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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                 | Active                                                                                                                                                            |
| Number of LABs/CLBs            | -                                                                                                                                                                 |
| Number of Logic Elements/Cells | -                                                                                                                                                                 |
| Total RAM Bits                 | 147456                                                                                                                                                            |
| Number of I/O                  | 97                                                                                                                                                                |
| Number of Gates                | 1000000                                                                                                                                                           |
| Voltage - Supply               | 1.425V ~ 1.575V                                                                                                                                                   |
| Mounting Type                  | Surface Mount                                                                                                                                                     |
| Operating Temperature          | 0°C ~ 85°C (TJ)                                                                                                                                                   |
| Package / Case                 | 144-LBGA                                                                                                                                                          |
| Supplier Device Package        | 144-FPBGA (13x13)                                                                                                                                                 |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/microchip-technology/m7a3p1000-fg144">https://www.e-xfl.com/product-detail/microchip-technology/m7a3p1000-fg144</a> |

## **User Nonvolatile FlashROM**

ProASIC3 devices have 1 kbit of on-chip, user-accessible, nonvolatile FlashROM. The FlashROM can be used in diverse system applications:

- Internet protocol addressing (wireless or fixed)
- System calibration settings
- Device serialization and/or inventory control
- Subscription-based business models (for example, set-top boxes)
- Secure key storage for secure communications algorithms
- Asset management/tracking
- Date stamping
- Version management

The FlashROM is written using the standard ProASIC3 IEEE 1532 JTAG programming interface. The core can be individually programmed (erased and written), and on-chip AES decryption can be used selectively to securely load data over public networks (except in the A3P015 and A3P030 devices), as in security keys stored in the FlashROM for a user design.

The FlashROM can be programmed via the JTAG programming interface, and its contents can be read back either through the JTAG programming interface or via direct FPGA core addressing. Note that the FlashROM can only be programmed from the JTAG interface and cannot be programmed from the internal logic array.

The FlashROM is programmed as 8 banks of 128 bits; however, reading is performed on a byte-by-byte basis using a synchronous interface. A 7-bit address from the FPGA core defines which of the 8 banks and which of the 16 bytes within that bank are being read. The three most significant bits (MSBs) of the FlashROM address determine the bank, and the four least significant bits (LSBs) of the FlashROM address define the byte.

The ProASIC3 development software solutions, Libero® System-on-Chip (SoC) and Designer, have extensive support for the FlashROM. One such feature is auto-generation of sequential programming files for applications requiring a unique serial number in each part. Another feature allows the inclusion of static data for system version control. Data for the FlashROM can be generated quickly and easily using Libero SoC and Designer software tools. Comprehensive programming file support is also included to allow for easy programming of large numbers of parts with differing FlashROM contents.

## **SRAM and FIFO**

ProASIC3 devices (except the A3P015 and A3P030 devices) have embedded SRAM blocks along their north and south sides. Each variable-aspect-ratio SRAM block is 4,608 bits in size. Available memory configurations are 256×18, 512×9, 1k×4, 2k×2, and 4k×1 bits. The individual blocks have independent read and write ports that can be configured with different bit widths on each port. For example, data can be sent through a 4-bit port and read as a single bitstream. The embedded SRAM blocks can be initialized via the device JTAG port (ROM emulation mode) using the UJTAG macro (except in A3P015 and A3P030 devices).

In addition, every SRAM block has an embedded FIFO control unit. The control unit allows the SRAM block to be configured as a synchronous FIFO without using additional core VersaTiles. The FIFO width and depth are programmable. The FIFO also features programmable Almost Empty (AEMPTY) and Almost Full (AFULL) flags in addition to the normal Empty and Full flags. The embedded FIFO control unit contains the counters necessary for generation of the read and write address pointers. The embedded SRAM/FIFO blocks can be cascaded to create larger configurations.

## **PLL and CCC**

ProASIC3 devices provide designers with very flexible clock conditioning capabilities. Each member of the ProASIC3 family contains six CCCs. One CCC (center west side) has a PLL. The A3P015 and A3P030 devices do not have a PLL.

The six CCC blocks are located at the four corners and the centers of the east and west sides.

All six CCC blocks are usable; the four corner CCCs and the east CCC allow simple clock delay operations as well as clock spine access.

The inputs of the six CCC blocks are accessible from the FPGA core or from one of several inputs located near the CCC that have dedicated connections to the CCC block.

## 2 – ProASIC3 DC and Switching Characteristics

### General Specifications

#### Operating Conditions

Stresses beyond those listed in [Table 2-1](#) may cause permanent damage to the device.

Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Absolute Maximum Ratings are stress ratings only; functional operation of the device at these or any other conditions beyond those listed under the Recommended Operating Conditions specified in [Table 2-2 on page 2-2](#) is not implied.

**Table 2-1 • Absolute Maximum Ratings**

| Symbol                        | Parameter                           | Limits                                                                                                                                                                  | Units |
|-------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| VCC                           | DC core supply voltage              | –0.3 to 1.65                                                                                                                                                            | V     |
| VJTAG                         | JTAG DC voltage                     | –0.3 to 3.75                                                                                                                                                            | V     |
| VPUMP                         | Programming voltage                 | –0.3 to 3.75                                                                                                                                                            | V     |
| VCCPLL                        | Analog power supply (PLL)           | –0.3 to 1.65                                                                                                                                                            | V     |
| VCCI                          | DC I/O output buffer supply voltage | –0.3 to 3.75                                                                                                                                                            | V     |
| VMV                           | DC I/O input buffer supply voltage  | –0.3 to 3.75                                                                                                                                                            | V     |
| VI                            | I/O input voltage                   | –0.3 V to 3.6 V<br>(when I/O hot insertion mode is enabled)<br>–0.3 V to (VCCI + 1 V) or 3.6 V, whichever voltage is lower<br>(when I/O hot-insertion mode is disabled) | V     |
| T <sub>STG</sub> <sup>2</sup> | Storage temperature                 | –65 to +150                                                                                                                                                             | °C    |
| T <sub>J</sub> <sup>2</sup>   | Junction temperature                | +125                                                                                                                                                                    | °C    |

**Notes:**

1. The device should be operated within the limits specified by the datasheet. During transitions, the input signal may undershoot or overshoot according to the limits shown in [Table 2-4 on page 2-3](#).
2. VMV pins must be connected to the corresponding VCCI pins. See the "VMVx I/O Supply Voltage (quiet)" section on [page 3-1](#) for further information.
3. For flash programming and retention maximum limits, refer to [Table 2-3 on page 2-3](#), and for recommended operating limits, refer to [Table 2-2 on page 2-2](#).

$F_{CLK}$  is the global clock signal frequency.

$N_{S-CELL}$  is the number of VersaTiles used as sequential modules in the design.

$P_{AC1}$ ,  $P_{AC2}$ ,  $P_{AC3}$ , and  $P_{AC4}$  are device-dependent.

#### **Sequential Cells Contribution— $P_{S-CELL}$**

$$P_{S-CELL} = N_{S-CELL} * (P_{AC5} + \alpha_1 / 2 * P_{AC6}) * F_{CLK}$$

$N_{S-CELL}$  is the number of VersaTiles used as sequential modules in the design. When a multi-tile sequential cell is used, it should be accounted for as 1.

$\alpha_1$  is the toggle rate of VersaTile outputs—guidelines are provided in [Table 2-16 on page 2-14](#).

$F_{CLK}$  is the global clock signal frequency.

#### **Combinatorial Cells Contribution— $P_{C-CELL}$**

$$P_{C-CELL} = N_{C-CELL} * \alpha_1 / 2 * P_{AC7} * F_{CLK}$$

$N_{C-CELL}$  is the number of VersaTiles used as combinatorial modules in the design.

$\alpha_1$  is the toggle rate of VersaTile outputs—guidelines are provided in [Table 2-16 on page 2-14](#).

$F_{CLK}$  is the global clock signal frequency.

#### **Routing Net Contribution— $P_{NET}$**

$$P_{NET} = (N_{S-CELL} + N_{C-CELL}) * \alpha_1 / 2 * P_{AC8} * F_{CLK}$$

$N_{S-CELL}$  is the number of VersaTiles used as sequential modules in the design.

$N_{C-CELL}$  is the number of VersaTiles used as combinatorial modules in the design.

$\alpha_1$  is the toggle rate of VersaTile outputs—guidelines are provided in [Table 2-16 on page 2-14](#).

$F_{CLK}$  is the global clock signal frequency.

#### **I/O Input Buffer Contribution— $P_{INPUTS}$**

$$P_{INPUTS} = N_{INPUTS} * \alpha_2 / 2 * P_{AC9} * F_{CLK}$$

$N_{INPUTS}$  is the number of I/O input buffers used in the design.

$\alpha_2$  is the I/O buffer toggle rate—guidelines are provided in [Table 2-16 on page 2-14](#).

$F_{CLK}$  is the global clock signal frequency.

#### **I/O Output Buffer Contribution— $P_{OUTPUTS}$**

$$P_{OUTPUTS} = N_{OUTPUTS} * \alpha_2 / 2 * \beta_1 * P_{AC10} * F_{CLK}$$

$N_{OUTPUTS}$  is the number of I/O output buffers used in the design.

$\alpha_2$  is the I/O buffer toggle rate—guidelines are provided in [Table 2-16 on page 2-14](#).

$\beta_1$  is the I/O buffer enable rate—guidelines are provided in [Table 2-17 on page 2-14](#).

$F_{CLK}$  is the global clock signal frequency.

**Table 2-26 • Summary of I/O Timing Characteristics—Software Default Settings**  
 –2 Speed Grade, Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst Case  $V_{CC} = 1.425\text{ V}$ ,  
 Worst-Case  $V_{CCI}$  (per standard)  
 Standard I/O Banks

| I/O Standard                         | Drive Strength    | Equiv. Software Default Drive Strength Option <sup>1</sup> | Slew Rate | Capacitive Load (pF) | External Resistor | $t_{DOUT}$ (ns) | $t_{DP}$ (ns) | $t_{DIN}$ (ns) | $t_{PY}$ (ns) | $t_{EOUT}$ (ns) | $t_{ZL}$ (ns) | $t_{ZH}$ (ns) | $t_{LZ}$ (ns) | $t_{HZ}$ (ns) | Units |
|--------------------------------------|-------------------|------------------------------------------------------------|-----------|----------------------|-------------------|-----------------|---------------|----------------|---------------|-----------------|---------------|---------------|---------------|---------------|-------|
| 3.3 V LVTTTL / 3.3 V LVCMOS          | 8 mA              | 8 mA                                                       | High      | 35                   | –                 | 0.45            | 3.29          | 0.03           | 0.75          | 0.32            | 3.36          | 2.80          | 1.79          | 2.01          | ns    |
| 3.3 V LVCMOS Wide Range <sup>2</sup> | 100 $\mu\text{A}$ | 8 mA                                                       | High      | 35                   | –                 | 0.45            | 5.09          | 0.03           | 1.13          | 0.32            | 5.09          | 4.25          | 2.77          | 3.11          | ns    |
| 2.5 V LVCMOS                         | 8 mA              | 8 mA                                                       | High      | 35                   | –                 | 0.45            | 3.56          | 0.03           | 0.96          | 0.32            | 3.40          | 3.56          | 1.78          | 1.91          | ns    |
| 1.8 V LVCMOS                         | 4 mA              | 4 mA                                                       | High      | 35                   | –                 | 0.45            | 4.74          | 0.03           | 0.90          | 0.32            | 4.02          | 4.74          | 1.80          | 1.85          | ns    |
| 1.5 V LVCMOS                         | 2 mA              | 2 mA                                                       | High      | 35                   | –                 | 0.45            | 5.71          | 0.03           | 1.06          | 0.32            | 4.71          | 5.71          | 1.83          | 1.83          | ns    |

**Notes:**

1. The minimum drive strength for any LVCMOS 3.3 V software configuration when run in wide range is  $\pm 100\text{ }\mu\text{A}$ . Drive strength displayed in the software is supported for normal range only. For a detailed I/V curve, refer to the IBIS models.
2. All LVCMOS 3.3 V software macros support LVCMOS 3.3 V wide range as specified in the JESD-8B specification.
3. For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

## Single-Ended I/O Characteristics

### 3.3 V LVTTTL / 3.3 V LVCMOS

Low-Voltage Transistor–Transistor Logic (LVTTTL) is a general-purpose standard (EIA/JESD) for 3.3 V applications. It uses an LVTTTL input buffer and push-pull output buffer.

**Table 2-37 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Advanced I/O Banks

| 3.3 V LVTTTL /<br>3.3 V LVCMOS | VIL      |          | VIH      |          | VOL      | VOH      | IOL | IOH | IOSL                   | IOSH                   | IIL <sup>1</sup> | IIH <sup>2</sup> |
|--------------------------------|----------|----------|----------|----------|----------|----------|-----|-----|------------------------|------------------------|------------------|------------------|
| Drive Strength                 | Min<br>V | Max<br>V | Min<br>V | Max<br>V | Max<br>V | Min<br>V | mA  | mA  | Max<br>mA <sup>3</sup> | Max<br>mA <sup>3</sup> | μA <sup>4</sup>  | μA <sup>4</sup>  |
| 2 mA                           | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 2   | 2   | 27                     | 25                     | 10               | 10               |
| 4 mA                           | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 4   | 4   | 27                     | 25                     | 10               | 10               |
| 6 mA                           | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 6   | 6   | 54                     | 51                     | 10               | 10               |
| 8 mA                           | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 8   | 8   | 54                     | 51                     | 10               | 10               |
| 12 mA                          | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 12  | 12  | 109                    | 103                    | 10               | 10               |
| 16 mA                          | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 16  | 16  | 127                    | 132                    | 10               | 10               |
| 24 mA                          | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 24  | 24  | 181                    | 268                    | 10               | 10               |

Notes:

1. IIL is the input leakage current per I/O pin over recommended operation conditions where  $-0.3\text{ V} < V_{IN} < V_{IL}$ .
2. IIH is the input leakage current per I/O pin over recommended operating conditions  $V_{IH} < V_{IN} < V_{CCI}$ . Input current is larger when operating outside recommended ranges
3. Currents are measured at 100°C junction temperature and maximum voltage.
4. Currents are measured at 85°C junction temperature.
5. Software default selection highlighted in gray.

**Table 2-38 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Standard Plus I/O Banks

| 3.3 V LVTTTL /<br>3.3 V LVCMOS | VIL      |          | VIH      |          | VOL      | VOH      | IOL | IOH | IOSL                   | IOSH                   | IIL <sup>1</sup> | IIH <sup>2</sup> |
|--------------------------------|----------|----------|----------|----------|----------|----------|-----|-----|------------------------|------------------------|------------------|------------------|
| Drive Strength                 | Min<br>V | Max<br>V | Min<br>V | Max<br>V | Max<br>V | Min<br>V | mA  | mA  | Max<br>mA <sup>3</sup> | Max<br>mA <sup>3</sup> | μA <sup>4</sup>  | μA <sup>4</sup>  |
| 2 mA                           | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 2   | 2   | 27                     | 25                     | 10               | 10               |
| 4 mA                           | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 4   | 4   | 27                     | 25                     | 10               | 10               |
| 6 mA                           | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 6   | 6   | 54                     | 51                     | 10               | 10               |
| 8 mA                           | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 8   | 8   | 54                     | 51                     | 10               | 10               |
| 12 mA                          | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 12  | 12  | 109                    | 103                    | 10               | 10               |
| 16 mA                          | –0.3     | 0.8      | 2        | 3.6      | 0.4      | 2.4      | 16  | 16  | 109                    | 103                    | 10               | 10               |

Notes:

1. IIL is the input leakage current per I/O pin over recommended operation conditions where  $-0.3\text{ V} < V_{IN} < V_{IL}$ .
2. IIH is the input leakage current per I/O pin over recommended operating conditions  $V_{IH} < V_{IN} < V_{CCI}$ . Input current is larger when operating outside recommended ranges
3. Currents are measured at 100°C junction temperature and maximum voltage.
4. Currents are measured at 85°C junction temperature.
5. Software default selection highlighted in gray.

**Table 2-52 • 3.3 V LVTTTL / 3.3 V LVCMOS High Slew**  
**Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case  $V_{CC} = 1.425\text{ V}$ , Worst-Case  $V_{CCI} = 3.0\text{ V}$**   
**Applicable to Standard Plus I/O Banks**

| Drive Strength    | Equiv. Software Default Drive Strength Option <sup>1</sup> | Speed Grade | $t_{DOUT}$ | $t_{DP}$ | $t_{DIN}$ | $t_{PY}$ | $t_{EOUT}$ | $t_{ZL}$ | $t_{ZH}$ | $t_{LZ}$ | $t_{HZ}$ | $t_{ZLS}$ | $t_{ZHS}$ | Units |
|-------------------|------------------------------------------------------------|-------------|------------|----------|-----------|----------|------------|----------|----------|----------|----------|-----------|-----------|-------|
| 100 $\mu\text{A}$ | 2 mA                                                       | Std.        | 0.60       | 11.14    | 0.04      | 1.52     | 0.43       | 11.14    | 9.54     | 3.51     | 3.61     | 14.53     | 12.94     | ns    |
|                   |                                                            | –1          | 0.51       | 9.48     | 0.04      | 1.29     | 0.36       | 9.48     | 8.12     | 2.99     | 3.07     | 12.36     | 11.00     | ns    |
|                   |                                                            | –2          | 0.45       | 8.32     | 0.03      | 1.14     | 0.32       | 8.32     | 7.13     | 2.62     | 2.70     | 10.85     | 9.66      | ns    |
| 100 $\mu\text{A}$ | 4 mA                                                       | Std.        | 0.60       | 6.96     | 0.04      | 1.52     | 0.43       | 6.96     | 5.79     | 3.99     | 4.45     | 10.35     | 9.19      | ns    |
|                   |                                                            | –1          | 0.51       | 5.92     | 0.04      | 1.29     | 0.36       | 5.92     | 4.93     | 3.39     | 3.78     | 8.81      | 7.82      | ns    |
|                   |                                                            | –2          | 0.45       | 5.20     | 0.03      | 1.14     | 0.32       | 5.20     | 4.33     | 2.98     | 3.32     | 7.73      | 6.86      | ns    |
| 100 $\mu\text{A}$ | 6 mA                                                       | Std.        | 0.60       | 6.96     | 0.04      | 1.52     | 0.43       | 6.96     | 5.79     | 3.99     | 4.45     | 10.35     | 9.19      | ns    |
|                   |                                                            | –1          | 0.51       | 5.92     | 0.04      | 1.29     | 0.36       | 5.92     | 4.93     | 3.39     | 3.78     | 8.81      | 7.82      | ns    |
|                   |                                                            | –2          | 0.45       | 5.20     | 0.03      | 1.14     | 0.32       | 5.20     | 4.33     | 2.98     | 3.32     | 7.73      | 6.86      | ns    |
| 100 $\mu\text{A}$ | 8 mA                                                       | Std.        | 0.60       | 4.89     | 0.04      | 1.52     | 0.43       | 4.89     | 3.92     | 4.31     | 4.98     | 8.28      | 7.32      | ns    |
|                   |                                                            | –1          | 0.51       | 4.16     | 0.04      | 1.29     | 0.36       | 4.16     | 3.34     | 3.67     | 4.24     | 7.04      | 6.22      | ns    |
|                   |                                                            | –2          | 0.45       | 3.65     | 0.03      | 1.14     | 0.32       | 3.65     | 2.93     | 3.22     | 3.72     | 6.18      | 5.46      | ns    |
| 100 $\mu\text{A}$ | 16 mA                                                      | Std.        | 0.60       | 4.89     | 0.04      | 1.52     | 0.43       | 4.89     | 3.92     | 4.31     | 4.98     | 8.28      | 7.32      | ns    |
|                   |                                                            | –1          | 0.51       | 4.16     | 0.04      | 1.29     | 0.36       | 4.16     | 3.34     | 3.67     | 4.24     | 7.04      | 6.22      | ns    |
|                   |                                                            | –2          | 0.45       | 3.65     | 0.03      | 1.14     | 0.32       | 3.65     | 2.93     | 3.22     | 3.72     | 6.18      | 5.46      | ns    |

**Notes:**

1. The minimum drive strength for any LVCMOS 3.3 V software configuration when run in wide range is  $\pm 100\text{ }\mu\text{A}$ . Drive strength displayed in the software is supported for normal range only. For a detailed I/V curve, refer to the IBIS models.
2. Software default selection highlighted in gray.
3. For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

**Table 2-90 • LVDS Minimum and Maximum DC Input and Output Levels**

| DC Parameter       | Description                 | Min.  | Typ.  | Max.  | Units |
|--------------------|-----------------------------|-------|-------|-------|-------|
| VCCI               | Supply Voltage              | 2.375 | 2.5   | 2.625 | V     |
| VOL                | Output Low Voltage          | 0.9   | 1.075 | 1.25  | V     |
| VOH                | Output High Voltage         | 1.25  | 1.425 | 1.6   | V     |
| IOL <sup>1</sup>   | Output Lower Current        | 0.65  | 0.91  | 1.16  | mA    |
| IOH <sup>1</sup>   | Output High Current         | 0.65  | 0.91  | 1.16  | mA    |
| VI                 | Input Voltage               | 0     |       | 2.925 | V     |
| IIH <sup>2,3</sup> | Input High Leakage Current  |       |       | 10    | μA    |
| IIL <sup>2,4</sup> | Input Low Leakage Current   |       |       | 10    | μA    |
| VODIFF             | Differential Output Voltage | 250   | 350   | 450   | mV    |
| VOCM               | Output Common Mode Voltage  | 1.125 | 1.25  | 1.375 | V     |
| VICM               | Input Common Mode Voltage   | 0.05  | 1.25  | 2.35  | V     |
| VIDIFF             | Input Differential Voltage  | 100   | 350   |       | mV    |

**Notes:**

1. IOL/IOH defined by VODIFF/(Resistor Network)
2. Currents are measured at 85°C junction temperature.
3. IIH is the input leakage current per I/O pin over recommended operating conditions  $V_{IH} < V_{IN} < V_{CCI}$ . Input current is larger when operating outside recommended ranges.
4. IIL is the input leakage current per I/O pin over recommended operation conditions where  $-0.3\text{ V} < V_{IN} < V_{IL}$ .

**Table 2-91 • AC Waveforms, Measuring Points, and Capacitive Loads**

| Input Low (V) | Input High (V) | Measuring Point* (V) |
|---------------|----------------|----------------------|
| 1.075         | 1.325          | Cross point          |

**Note:** \*Measuring point =  $V_{trip}$ . See Table 2-22 on page 2-22 for a complete table of trip points.

**Timing Characteristics**
**Table 2-92 • LVDS**

Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case VCC = 1.425 V, Worst-Case VCCI = 2.3 V

| Speed Grade | $t_{DOUT}$ | $t_{DP}$ | $t_{DIN}$ | $t_{PY}$ | Units |
|-------------|------------|----------|-----------|----------|-------|
| Std.        | 0.66       | 1.83     | 0.04      | 1.60     | ns    |
| –1          | 0.56       | 1.56     | 0.04      | 1.36     | ns    |
| –2          | 0.49       | 1.37     | 0.03      | 1.20     | ns    |

**Note:** For specific junction temperature and voltage supply levels, refer to Table 2-6 on page 2-6 for derating values.

**Table 2-113 • A3P600 Global Resource**  
**Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ ,  $V_{CC} = 1.425\text{ V}$**

| Parameter     | Description                               | -2                |                   | -1                |                   | Std.              |                   | Units |
|---------------|-------------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------|
|               |                                           | Min. <sup>1</sup> | Max. <sup>2</sup> | Min. <sup>1</sup> | Max. <sup>2</sup> | Min. <sup>1</sup> | Max. <sup>2</sup> |       |
| $t_{RCKL}$    | Input Low Delay for Global Clock          | 0.87              | 1.09              | 0.99              | 1.24              | 1.17              | 1.46              | ns    |
| $t_{RCKH}$    | Input High Delay for Global Clock         | 0.86              | 1.11              | 0.98              | 1.27              | 1.15              | 1.49              | ns    |
| $t_{RCKMPWH}$ | Minimum Pulse Width High for Global Clock | 0.75              |                   | 0.85              |                   | 1.00              |                   | ns    |
| $t_{RCKMPWL}$ | Minimum Pulse Width Low for Global Clock  | 0.85              |                   | 0.96              |                   | 1.13              |                   | ns    |
| $t_{RCKSW}$   | Maximum Skew for Global Clock             |                   | 0.26              |                   | 0.29              |                   | 0.34              | ns    |

**Notes:**

1. Value reflects minimum load. The delay is measured from the CCC output to the clock pin of a sequential element, located in a lightly loaded row (single element is connected to the global net).
2. Value reflects maximum load. The delay is measured on the clock pin of the farthest sequential element, located in a fully loaded row (all available flip-flops are connected to the global net in the row).
3. For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

**Table 2-114 • A3P1000 Global Resource**  
**Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ ,  $V_{CC} = 1.425\text{ V}$**

| Parameter     | Description                               | -2                |                   | -1                |                   | Std.              |                   | Units |
|---------------|-------------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------|
|               |                                           | Min. <sup>1</sup> | Max. <sup>2</sup> | Min. <sup>1</sup> | Max. <sup>2</sup> | Min. <sup>1</sup> | Max. <sup>2</sup> |       |
| $t_{RCKL}$    | Input Low Delay for Global Clock          | 0.94              | 1.16              | 1.07              | 1.32              | 1.26              | 1.55              | ns    |
| $t_{RCKH}$    | Input High Delay for Global Clock         | 0.93              | 1.19              | 1.06              | 1.35              | 1.24              | 1.59              | ns    |
| $t_{RCKMPWH}$ | Minimum Pulse Width High for Global Clock | 0.75              |                   | 0.85              |                   | 1.00              |                   | ns    |
| $t_{RCKMPWL}$ | Minimum Pulse Width Low for Global Clock  | 0.85              |                   | 0.96              |                   | 1.13              |                   | ns    |
| $t_{RCKSW}$   | Maximum Skew for Global Clock             |                   | 0.26              |                   | 0.29              |                   | 0.35              | ns    |

**Notes:**

1. Value reflects minimum load. The delay is measured from the CCC output to the clock pin of a sequential element, located in a lightly loaded row (single element is connected to the global net).
2. Value reflects maximum load. The delay is measured on the clock pin of the farthest sequential element, located in a fully loaded row (all available flip-flops are connected to the global net in the row).
3. For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

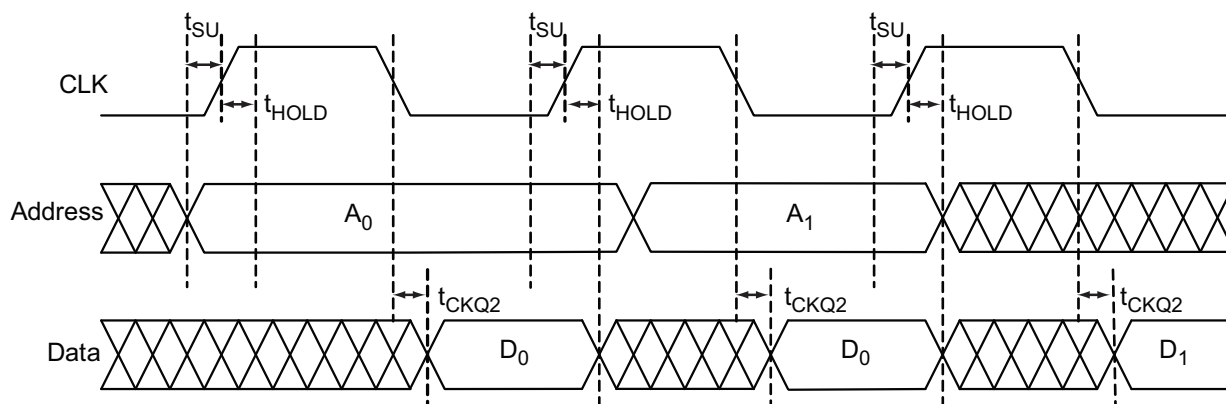
**Table 2-121 • A3P250 FIFO 1k×4****Worst Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ ,  $V_{CC} = 1.425\text{ V}$** 

| Parameter            | Description                                       | –2   | –1   | Std. | Units |
|----------------------|---------------------------------------------------|------|------|------|-------|
| $t_{\text{ENS}}$     | REN, WEN Setup Time                               | 4.05 | 4.61 | 5.42 | ns    |
| $t_{\text{ENH}}$     | REN, WEN Hold Time                                | 0.00 | 0.00 | 0.00 | ns    |
| $t_{\text{BKS}}$     | BLK Setup Time                                    | 0.19 | 0.22 | 0.26 | ns    |
| $t_{\text{BKH}}$     | BLK Hold Time                                     | 0.00 | 0.00 | 0.00 | ns    |
| $t_{\text{DS}}$      | Input Data (WD) Setup Time                        | 0.18 | 0.21 | 0.25 | ns    |
| $t_{\text{DH}}$      | Input Data (WD) Hold Time                         | 0.00 | 0.00 | 0.00 | ns    |
| $t_{\text{CKQ1}}$    | Clock High to New Data Valid on RD (flow-through) | 2.36 | 2.68 | 3.15 | ns    |
| $t_{\text{CKQ2}}$    | Clock High to New Data Valid on RD (pipelined)    | 0.89 | 1.02 | 1.20 | ns    |
| $t_{\text{RCKEF}}$   | RCLK High to Empty Flag Valid                     | 1.72 | 1.96 | 2.30 | ns    |
| $t_{\text{WCKFF}}$   | WCLK High to Full Flag Valid                      | 1.63 | 1.86 | 2.18 | ns    |
| $t_{\text{CKAF}}$    | Clock High to Almost Empty/Full Flag Valid        | 6.19 | 7.05 | 8.29 | ns    |
| $t_{\text{RSTFG}}$   | RESET Low to Empty/Full Flag Valid                | 1.69 | 1.93 | 2.27 | ns    |
| $t_{\text{RSTAF}}$   | RESET Low to Almost Empty/Full Flag Valid         | 6.13 | 6.98 | 8.20 | ns    |
| $t_{\text{RSTBQ}}$   | RESET Low to Data Out Low on RD (flow-through)    | 0.92 | 1.05 | 1.23 | ns    |
|                      | RESET Low to Data Out Low on RD (pipelined)       | 0.92 | 1.05 | 1.23 | ns    |
| $t_{\text{REMRSTB}}$ | RESET Removal                                     | 0.29 | 0.33 | 0.38 | ns    |
| $t_{\text{RECRSTB}}$ | RESET Recovery                                    | 1.50 | 1.71 | 2.01 | ns    |
| $t_{\text{MPWRSTB}}$ | RESET Minimum Pulse Width                         | 0.21 | 0.24 | 0.29 | ns    |
| $t_{\text{CYC}}$     | Clock Cycle Time                                  | 3.23 | 3.68 | 4.32 | ns    |
| $F_{\text{MAX}}$     | Maximum Frequency for FIFO                        | 310  | 272  | 231  | MHz   |

**Table 2-123 • A3P250 FIFO 4k×1 (continued)****Worst Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ ,  $V_{CC} = 1.425\text{ V}$** 

| Parameter            | Description                                    | -2   | -1   | Std. | Units |
|----------------------|------------------------------------------------|------|------|------|-------|
| $t_{\text{RSTAF}}$   | RESET Low to Almost Empty/Full Flag Valid      | 6.13 | 6.98 | 8.20 | ns    |
| $t_{\text{RSTBQ}}$   | RESET Low to Data Out Low on DO (pass-through) | 0.92 | 1.05 | 1.23 | ns    |
|                      | RESET Low to Data Out Low on DO (pipelined)    | 0.92 | 1.05 | 1.23 | ns    |
| $t_{\text{REMRSTB}}$ | RESET Removal                                  | 0.29 | 0.33 | 0.38 | ns    |
| $t_{\text{RECRSTB}}$ | RESET Recovery                                 | 1.50 | 1.71 | 2.01 | ns    |
| $t_{\text{MPWRSTB}}$ | RESET Minimum Pulse Width                      | 0.21 | 0.24 | 0.29 | ns    |
| $t_{\text{CYC}}$     | Clock Cycle Time                               | 3.23 | 3.68 | 4.32 | ns    |
| $F_{\text{MAX}}$     | Maximum Frequency                              | 310  | 272  | 231  | MHz   |

## Embedded FlashROM Characteristics

**Figure 2-44 • Timing Diagram**

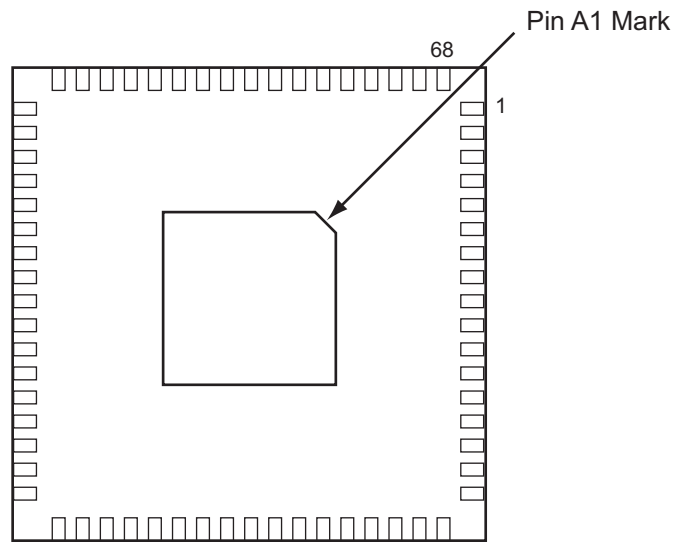
### Timing Characteristics

**Table 2-124 • Embedded FlashROM Access Time**

| Parameter         | Description             | -2    | -1    | Std.  | Units |
|-------------------|-------------------------|-------|-------|-------|-------|
| $t_{\text{SU}}$   | Address Setup Time      | 0.53  | 0.61  | 0.71  | ns    |
| $t_{\text{HOLD}}$ | Address Hold Time       | 0.00  | 0.00  | 0.00  | ns    |
| $t_{\text{CK2Q}}$ | Clock to Out            | 21.42 | 24.40 | 28.68 | ns    |
| $F_{\text{MAX}}$  | Maximum Clock Frequency | 15    | 15    | 15    | MHz   |

## QN68 – Bottom View

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**Note:** The die attach paddle center of the package is tied to ground (GND).

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### **Note**

For more information on package drawings, see [PD3068: Package Mechanical Drawings](#).

| <b>QN132</b>      |                        |
|-------------------|------------------------|
| <b>Pin Number</b> | <b>A3P030 Function</b> |
| C17               | IO51RSB1               |
| C18               | NC                     |
| C19               | TCK                    |
| C20               | NC                     |
| C21               | VPUMP                  |
| C22               | VJTAG                  |
| C23               | NC                     |
| C24               | NC                     |
| C25               | NC                     |
| C26               | GDB0/IO38RSB0          |
| C27               | NC                     |
| C28               | VCCIB0                 |
| C29               | IO32RSB0               |
| C30               | IO29RSB0               |
| C31               | IO28RSB0               |
| C32               | IO25RSB0               |
| C33               | NC                     |
| C34               | NC                     |
| C35               | VCCIB0                 |
| C36               | IO17RSB0               |
| C37               | IO14RSB0               |
| C38               | IO11RSB0               |
| C39               | IO07RSB0               |
| C40               | IO04RSB0               |
| D1                | GND                    |
| D2                | GND                    |
| D3                | GND                    |
| D4                | GND                    |

| QN132      |                 |
|------------|-----------------|
| Pin Number | A3P250 Function |
| A1         | GAB2/IO117UPB3  |
| A2         | IO117VPB3       |
| A3         | VCCIB3          |
| A4         | GFC1/IO110PDB3  |
| A5         | GFB0/IO109NPB3  |
| A6         | VCCPLF          |
| A7         | GFA1/IO108PPB3  |
| A8         | GFC2/IO105PPB3  |
| A9         | IO103NDB3       |
| A10        | VCC             |
| A11        | GEA1/IO98PPB3   |
| A12        | GEA0/IO98NPB3   |
| A13        | GEC2/IO95RSB2   |
| A14        | IO91RSB2        |
| A15        | VCC             |
| A16        | IO90RSB2        |
| A17        | IO87RSB2        |
| A18        | IO85RSB2        |
| A19        | IO82RSB2        |
| A20        | IO76RSB2        |
| A21        | IO70RSB2        |
| A22        | VCC             |
| A23        | GDB2/IO62RSB2   |
| A24        | TDI             |
| A25        | TRST            |
| A26        | GDC1/IO58UDB1   |
| A27        | VCC             |
| A28        | IO54NDB1        |
| A29        | IO52NDB1        |
| A30        | GCA2/IO51PPB1   |
| A31        | GCA0/IO50NPB1   |
| A32        | GCB1/IO49PDB1   |
| A33        | IO47NSB1        |
| A34        | VCC             |
| A35        | IO41NPB1        |
| A36        | GBA2/IO41PPB1   |

| QN132      |                 |
|------------|-----------------|
| Pin Number | A3P250 Function |
| A37        | GBB1/IO38RSB0   |
| A38        | GBC0/IO35RSB0   |
| A39        | VCCIB0          |
| A40        | IO28RSB0        |
| A41        | IO22RSB0        |
| A42        | IO18RSB0        |
| A43        | IO14RSB0        |
| A44        | IO11RSB0        |
| A45        | IO07RSB0        |
| A46        | VCC             |
| A47        | GAC1/IO05RSB0   |
| A48        | GAB0/IO02RSB0   |
| B1         | IO118VDB3       |
| B2         | GAC2/IO116UDB3  |
| B3         | GND             |
| B4         | GFC0/IO110NDB3  |
| B5         | VCOMPLF         |
| B6         | GND             |
| B7         | GFB2/IO106PSB3  |
| B8         | IO103PDB3       |
| B9         | GND             |
| B10        | GEB0/IO99NDB3   |
| B11        | VMV3            |
| B12        | GEB2/IO96RSB2   |
| B13        | IO92RSB2        |
| B14        | GND             |
| B15        | IO89RSB2        |
| B16        | IO86RSB2        |
| B17        | GND             |
| B18        | IO78RSB2        |
| B19        | IO72RSB2        |
| B20        | GND             |
| B21        | GNDQ            |
| B22        | TMS             |
| B23        | TDO             |
| B24        | GDC0/IO58VDB1   |

| QN132      |                 |
|------------|-----------------|
| Pin Number | A3P250 Function |
| B25        | GND             |
| B26        | IO54PDB1        |
| B27        | GCB2/IO52PDB1   |
| B28        | GND             |
| B29        | GCB0/IO49NDB1   |
| B30        | GCC1/IO48PDB1   |
| B31        | GND             |
| B32        | GBB2/IO42PDB1   |
| B33        | VMV1            |
| B34        | GBA0/IO39RSB0   |
| B35        | GBC1/IO36RSB0   |
| B36        | GND             |
| B37        | IO26RSB0        |
| B38        | IO21RSB0        |
| B39        | GND             |
| B40        | IO13RSB0        |
| B41        | IO08RSB0        |
| B42        | GND             |
| B43        | GAC0/IO04RSB0   |
| B44        | GNDQ            |
| C1         | GAA2/IO118UDB3  |
| C2         | IO116VDB3       |
| C3         | VCC             |
| C4         | GFB1/IO109PPB3  |
| C5         | GFA0/IO108NPB3  |
| C6         | GFA2/IO107PSB3  |
| C7         | IO105NPB3       |
| C8         | VCCIB3          |
| C9         | GEB1/IO99PDB3   |
| C10        | GNDQ            |
| C11        | GEA2/IO97RSB2   |
| C12        | IO94RSB2        |
| C13        | VCCIB2          |
| C14        | IO88RSB2        |
| C15        | IO84RSB2        |
| C16        | IO80RSB2        |

| PQ208      |                 |
|------------|-----------------|
| Pin Number | A3P600 Function |
| 109        | TRST            |
| 110        | VJTAG           |
| 111        | GDA0/IO88NDB1   |
| 112        | GDA1/IO88PDB1   |
| 113        | GDB0/IO87NDB1   |
| 114        | GDB1/IO87PDB1   |
| 115        | GDC0/IO86NDB1   |
| 116        | GDC1/IO86PDB1   |
| 117        | IO84NDB1        |
| 118        | IO84PDB1        |
| 119        | IO82NDB1        |
| 120        | IO82PDB1        |
| 121        | IO81PSB1        |
| 122        | GND             |
| 123        | VCCIB1          |
| 124        | IO77NDB1        |
| 125        | IO77PDB1        |
| 126        | NC              |
| 127        | IO74NDB1        |
| 128        | GCC2/IO74PDB1   |
| 129        | GCB2/IO73PSB1   |
| 130        | GND             |
| 131        | GCA2/IO72PSB1   |
| 132        | GCA1/IO71PDB1   |
| 133        | GCA0/IO71NDB1   |
| 134        | GCB0/IO70NDB1   |
| 135        | GCB1/IO70PDB1   |
| 136        | GCC0/IO69NDB1   |
| 137        | GCC1/IO69PDB1   |
| 138        | IO67NDB1        |
| 139        | IO67PDB1        |
| 140        | VCCIB1          |
| 141        | GND             |
| 142        | VCC             |
| 143        | IO65PSB1        |
| 144        | IO64NDB1        |

| PQ208      |                 |
|------------|-----------------|
| Pin Number | A3P600 Function |
| 145        | IO64PDB1        |
| 146        | IO63NDB1        |
| 147        | IO63PDB1        |
| 148        | IO62NDB1        |
| 149        | GBC2/IO62PDB1   |
| 150        | IO61NDB1        |
| 151        | GBB2/IO61PDB1   |
| 152        | IO60NDB1        |
| 153        | GBA2/IO60PDB1   |
| 154        | VMV1            |
| 155        | GNDQ            |
| 156        | GND             |
| 157        | VMV0            |
| 158        | GBA1/IO59RSB0   |
| 159        | GBA0/IO58RSB0   |
| 160        | GBB1/IO57RSB0   |
| 161        | GBB0/IO56RSB0   |
| 162        | GND             |
| 163        | GBC1/IO55RSB0   |
| 164        | GBC0/IO54RSB0   |
| 165        | IO52RSB0        |
| 166        | IO50RSB0        |
| 167        | IO48RSB0        |
| 168        | IO46RSB0        |
| 169        | IO44RSB0        |
| 170        | VCCIB0          |
| 171        | VCC             |
| 172        | IO36RSB0        |
| 173        | IO35RSB0        |
| 174        | IO34RSB0        |
| 175        | IO33RSB0        |
| 176        | IO32RSB0        |
| 177        | IO31RSB0        |
| 178        | GND             |
| 179        | IO29RSB0        |
| 180        | IO28RSB0        |

| PQ208      |                 |
|------------|-----------------|
| Pin Number | A3P600 Function |
| 181        | IO27RSB0        |
| 182        | IO26RSB0        |
| 183        | IO25RSB0        |
| 184        | IO24RSB0        |
| 185        | IO23RSB0        |
| 186        | VCCIB0          |
| 187        | VCC             |
| 188        | IO20RSB0        |
| 189        | IO19RSB0        |
| 190        | IO18RSB0        |
| 191        | IO17RSB0        |
| 192        | IO16RSB0        |
| 193        | IO14RSB0        |
| 194        | IO12RSB0        |
| 195        | GND             |
| 196        | IO10RSB0        |
| 197        | IO09RSB0        |
| 198        | IO08RSB0        |
| 199        | IO07RSB0        |
| 200        | VCCIB0          |
| 201        | GAC1/IO05RSB0   |
| 202        | GAC0/IO04RSB0   |
| 203        | GAB1/IO03RSB0   |
| 204        | GAB0/IO02RSB0   |
| 205        | GAA1/IO01RSB0   |
| 206        | GAA0/IO00RSB0   |
| 207        | GNDQ            |
| 208        | VMV0            |

| PQ208      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| 109        | TRST             |
| 110        | VJTAG            |
| 111        | GDA0/IO113NDB1   |
| 112        | GDA1/IO113PDB1   |
| 113        | GDB0/IO112NDB1   |
| 114        | GDB1/IO112PDB1   |
| 115        | GDC0/IO111NDB1   |
| 116        | GDC1/IO111PDB1   |
| 117        | IO109NDB1        |
| 118        | IO109PDB1        |
| 119        | IO106NDB1        |
| 120        | IO106PDB1        |
| 121        | IO104PSB1        |
| 122        | GND              |
| 123        | VCCIB1           |
| 124        | IO99NDB1         |
| 125        | IO99PDB1         |
| 126        | NC               |
| 127        | IO96NDB1         |
| 128        | GCC2/IO96PDB1    |
| 129        | GCB2/IO95PSB1    |
| 130        | GND              |
| 131        | GCA2/IO94PSB1    |
| 132        | GCA1/IO93PDB1    |
| 133        | GCA0/IO93NDB1    |
| 134        | GCB0/IO92NDB1    |
| 135        | GCB1/IO92PDB1    |
| 136        | GCC0/IO91NDB1    |
| 137        | GCC1/IO91PDB1    |
| 138        | IO88NDB1         |
| 139        | IO88PDB1         |
| 140        | VCCIB1           |
| 141        | GND              |
| 142        | VCC              |
| 143        | IO86PSB1         |
| 144        | IO84NDB1         |

| PQ208      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| 145        | IO84PDB1         |
| 146        | IO82NDB1         |
| 147        | IO82PDB1         |
| 148        | IO80NDB1         |
| 149        | GBC2/IO80PDB1    |
| 150        | IO79NDB1         |
| 151        | GBB2/IO79PDB1    |
| 152        | IO78NDB1         |
| 153        | GBA2/IO78PDB1    |
| 154        | VMV1             |
| 155        | GNDQ             |
| 156        | GND              |
| 157        | VMV0             |
| 158        | GBA1/IO77RSB0    |
| 159        | GBA0/IO76RSB0    |
| 160        | GBB1/IO75RSB0    |
| 161        | GBB0/IO74RSB0    |
| 162        | GND              |
| 163        | GBC1/IO73RSB0    |
| 164        | GBC0/IO72RSB0    |
| 165        | IO70RSB0         |
| 166        | IO67RSB0         |
| 167        | IO63RSB0         |
| 168        | IO60RSB0         |
| 169        | IO57RSB0         |
| 170        | VCCIB0           |
| 171        | VCC              |
| 172        | IO54RSB0         |
| 173        | IO51RSB0         |
| 174        | IO48RSB0         |
| 175        | IO45RSB0         |
| 176        | IO42RSB0         |
| 177        | IO40RSB0         |
| 178        | GND              |
| 179        | IO38RSB0         |
| 180        | IO35RSB0         |

| PQ208      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| 181        | IO33RSB0         |
| 182        | IO31RSB0         |
| 183        | IO29RSB0         |
| 184        | IO27RSB0         |
| 185        | IO25RSB0         |
| 186        | VCCIB0           |
| 187        | VCC              |
| 188        | IO22RSB0         |
| 189        | IO20RSB0         |
| 190        | IO18RSB0         |
| 191        | IO16RSB0         |
| 192        | IO15RSB0         |
| 193        | IO14RSB0         |
| 194        | IO13RSB0         |
| 195        | GND              |
| 196        | IO12RSB0         |
| 197        | IO11RSB0         |
| 198        | IO10RSB0         |
| 199        | IO09RSB0         |
| 200        | VCCIB0           |
| 201        | GAC1/IO05RSB0    |
| 202        | GAC0/IO04RSB0    |
| 203        | GAB1/IO03RSB0    |
| 204        | GAB0/IO02RSB0    |
| 205        | GAA1/IO01RSB0    |
| 206        | GAA0/IO00RSB0    |
| 207        | GNDQ             |
| 208        | VMV0             |

| FG144      |                 |
|------------|-----------------|
| Pin Number | A3P060 Function |
| A1         | GNDQ            |
| A2         | VMV0            |
| A3         | GAB0/IO04RSB0   |
| A4         | GAB1/IO05RSB0   |
| A5         | IO08RSB0        |
| A6         | GND             |
| A7         | IO11RSB0        |
| A8         | VCC             |
| A9         | IO16RSB0        |
| A10        | GBA0/IO23RSB0   |
| A11        | GBA1/IO24RSB0   |
| A12        | GNDQ            |
| B1         | GAB2/IO53RSB1   |
| B2         | GND             |
| B3         | GAA0/IO02RSB0   |
| B4         | GAA1/IO03RSB0   |
| B5         | IO00RSB0        |
| B6         | IO10RSB0        |
| B7         | IO12RSB0        |
| B8         | IO14RSB0        |
| B9         | GBB0/IO21RSB0   |
| B10        | GBB1/IO22RSB0   |
| B11        | GND             |
| B12        | VMV0            |
| C1         | IO95RSB1        |
| C2         | GFA2/IO83RSB1   |
| C3         | GAC2/IO94RSB1   |
| C4         | VCC             |
| C5         | IO01RSB0        |
| C6         | IO09RSB0        |
| C7         | IO13RSB0        |
| C8         | IO15RSB0        |
| C9         | IO17RSB0        |
| C10        | GBA2/IO25RSB0   |
| C11        | IO26RSB0        |
| C12        | GBC2/IO29RSB0   |

| FG144      |                 |
|------------|-----------------|
| Pin Number | A3P060 Function |
| D1         | IO91RSB1        |
| D2         | IO92RSB1        |
| D3         | IO93RSB1        |
| D4         | GAA2/IO51RSB1   |
| D5         | GAC0/IO06RSB0   |
| D6         | GAC1/IO07RSB0   |
| D7         | GBC0/IO19RSB0   |
| D8         | GBC1/IO20RSB0   |
| D9         | GBB2/IO27RSB0   |
| D10        | IO18RSB0        |
| D11        | IO28RSB0        |
| D12        | GCB1/IO37RSB0   |
| E1         | VCC             |
| E2         | GFC0/IO88RSB1   |
| E3         | GFC1/IO89RSB1   |
| E4         | VCCIB1          |
| E5         | IO52RSB1        |
| E6         | VCCIB0          |
| E7         | VCCIB0          |
| E8         | GCC1/IO35RSB0   |
| E9         | VCCIB0          |
| E10        | VCC             |
| E11        | GCA0/IO40RSB0   |
| E12        | IO30RSB0        |
| F1         | GFB0/IO86RSB1   |
| F2         | VCOMPLF         |
| F3         | GFB1/IO87RSB1   |
| F4         | IO90RSB1        |
| F5         | GND             |
| F6         | GND             |
| F7         | GND             |
| F8         | GCC0/IO36RSB0   |
| F9         | GCB0/IO38RSB0   |
| F10        | GND             |
| F11        | GCA1/IO39RSB0   |
| F12        | GCA2/IO41RSB0   |

| FG144      |                 |
|------------|-----------------|
| Pin Number | A3P060 Function |
| G1         | GFA1/IO84RSB1   |
| G2         | GND             |
| G3         | VCCPLF          |
| G4         | GFA0/IO85RSB1   |
| G5         | GND             |
| G6         | GND             |
| G7         | GND             |
| G8         | GDC1/IO45RSB0   |
| G9         | IO32RSB0        |
| G10        | GCC2/IO43RSB0   |
| G11        | IO31RSB0        |
| G12        | GCB2/IO42RSB0   |
| H1         | VCC             |
| H2         | GFB2/IO82RSB1   |
| H3         | GFC2/IO81RSB1   |
| H4         | GEC1/IO77RSB1   |
| H5         | VCC             |
| H6         | IO34RSB0        |
| H7         | IO44RSB0        |
| H8         | GDB2/IO55RSB1   |
| H9         | GDC0/IO46RSB0   |
| H10        | VCCIB0          |
| H11        | IO33RSB0        |
| H12        | VCC             |
| J1         | GEB1/IO75RSB1   |
| J2         | IO78RSB1        |
| J3         | VCCIB1          |
| J4         | GEC0/IO76RSB1   |
| J5         | IO79RSB1        |
| J6         | IO80RSB1        |
| J7         | VCC             |
| J8         | TCK             |
| J9         | GDA2/IO54RSB1   |
| J10        | TDO             |
| J11        | GDA1/IO49RSB0   |
| J12        | GDB1/IO47RSB0   |

| <b>FG144</b>      |                        |
|-------------------|------------------------|
| <b>Pin Number</b> | <b>A3P400 Function</b> |
| K1                | GEB0/IO136NDB3         |
| K2                | GEA1/IO135PDB3         |
| K3                | GEA0/IO135NDB3         |
| K4                | GEA2/IO134RSB2         |
| K5                | IO127RSB2              |
| K6                | IO121RSB2              |
| K7                | GND                    |
| K8                | IO104RSB2              |
| K9                | GDC2/IO82RSB2          |
| K10               | GND                    |
| K11               | GDA0/IO79VDB1          |
| K12               | GDB0/IO78VDB1          |
| L1                | GND                    |
| L2                | VMV3                   |
| L3                | GEB2/IO133RSB2         |
| L4                | IO128RSB2              |
| L5                | VCCIB2                 |
| L6                | IO119RSB2              |
| L7                | IO114RSB2              |
| L8                | IO110RSB2              |
| L9                | TMS                    |
| L10               | VJTAG                  |
| L11               | VMV2                   |
| L12               | TRST                   |
| M1                | GNDQ                   |
| M2                | GEC2/IO132RSB2         |
| M3                | IO129RSB2              |
| M4                | IO126RSB2              |
| M5                | IO124RSB2              |
| M6                | IO122RSB2              |
| M7                | IO117RSB2              |
| M8                | IO115RSB2              |
| M9                | TDI                    |
| M10               | VCCIB2                 |
| M11               | VPUMP                  |
| M12               | GNDQ                   |

| FG256      |                 |
|------------|-----------------|
| Pin Number | A3P250 Function |
| A1         | GND             |
| A2         | GAA0/IO00RSB0   |
| A3         | GAA1/IO01RSB0   |
| A4         | GAB0/IO02RSB0   |
| A5         | IO07RSB0        |
| A6         | IO10RSB0        |
| A7         | IO11RSB0        |
| A8         | IO15RSB0        |
| A9         | IO20RSB0        |
| A10        | IO25RSB0        |
| A11        | IO29RSB0        |
| A12        | IO33RSB0        |
| A13        | GBB1/IO38RSB0   |
| A14        | GBA0/IO39RSB0   |
| A15        | GBA1/IO40RSB0   |
| A16        | GND             |
| B1         | GAB2/IO117UDB3  |
| B2         | GAA2/IO118UDB3  |
| B3         | NC              |
| B4         | GAB1/IO03RSB0   |
| B5         | IO06RSB0        |
| B6         | IO09RSB0        |
| B7         | IO12RSB0        |
| B8         | IO16RSB0        |
| B9         | IO21RSB0        |
| B10        | IO26RSB0        |
| B11        | IO30RSB0        |
| B12        | GBC1/IO36RSB0   |
| B13        | GBB0/IO37RSB0   |
| B14        | NC              |
| B15        | GBA2/IO41PDB1   |
| B16        | IO41NDB1        |
| C1         | IO117VDB3       |
| C2         | IO118VDB3       |
| C3         | NC              |
| C4         | NC              |

| FG256      |                 |
|------------|-----------------|
| Pin Number | A3P250 Function |
| C5         | GAC0/IO04RSB0   |
| C6         | GAC1/IO05RSB0   |
| C7         | IO13RSB0        |
| C8         | IO17RSB0        |
| C9         | IO22RSB0        |
| C10        | IO27RSB0        |
| C11        | IO31RSB0        |
| C12        | GBC0/IO35RSB0   |
| C13        | IO34RSB0        |
| C14        | NC              |
| C15        | IO42NPB1        |
| C16        | IO44PDB1        |
| D1         | IO114VDB3       |
| D2         | IO114UDB3       |
| D3         | GAC2/IO116UDB3  |
| D4         | NC              |
| D5         | GNDQ            |
| D6         | IO08RSB0        |
| D7         | IO14RSB0        |
| D8         | IO18RSB0        |
| D9         | IO23RSB0        |
| D10        | IO28RSB0        |
| D11        | IO32RSB0        |
| D12        | GNDQ            |
| D13        | NC              |
| D14        | GBB2/IO42PPB1   |
| D15        | NC              |
| D16        | IO44NDB1        |
| E1         | IO113PDB3       |
| E2         | NC              |
| E3         | IO116VDB3       |
| E4         | IO115UDB3       |
| E5         | VMV0            |
| E6         | VCCIB0          |
| E7         | VCCIB0          |
| E8         | IO19RSB0        |

| FG256      |                 |
|------------|-----------------|
| Pin Number | A3P250 Function |
| E9         | IO24RSB0        |
| E10        | VCCIB0          |
| E11        | VCCIB0          |
| E12        | VMV1            |
| E13        | GBC2/IO43PDB1   |
| E14        | IO46RSB1        |
| E15        | NC              |
| E16        | IO45PDB1        |
| F1         | IO113NDB3       |
| F2         | IO112PPB3       |
| F3         | NC              |
| F4         | IO115VDB3       |
| F5         | VCCIB3          |
| F6         | GND             |
| F7         | VCC             |
| F8         | VCC             |
| F9         | VCC             |
| F10        | VCC             |
| F11        | GND             |
| F12        | VCCIB1          |
| F13        | IO43NDB1        |
| F14        | NC              |
| F15        | IO47PPB1        |
| F16        | IO45NDB1        |
| G1         | IO111NDB3       |
| G2         | IO111PDB3       |
| G3         | IO112NPB3       |
| G4         | GFC1/IO110PPB3  |
| G5         | VCCIB3          |
| G6         | VCC             |
| G7         | GND             |
| G8         | GND             |
| G9         | GND             |
| G10        | GND             |
| G11        | VCC             |
| G12        | VCCIB1          |

| FG256      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| A1         | GND              |
| A2         | GAA0/IO00RSB0    |
| A3         | GAA1/IO01RSB0    |
| A4         | GAB0/IO02RSB0    |
| A5         | IO16RSB0         |
| A6         | IO22RSB0         |
| A7         | IO28RSB0         |
| A8         | IO35RSB0         |
| A9         | IO45RSB0         |
| A10        | IO50RSB0         |
| A11        | IO55RSB0         |
| A12        | IO61RSB0         |
| A13        | GBB1/IO75RSB0    |
| A14        | GBA0/IO76RSB0    |
| A15        | GBA1/IO77RSB0    |
| A16        | GND              |
| B1         | GAB2/IO224PDB3   |
| B2         | GAA2/IO225PDB3   |
| B3         | GNDQ             |
| B4         | GAB1/IO03RSB0    |
| B5         | IO17RSB0         |
| B6         | IO21RSB0         |
| B7         | IO27RSB0         |
| B8         | IO34RSB0         |
| B9         | IO44RSB0         |
| B10        | IO51RSB0         |
| B11        | IO57RSB0         |
| B12        | GBC1/IO73RSB0    |
| B13        | GBB0/IO74RSB0    |
| B14        | IO71RSB0         |
| B15        | GBA2/IO78PDB1    |
| B16        | IO81PDB1         |
| C1         | IO224NDB3        |
| C2         | IO225NDB3        |
| C3         | VMV3             |
| C4         | IO11RSB0         |
| C5         | GAC0/IO04RSB0    |
| C6         | GAC1/IO05RSB0    |

| FG256      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| C7         | IO25RSB0         |
| C8         | IO36RSB0         |
| C9         | IO42RSB0         |
| C10        | IO49RSB0         |
| C11        | IO56RSB0         |
| C12        | GBC0/IO72RSB0    |
| C13        | IO62RSB0         |
| C14        | VMV0             |
| C15        | IO78NDB1         |
| C16        | IO81NDB1         |
| D1         | IO222NDB3        |
| D2         | IO222PDB3        |
| D3         | GAC2/IO223PDB3   |
| D4         | IO223NDB3        |
| D5         | GNDQ             |
| D6         | IO23RSB0         |
| D7         | IO29RSB0         |
| D8         | IO33RSB0         |
| D9         | IO46RSB0         |
| D10        | IO52RSB0         |
| D11        | IO60RSB0         |
| D12        | GNDQ             |
| D13        | IO80NDB1         |
| D14        | GBB2/IO79PDB1    |
| D15        | IO79NDB1         |
| D16        | IO82NSB1         |
| E1         | IO217PDB3        |
| E2         | IO218PDB3        |
| E3         | IO221NDB3        |
| E4         | IO221PDB3        |
| E5         | VMV0             |
| E6         | VCCIB0           |
| E7         | VCCIB0           |
| E8         | IO38RSB0         |
| E9         | IO47RSB0         |
| E10        | VCCIB0           |
| E11        | VCCIB0           |
| E12        | VMV1             |

| FG256      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| E13        | GBC2/IO80PDB1    |
| E14        | IO83PPB1         |
| E15        | IO86PPB1         |
| E16        | IO87PDB1         |
| F1         | IO217NDB3        |
| F2         | IO218NDB3        |
| F3         | IO216PDB3        |
| F4         | IO216NDB3        |
| F5         | VCCIB3           |
| F6         | GND              |
| F7         | VCC              |
| F8         | VCC              |
| F9         | VCC              |
| F10        | VCC              |
| F11        | GND              |
| F12        | VCCIB1           |
| F13        | IO83NPB1         |
| F14        | IO86NPB1         |
| F15        | IO90PPB1         |
| F16        | IO87NDB1         |
| G1         | IO210PSB3        |
| G2         | IO213NDB3        |
| G3         | IO213PDB3        |
| G4         | GFC1/IO209PPB3   |
| G5         | VCCIB3           |
| G6         | VCC              |
| G7         | GND              |
| G8         | GND              |
| G9         | GND              |
| G10        | GND              |
| G11        | VCC              |
| G12        | VCCIB1           |
| G13        | GCC1/IO91PPB1    |
| G14        | IO90NPB1         |
| G15        | IO88PDB1         |
| G16        | IO88NDB1         |
| H1         | GFB0/IO208NPB3   |
| H2         | GFA0/IO207NDB3   |

| FG484      |                 |
|------------|-----------------|
| Pin Number | A3P600 Function |
| R17        | GDB1/IO87PPB1   |
| R18        | GDC1/IO86PDB1   |
| R19        | IO84NDB1        |
| R20        | VCC             |
| R21        | IO81NDB1        |
| R22        | IO82PDB1        |
| T1         | IO152PDB3       |
| T2         | IO152NDB3       |
| T3         | NC              |
| T4         | IO150NDB3       |
| T5         | IO147PPB3       |
| T6         | GEC1/IO146PPB3  |
| T7         | IO140RSB2       |
| T8         | GNDQ            |
| T9         | GEA2/IO143RSB2  |
| T10        | IO126RSB2       |
| T11        | IO120RSB2       |
| T12        | IO108RSB2       |
| T13        | IO103RSB2       |
| T14        | IO99RSB2        |
| T15        | GNDQ            |
| T16        | IO92RSB2        |
| T17        | VJTAG           |
| T18        | GDC0/IO86NDB1   |
| T19        | GDA1/IO88PDB1   |
| T20        | NC              |
| T21        | IO83PDB1        |
| T22        | IO82NDB1        |
| U1         | IO149PDB3       |
| U2         | IO149NDB3       |
| U3         | NC              |
| U4         | GEB1/IO145PDB3  |
| U5         | GEB0/IO145NDB3  |
| U6         | VMV2            |
| U7         | IO138RSB2       |
| U8         | IO136RSB2       |

| FG484      |                 |
|------------|-----------------|
| Pin Number | A3P600 Function |
| U9         | IO131RSB2       |
| U10        | IO124RSB2       |
| U11        | IO119RSB2       |
| U12        | IO107RSB2       |
| U13        | IO104RSB2       |
| U14        | IO97RSB2        |
| U15        | VMV1            |
| U16        | TCK             |
| U17        | VPUMP           |
| U18        | TRST            |
| U19        | GDA0/IO88NDB1   |
| U20        | NC              |
| U21        | IO83NDB1        |
| U22        | NC              |
| V1         | NC              |
| V2         | NC              |
| V3         | GND             |
| V4         | GEA1/IO144PDB3  |
| V5         | GEA0/IO144NDB3  |
| V6         | IO139RSB2       |
| V7         | GEC2/IO141RSB2  |
| V8         | IO132RSB2       |
| V9         | IO127RSB2       |
| V10        | IO121RSB2       |
| V11        | IO114RSB2       |
| V12        | IO109RSB2       |
| V13        | IO105RSB2       |
| V14        | IO98RSB2        |
| V15        | IO96RSB2        |
| V16        | GDB2/IO90RSB2   |
| V17        | TDI             |
| V18        | GNDQ            |
| V19        | TDO             |
| V20        | GND             |
| V21        | NC              |
| V22        | NC              |

| FG484      |                 |
|------------|-----------------|
| Pin Number | A3P600 Function |
| W1         | NC              |
| W2         | IO148PDB3       |
| W3         | NC              |
| W4         | GND             |
| W5         | IO137RSB2       |
| W6         | GEB2/IO142RSB2  |
| W7         | IO134RSB2       |
| W8         | IO125RSB2       |
| W9         | IO123RSB2       |
| W10        | IO118RSB2       |
| W11        | IO115RSB2       |
| W12        | IO111RSB2       |
| W13        | IO106RSB2       |
| W14        | IO102RSB2       |
| W15        | GDC2/IO91RSB2   |
| W16        | IO93RSB2        |
| W17        | GDA2/IO89RSB2   |
| W18        | TMS             |
| W19        | GND             |
| W20        | NC              |
| W21        | NC              |
| W22        | NC              |
| Y1         | VCCIB3          |
| Y2         | IO148NDB3       |
| Y3         | NC              |
| Y4         | NC              |
| Y5         | GND             |
| Y6         | NC              |
| Y7         | NC              |
| Y8         | VCC             |
| Y9         | VCC             |
| Y10        | NC              |
| Y11        | NC              |
| Y12        | NC              |
| Y13        | NC              |
| Y14        | VCC             |