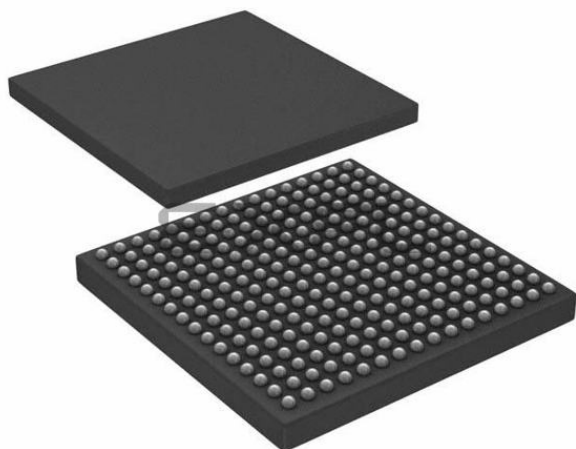




Welcome to [E-XFL.COM](https://www.e-xfl.com)

### 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                  | 177                                                                                                                                                             |
| Number of Gates                | 1000000                                                                                                                                                         |
| Voltage - Supply               | 1.425V ~ 1.575V                                                                                                                                                 |
| Mounting Type                  | Surface Mount                                                                                                                                                   |
| Operating Temperature          | 0°C ~ 85°C (TJ)                                                                                                                                                 |
| Package / Case                 | 256-LBGA                                                                                                                                                        |
| Supplier Device Package        | 256-FPBGA (17x17)                                                                                                                                               |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/microchip-technology/a3p1000-1fg256">https://www.e-xfl.com/product-detail/microchip-technology/a3p1000-1fg256</a> |

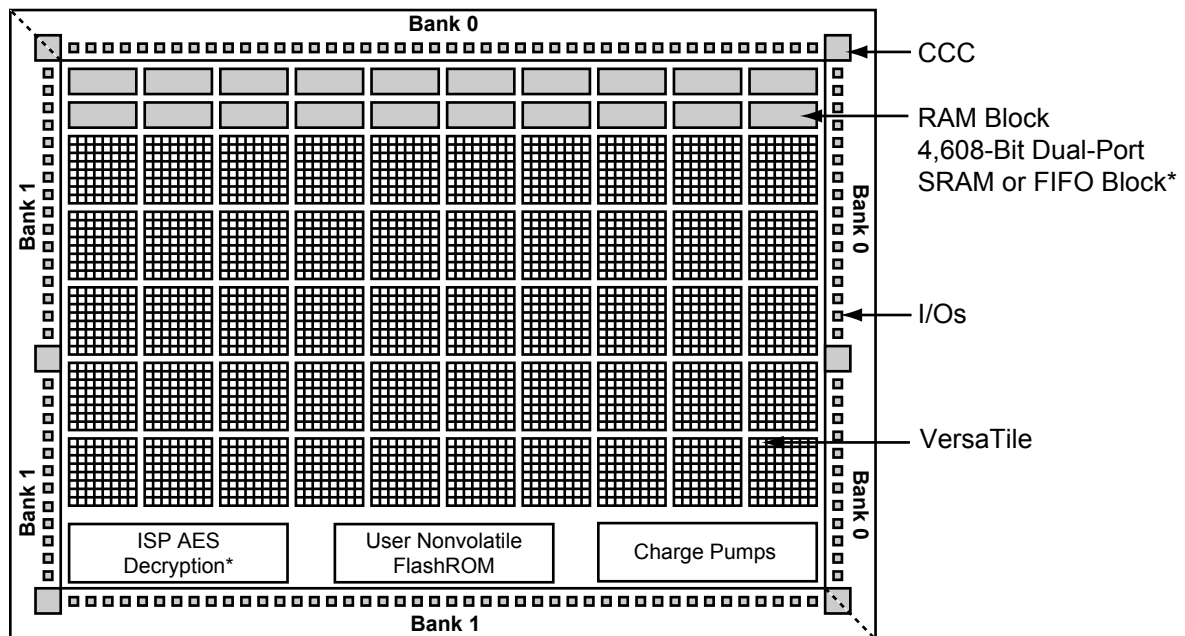
## Advanced Flash Technology

The ProASIC3 family offers many benefits, including nonvolatility and reprogrammability through an advanced flash-based, 130-nm LVCMOS process with seven layers of metal. Standard CMOS design techniques are used to implement logic and control functions. The combination of fine granularity, enhanced flexible routing resources, and abundant flash switches allows for very high logic utilization without compromising device routability or performance. Logic functions within the device are interconnected through a four-level routing hierarchy.

## Advanced Architecture

The proprietary ProASIC3 architecture provides granularity comparable to standard-cell ASICs. The ProASIC3 device consists of five distinct and programmable architectural features (Figure 1-1 and Figure 1-2 on page 1-4):

- FPGA VersaTiles
- Dedicated FlashROM
- Dedicated SRAM/FIFO memory<sup>†</sup>
- Extensive CCCs and PLLs<sup>†</sup>
- Advanced I/O structure



**Note:** \*Not supported by A3P015 and A3P030 devices

**Figure 1-1 • ProASIC3 Device Architecture Overview with Two I/O Banks (A3P015, A3P030, A3P060, and A3P125)**

<sup>†</sup> The A3P015 and A3P030 do not support PLL or SRAM.

## 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.

**Table 2-25 • 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 Plus 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) | $t_{ZLS}$ (ns) | $t_{ZHS}$ (ns) | Units |
|--------------------------------------|-------------------|------------------------------------------------------------|-----------|----------------------|-------------------|-----------------|---------------|----------------|---------------|-----------------|---------------|---------------|---------------|---------------|----------------|----------------|-------|
| 3.3 V LVTTTL / 3.3 V LVCMOS          | 12 mA             | 12 mA                                                      | High      | 35                   | –                 | 0.45            | 2.36          | 0.03           | 0.75          | 0.32            | 2.40          | 1.93          | 2.08          | 2.41          | 4.07           | 3.60           | ns    |
| 3.3 V LVCMOS Wide Range <sup>2</sup> | 100 $\mu\text{A}$ | 12 mA                                                      | High      | 35                   | –                 | 0.45            | 3.65          | 0.03           | 1.14          | 0.32            | 3.65          | 2.93          | 3.22          | 3.72          | 6.18           | 5.46           | ns    |
| 2.5 V LVCMOS                         | 12 mA             | 12 mA                                                      | High      | 35                   | –                 | 0.45            | 2.39          | 0.03           | 0.97          | 0.32            | 2.44          | 2.35          | 2.11          | 2.32          | 4.11           | 4.02           | ns    |
| 1.8 V LVCMOS                         | 8 mA              | 8 mA                                                       | High      | 35                   | –                 | 0.45            | 3.03          | 0.03           | 0.90          | 0.32            | 2.87          | 3.03          | 2.19          | 2.32          | 4.54           | 4.70           | ns    |
| 1.5 V LVCMOS                         | 4 mA              | 4 mA                                                       | High      | 35                   | –                 | 0.45            | 3.61          | 0.03           | 1.06          | 0.32            | 3.35          | 3.61          | 2.26          | 2.34          | 5.02           | 5.28           | ns    |
| 3.3 V PCI                            | Per PCI spec      | –                                                          | High      | 10                   | 25 <sup>4</sup>   | 0.45            | 1.72          | 0.03           | 0.64          | 0.32            | 1.76          | 1.27          | 2.08          | 2.41          | 3.42           | 2.94           | ns    |
| 3.3 V PCI-X                          | Per PCI-X spec    | –                                                          | High      | 10                   | 25 <sup>4</sup>   | 0.45            | 1.72          | 0.03           | 0.62          | 0.32            | 1.76          | 1.27          | 2.08          | 2.41          | 3.42           | 2.94           | 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 JESD8-B specification.
3. For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.
4. Resistance is used to measure I/O propagation delays as defined in PCI specifications. See [Figure 2-11 on page 2-64](#) for connectivity. This resistor is not required during normal operation.

## Timing Characteristics

**Table 2-41 • 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 Advanced I/O Banks

| Drive Strength | 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 |
|----------------|-------------|------------|----------|-----------|----------|------------|----------|----------|----------|----------|-----------|-----------|-------|
| 2 mA           | Std.        | 0.66       | 7.66     | 0.04      | 1.02     | 0.43       | 7.80     | 6.59     | 2.65     | 2.61     | 10.03     | 8.82      | ns    |
|                | –1          | 0.56       | 6.51     | 0.04      | 0.86     | 0.36       | 6.63     | 5.60     | 2.25     | 2.22     | 8.54      | 7.51      | ns    |
|                | –2          | 0.49       | 5.72     | 0.03      | 0.76     | 0.32       | 5.82     | 4.92     | 1.98     | 1.95     | 7.49      | 6.59      | ns    |
| 4 mA           | Std.        | 0.66       | 7.66     | 0.04      | 1.02     | 0.43       | 7.80     | 6.59     | 2.65     | 2.61     | 10.03     | 8.82      | ns    |
|                | –1          | 0.56       | 6.51     | 0.04      | 0.86     | 0.36       | 6.63     | 5.60     | 2.25     | 2.22     | 8.54      | 7.51      | ns    |
|                | –2          | 0.49       | 5.72     | 0.03      | 0.76     | 0.32       | 5.82     | 4.92     | 1.98     | 1.95     | 7.49      | 6.59      | ns    |
| 6 mA           | Std.        | 0.66       | 4.91     | 0.04      | 1.02     | 0.43       | 5.00     | 4.07     | 2.99     | 3.20     | 7.23      | 6.31      | ns    |
|                | –1          | 0.56       | 4.17     | 0.04      | 0.86     | 0.36       | 4.25     | 3.46     | 2.54     | 2.73     | 6.15      | 5.36      | ns    |
|                | –2          | 0.49       | 3.66     | 0.03      | 0.76     | 0.32       | 3.73     | 3.04     | 2.23     | 2.39     | 5.40      | 4.71      | ns    |
| 8 mA           | Std.        | 0.66       | 4.91     | 0.04      | 1.02     | 0.43       | 5.00     | 4.07     | 2.99     | 3.20     | 7.23      | 6.31      | ns    |
|                | –1          | 0.56       | 4.17     | 0.04      | 0.86     | 0.36       | 4.25     | 3.46     | 2.54     | 2.73     | 6.15      | 5.36      | ns    |
|                | –2          | 0.49       | 3.66     | 0.03      | 0.76     | 0.32       | 3.73     | 3.04     | 2.23     | 2.39     | 5.40      | 4.71      | ns    |
| 12 mA          | Std.        | 0.66       | 3.53     | 0.04      | 1.02     | 0.43       | 3.60     | 2.82     | 3.21     | 3.58     | 5.83      | 5.06      | ns    |
|                | –1          | 0.56       | 3.00     | 0.04      | 0.86     | 0.36       | 3.06     | 2.40     | 2.73     | 3.05     | 4.96      | 4.30      | ns    |
|                | –2          | 0.49       | 2.64     | 0.03      | 0.76     | 0.32       | 2.69     | 2.11     | 2.40     | 2.68     | 4.36      | 3.78      | ns    |
| 16 mA          | Std.        | 0.66       | 3.33     | 0.04      | 1.02     | 0.43       | 3.39     | 2.56     | 3.26     | 3.68     | 5.63      | 4.80      | ns    |
|                | –1          | 0.56       | 2.83     | 0.04      | 0.86     | 0.36       | 2.89     | 2.18     | 2.77     | 3.13     | 4.79      | 4.08      | ns    |
|                | –2          | 0.49       | 2.49     | 0.03      | 0.76     | 0.32       | 2.53     | 1.91     | 2.44     | 2.75     | 4.20      | 3.58      | ns    |
| 24 mA          | Std.        | 0.66       | 3.08     | 0.04      | 1.02     | 0.43       | 3.13     | 2.12     | 3.32     | 4.06     | 5.37      | 4.35      | ns    |
|                | –1          | 0.56       | 2.62     | 0.04      | 0.86     | 0.36       | 2.66     | 1.80     | 2.83     | 3.45     | 4.57      | 3.70      | ns    |
|                | –2          | 0.49       | 2.30     | 0.03      | 0.76     | 0.32       | 2.34     | 1.58     | 2.48     | 3.03     | 4.01      | 3.25      | ns    |

**Notes:**

1. Software default selection highlighted in gray.
2. For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

### 3.3 V LVC MOS Wide Range

**Table 2-47 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Advanced I/O Banks

| 3.3 V LVC MOS Wide Range | Equiv. Software Default Drive Strength Option <sup>1</sup> | VIL   |       | VIH   |       | VOL   | VOH       | IOL | IOH | IOSL                | IOSH                | IIL <sup>2</sup> | IIH <sup>3</sup> |
|--------------------------|------------------------------------------------------------|-------|-------|-------|-------|-------|-----------|-----|-----|---------------------|---------------------|------------------|------------------|
|                          |                                                            | Min V | Max V | Min V | Max V | Max V | Min V     | μA  | μA  | Max mA <sup>4</sup> | Max mA <sup>4</sup> | μA <sup>5</sup>  | μA <sup>5</sup>  |
| 100 μA                   | 2 mA                                                       | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 25                  | 27                  | 10               | 10               |
| 100 μA                   | 4 mA                                                       | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 25                  | 27                  | 10               | 10               |
| 100 μA                   | 6 mA                                                       | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 51                  | 54                  | 10               | 10               |
| 100 μA                   | 8 mA                                                       | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 51                  | 54                  | 10               | 10               |
| 100 μA                   | 12 mA                                                      | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 103                 | 109                 | 10               | 10               |
| 100 μA                   | 16 mA                                                      | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 132                 | 127                 | 10               | 10               |
| 100 μA                   | 24 mA                                                      | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 268                 | 181                 | 10               | 10               |

**Notes:**

1. The minimum drive strength for any LVC MOS 3.3 V software configuration when run in wide range is ±100 μA. Drive strength displayed in the software is supported for normal range only. For a detailed I/V curve, refer to the IBIS models.
2. IIL is the input leakage current per I/O pin over recommended operation conditions where −0.3 V < VIN < VIL.
3. IIH is the input leakage current per I/O pin over recommended operating conditions VIH < VIN < VCCI. Input current is larger when operating outside recommended ranges
4. Currents are measured at 85°C junction temperature.
5. All LVC MOS 3.3 V software macros support LVC MOS 3.3 V wide range as specified in the JESD8-B specification.
6. Software default selection highlighted in gray.

**Table 2-48 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Standard Plus I/O Banks

| 3.3 V LVC MOS Wide Range | Equiv. Software Default Drive Strength Option <sup>1</sup> | VIL   |       | VIH   |       | VOL   | VOH       | IOL | IOH | IOSL                | IOSH                | IIL <sup>2</sup> | IIH <sup>3</sup> |
|--------------------------|------------------------------------------------------------|-------|-------|-------|-------|-------|-----------|-----|-----|---------------------|---------------------|------------------|------------------|
|                          |                                                            | Min V | Max V | Min V | Max V | Max V | Min V     | μA  | μA  | Max mA <sup>4</sup> | Max mA <sup>4</sup> | μA <sup>5</sup>  | μA <sup>5</sup>  |
| 100 μA                   | 2 mA                                                       | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 25                  | 27                  | 10               | 10               |
| 100 μA                   | 4 mA                                                       | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 25                  | 27                  | 10               | 10               |
| 100 μA                   | 6 mA                                                       | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 51                  | 54                  | 10               | 10               |
| 100 μA                   | 8 mA                                                       | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 51                  | 54                  | 10               | 10               |
| 100 μA                   | 12 mA                                                      | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 103                 | 109                 | 10               | 10               |
| 100 μA                   | 16 mA                                                      | −0.3  | 0.8   | 2     | 3.6   | 0.2   | VDD − 0.2 | 100 | 100 | 103                 | 109                 | 10               | 10               |

**Notes:**

1. The minimum drive strength for any LVC MOS 3.3 V software configuration when run in wide range is ±100 μA. Drive strength displayed in the software is supported for normal range only. For a detailed I/V curve, refer to the IBIS models.
2. IIL is the input leakage current per I/O pin over recommended operation conditions where −0.3 V < VIN < VIL.
3. IIH is the input leakage current per I/O pin over recommended operating conditions VIH < VIN < VCCI. Input current is larger when operating outside recommended ranges
4. Currents are measured at 85°C junction temperature.
5. All LVC MOS 3.3 V software macros support LVC MOS 3.3 V wide range as specified in the JESD8-B specification.
6. Software default selection highlighted in gray.

## 1.8 V LVCMOS

Low-voltage CMOS for 1.8 V is an extension of the LVCMOS standard (JESD8-5) used for general-purpose 1.8 V applications. It uses a 1.8 V input buffer and a push-pull output buffer.

**Table 2-66 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Advanced I/O Banks

| 1.8 V LVCMOS   | VIL   |             | VIH         |       | VOL   | VOH         | IOL | IOH | IOSL                | IOSH                | IIL <sup>1</sup> | IIH <sup>2</sup> |
|----------------|-------|-------------|-------------|-------|-------|-------------|-----|-----|---------------------|---------------------|------------------|------------------|
| Drive Strength | Min V | Max V       | Min V       | Max V | Max V | Min V       | mA  | mA  | Max mA <sup>3</sup> | Max mA <sup>3</sup> | μA <sup>4</sup>  | μA <sup>4</sup>  |
| 2 mA           | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 1.9   | 0.45  | VCCI − 0.45 | 2   | 2   | 11                  | 9                   | 10               | 10               |
| 4 mA           | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 1.9   | 0.45  | VCCI − 0.45 | 4   | 4   | 22                  | 17                  | 10               | 10               |
| 6 mA           | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 1.9   | 0.45  | VCCI − 0.45 | 6   | 6   | 44                  | 35                  | 10               | 10               |
| 8 mA           | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 1.9   | 0.45  | VCCI − 0.45 | 8   | 8   | 51                  | 45                  | 10               | 10               |
| 12 mA          | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 1.9   | 0.45  | VCCI − 0.45 | 12  | 12  | 74                  | 91                  | 10               | 10               |
| 16 mA          | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 1.9   | 0.45  | VCCI − 0.45 | 16  | 16  | 74                  | 91                  | 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 high temperature (100°C junction temperature) and maximum voltage.
4. Currents are measured at 85°C junction temperature.
5. Software default selection highlighted in gray.

**Table 2-67 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Standard Plus I/O Banks

| 1.8 V LVCMOS   | VIL   |             | VIH         |       | VOL   | VOH         | IOL | IOH | IOSL                | IOSH                | IIL <sup>1</sup> | IIH <sup>2</sup> |
|----------------|-------|-------------|-------------|-------|-------|-------------|-----|-----|---------------------|---------------------|------------------|------------------|
| Drive Strength | Min V | Max V       | Min V       | Max V | Max V | Min V       | mA  | mA  | Max mA <sup>3</sup> | Max mA <sup>3</sup> | μA <sup>4</sup>  | μA <sup>4</sup>  |
| 2 mA           | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 3.6   | 0.45  | VCCI − 0.45 | 2   | 2   | 11                  | 9                   | 10               | 10               |
| 4 mA           | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 3.6   | 0.45  | VCCI − 0.45 | 4   | 4   | 22                  | 17                  | 10               | 10               |
| 6 mA           | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 3.6   | 0.45  | VCCI − 0.45 | 6   | 6   | 44                  | 35                  | 10               | 10               |
| 8 mA           | −0.3  | 0.35 * VCCI | 0.65 * VCCI | 3.6   | 0.45  | VCCI − 0.45 | 8   | 8   | 44                  | 35                  | 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 high temperature (100°C junction temperature) and maximum voltage.
4. Currents are measured at 85°C junction temperature.
5. Software default selection highlighted in gray.

**Table 2-93 • Minimum and Maximum DC Input and Output Levels**

| DC Parameter | Description                    | Min.  | Max. | Min.  | Max. | Min.  | Max. | Units |
|--------------|--------------------------------|-------|------|-------|------|-------|------|-------|
| VCCI         | Supply Voltage                 | 3.0   |      | 3.3   |      | 3.6   |      | V     |
| VOL          | Output Low Voltage             | 0.96  | 1.27 | 1.06  | 1.43 | 1.30  | 1.57 | V     |
| VOH          | Output High Voltage            | 1.8   | 2.11 | 1.92  | 2.28 | 2.13  | 2.41 | V     |
| VIL, VIH     | Input Low, Input High Voltages | 0     | 3.6  | 0     | 3.6  | 0     | 3.6  | V     |
| VODIFF       | Differential Output Voltage    | 0.625 | 0.97 | 0.625 | 0.97 | 0.625 | 0.97 | V     |
| VOCM         | Output Common-Mode Voltage     | 1.762 | 1.98 | 1.762 | 1.98 | 1.762 | 1.98 | V     |
| VICM         | Input Common-Mode Voltage      | 1.01  | 2.57 | 1.01  | 2.57 | 1.01  | 2.57 | V     |
| VIDIFF       | Input Differential Voltage     | 300   |      | 300   |      | 300   |      | mV    |

**Table 2-94 • AC Waveforms, Measuring Points, and Capacitive Loads**

| Input Low (V) | Input High (V) | Measuring Point* (V) |
|---------------|----------------|----------------------|
| 1.64          | 1.94           | Cross point          |

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

### Timing Characteristics

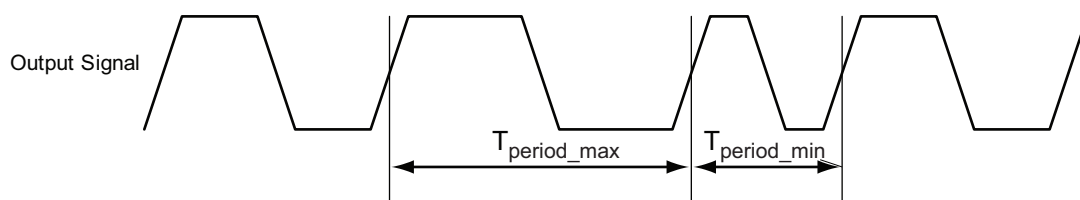
**Table 2-95 • LVPECL**

Commercial-Case Conditions:  $T_J = 70^{\circ}\text{C}$ , Worst-Case VCC = 1.425 V, Worst-Case VCCI = 3.0 V

| Speed Grade | $t_{DOUT}$ | $t_{DP}$ | $t_{DIN}$ | $t_{PY}$ | Units |
|-------------|------------|----------|-----------|----------|-------|
| Std.        | 0.66       | 1.80     | 0.04      | 1.40     | ns    |
| –1          | 0.56       | 1.53     | 0.04      | 1.19     | ns    |
| –2          | 0.49       | 1.34     | 0.03      | 1.05     | ns    |

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





*Note:* Peak-to-peak jitter measurements are defined by  $T_{\text{peak-to-peak}} = T_{\text{period\_max}} - T_{\text{period\_min}}$ .

**Figure 2-29 • Peak-to-Peak Jitter Definition**

## Embedded SRAM and FIFO Characteristics

### SRAM

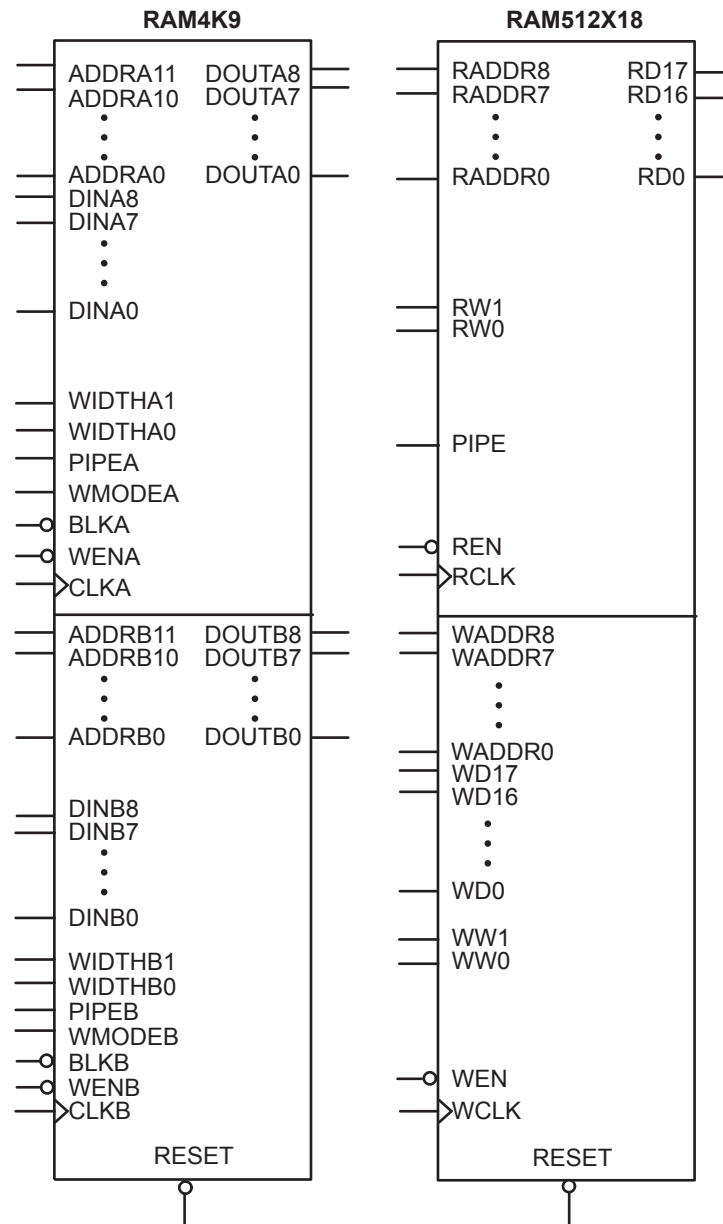


Figure 2-30 • RAM Models

**Table 2-120 • A3P250 FIFO 512×8**
**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                               | 3.75 | 4.27 | 5.02 | 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) | 2.17 | 2.47 | 2.90 | ns    |
| $t_{\text{CKQ2}}$    | Clock High to New Data Valid on RD (pipelined)    | 0.94 | 1.07 | 1.26 | 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 2-122 • A3P250 FIFO 2k×2**
**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                               | 4.39 | 5.00 | 5.88 | 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   |

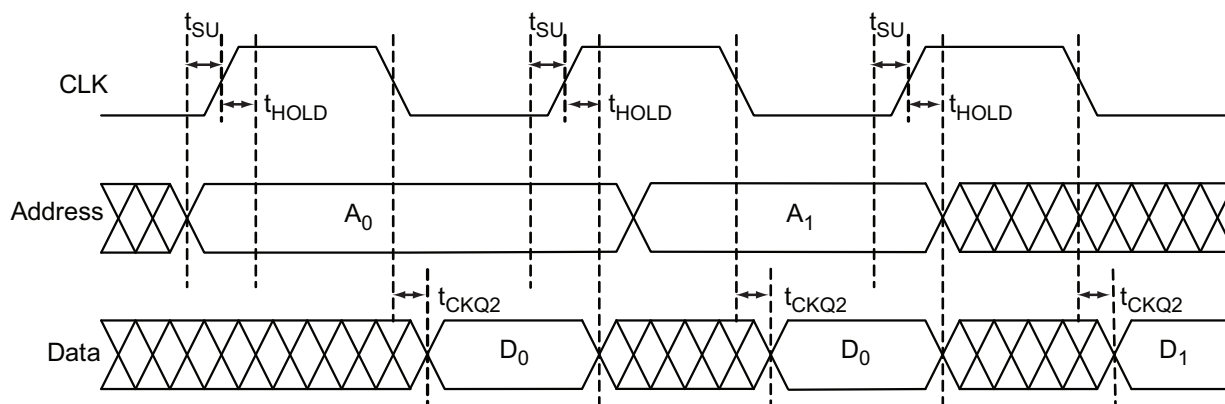
**Table 2-123 • A3P250 FIFO 4k×1**
**Worst Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ ,  $V_{CC} = 1.425\text{ V}$** 

| Parameter          | Description                                       | –2   | –1   | Std. | Units |
|--------------------|---------------------------------------------------|------|------|------|-------|
| $t_{\text{ENS}}$   | REN, WEN Setup Time                               | 4.86 | 5.53 | 6.50 | 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    |

**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**

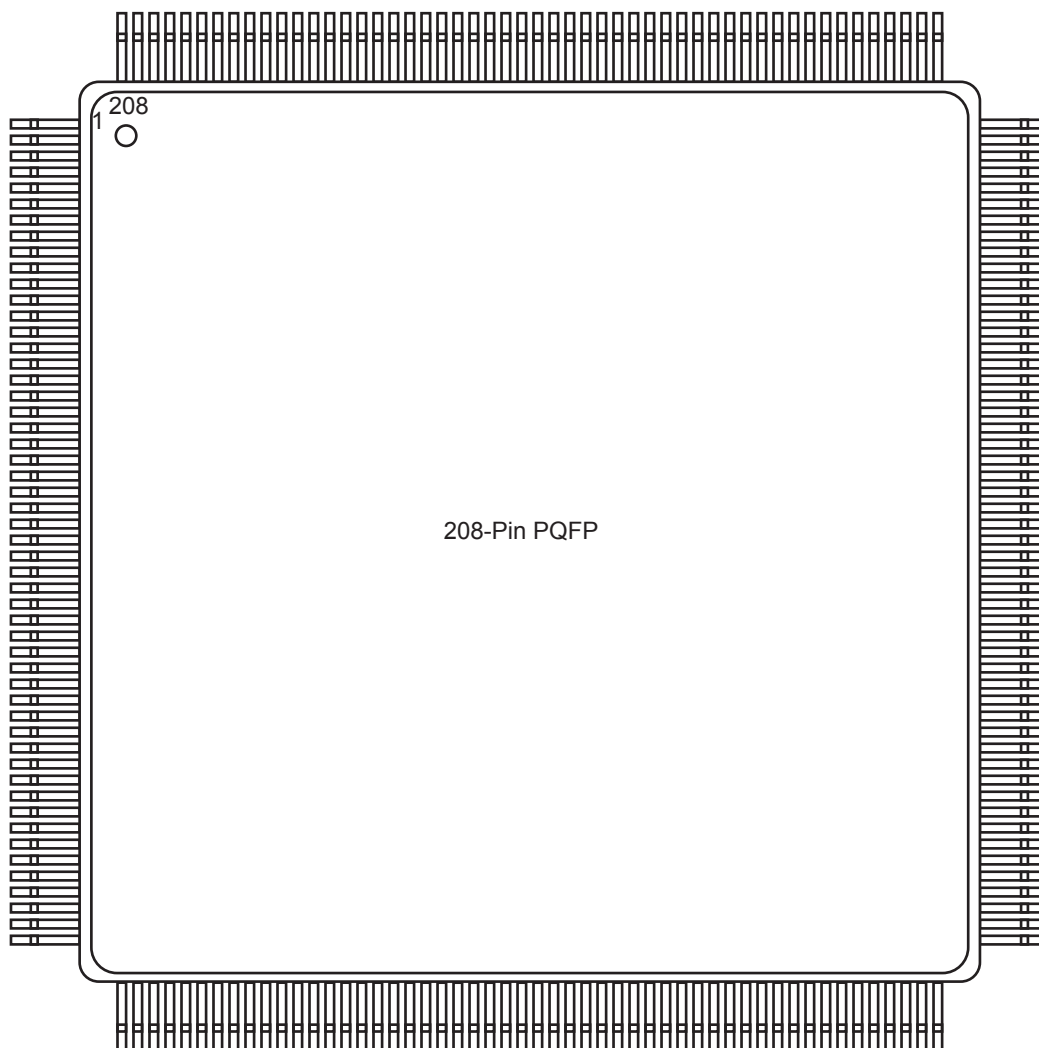
| Parameter         | Description             | -2    | -1    | Std.  | Units |
|-------------------|-------------------------|-------|-------|-------|-------|
| $t_{\text{SU}}$   | Address Setup Time      | 0.53  | 0.61  | 0.71  | ns    |
| $t_{\text{HOLD}}$ | Address Hold Time       | 0.00  | 0.00  | 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   |

| VQ100      |                 | VQ100      |                 | VQ100      |                 |
|------------|-----------------|------------|-----------------|------------|-----------------|
| Pin Number | A3P030 Function | Pin Number | A3P030 Function | Pin Number | A3P030 Function |
| 1          | GND             | 37         | VCC             | 73         | IO27RSB0        |
| 2          | IO82RSB1        | 38         | GND             | 74         | IO26RSB0        |
| 3          | IO81RSB1        | 39         | VCCIB1          | 75         | IO25RSB0        |
| 4          | IO80RSB1        | 40         | IO49RSB1        | 76         | IO24RSB0        |
| 5          | IO79RSB1        | 41         | IO47RSB1        | 77         | IO23RSB0        |
| 6          | IO78RSB1        | 42         | IO46RSB1        | 78         | IO22RSB0        |
| 7          | IO77RSB1        | 43         | IO45RSB1        | 79         | IO21RSB0        |
| 8          | IO76RSB1        | 44         | IO44RSB1        | 80         | IO20RSB0        |
| 9          | GND             | 45         | IO43RSB1        | 81         | IO19RSB0        |
| 10         | IO75RSB1        | 46         | IO42RSB1        | 82         | IO18RSB0        |
| 11         | IO74RSB1        | 47         | TCK             | 83         | IO17RSB0        |
| 12         | GEC0/IO73RSB1   | 48         | TDI             | 84         | IO16RSB0        |
| 13         | GEA0/IO72RSB1   | 49         | TMS             | 85         | IO15RSB0        |
| 14         | GEB0/IO71RSB1   | 50         | NC              | 86         | IO14RSB0        |
| 15         | IO70RSB1        | 51         | GND             | 87         | VCCIB0          |
| 16         | IO69RSB1        | 52         | VPUMP           | 88         | GND             |
| 17         | VCC             | 53         | NC              | 89         | VCC             |
| 18         | VCCIB1          | 54         | TDO             | 90         | IO12RSB0        |
| 19         | IO68RSB1        | 55         | TRST            | 91         | IO10RSB0        |
| 20         | IO67RSB1        | 56         | VJTAG           | 92         | IO08RSB0        |
| 21         | IO66RSB1        | 57         | IO41RSB0        | 93         | IO07RSB0        |
| 22         | IO65RSB1        | 58         | IO40RSB0        | 94         | IO06RSB0        |
| 23         | IO64RSB1        | 59         | IO39RSB0        | 95         | IO05RSB0        |
| 24         | IO63RSB1        | 60         | IO38RSB0        | 96         | IO04RSB0        |
| 25         | IO62RSB1        | 61         | IO37RSB0        | 97         | IO03RSB0        |
| 26         | IO61RSB1        | 62         | IO36RSB0        | 98         | IO02RSB0        |
| 27         | IO60RSB1        | 63         | GDB0/IO34RSB0   | 99         | IO01RSB0        |
| 28         | IO59RSB1        | 64         | GDA0/IO33RSB0   | 100        | IO00RSB0        |
| 29         | IO58RSB1        | 65         | GDC0/IO32RSB0   |            |                 |
| 30         | IO57RSB1        | 66         | VCCIB0          |            |                 |
| 31         | IO56RSB1        | 67         | GND             |            |                 |
| 32         | IO55RSB1        | 68         | VCC             |            |                 |
| 33         | IO54RSB1        | 69         | IO31RSB0        |            |                 |
| 34         | IO53RSB1        | 70         | IO30RSB0        |            |                 |
| 35         | IO52RSB1        | 71         | IO29RSB0        |            |                 |
| 36         | IO51RSB1        | 72         | IO28RSB0        |            |                 |

| TQ144      |                 |
|------------|-----------------|
| Pin Number | A3P125 Function |
| 109        | GBA1/IO40RSB0   |
| 110        | GBA0/IO39RSB0   |
| 111        | GBB1/IO38RSB0   |
| 112        | GBB0/IO37RSB0   |
| 113        | GBC1/IO36RSB0   |
| 114        | GBC0/IO35RSB0   |
| 115        | IO34RSB0        |
| 116        | IO33RSB0        |
| 117        | VCCIB0          |
| 118        | GND             |
| 119        | VCC             |
| 120        | IO29RSB0        |
| 121        | IO28RSB0        |
| 122        | IO27RSB0        |
| 123        | IO25RSB0        |
| 124        | IO23RSB0        |
| 125        | IO21RSB0        |
| 126        | IO19RSB0        |
| 127        | IO17RSB0        |
| 128        | IO16RSB0        |
| 129        | IO14RSB0        |
| 130        | IO12RSB0        |
| 131        | IO10RSB0        |
| 132        | IO08RSB0        |
| 133        | IO06RSB0        |
| 134        | VCCIB0          |
| 135        | GND             |
| 136        | VCC             |
| 137        | GAC1/IO05RSB0   |
| 138        | GAC0/IO04RSB0   |
| 139        | GAB1/IO03RSB0   |
| 140        | GAB0/IO02RSB0   |
| 141        | GAA1/IO01RSB0   |
| 142        | GAA0/IO00RSB0   |
| 143        | GNDQ            |
| 144        | VMV0            |

## PQ208 – Top View

---



---

### Note

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



| FG144      |                 |
|------------|-----------------|
| Pin Number | A3P400 Function |
| A1         | GNDQ            |
| A2         | VMV0            |
| A3         | GAB0/IO02RSB0   |
| A4         | GAB1/IO03RSB0   |
| A5         | IO16RSB0        |
| A6         | GND             |
| A7         | IO30RSB0        |
| A8         | VCC             |
| A9         | IO34RSB0        |
| A10        | GBA0/IO58RSB0   |
| A11        | GBA1/IO59RSB0   |
| A12        | GNDQ            |
| B1         | GAB2/IO154UDB3  |
| B2         | GND             |
| B3         | GAA0/IO00RSB0   |
| B4         | GAA1/IO01RSB0   |
| B5         | IO14RSB0        |
| B6         | IO19RSB0        |
| B7         | IO23RSB0        |
| B8         | IO31RSB0        |
| B9         | GBB0/IO56RSB0   |
| B10        | GBB1/IO57RSB0   |
| B11        | GND             |
| B12        | VMV1            |
| C1         | IO154VDB3       |
| C2         | GFA2/IO144PPB3  |
| C3         | GAC2/IO153UDB3  |
| C4         | VCC             |
| C5         | IO12RSB0        |
| C6         | IO17RSB0        |
| C7         | IO25RSB0        |
| C8         | IO32RSB0        |
| C9         | IO53RSB0        |
| C10        | GBA2/IO60PDB1   |
| C11        | IO60NDB1        |
| C12        | GBC2/IO62PPB1   |

| FG144      |                 |
|------------|-----------------|
| Pin Number | A3P400 Function |
| D1         | IO149NDB3       |
| D2         | IO149PDB3       |
| D3         | IO153VDB3       |
| D4         | GAA2/IO155UPB3  |
| D5         | GAC0/IO04RSB0   |
| D6         | GAC1/IO05RSB0   |
| D7         | GBC0/IO54RSB0   |
| D8         | GBC1/IO55RSB0   |
| D9         | GBB2/IO61PDB1   |
| D10        | IO61NDB1        |
| D11        | IO62NPB1        |
| D12        | GCB1/IO68PPB1   |
| E1         | VCC             |
| E2         | GFC0/IO147NDB3  |
| E3         | GFC1/IO147PDB3  |
| E4         | VCCIB3          |
| E5         | IO155VPB3       |
| E6         | VCCIB0          |
| E7         | VCCIB0          |
| E8         | GCC1/IO67PDB1   |
| E9         | VCCIB1          |
| E10        | VCC             |
| E11        | GCA0/IO69NDB1   |
| E12        | IO70NDB1        |
| F1         | GFB0/IO146NPB3  |
| F2         | VCOMPLF         |
| F3         | GFB1/IO146PPB3  |
| F4         | IO144NPB3       |
| F5         | GND             |
| F6         | GND             |
| F7         | GND             |
| F8         | GCC0/IO67NDB1   |
| F9         | GCB0/IO68NPB1   |
| F10        | GND             |
| F11        | GCA1/IO69PDB1   |
| F12        | GCA2/IO70PDB1   |

| FG144      |                 |
|------------|-----------------|
| Pin Number | A3P400 Function |
| G1         | GFA1/IO145PPB3  |
| G2         | GND             |
| G3         | VCCPLF          |
| G4         | GFA0/IO145NPB3  |
| G5         | GND             |
| G6         | GND             |
| G7         | GND             |
| G8         | GDC1/IO77UPB1   |
| G9         | IO72NDB1        |
| G10        | GCC2/IO72PDB1   |
| G11        | IO71NDB1        |
| G12        | GCB2/IO71PDB1   |
| H1         | VCC             |
| H2         | GFB2/IO143PDB3  |
| H3         | GFC2/IO142PSB3  |
| H4         | GEC1/IO137PDB3  |
| H5         | VCC             |
| H6         | IO75PDB1        |
| H7         | IO75NDB1        |
| H8         | GDB2/IO81RSB2   |
| H9         | GDC0/IO77VPB1   |
| H10        | VCCIB1          |
| H11        | IO73PSB1        |
| H12        | VCC             |
| J1         | GEB1/IO136PDB3  |
| J2         | IO143NDB3       |
| J3         | VCCIB3          |
| J4         | GEC0/IO137NDB3  |
| J5         | IO125RSB2       |
| J6         | IO116RSB2       |
| J7         | VCC             |
| J8         | TCK             |
| J9         | GDA2/IO80RSB2   |
| J10        | TDO             |
| J11        | GDA1/IO79UDB1   |
| J12        | GDB1/IO78UDB1   |

| FG144      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| A1         | GNDQ             |
| A2         | VMV0             |
| A3         | GAB0/IO02RSB0    |
| A4         | GAB1/IO03RSB0    |
| A5         | IO10RSB0         |
| A6         | GND              |
| A7         | IO44RSB0         |
| A8         | VCC              |
| A9         | IO69RSB0         |
| A10        | GBA0/IO76RSB0    |
| A11        | GBA1/IO77RSB0    |
| A12        | GNDQ             |
| B1         | GAB2/IO224PDB3   |
| B2         | GND              |
| B3         | GAA0/IO00RSB0    |
| B4         | GAA1/IO01RSB0    |
| B5         | IO13RSB0         |
| B6         | IO26RSB0         |
| B7         | IO35RSB0         |
| B8         | IO60RSB0         |
| B9         | GBB0/IO74RSB0    |
| B10        | GBB1/IO75RSB0    |
| B11        | GND              |
| B12        | VMV1             |
| C1         | IO224NDB3        |
| C2         | GFA2/IO206PPB3   |
| C3         | GAC2/IO223PDB3   |
| C4         | VCC              |
| C5         | IO16RSB0         |
| C6         | IO29RSB0         |
| C7         | IO32RSB0         |
| C8         | IO63RSB0         |
| C9         | IO66RSB0         |
| C10        | GBA2/IO78PDB1    |
| C11        | IO78NDB1         |
| C12        | GBC2/IO80PPB1    |

| FG144      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| D1         | IO213PDB3        |
| D2         | IO213NDB3        |
| D3         | IO223NDB3        |
| D4         | GAA2/IO225PPB3   |
| D5         | GAC0/IO04RSB0    |
| D6         | GAC1/IO05RSB0    |
| D7         | GBC0/IO72RSB0    |
| D8         | GBC1/IO73RSB0    |
| D9         | GBB2/IO79PDB1    |
| D10        | IO79NDB1         |
| D11        | IO80NPB1         |
| D12        | GCB1/IO92PPB1    |
| E1         | VCC              |
| E2         | GFC0/IO209NDB3   |
| E3         | GFC1/IO209PDB3   |
| E4         | VCCIB3           |
| E5         | IO225NPB3        |
| E6         | VCCIB0           |
| E7         | VCCIB0           |
| E8         | GCC1/IO91PDB1    |
| E9         | VCCIB1           |
| E10        | VCC              |
| E11        | GCA0/IO93NDB1    |
| E12        | IO94NDB1         |
| F1         | GFB0/IO208NPB3   |
| F2         | VCOMPLF          |
| F3         | GFB1/IO208PPB3   |
| F4         | IO206NPB3        |
| F5         | GND              |
| F6         | GND              |
| F7         | GND              |
| F8         | GCC0/IO91NDB1    |
| F9         | GCB0/IO92NPB1    |
| F10        | GND              |
| F11        | GCA1/IO93PDB1    |
| F12        | GCA2/IO94PDB1    |

| FG144      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| G1         | GFA1/IO207PPB3   |
| G2         | GND              |
| G3         | VCCPLF           |
| G4         | GFA0/IO207NPB3   |
| G5         | GND              |
| G6         | GND              |
| G7         | GND              |
| G8         | GDC1/IO111PPB1   |
| G9         | IO96NDB1         |
| G10        | GCC2/IO96PDB1    |
| G11        | IO95NDB1         |
| G12        | GCB2/IO95PDB1    |
| H1         | VCC              |
| H2         | GFB2/IO205PDB3   |
| H3         | GFC2/IO204PSB3   |
| H4         | GEC1/IO190PDB3   |
| H5         | VCC              |
| H6         | IO105PDB1        |
| H7         | IO105NDB1        |
| H8         | GDB2/IO115RSB2   |
| H9         | GDC0/IO111NPB1   |
| H10        | VCCIB1           |
| H11        | IO101PSB1        |
| H12        | VCC              |
| J1         | GEB1/IO189PDB3   |
| J2         | IO205NDB3        |
| J3         | VCCIB3           |
| J4         | GEC0/IO190NDB3   |
| J5         | IO160RSB2        |
| J6         | IO157RSB2        |
| J7         | VCC              |
| J8         | TCK              |
| J9         | GDA2/IO114RSB2   |
| J10        | TDO              |
| J11        | GDA1/IO113PDB1   |
| J12        | GDB1/IO112PDB1   |

| FG256      |                 |
|------------|-----------------|
| Pin Number | A3P400 Function |
| A1         | GND             |
| A2         | GAA0/IO00RSB0   |
| A3         | GAA1/IO01RSB0   |
| A4         | GAB0/IO02RSB0   |
| A5         | IO16RSB0        |
| A6         | IO17RSB0        |
| A7         | IO22RSB0        |
| A8         | IO28RSB0        |
| A9         | IO34RSB0        |
| A10        | IO37RSB0        |
| A11        | IO41RSB0        |
| A12        | IO43RSB0        |
| A13        | GBB1/IO57RSB0   |
| A14        | GBA0/IO58RSB0   |
| A15        | GBA1/IO59RSB0   |
| A16        | GND             |
| B1         | GAB2/IO154UDB3  |
| B2         | GAA2/IO155UDB3  |
| B3         | IO12RSB0        |
| B4         | GAB1/IO03RSB0   |
| B5         | IO13RSB0        |
| B6         | IO14RSB0        |
| B7         | IO21RSB0        |
| B8         | IO27RSB0        |
| B9         | IO32RSB0        |
| B10        | IO38RSB0        |
| B11        | IO42RSB0        |
| B12        | GBC1/IO55RSB0   |
| B13        | GBB0/IO56RSB0   |
| B14        | IO44RSB0        |
| B15        | GBA2/IO60PDB1   |
| B16        | IO60NDB1        |
| C1         | IO154VDB3       |
| C2         | IO155VDB3       |
| C3         | IO11RSB0        |
| C4         | IO07RSB0        |

| FG256      |                 |
|------------|-----------------|
| Pin Number | A3P400 Function |
| C5         | GAC0/IO04RSB0   |
| C6         | GAC1/IO05RSB0   |
| C7         | IO20RSB0        |
| C8         | IO24RSB0        |
| C9         | IO33RSB0        |
| C10        | IO39RSB0        |
| C11        | IO45RSB0        |
| C12        | GBC0/IO54RSB0   |
| C13        | IO48RSB0        |
| C14        | VMV0            |
| C15        | IO61NPB1        |
| C16        | IO63PDB1        |
| D1         | IO151VDB3       |
| D2         | IO151UDB3       |
| D3         | GAC2/IO153UDB3  |
| D4         | IO06RSB0        |
| D5         | GNDQ            |
| D6         | IO10RSB0        |
| D7         | IO19RSB0        |
| D8         | IO26RSB0        |
| D9         | IO30RSB0        |
| D10        | IO40RSB0        |
| D11        | IO46RSB0        |
| D12        | GNDQ            |
| D13        | IO47RSB0        |
| D14        | GBB2/IO61PPB1   |
| D15        | IO53RSB0        |
| D16        | IO63NDB1        |
| E1         | IO150PDB3       |
| E2         | IO08RSB0        |
| E3         | IO153VDB3       |
| E4         | IO152VDB3       |
| E5         | VMV0            |
| E6         | VCCIB0          |
| E7         | VCCIB0          |
| E8         | IO25RSB0        |

| FG256      |                 |
|------------|-----------------|
| Pin Number | A3P400 Function |
| E9         | IO31RSB0        |
| E10        | VCCIB0          |
| E11        | VCCIB0          |
| E12        | VMV1            |
| E13        | GBC2/IO62PDB1   |
| E14        | IO65RSB1        |
| E15        | IO52RSB0        |
| E16        | IO66PDB1        |
| F1         | IO150NDB3       |
| F2         | IO149NPB3       |
| F3         | IO09RSB0        |
| F4         | IO152UDB3       |
| F5         | VCCIB3          |
| F6         | GND             |
| F7         | VCC             |
| F8         | VCC             |
| F9         | VCC             |
| F10        | VCC             |
| F11        | GND             |
| F12        | VCCIB1          |
| F13        | IO62NDB1        |
| F14        | IO49RSB0        |
| F15        | IO64PPB1        |
| F16        | IO66NDB1        |
| G1         | IO148NDB3       |
| G2         | IO148PDB3       |
| G3         | IO149PPB3       |
| G4         | GFC1/IO147PPB3  |
| G5         | VCCIB3          |
| G6         | VCC             |
| G7         | GND             |
| G8         | GND             |
| G9         | GND             |
| G10        | GND             |
| G11        | VCC             |
| G12        | VCCIB1          |

| FG256      |                 |
|------------|-----------------|
| Pin Number | A3P400 Function |
| P9         | IO98RSB2        |
| P10        | IO95RSB2        |
| P11        | IO88RSB2        |
| P12        | IO84RSB2        |
| P13        | TCK             |
| P14        | VPUMP           |
| P15        | TRST            |
| P16        | GDA0/IO79VDB1   |
| R1         | GEA1/IO135PDB3  |
| R2         | GEA0/IO135NDB3  |
| R3         | IO127RSB2       |
| R4         | GEC2/IO132RSB2  |
| R5         | IO123RSB2       |
| R6         | IO118RSB2       |
| R7         | IO112RSB2       |
| R8         | IO106RSB2       |
| R9         | IO100RSB2       |
| R10        | IO96RSB2        |
| R11        | IO89RSB2        |
| R12        | IO85RSB2        |
| R13        | GDB2/IO81RSB2   |
| R14        | TDI             |
| R15        | NC              |
| R16        | TDO             |
| T1         | GND             |
| T2         | IO126RSB2       |
| T3         | GEB2/IO133RSB2  |
| T4         | IO124RSB2       |
| T5         | IO116RSB2       |
| T6         | IO113RSB2       |
| T7         | IO107RSB2       |
| T8         | IO105RSB2       |
| T9         | IO102RSB2       |
| T10        | IO97RSB2        |
| T11        | IO92RSB2        |
| T12        | GDC2/IO82RSB2   |

| FG256      |                 |
|------------|-----------------|
| Pin Number | A3P400 Function |
| T13        | IO86RSB2        |
| T14        | GDA2/IO80RSB2   |
| T15        | TMS             |
| T16        | GND             |

| FG484      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| Y15        | VCC              |
| Y16        | NC               |
| Y17        | NC               |
| Y18        | GND              |
| Y19        | NC               |
| Y20        | NC               |
| Y21        | NC               |
| Y22        | VCCIB1           |
| AA1        | GND              |
| AA2        | VCCIB3           |
| AA3        | NC               |
| AA4        | IO181RSB2        |
| AA5        | IO178RSB2        |
| AA6        | IO175RSB2        |
| AA7        | IO169RSB2        |
| AA8        | IO166RSB2        |
| AA9        | IO160RSB2        |
| AA10       | IO152RSB2        |
| AA11       | IO146RSB2        |
| AA12       | IO139RSB2        |
| AA13       | IO133RSB2        |
| AA14       | NC               |
| AA15       | NC               |
| AA16       | IO122RSB2        |
| AA17       | IO119RSB2        |
| AA18       | IO117RSB2        |
| AA19       | NC               |
| AA20       | NC               |
| AA21       | VCCIB1           |
| AA22       | GND              |
| AB1        | GND              |
| AB2        | GND              |
| AB3        | VCCIB2           |
| AB4        | IO180RSB2        |
| AB5        | IO176RSB2        |
| AB6        | IO173RSB2        |

| FG484      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| AB7        | IO167RSB2        |
| AB8        | IO162RSB2        |
| AB9        | IO156RSB2        |
| AB10       | IO150RSB2        |
| AB11       | IO145RSB2        |
| AB12       | IO144RSB2        |
| AB13       | IO132RSB2        |
| AB14       | IO127RSB2        |
| AB15       | IO126RSB2        |
| AB16       | IO123RSB2        |
| AB17       | IO121RSB2        |
| AB18       | IO118RSB2        |
| AB19       | NC               |
| AB20       | VCCIB2           |
| AB21       | GND              |
| AB22       | GND              |