               |
| U2          | PR36B         | 3          |               | PR45B         | 3          |               |
| U1          | PR36A         | 3          |               | PR45A         | 3          |               |
| U5          | PR35D         | 3          |               | PR44D         | 3          |               |
| T6          | PR35C         | 3          |               | PR44C         | 3          |               |
| T1          | PR35B         | 3          |               | PR44B         | 3          |               |
| T2          | PR35A         | 3          |               | PR44A         | 3          |               |
| U9          | PR34D         | 3          |               | PR43D         | 3          |               |
| U10         | PR34C         | 3          | VREF1_3       | PR43C         | 3          | VREF1_3       |
| R1          | PR34B         | 3          |               | PR43B         | 3          |               |
| R2          | PR34A         | 3          |               | PR43A         | 3          |               |
| T7          | PR31D         | 3          | PCLKC3_2      | PR40D         | 3          | PCLKC3_2      |
| T8          | PR31C         | 3          | PCLKT3_2      | PR40C         | 3          | PCLKT3_2      |
| R4          | PR31B         | 3          |               | PR40B         | 3          |               |
| R3          | PR31A         | 3          |               | PR40A         | 3          |               |
| T5          | PR30D         | 3          | PCLKC3_3      | PR39D         | 3          | PCLKC3_3      |
| R5          | PR30C         | 3          | PCLKT3_3      | PR39C         | 3          | PCLKT3_3      |
| P2          | PR30B         | 3          |               | PR39B         | 3          |               |
| P1          | PR30A         | 3          |               | PR39A         | 3          |               |
| T9          | PR29D         | 3          | PCLKC3_1      | PR38D         | 3          | PCLKC3_1      |
| T10         | PR29C         | 3          | PCLKT3_1      | PR38C         | 3          | PCLKT3_1      |
| P4          | PR29B         | 3          | PCLKC3_0      | PR38B         | 3          | PCLKC3_0      |
| P3          | PR29A         | 3          | PCLKT3_0      | PR38A         | 3          | PCLKT3_0      |
| P5          | PR27D         | 2          | PCLKC2_2      | PR36D         | 2          | PCLKC2_2      |
| P6          | PR27C         | 2          | PCLKT2_2      | PR36C         | 2          | PCLKT2_2      |
| N1          | PR27B         | 2          | PCLKC2_0      | PR36B         | 2          | PCLKC2_0      |
| N2          | PR27A         | 2          | PCLKT2_0      | PR36A         | 2          | PCLKT2_0      |
| R9          | PR26D         | 2          | PCLKC2_3      | PR35D         | 2          | PCLKC2_3      |
| R8          | PR26C         | 2          | PCLKT2_3      | PR35C         | 2          | PCLKT2_3      |
| M1          | PR26B         | 2          | PCLKC2_1      | PR35B         | 2          | PCLKC2_1      |
| L1          | PR26A         | 2          | PCLKT2_1      | PR35A         | 2          | PCLKT2_1      |
| N9          | PR25D         | 2          | DIFFR_2       | PR23D         | 2          | DIFFR_2       |
| M9          | PR25C         | 2          | VREF1_2       | PR23C         | 2          | VREF1_2       |

**LFSC/M25, LFSC/M40 Logic Signal Connections: 1020 fcBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M25      |            |               | LFSC/M40      |            |               |
|-------------|---------------|------------|---------------|---------------|------------|---------------|
|             | Ball Function | VCCIO Bank | Dual Function | Ball Function | VCCIO Bank | Dual Function |
| E22         | VCC12         | -          |               | VCC12         | -          |               |
| E21         | VCC12         | -          |               | VCC12         | -          |               |
| E3          | VCC12         | -          |               | VCC12         | -          |               |
| E4          | VCC12         | -          |               | VCC12         | -          |               |
| E6          | VCC12         | -          |               | VCC12         | -          |               |
| E7          | VCC12         | -          |               | VCC12         | -          |               |
| E8          | VCC12         | -          |               | VCC12         | -          |               |
| E9          | VCC12         | -          |               | VCC12         | -          |               |
| E11         | VCC12         | -          |               | VCC12         | -          |               |
| E12         | VCC12         | -          |               | VCC12         | -          |               |
| A23         | GND           | -          |               | GND           | -          |               |
| A31         | GND           | -          |               | GND           | -          |               |
| AA13        | GND           | -          |               | GND           | -          |               |
| AA15        | GND           | -          |               | GND           | -          |               |
| AA18        | GND           | -          |               | GND           | -          |               |
| AA20        | GND           | -          |               | GND           | -          |               |
| AA26        | GND           | -          |               | GND           | -          |               |
| AA6         | GND           | -          |               | GND           | -          |               |
| AB10        | GND           | -          |               | GND           | -          |               |
| AB24        | GND           | -          |               | GND           | -          |               |
| AC14        | GND           | -          |               | GND           | -          |               |
| AC22        | GND           | -          |               | GND           | -          |               |
| AC29        | GND           | -          |               | GND           | -          |               |
| AC3         | GND           | -          |               | GND           | -          |               |
| AD11        | GND           | -          |               | GND           | -          |               |
| AD19        | GND           | -          |               | GND           | -          |               |
| AD27        | GND           | -          |               | GND           | -          |               |
| AD7         | GND           | -          |               | GND           | -          |               |
| AF12        | GND           | -          |               | GND           | -          |               |
| AF18        | GND           | -          |               | GND           | -          |               |
| AF24        | GND           | -          |               | GND           | -          |               |
| AF30        | GND           | -          |               | GND           | -          |               |
| AF4         | GND           | -          |               | GND           | -          |               |
| AG15        | GND           | -          |               | GND           | -          |               |
| AG21        | GND           | -          |               | GND           | -          |               |
| AG9         | GND           | -          |               | GND           | -          |               |
| AJ10        | GND           | -          |               | GND           | -          |               |
| AJ16        | GND           | -          |               | GND           | -          |               |
| AJ20        | GND           | -          |               | GND           | -          |               |
| AJ26        | GND           | -          |               | GND           | -          |               |
| AJ29        | GND           | -          |               | GND           | -          |               |
| AJ4         | GND           | -          |               | GND           | -          |               |
| AK13        | GND           | -          |               | GND           | -          |               |
| AK17        | GND           | -          |               | GND           | -          |               |
| AK23        | GND           | -          |               | GND           | -          |               |
| AK7         | GND           | -          |               | GND           | -          |               |
| AL1         | GND           | -          |               | GND           | -          |               |
| AL32        | GND           | -          |               | GND           | -          |               |
| AM2         | GND           | -          |               | GND           | -          |               |
| AM31        | GND           | -          |               | GND           | -          |               |

**LFSC/M40, LFSC/M80 Logic Signal Connections: 1152 fcBGA<sup>1, 2</sup>**

| Ball Number | LFSC/M40      |            |                             | LFSC/M80      |            |                             |
|-------------|---------------|------------|-----------------------------|---------------|------------|-----------------------------|
|             | Ball Function | VCCIO Bank | Dual Function               | Ball Function | VCCIO Bank | Dual Function               |
| G27         | A_REFCLKP_L   | -          |                             | A_REFCLKP_L   | -          |                             |
| H27         | A_REFCLKN_L   | -          |                             | A_REFCLKN_L   | -          |                             |
| H25         | VCC12         | -          |                             | VCC12         | -          |                             |
| H26         | RESP_ULC      | -          |                             | RESP_ULC      | -          |                             |
| B33         | RESETN        | 1          |                             | RESETN        | 1          |                             |
| C34         | TSALLN        | 1          |                             | TSALLN        | 1          |                             |
| D34         | DONE          | 1          |                             | DONE          | 1          |                             |
| C33         | INITN         | 1          |                             | INITN         | 1          |                             |
| J27         | M0            | 1          |                             | M0            | 1          |                             |
| K27         | M1            | 1          |                             | M1            | 1          |                             |
| M26         | M2            | 1          |                             | M2            | 1          |                             |
| L26         | M3            | 1          |                             | M3            | 1          |                             |
| F30         | PL16A         | 7          | ULC_PLLT_IN_A/ULC_PLLT_FB_B | PL16A         | 7          | ULC_PLLT_IN_A/ULC_PLLT_FB_B |
| G30         | PL16B         | 7          | ULC_PLLC_IN_A/ULC_PLLC_FB_B | PL16B         | 7          | ULC_PLLC_IN_A/ULC_PLLC_FB_B |
| H28         | PL16C         | 7          |                             | PL16C         | 7          |                             |
| J28         | PL16D         | 7          |                             | PL16D         | 7          |                             |
| F31         | PL17A         | 7          | ULC_DLLT_IN_C/ULC_DLLT_FB_D | PL17A         | 7          | ULC_DLLT_IN_C/ULC_DLLT_FB_D |
| G31         | PL17B         | 7          | ULC_DLLC_IN_C/ULC_DLLC_FB_D | PL17B         | 7          | ULC_DLLC_IN_C/ULC_DLLC_FB_D |
| N25         | PL17C         | 7          | ULC_PLLT_IN_B/ULC_PLLT_FB_A | PL17C         | 7          | ULC_PLLT_IN_B/ULC_PLLT_FB_A |
| P25         | PL17D         | 7          | ULC_PLLC_IN_B/ULC_PLLC_FB_A | PL17D         | 7          | ULC_PLLC_IN_B/ULC_PLLC_FB_A |
| D33         | PL18A         | 7          | ULC_DLLT_IN_D/ULC_DLLT_FB_C | PL18A         | 7          | ULC_DLLT_IN_D/ULC_DLLT_FB_C |
| E33         | PL18B         | 7          | ULC_DLLC_IN_D/ULC_DLLC_FB_C | PL18B         | 7          | ULC_DLLC_IN_D/ULC_DLLC_FB_C |
| H29         | PL18C         | 7          |                             | PL18C         | 7          |                             |
| J29         | PL18D         | 7          | VREF2_7                     | PL18D         | 7          | VREF2_7                     |
| F32         | PL21A         | 7          |                             | PL20A         | 7          |                             |
| G32         | PL21B         | 7          |                             | PL20B         | 7          |                             |
| P26         | PL21C         | 7          |                             | PL20C         | 7          |                             |
| N26         | PL21D         | 7          |                             | PL20D         | 7          |                             |
| H30         | PL22A         | 7          |                             | PL21A         | 7          |                             |
| J30         | PL22B         | 7          |                             | PL21B         | 7          |                             |
| L28         | PL22C         | 7          |                             | PL21C         | 7          |                             |
| M28         | PL22D         | 7          |                             | PL21D         | 7          |                             |
| J31         | PL23A         | 7          |                             | PL29A         | 7          |                             |
| K31         | PL23B         | 7          |                             | PL29B         | 7          |                             |
| L27         | PL23C         | 7          | VREF1_7                     | PL29C         | 7          | VREF1_7                     |
| M27         | PL23D         | 7          | DIFFR_7                     | PL29D         | 7          | DIFFR_7                     |
| J32         | PL25A         | 7          |                             | PL31A         | 7          |                             |
| K32         | PL25B         | 7          |                             | PL31B         | 7          |                             |
| L29         | PL25C         | 7          |                             | PL31C         | 7          |                             |
| M29         | PL25D         | 7          |                             | PL31D         | 7          |                             |
| H33         | PL26A         | 7          |                             | PL33A         | 7          |                             |
| J33         | PL26B         | 7          |                             | PL33B         | 7          |                             |
| N27         | PL26C         | 7          |                             | PL33C         | 7          |                             |
| P27         | PL26D         | 7          |                             | PL33D         | 7          |                             |
| K33         | PL27A         | 7          |                             | PL35A         | 7          |                             |

**LFSC/M40, LFSC/M80 Logic Signal Connections: 1152 fcBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M40      |             |               | LFSC/M80      |             |               |
|-------------|---------------|-------------|---------------|---------------|-------------|---------------|
|             | Ball Function | VCCI/O Bank | Dual Function | Ball Function | VCCI/O Bank | Dual Function |
| AH27        | PB5C          | 5           |               | PB5C          | 5           |               |
| AH26        | PB5D          | 5           | VREF1_5       | PB5D          | 5           | VREF1_5       |
| AN32        | PB7A          | 5           |               | PB7A          | 5           |               |
| AP32        | PB7B          | 5           |               | PB7B          | 5           |               |
| AF25        | PB7C          | 5           |               | PB7C          | 5           |               |
| AE25        | PB7D          | 5           |               | PB7D          | 5           |               |
| AN31        | PB8A          | 5           |               | PB9A          | 5           |               |
| AN30        | PB8B          | 5           |               | PB9B          | 5           |               |
| AK29        | PB8C          | 5           |               | PB9C          | 5           |               |
| AK28        | PB8D          | 5           |               | PB9D          | 5           |               |
| AP31        | PB9A          | 5           |               | PB11A         | 5           |               |
| AP30        | PB9B          | 5           |               | PB11B         | 5           |               |
| AD24        | PB9C          | 5           |               | PB11C         | 5           |               |
| AE24        | PB9D          | 5           |               | PB11D         | 5           |               |
| AM29        | PB11A         | 5           |               | PB13A         | 5           |               |
| AM28        | PB11B         | 5           |               | PB13B         | 5           |               |
| AJ27        | PB11C         | 5           |               | PB13C         | 5           |               |
| AJ26        | PB11D         | 5           |               | PB13D         | 5           |               |
| AP29        | PB13A         | 5           |               | PB15A         | 5           |               |
| AP28        | PB13B         | 5           |               | PB15B         | 5           |               |
| AK27        | PB13C         | 5           |               | PB15C         | 5           |               |
| AK26        | PB13D         | 5           |               | PB15D         | 5           |               |
| AN29        | PB15A         | 5           |               | PB17A         | 5           |               |
| AN28        | PB15B         | 5           |               | PB17B         | 5           |               |
| AG25        | PB15C         | 5           |               | PB17C         | 5           |               |
| AG24        | PB15D         | 5           |               | PB17D         | 5           |               |
| AL26        | PB17A         | 5           |               | PB19A         | 5           |               |
| AL25        | PB17B         | 5           |               | PB19B         | 5           |               |
| AG23        | PB17C         | 5           |               | PB19C         | 5           |               |
| AG22        | PB17D         | 5           |               | PB19D         | 5           |               |
| AN27        | PB19A         | 5           |               | PB21A         | 5           |               |
| AN26        | PB19B         | 5           |               | PB21B         | 5           |               |
| AF24        | PB19C         | 5           |               | PB21C         | 5           |               |
| AF23        | PB19D         | 5           |               | PB21D         | 5           |               |
| AP27        | PB22A         | 5           |               | PB24A         | 5           |               |
| AP26        | PB22B         | 5           |               | PB24B         | 5           |               |
| AK25        | PB22C         | 5           |               | PB24C         | 5           |               |
| AK24        | PB22D         | 5           |               | PB24D         | 5           |               |
| AN25        | PB25A         | 5           |               | PB27A         | 5           |               |
| AN24        | PB25B         | 5           |               | PB27B         | 5           |               |
| AE22        | PB25C         | 5           |               | PB27C         | 5           |               |
| AE21        | PB25D         | 5           |               | PB27D         | 5           |               |
| AM26        | PB26A         | 5           |               | PB29A         | 5           |               |
| AM25        | PB26B         | 5           |               | PB29B         | 5           |               |
| AF22        | PB26C         | 5           |               | PB29C         | 5           |               |

**LFSC/M40, LFSC/M80 Logic Signal Connections: 1152 fcBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M40      |            |               | LFSC/M80      |            |               |
|-------------|---------------|------------|---------------|---------------|------------|---------------|
|             | Ball Function | VCCIO Bank | Dual Function | Ball Function | VCCIO Bank | Dual Function |
| AF21        | PB26D         | 5          |               | PB29D         | 5          |               |
| AN23        | PB27A         | 5          |               | PB45A         | 5          |               |
| AN22        | PB27B         | 5          |               | PB45B         | 5          |               |
| AP23        | PB29A         | 5          |               | PB55A         | 5          |               |
| AP22        | PB29B         | 5          |               | PB55B         | 5          |               |
| AG21        | PB29C         | 5          |               | PB55C         | 5          |               |
| AG20        | PB29D         | 5          |               | PB55D         | 5          |               |
| AP25        | PB30A         | 5          | PCLKT5_3      | PB48A         | 5          | PCLKT5_3      |
| AP24        | PB30B         | 5          | PCLKC5_3      | PB48B         | 5          | PCLKC5_3      |
| AD21        | PB30C         | 5          | PCLKT5_4      | PB48C         | 5          | PCLKT5_4      |
| AD20        | PB30D         | 5          | PCLKC5_4      | PB48D         | 5          | PCLKC5_4      |
| AL23        | PB31A         | 5          | PCLKT5_5      | PB49A         | 5          | PCLKT5_5      |
| AL22        | PB31B         | 5          | PCLKC5_5      | PB49B         | 5          | PCLKC5_5      |
| AH24        | PB31C         | 5          |               | PB49C         | 5          |               |
| AH23        | PB31D         | 5          |               | PB49D         | 5          |               |
| AM23        | PB33A         | 5          | PCLKT5_0      | PB51A         | 5          | PCLKT5_0      |
| AM22        | PB33B         | 5          | PCLKC5_0      | PB51B         | 5          | PCLKC5_0      |
| AJ24        | PB33C         | 5          |               | PB51C         | 5          |               |
| AJ23        | PB33D         | 5          | VREF2_5       | PB51D         | 5          | VREF2_5       |
| AN21        | PB34A         | 5          | PCLKT5_1      | PB52A         | 5          | PCLKT5_1      |
| AN20        | PB34B         | 5          | PCLKC5_1      | PB52B         | 5          | PCLKC5_1      |
| AE19        | PB34C         | 5          | PCLKT5_6      | PB52C         | 5          | PCLKT5_6      |
| AD19        | PB34D         | 5          | PCLKC5_6      | PB52D         | 5          | PCLKC5_6      |
| AK21        | PB35A         | 5          | PCLKT5_2      | PB53A         | 5          | PCLKT5_2      |
| AK20        | PB35B         | 5          | PCLKC5_2      | PB53B         | 5          | PCLKC5_2      |
| AK23        | PB35C         | 5          | PCLKT5_7      | PB53C         | 5          | PCLKT5_7      |
| AK22        | PB35D         | 5          | PCLKC5_7      | PB53D         | 5          | PCLKC5_7      |
| AL20        | PB37A         | 5          |               | PB56A         | 5          |               |
| AL19        | PB37B         | 5          |               | PB56B         | 5          |               |
| AG19        | PB37C         | 5          |               | PB56C         | 5          |               |
| AF19        | PB37D         | 5          |               | PB56D         | 5          |               |
| AP21        | PB38A         | 5          |               | PB57A         | 5          |               |
| AP20        | PB38B         | 5          |               | PB57B         | 5          |               |
| AH21        | PB38C         | 5          |               | PB57C         | 5          |               |
| AH20        | PB38D         | 5          |               | PB57D         | 5          |               |
| AM20        | PB39A         | 5          |               | PB59A         | 5          |               |
| AM19        | PB39B         | 5          |               | PB59B         | 5          |               |
| AJ21        | PB39C         | 5          |               | PB59C         | 5          |               |
| AJ20        | PB39D         | 5          |               | PB59D         | 5          |               |
| AK19        | PB41A         | 5          |               | PB60A         | 5          |               |
| AK18        | PB41B         | 5          |               | PB60B         | 5          |               |
| AE18        | PB41C         | 5          |               | PB60C         | 5          |               |
| AD18        | PB41D         | 5          |               | PB60D         | 5          |               |
| AN19        | PB42A         | 5          |               | PB61A         | 5          |               |
| AN18        | PB42B         | 5          |               | PB61B         | 5          |               |

**LFSC/M40, LFSC/M80 Logic Signal Connections: 1152 fcBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M40      |            |                    | LFSC/M80      |            |                    |
|-------------|---------------|------------|--------------------|---------------|------------|--------------------|
|             | Ball Function | VCCIO Bank | Dual Function      | Ball Function | VCCIO Bank | Dual Function      |
| C2          | VCCJ          | -          |                    | VCCJ          | -          |                    |
| M9          | TDO           | -          | TDO                | TDO           | -          | TDO                |
| L9          | TMS           | -          |                    | TMS           | -          |                    |
| D1          | TCK           | -          |                    | TCK           | -          |                    |
| C1          | TDI           | -          |                    | TDI           | -          |                    |
| J8          | PROGRAMN      | 1          |                    | PROGRAMN      | 1          |                    |
| K8          | MPIIRQN       | 1          | CFGIRQN/MPI_IRQ_N  | MPIIRQN       | 1          | CFGIRQN/MPI_IRQ_N  |
| B2          | CCLK          | 1          |                    | CCLK          | 1          |                    |
| H9          | RESP_URC      | -          |                    | RESP_URC      | -          |                    |
| H10         | VCC12         | -          |                    | VCC12         | -          |                    |
| H8          | A_REFCLKN_R   | -          |                    | A_REFCLKN_R   | -          |                    |
| G8          | A_REFCLKP_R   | -          |                    | A_REFCLKP_R   | -          |                    |
| C3          | VCC12         | -          |                    | VCC12         | -          |                    |
| D3          | A_VDDIB0_R    | -          |                    | A_VDDIB0_R    | -          |                    |
| A3          | A_HDINP0_R    | -          | PCS 3E0 CH 0 IN P  | A_HDINP0_R    | -          | PCS 3E0 CH 0 IN P  |
| B3          | A_HDINN0_R    | -          | PCS 3E0 CH 0 IN N  | A_HDINN0_R    | -          | PCS 3E0 CH 0 IN N  |
| E5          | VCC12         | -          |                    | VCC12         | -          |                    |
| A4          | A_HDOUTP0_R   | -          | PCS 3E0 CH 0 OUT P | A_HDOUTP0_R   | -          | PCS 3E0 CH 0 OUT P |
| F6          | A_VDDOB0_R    | -          |                    | A_VDDOB0_R    | -          |                    |
| B4          | A_HDOUTN0_R   | -          | PCS 3E0 CH 0 OUT N | A_HDOUTN0_R   | -          | PCS 3E0 CH 0 OUT N |
| F7          | A_VDDOB1_R    | -          |                    | A_VDDOB1_R    | -          |                    |
| B5          | A_HDOUTN1_R   | -          | PCS 3E0 CH 1 OUT N | A_HDOUTN1_R   | -          | PCS 3E0 CH 1 OUT N |
| E6          | VCC12         | -          |                    | VCC12         | -          |                    |
| A5          | A_HDOUTP1_R   | -          | PCS 3E0 CH 1 OUT P | A_HDOUTP1_R   | -          | PCS 3E0 CH 1 OUT P |
| B6          | A_HDINN1_R    | -          | PCS 3E0 CH 1 IN N  | A_HDINN1_R    | -          | PCS 3E0 CH 1 IN N  |
| A6          | A_HDINP1_R    | -          | PCS 3E0 CH 1 IN P  | A_HDINP1_R    | -          | PCS 3E0 CH 1 IN P  |
| C6          | VCC12         | -          |                    | VCC12         | -          |                    |
| D4          | A_VDDIB1_R    | -          |                    | A_VDDIB1_R    | -          |                    |
| C7          | VCC12         | -          |                    | VCC12         | -          |                    |
| D5          | A_VDDIB2_R    | -          |                    | A_VDDIB2_R    | -          |                    |
| A7          | A_HDINP2_R    | -          | PCS 3E0 CH 2 IN P  | A_HDINP2_R    | -          | PCS 3E0 CH 2 IN P  |
| B7          | A_HDINN2_R    | -          | PCS 3E0 CH 2 IN N  | A_HDINN2_R    | -          | PCS 3E0 CH 2 IN N  |
| E7          | VCC12         | -          |                    | VCC12         | -          |                    |
| A8          | A_HDOUTP2_R   | -          | PCS 3E0 CH 2 OUT P | A_HDOUTP2_R   | -          | PCS 3E0 CH 2 OUT P |
| F8          | A_VDDOB2_R    | -          |                    | A_VDDOB2_R    | -          |                    |
| B8          | A_HDOUTN2_R   | -          | PCS 3E0 CH 2 OUT N | A_HDOUTN2_R   | -          | PCS 3E0 CH 2 OUT N |
| F9          | A_VDDOB3_R    | -          |                    | A_VDDOB3_R    | -          |                    |
| B9          | A_HDOUTN3_R   | -          | PCS 3E0 CH 3 OUT N | A_HDOUTN3_R   | -          | PCS 3E0 CH 3 OUT N |
| E8          | VCC12         | -          |                    | VCC12         | -          |                    |
| A9          | A_HDOUTP3_R   | -          | PCS 3E0 CH 3 OUT P | A_HDOUTP3_R   | -          | PCS 3E0 CH 3 OUT P |
| B10         | A_HDINN3_R    | -          | PCS 3E0 CH 3 IN N  | A_HDINN3_R    | -          | PCS 3E0 CH 3 IN N  |
| A10         | A_HDINP3_R    | -          | PCS 3E0 CH 3 IN P  | A_HDINP3_R    | -          | PCS 3E0 CH 3 IN P  |
| C10         | VCC12         | -          |                    | VCC12         | -          |                    |
| D6          | A_VDDIB3_R    | -          |                    | A_VDDIB3_R    | -          |                    |
| G10         | VCC12         | -          |                    | VCC12         | -          |                    |

**LFSC/M40, LFSC/M80 Logic Signal Connections: 1152 fcBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M40      |            |               | LFSC/M80      |            |               |
|-------------|---------------|------------|---------------|---------------|------------|---------------|
|             | Ball Function | VCCIO Bank | Dual Function | Ball Function | VCCIO Bank | Dual Function |
| K20         | GND           | -          |               | GND           | -          |               |
| K23         | GND           | -          |               | GND           | -          |               |
| K26         | GND           | -          |               | GND           | -          |               |
| K28         | GND           | -          |               | GND           | -          |               |
| K6          | GND           | -          |               | GND           | -          |               |
| K9          | GND           | -          |               | GND           | -          |               |
| L12         | GND           | -          |               | GND           | -          |               |
| L32         | GND           | -          |               | GND           | -          |               |
| L4          | GND           | -          |               | GND           | -          |               |
| M10         | GND           | -          |               | GND           | -          |               |
| M17         | GND           | -          |               | GND           | -          |               |
| M24         | GND           | -          |               | GND           | -          |               |
| N29         | GND           | -          |               | GND           | -          |               |
| N7          | GND           | -          |               | GND           | -          |               |
| P15         | GND           | -          |               | GND           | -          |               |
| P20         | GND           | -          |               | GND           | -          |               |
| P3          | GND           | -          |               | GND           | -          |               |
| P31         | GND           | -          |               | GND           | -          |               |
| R10         | GND           | -          |               | GND           | -          |               |
| R14         | GND           | -          |               | GND           | -          |               |
| R16         | GND           | -          |               | GND           | -          |               |
| R19         | GND           | -          |               | GND           | -          |               |
| R21         | GND           | -          |               | GND           | -          |               |
| R26         | GND           | -          |               | GND           | -          |               |
| T15         | GND           | -          |               | GND           | -          |               |
| T17         | GND           | -          |               | GND           | -          |               |
| T18         | GND           | -          |               | GND           | -          |               |
| T20         | GND           | -          |               | GND           | -          |               |
| T28         | GND           | -          |               | GND           | -          |               |
| T6          | GND           | -          |               | GND           | -          |               |
| U16         | GND           | -          |               | GND           | -          |               |
| U19         | GND           | -          |               | GND           | -          |               |
| U23         | GND           | -          |               | GND           | -          |               |
| U32         | GND           | -          |               | GND           | -          |               |
| U4          | GND           | -          |               | GND           | -          |               |
| V12         | GND           | -          |               | GND           | -          |               |
| V16         | GND           | -          |               | GND           | -          |               |
| V19         | GND           | -          |               | GND           | -          |               |
| V3          | GND           | -          |               | GND           | -          |               |
| V31         | GND           | -          |               | GND           | -          |               |
| W15         | GND           | -          |               | GND           | -          |               |
| W17         | GND           | -          |               | GND           | -          |               |
| W18         | GND           | -          |               | GND           | -          |               |
| W20         | GND           | -          |               | GND           | -          |               |
| W29         | GND           | -          |               | GND           | -          |               |

**LFSC/M40, LFSC/M80 Logic Signal Connections: 1152 fcBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M40      |            |               | LFSC/M80      |            |               |
|-------------|---------------|------------|---------------|---------------|------------|---------------|
|             | Ball Function | VCCIO Bank | Dual Function | Ball Function | VCCIO Bank | Dual Function |
| AB15        | VCC12         | -          |               | VCC12         | -          |               |
| AB20        | VCC12         | -          |               | VCC12         | -          |               |
| N15         | VCC12         | -          |               | VCC12         | -          |               |
| N20         | VCC12         | -          |               | VCC12         | -          |               |
| R13         | VCC12         | -          |               | VCC12         | -          |               |
| R22         | VCC12         | -          |               | VCC12         | -          |               |
| Y13         | VCC12         | -          |               | VCC12         | -          |               |
| Y22         | VCC12         | -          |               | VCC12         | -          |               |
| AA12        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AA23        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AB12        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AB16        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AB17        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AB18        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AB19        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AB23        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC12        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC13        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| Y19         | GND           | -          |               | GND           | -          |               |
| AC14        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC17        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC21        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC22        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| AC23        | VCCAUX        | -          |               | VCCAUX        | -          |               |
| M13         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| M14         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| M18         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| M21         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| M22         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| N12         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| N16         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| N17         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| N18         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| N19         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| N23         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| P12         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| P23         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| T13         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| T22         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| U12         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| U13         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| U22         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| V13         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| V22         | VCCAUX        | -          |               | VCCAUX        | -          |               |
| V23         | VCCAUX        | -          |               | VCCAUX        | -          |               |

**LFSC/M115 Logic Signal Connections: 1152 fcBGA<sup>1, 2</sup>**

| Ball Number | LFSC/M115     |            |                             |
|-------------|---------------|------------|-----------------------------|
|             | Ball Function | VCCIO Bank | Dual Function               |
| AL4         | PR117B        | 3          | LRC_DLLC_IN_F/LRC_DLLC_FB_E |
| AL3         | PR117A        | 3          | LRC_DLLT_IN_F/LRC_DLLT_FB_E |
| AD10        | PR116D        | 3          |                             |
| AD9         | PR116C        | 3          |                             |
| AH4         | PR116B        | 3          |                             |
| AJ4         | PR116A        | 3          |                             |
| AK5         | PR115D        | 3          | LRC_DLLC_IN_E/LRC_DLLC_FB_F |
| AJ5         | PR115C        | 3          | LRC_DLLT_IN_E/LRC_DLLT_FB_F |
| AM1         | PR115B        | 3          |                             |
| AL1         | PR115A        | 3          |                             |
| AH5         | PR112D        | 3          |                             |
| AG5         | PR112C        | 3          |                             |
| AL2         | PR112B        | 3          |                             |
| AK2         | PR112A        | 3          |                             |
| AB9         | PR109D        | 3          |                             |
| AC9         | PR109C        | 3          |                             |
| AH1         | PR109B        | 3          |                             |
| AG1         | PR109A        | 3          |                             |
| AE8         | PR107D        | 3          | VREF2_3                     |
| AD8         | PR107C        | 3          |                             |
| AJ3         | PR107B        | 3          |                             |
| AH3         | PR107A        | 3          |                             |
| AD7         | PR104D        | 3          |                             |
| AC7         | PR104C        | 3          |                             |
| AJ2         | PR104B        | 3          |                             |
| AH2         | PR104A        | 3          |                             |
| AF6         | PR103D        | 3          |                             |
| AF5         | PR103C        | 3          |                             |
| AF4         | PR103B        | 3          |                             |
| AE4         | PR103A        | 3          |                             |
| AD6         | PR99D         | 3          |                             |
| AC6         | PR99C         | 3          |                             |
| AG2         | PR99B         | 3          |                             |
| AF2         | PR99A         | 3          |                             |
| AC8         | PR98D         | 3          |                             |
| AB8         | PR98C         | 3          |                             |
| AK1         | PR98B         | 3          |                             |
| AJ1         | PR98A         | 3          |                             |
| AB10        | PR96D         | 3          |                             |
| AA10        | PR96C         | 3          |                             |
| AF3         | PR96B         | 3          |                             |
| AE3         | PR96A         | 3          |                             |
| AE5         | PR94D         | 3          |                             |

**LFSC/M80, LFSC/M115 Logic Signal Connections: 1704 fcBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M80      |             |               | LFSC/M115     |             |               |
|-------------|---------------|-------------|---------------|---------------|-------------|---------------|
|             | Ball Function | VCCI/O Bank | Dual Function | Ball Function | VCCI/O Bank | Dual Function |
| AY41        | PB12A         | 5           |               | PB13A         | 5           |               |
| BA41        | PB12B         | 5           |               | PB13B         | 5           |               |
| AT39        | PB12C         | 5           |               | PB13C         | 5           |               |
| AT38        | PB12D         | 5           |               | PB13D         | 5           |               |
| AV37        | PB13A         | 5           |               | PB15A         | 5           |               |
| AV36        | PB13B         | 5           |               | PB15B         | 5           |               |
| AM31        | PB13C         | 5           |               | PB15C         | 5           |               |
| AM32        | PB13D         | 5           |               | PB15D         | 5           |               |
| BA40        | PB15A         | 5           |               | PB16A         | 5           |               |
| BB40        | PB15B         | 5           |               | PB16B         | 5           |               |
| AM29        | PB15C         | 5           |               | PB16C         | 5           |               |
| AL29        | PB15D         | 5           |               | PB16D         | 5           |               |
| AY39        | PB16A         | 5           |               | PB17A         | 5           |               |
| AY38        | PB16B         | 5           |               | PB17B         | 5           |               |
| AN33        | PB16C         | 5           |               | PB17C         | 5           |               |
| AN32        | PB16D         | 5           |               | PB17D         | 5           |               |
| BA39        | PB17A         | 5           |               | PB19A         | 5           |               |
| BA38        | PB17B         | 5           |               | PB19B         | 5           |               |
| AT37        | PB17C         | 5           |               | PB19C         | 5           |               |
| AT36        | PB17D         | 5           |               | PB19D         | 5           |               |
| AW36        | PB19A         | 5           |               | PB20A         | 5           |               |
| AW35        | PB19B         | 5           |               | PB20B         | 5           |               |
| AM28        | PB19C         | 5           |               | PB20C         | 5           |               |
| AL28        | PB19D         | 5           |               | PB20D         | 5           |               |
| BB38        | PB20A         | 5           |               | PB21A         | 5           |               |
| BB39        | PB20B         | 5           |               | PB21B         | 5           |               |
| AR34        | PB20C         | 5           |               | PB21C         | 5           |               |
| AR33        | PB20D         | 5           |               | PB21D         | 5           |               |
| AV35        | PB21A         | 5           |               | PB23A         | 5           |               |
| AV34        | PB21B         | 5           |               | PB23B         | 5           |               |
| AT33        | PB21C         | 5           |               | PB23C         | 5           |               |
| AT34        | PB21D         | 5           |               | PB23D         | 5           |               |
| BA37        | PB23A         | 5           |               | PB25A         | 5           |               |
| BA36        | PB23B         | 5           |               | PB25B         | 5           |               |
| AP33        | PB23C         | 5           |               | PB25C         | 5           |               |
| AP32        | PB23D         | 5           |               | PB25D         | 5           |               |
| AY36        | PB24A         | 5           |               | PB26A         | 5           |               |
| AY35        | PB24B         | 5           |               | PB26B         | 5           |               |
| AN31        | PB24C         | 5           |               | PB26C         | 5           |               |
| AN30        | PB24D         | 5           |               | PB26D         | 5           |               |
| BB37        | PB25A         | 5           |               | PB27A         | 5           |               |
| BB36        | PB25B         | 5           |               | PB27B         | 5           |               |
| AP31        | PB25C         | 5           |               | PB27C         | 5           |               |
| AP30        | PB25D         | 5           |               | PB27D         | 5           |               |
| AV33        | PB27A         | 5           |               | PB29A         | 5           |               |

**LFSC/M80, LFSC/M115 Logic Signal Connections: 1704 fcBGA<sup>1, 2</sup> (Cont.)**

| Ball Number | LFSC/M80      |            |               | LFSC/M115     |            |               |
|-------------|---------------|------------|---------------|---------------|------------|---------------|
|             | Ball Function | VCCIO Bank | Dual Function | Ball Function | VCCIO Bank | Dual Function |
| AL23        | PB56D         | 5          |               | PB58D         | 5          |               |
| AW24        | PB57A         | 5          |               | PB61A         | 5          |               |
| AW23        | PB57B         | 5          |               | PB61B         | 5          |               |
| AN23        | PB57C         | 5          |               | PB61C         | 5          |               |
| AP23        | PB57D         | 5          |               | PB61D         | 5          |               |
| AY23        | PB59A         | 5          |               | PB63A         | 5          |               |
| AY24        | PB59B         | 5          |               | PB63B         | 5          |               |
| AU23        | PB59C         | 5          |               | PB63C         | 5          |               |
| AU22        | PB59D         | 5          |               | PB63D         | 5          |               |
| AV23        | PB60A         | 5          |               | PB66A         | 5          |               |
| AV22        | PB60B         | 5          |               | PB66B         | 5          |               |
| AM22        | PB60C         | 5          |               | PB66C         | 5          |               |
| AL22        | PB60D         | 5          |               | PB66D         | 5          |               |
| BA23        | PB61A         | 5          |               | PB69A         | 5          |               |
| BA22        | PB61B         | 5          |               | PB69B         | 5          |               |
| AN22        | PB61C         | 5          |               | PB69C         | 5          |               |
| AP22        | PB61D         | 5          |               | PB69D         | 5          |               |
| BB23        | PB63A         | 5          |               | PB71A         | 5          |               |
| BB22        | PB63B         | 5          |               | PB71B         | 5          |               |
| AT22        | PB63C         | 5          |               | PB71C         | 5          |               |
| AR22        | PB63D         | 5          |               | PB71D         | 5          |               |
| BB21        | PB65A         | 4          |               | PB73A         | 4          |               |
| BB20        | PB65B         | 4          |               | PB73B         | 4          |               |
| AR21        | PB65C         | 4          |               | PB73C         | 4          |               |
| AT21        | PB65D         | 4          |               | PB73D         | 4          |               |
| BA21        | PB66A         | 4          |               | PB75A         | 4          |               |
| BA20        | PB66B         | 4          |               | PB75B         | 4          |               |
| AP21        | PB66C         | 4          |               | PB75C         | 4          |               |
| AN21        | PB66D         | 4          |               | PB75D         | 4          |               |
| AV21        | PB67A         | 4          |               | PB78A         | 4          |               |
| AV20        | PB67B         | 4          |               | PB78B         | 4          |               |
| AM21        | PB67C         | 4          |               | PB78C         | 4          |               |
| AL21        | PB67D         | 4          |               | PB78D         | 4          |               |
| AY20        | PB69A         | 4          |               | PB81A         | 4          |               |
| AY19        | PB69B         | 4          |               | PB81B         | 4          |               |
| AU21        | PB69C         | 4          |               | PB81C         | 4          |               |
| AU20        | PB69D         | 4          |               | PB81D         | 4          |               |
| AW20        | PB70A         | 4          |               | PB83A         | 4          |               |
| AW19        | PB70B         | 4          |               | PB83B         | 4          |               |
| AP20        | PB70C         | 4          |               | PB83C         | 4          |               |
| AN20        | PB70D         | 4          |               | PB83D         | 4          |               |
| BB19        | PB71A         | 4          |               | PB86A         | 4          |               |
| BB18        | PB71B         | 4          |               | PB86B         | 4          |               |
| AM20        | PB71C         | 4          |               | PB86C         | 4          |               |
| AL20        | PB71D         | 4          |               | PB86D         | 4          |               |