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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 | 24576                                                                                                                                                             |
| Total RAM Bits                 | 147456                                                                                                                                                            |
| Number of I/O                  | 300                                                                                                                                                               |
| Number of Gates                | 1000000                                                                                                                                                           |
| Voltage - Supply               | 1.425V ~ 1.575V                                                                                                                                                   |
| Mounting Type                  | Surface Mount                                                                                                                                                     |
| Operating Temperature          | 0°C ~ 70°C (TA)                                                                                                                                                   |
| Package / Case                 | 484-BGA                                                                                                                                                           |
| Supplier Device Package        | 484-FPBGA (23x23)                                                                                                                                                 |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/microchip-technology/agl1000v5-fg484">https://www.e-xfl.com/product-detail/microchip-technology/agl1000v5-fg484</a> |

**Table 2-10 • Quiescent Supply Current (IDD) Characteristics, IGLOO Sleep Mode\***

|                                              | Core Voltage  | AGL015 | AGL030 | AGL060 | AGL125 | AGL250 | AGL400 | AGL600 | AGL1000 | Units |
|----------------------------------------------|---------------|--------|--------|--------|--------|--------|--------|--------|---------|-------|
| VCCI/VJTAG = 1.2 V (per bank) Typical (25°C) | 1.2 V         | 1.7    | 1.7    | 1.7    | 1.7    | 1.7    | 1.7    | 1.7    | 1.7     | μA    |
| VCCI/VJTAG = 1.5 V (per bank) Typical (25°C) | 1.2 V / 1.5 V | 1.8    | 1.8    | 1.8    | 1.8    | 1.8    | 1.8    | 1.8    | 1.8     | μA    |
| VCCI/VJTAG = 1.8 V (per bank) Typical (25°C) | 1.2 V / 1.5 V | 1.9    | 1.9    | 1.9    | 1.9    | 1.9    | 1.9    | 1.9    | 1.9     | μA    |
| VCCI/VJTAG = 2.5 V (per bank) Typical (25°C) | 1.2 V / 1.5 V | 2.2    | 2.2    | 2.2    | 2.2    | 2.2    | 2.2    | 2.2    | 2.2     | μA    |
| VCCI/VJTAG = 3.3 V (per bank) Typical (25°C) | 1.2 V / 1.5 V | 2.5    | 2.5    | 2.5    | 2.5    | 2.5    | 2.5    | 2.5    | 2.5     | μA    |

Note:  $IDD = N_{BANKS} \times ICCI$ . Values do not include I/O static contribution, which is shown in Table 2-13 on page 2-10 through Table 2-15 on page 2-11 and Table 2-16 on page 2-11 through Table 2-18 on page 2-12 (PDC6 and PDC7).

**Table 2-11 • Quiescent Supply Current (IDD) Characteristics, IGLOO Shutdown Mode**

|                | Core Voltage  | AGL015 | AGL030 | Units |
|----------------|---------------|--------|--------|-------|
| Typical (25°C) | 1.2 V / 1.5 V | 0      | 0      | μA    |

**Table 2-12 • Quiescent Supply Current (IDD), No IGLOO Flash\*Freeze Mode<sup>1</sup>**

|                                              | Core Voltage  | AGL015 | AGL030 | AGL060 | AGL125 | AGL250 | AGL400 | AGL600 | AGL1000 | Units |
|----------------------------------------------|---------------|--------|--------|--------|--------|--------|--------|--------|---------|-------|
| <b>ICCA Current<sup>2</sup></b>              |               |        |        |        |        |        |        |        |         |       |
| Typical (25°C)                               | 1.2 V         | 5      | 6      | 10     | 13     | 18     | 25     | 28     | 42      | μA    |
|                                              | 1.5 V         | 14     | 16     | 20     | 28     | 44     | 66     | 82     | 137     | μA    |
| <b>ICCI or IJTAG Current<sup>3</sup></b>     |               |        |        |        |        |        |        |        |         |       |
| VCCI/VJTAG = 1.2 V (per bank) Typical (25°C) | 1.2 V         | 1.7    | 1.7    | 1.7    | 1.7    | 1.7    | 1.7    | 1.7    | 1.7     | μA    |
| VCCI/VJTAG = 1.5 V (per bank) Typical (25°C) | 1.2 V / 1.5 V | 1.8    | 1.8    | 1.8    | 1.8    | 1.8    | 1.8    | 1.8    | 1.8     | μA    |
| VCCI/VJTAG = 1.8 V (per bank) Typical (25°C) | 1.2 V / 1.5 V | 1.9    | 1.9    | 1.9    | 1.9    | 1.9    | 1.9    | 1.9    | 1.9     | μA    |
| VCCI/VJTAG = 2.5 V (per bank) Typical (25°C) | 1.2 V / 1.5 V | 2.2    | 2.2    | 2.2    | 2.2    | 2.2    | 2.2    | 2.2    | 2.2     | μA    |
| VCCI/VJTAG = 3.3 V (per bank) Typical (25°C) | 1.2 V / 1.5 V | 2.5    | 2.5    | 2.5    | 2.5    | 2.5    | 2.5    | 2.5    | 2.5     | μA    |

Notes:

1.  $IDD = N_{BANKS} \times ICCI + ICCA$ . JTAG counts as one bank when powered.
2. Includes VCC, VPUMP, and VCCPLL currents.
3. Values do not include I/O static contribution (PDC6 and PDC7).

**Table 2-22 • Different Components Contributing to the Static Power Consumption in IGLOO Device  
For IGLOO V2 Devices, 1.2 V DC Core Supply Voltage**

| Parameter | Definition                                       | Device Specific Static Power (mW)                            |        |        |        |        |        |        |        |
|-----------|--------------------------------------------------|--------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|           |                                                  | AGL1000                                                      | AGL600 | AGL400 | AGL250 | AGL125 | AGL060 | AGL030 | AGL015 |
| PDC1      | Array static power in Active mode                | See Table 2-12 on page 2-9.                                  |        |        |        |        |        |        |        |
| PDC2      | Array static power in Static (Idle) mode         | See Table 2-11 on page 2-8.                                  |        |        |        |        |        |        |        |
| PDC3      | Array static power in Flash*Freeze mode          | See Table 2-9 on page 2-7.                                   |        |        |        |        |        |        |        |
| PDC4      | Static PLL contribution                          | 0.90                                                         |        |        |        |        |        |        |        |
| PDC5      | Bank quiescent power (VCCI-Dependent)            | See Table 2-12 on page 2-9.                                  |        |        |        |        |        |        |        |
| PDC6      | I/O input pin static power (standard-dependent)  | See Table 2-13 on page 2-10 through Table 2-15 on page 2-11. |        |        |        |        |        |        |        |
| PDC7      | I/O output pin static power (standard-dependent) | See Table 2-16 on page 2-11 through Table 2-18 on page 2-12. |        |        |        |        |        |        |        |

*Note: For a different output load, drive strength, or slew rate, Microsemi recommends using the Microsemi power spreadsheet calculator or SmartPower tool in Libero SoC.*

**Table 2-54 • 3.3 V LVTTL / 3.3 V LVCMOS High Slew – Applies to 1.5 V DC Core Voltage**  
**Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case VCC = 1.425 V, Worst-Case VCCI = 3.0 V**  
**Applicable to Standard Plus Banks**

| Drive Strength | Speed Grade | $t_{\text{DOUT}}$ | $t_{\text{DP}}$ | $t_{\text{DIN}}$ | $t_{\text{PY}}$ | $t_{\text{EOUT}}$ | $t_{\text{ZL}}$ | $t_{\text{ZH}}$ | $t_{\text{LZ}}$ | $t_{\text{HZ}}$ | $t_{\text{ZLS}}$ | $t_{\text{ZHS}}$ | Units |
|----------------|-------------|-------------------|-----------------|------------------|-----------------|-------------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|-------|
| 2 mA           | Std.        | 0.97              | 2.32            | 0.18             | 0.85            | 0.66              | 2.37            | 1.90            | 1.98            | 2.13            | 5.96             | 5.49             | ns    |
| 4 mA           | Std.        | 0.97              | 2.32            | 0.18             | 0.85            | 0.66              | 2.37            | 1.90            | 1.98            | 2.13            | 5.96             | 5.49             | ns    |
| 6 mA           | Std.        | 0.97              | 1.94            | 0.18             | 0.85            | 0.66              | 1.99            | 1.57            | 2.20            | 2.53            | 5.58             | 5.16             | ns    |
| 8 mA           | Std.        | 0.97              | 1.94            | 0.18             | 0.85            | 0.66              | 1.99            | 1.57            | 2.20            | 2.53            | 5.58             | 5.16             | ns    |
| 12 mA          | Std.        | 0.97              | 1.75            | 0.18             | 0.85            | 0.66              | 1.79            | 1.40            | 2.36            | 2.79            | 5.38             | 4.99             | ns    |
| 16 mA          | Std.        | 0.97              | 1.75            | 0.18             | 0.85            | 0.66              | 1.79            | 1.40            | 2.36            | 2.79            | 5.38             | 4.99             | 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 2-7 for derating values.

**Table 2-55 • 3.3 V LVTTL / 3.3 V LVCMOS Low Slew – Applies to 1.5 V DC Core Voltage**  
**Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case VCC = 1.425 V, Worst-Case VCCI = 3.0 V**  
**Applicable to Standard Banks**

| Drive Strength | Speed Grade | $t_{\text{DOUT}}$ | $t_{\text{DP}}$ | $t_{\text{DIN}}$ | $t_{\text{PY}}$ | $t_{\text{EOUT}}$ | $t_{\text{ZL}}$ | $t_{\text{ZH}}$ | $t_{\text{LZ}}$ | $t_{\text{HZ}}$ | Units |
|----------------|-------------|-------------------|-----------------|------------------|-----------------|-------------------|-----------------|-----------------|-----------------|-----------------|-------|
| 2 mA           | Std.        | 0.97              | 3.80            | 0.18             | 0.83            | 0.66              | 3.88            | 3.41            | 1.74            | 1.78            | ns    |
| 4 mA           | Std.        | 0.97              | 3.80            | 0.18             | 0.83            | 0.66              | 3.88            | 3.41            | 1.74            | 1.78            | ns    |
| 6 mA           | Std.        | 0.97              | 3.15            | 0.18             | 0.83            | 0.66              | 3.21            | 2.94            | 1.96            | 2.17            | ns    |
| 8 mA           | Std.        | 0.97              | 3.15            | 0.18             | 0.83            | 0.66              | 3.21            | 2.94            | 1.96            | 2.17            | ns    |

Note: For specific junction temperature and voltage supply levels, refer to Table 2-6 on page 2-7 for derating values.

**Table 2-56 • 3.3 V LVTTL / 3.3 V LVCMOS High Slew – Applies to 1.5 V DC Core Voltage**  
**Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case VCC = 1.425 V, Worst-Case VCCI = 3.0 V**  
**Applicable to Standard Banks**

| Drive Strength | Speed Grade | $t_{\text{DOUT}}$ | $t_{\text{DP}}$ | $t_{\text{DIN}}$ | $t_{\text{PY}}$ | $t_{\text{EOUT}}$ | $t_{\text{ZL}}$ | $t_{\text{ZH}}$ | $t_{\text{LZ}}$ | $t_{\text{HZ}}$ | Units |
|----------------|-------------|-------------------|-----------------|------------------|-----------------|-------------------|-----------------|-----------------|-----------------|-----------------|-------|
| 2 mA           | Std.        | 0.97              | 2.19            | 0.18             | 0.83            | 0.66              | 2.24            | 1.79            | 1.74            | 1.87            | ns    |
| 4 mA           | Std.        | 0.97              | 2.19            | 0.18             | 0.83            | 0.66              | 2.24            | 1.79            | 1.74            | 1.87            | ns    |
| 6 mA           | Std.        | 0.97              | 1.85            | 0.18             | 0.83            | 0.66              | 1.89            | 1.46            | 1.96            | 2.26            | ns    |
| 8 mA           | Std.        | 0.97              | 1.85            | 0.18             | 0.83            | 0.66              | 1.89            | 1.46            | 1.96            | 2.26            | 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 2-7 for derating values.

**Table 2-75 • 3.3 V LVC MOS Wide Range Low Slew – Applies to 1.2 V DC Core Voltage**  
**Commercial-Case Conditions:  $T_j = 70^\circ\text{C}$ , Worst-Case  $V_{CC} = 1.14\text{ V}$ , Worst-Case  $V_{CCI} = 2.7$**   
**Applicable to Standard Plus Banks**

| Drive Strength    | Equivalent 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.        | 1.55       | 6.69     | 0.26      | 1.32     | 1.10       | 6.69     | 5.73     | 3.41     | 3.72     | 12.48     | 11.52     | ns    |
| 100 $\mu\text{A}$ | 4 mA                                                           | Std.        | 1.55       | 6.69     | 0.26      | 1.32     | 1.10       | 6.69     | 5.73     | 3.41     | 3.72     | 12.48     | 11.52     | ns    |
| 100 $\mu\text{A}$ | 6 mA                                                           | Std.        | 1.55       | 5.58     | 0.26      | 1.32     | 1.10       | 5.58     | 5.01     | 3.77     | 4.35     | 11.36     | 10.79     | ns    |
| 100 $\mu\text{A}$ | 8 mA                                                           | Std.        | 1.55       | 5.58     | 0.26      | 1.32     | 1.10       | 5.58     | 5.01     | 3.77     | 4.35     | 11.36     | 10.79     | ns    |
| 100 $\mu\text{A}$ | 12 mA                                                          | Std.        | 1.55       | 4.82     | 0.26      | 1.32     | 1.10       | 4.82     | 4.44     | 4.02     | 4.76     | 10.61     | 10.23     | ns    |
| 100 $\mu\text{A}$ | 16 mA                                                          | Std.        | 1.55       | 4.82     | 0.26      | 1.32     | 1.10       | 4.82     | 4.44     | 4.02     | 4.76     | 10.61     | 10.23     | ns    |

Notes:

1. The minimum drive strength for any LVC MOS 3.3 V software configuration when run in wide range is  $\pm 100\text{ }\mu\text{A}$ . Drive strengths displayed in software are supported for normal range only. For a detailed I/V curve, refer to the IBIS models.
2. For specific junction temperature and voltage supply levels, refer to Table 2-6 on page 2-7 for derating values.

**Table 2-76 • 3.3 V LVC MOS Wide Range High Slew – Applies to 1.2 V DC Core Voltage**  
**Commercial-Case Conditions:  $T_j = 70^\circ\text{C}$ , Worst-Case  $V_{CC} = 1.14\text{ V}$ , Worst-Case  $V_{CCI} = 2.7$**   
**Applicable to Standard Plus Banks**

| Drive Strength    | Equivalent 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.        | 1.55       | 4.10     | 0.26      | 1.32     | 1.10       | 4.10     | 3.30     | 3.40     | 3.92     | 9.89      | 9.09      | ns    |
| 100 $\mu\text{A}$ | 4 mA                                                           | Std.        | 1.55       | 4.10     | 0.26      | 1.32     | 1.10       | 4.10     | 3.30     | 3.40     | 3.92     | 9.89      | 9.09      | ns    |
| 100 $\mu\text{A}$ | 6 mA                                                           | Std.        | 1.55       | 3.51     | 0.26      | 1.32     | 1.10       | 3.51     | 2.79     | 3.76     | 4.56     | 9.30      | 8.57      | ns    |
| 100 $\mu\text{A}$ | 8 mA                                                           | Std.        | 1.55       | 3.51     | 0.26      | 1.32     | 1.10       | 3.51     | 2.79     | 3.76     | 4.56     | 9.30      | 8.57      | ns    |
| 100 $\mu\text{A}$ | 12 mA                                                          | Std.        | 1.55       | 3.20     | 0.26      | 1.32     | 1.10       | 3.20     | 2.52     | 4.01     | 4.97     | 8.99      | 8.31      | ns    |
| 100 $\mu\text{A}$ | 16 mA                                                          | Std.        | 1.55       | 3.20     | 0.26      | 1.32     | 1.10       | 3.20     | 2.52     | 4.01     | 4.97     | 8.99      | 8.31      | ns    |

Notes:

1. The minimum drive strength for any LVC MOS 3.3 V software configuration when run in wide range is  $\pm 100\text{ }\mu\text{A}$ . Drive strengths displayed in software are supported for normal range only. For a detailed I/V curve, refer to the IBIS models.
2. For specific junction temperature and voltage supply levels, refer to Table 2-6 on page 2-7 for derating values.
3. Software default selection highlighted in gray.

## 2.5 V LVCMOS

Low-Voltage CMOS for 2.5 V is an extension of the LVCMOS standard (JESD8-5) used for general-purpose 2.5 V applications.

**Table 2-79 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Advanced I/O Banks

| 2.5 V LVCMOS   | VIL    |        | VIH    |        | VOL    | VOH    | IOL | IOH | IOSH                 | IOSL                 | 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   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 2   | 2   | 16                   | 18                   | 10               | 10               |
| 4 mA           | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 4   | 4   | 16                   | 18                   | 10               | 10               |
| 6 mA           | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 6   | 6   | 32                   | 37                   | 10               | 10               |
| 8 mA           | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 8   | 8   | 32                   | 37                   | 10               | 10               |
| 12 mA          | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 12  | 12  | 65                   | 74                   | 10               | 10               |
| 16 mA          | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 16  | 16  | 83                   | 87                   | 10               | 10               |
| 24 mA          | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 24  | 24  | 169                  | 124                  | 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 2-80 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Standard Plus I/O Banks

| 2.5 V LVCMOS   | VIL    |        | VIH    |        | VOL    | VOH    | IOL | IOH | IOSH                 | IOSL                 | 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   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 2   | 2   | 16                   | 18                   | 10               | 10               |
| 4 mA           | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 4   | 4   | 16                   | 18                   | 10               | 10               |
| 6 mA           | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 6   | 6   | 32                   | 37                   | 10               | 10               |
| 8 mA           | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 8   | 8   | 32                   | 37                   | 10               | 10               |
| 12 mA          | −0.3   | 0.7    | 1.7    | 2.7    | 0.7    | 1.7    | 12  | 12  | 65                   | 74                   | 10               | 10               |

Notes:

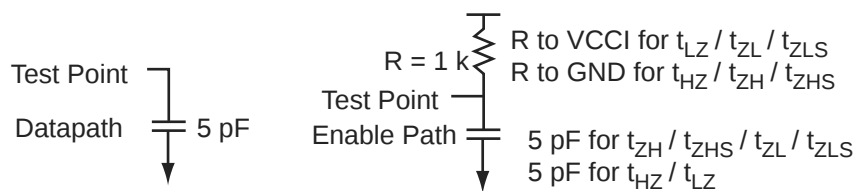
1. IIL is the input leakage current per I/O pin over recommended operation conditions where  $-0.3\text{ V} < V_{IN} < V_{IL}$ .
2. IIH is the input leakage current per I/O pin over recommended operating conditions  $V_{IH} < V_{IN} < V_{CCI}$ . Input current is larger when operating outside recommended 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 2-81 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Standard I/O Banks

| 2.5 V<br>LVCMOS   | VIL       |           | VIH       |           | VOL       | VOH       | IOL | IOH | IOSH                    | IOSL                    | IIL <sup>1</sup> | IIH <sup>2</sup> |
|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----|-----|-------------------------|-------------------------|------------------|------------------|
| Drive<br>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      | 0.7       | 1.7       | 3.6       | 0.7       | 1.7       | 2   | 2   | 16                      | 18                      | 10               | 10               |
| 4 mA              | −0.3      | 0.7       | 1.7       | 3.6       | 0.7       | 1.7       | 4   | 4   | 16                      | 18                      | 10               | 10               |
| 6 mA              | −0.3      | 0.7       | 1.7       | 3.6       | 0.7       | 1.7       | 6   | 6   | 32                      | 37                      | 10               | 10               |
| 8 mA              | −0.3      | 0.7       | 1.7       | 3.6       | 0.7       | 1.7       | 8   | 8   | 32                      | 37                      | 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.

**Figure 2-8 • AC Loading****Table 2-82 • AC Waveforms, Measuring Points, and Capacitive Loads**

| Input Low (V) | Input High (V) | Measuring Point* (V) | C <sub>LOAD</sub> (pF) |
|---------------|----------------|----------------------|------------------------|
| 0             | 2.5            | 1.2                  | 5                      |

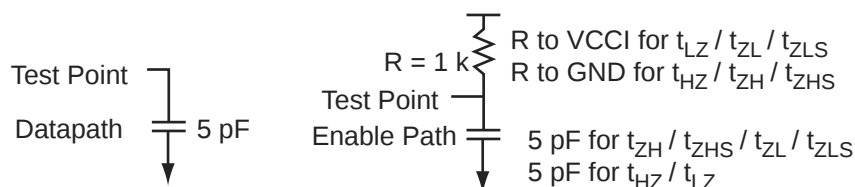
Note: \*Measuring point = Vtrip. See Table 2-29 on page 2-28 for a complete table of trip points.

**Table 2-97 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Standard I/O Banks

| 1.8 V LVCMOS   | VIL    |             | VIH         |        | VOL    | VOH         | IOL | IOH | IOSH                 | IOSL                 | 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   | 9                    | 11                   | 10               | 10               |
| 4 mA           | −0.3   | 0.35 * VCCI | 0.65 * VCCI | 3.6    | 0.45   | VCCI − 0.45 | 4   | 4   | 17                   | 22                   | 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.

**Figure 2-9 • AC Loading****Table 2-98 • AC Waveforms, Measuring Points, and Capacitive Loads**

| Input Low (V) | Input High (V) | Measuring Point* (V) | C <sub>LOAD</sub> (pF) |
|---------------|----------------|----------------------|------------------------|
| 0             | 1.8            | 0.9                  | 5                      |

Note: \*Measuring point = Vtrip. See Table 2-29 on page 2-28 for a complete table of trip points.

**Timing Characteristics****1.5 V DC Core Voltage****Table 2-99 • 1.8 V LVCMOS Low Slew – Applies to 1.5 V DC Core Voltage**  
Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case VCC = 1.425 V, Worst-Case VCCI = 1.7 V  
Applicable to Advanced I/O Banks

| Drive Strength | Speed Grade | t <sub>DOUT</sub> | t <sub>DP</sub> | t <sub>DIN</sub> | t <sub>PY</sub> | t <sub>EOUT</sub> | t <sub>ZL</sub> | t <sub>ZH</sub> | t <sub>LZ</sub> | t <sub>HZ</sub> | t <sub>ZLS</sub> | t <sub>ZHS</sub> | Units |
|----------------|-------------|-------------------|-----------------|------------------|-----------------|-------------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|-------|
| 2 mA           | Std.        | 0.97              | 6.38            | 0.18             | 1.01            | 0.66              | 6.51            | 5.93            | 2.33            | 1.56            | 10.10            | 9.53             | ns    |
| 4 mA           | Std.        | 0.97              | 5.35            | 0.18             | 1.01            | 0.66              | 5.46            | 5.04            | 2.67            | 2.38            | 9.05             | 8.64             | ns    |
| 6 mA           | Std.        | 0.97              | 4.62            | 0.18             | 1.01            | 0.66              | 4.71            | 4.44            | 2.90            | 2.79            | 8.31             | 8.04             | ns    |
| 8 mA           | Std.        | 0.97              | 4.37            | 0.18             | 1.01            | 0.66              | 4.46            | 4.31            | 2.95            | 2.89            | 8.05             | 7.90             | ns    |
| 12 mA          | Std.        | 0.97              | 4.32            | 0.18             | 1.01            | 0.66              | 4.37            | 4.32            | 3.03            | 3.30            | 7.97             | 7.92             | ns    |
| 16 mA          | Std.        | 0.97              | 4.32            | 0.18             | 1.01            | 0.66              | 4.37            | 4.32            | 3.03            | 3.30            | 7.97             | 7.92             | ns    |

Note: For specific junction temperature and voltage supply levels, refer to Table 2-6 on page 2-7 for derating values.

**Table 2-107 • 1.8 V LVCMOS Low Slew – Applies to 1.2 V DC Core Voltage****Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case VCC = 1.14 V, Worst-Case VCCI = 1.7 V****Applicable to Standard Plus 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.        | 1.55       | 6.32     | 0.26      | 1.11     | 1.10       | 6.43     | 5.81     | 2.47     | 2.16     | 12.22     | 11.60     | ns    |
| 4 mA           | Std.        | 1.55       | 5.27     | 0.26      | 1.11     | 1.10       | 5.35     | 5.01     | 2.78     | 2.92     | 11.14     | 10.79     | ns    |
| 6 mA           | Std.        | 1.55       | 4.56     | 0.26      | 1.11     | 1.10       | 4.64     | 4.44     | 3.00     | 3.30     | 10.42     | 10.22     | ns    |
| 8 mA           | Std.        | 1.55       | 4.56     | 0.26      | 1.11     | 1.10       | 4.64     | 4.44     | 3.00     | 3.30     | 10.42     | 10.22     | ns    |

Note: For specific junction temperature and voltage supply levels, refer to Table 2-7 on page 2-7 for derating values.

**Table 2-108 • 1.8 V LVCMOS High Slew – Applies to 1.2 V DC Core Voltage****Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case VCC = 1.14 V, Worst-Case VCCI = 1.7 V****Applicable to Standard Plus 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.        | 1.55       | 3.22     | 0.26      | 1.11     | 1.10       | 3.26     | 3.18     | 2.47     | 2.20     | 9.05      | 8.97      | ns    |
| 4 mA           | Std.        | 1.55       | 2.72     | 0.26      | 1.11     | 1.10       | 2.75     | 2.50     | 2.78     | 3.01     | 8.54      | 8.29      | ns    |
| 6 mA           | Std.        | 1.55       | 2.43     | 0.26      | 1.11     | 1.10       | 2.47     | 2.16     | 2.99     | 3.39     | 8.25      | 7.94      | ns    |
| 8 mA           | Std.        | 1.55       | 2.43     | 0.26      | 1.11     | 1.10       | 2.47     | 2.16     | 2.99     | 3.39     | 8.25      | 7.94      | ns    |

Notes:

1. Software default selection highlighted in gray.
2. For specific junction temperature and voltage supply levels, refer to Table 2-7 on page 2-7 for derating values.

**Table 2-109 • 1.8 V LVCMOS Low Slew – Applies to 1.2 V DC Core Voltage****Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case VCC = 1.14 V, Worst-Case VCCI = 1.7 V****Applicable to Standard Banks**

| Drive Strength | Speed Grade | $t_{DOUT}$ | $t_{DP}$ | $t_{DIN}$ | $t_{PY}$ | $t_{EOUT}$ | $t_{ZL}$ | $t_{ZH}$ | $t_{LZ}$ | $t_{HZ}$ | Units |
|----------------|-------------|------------|----------|-----------|----------|------------|----------|----------|----------|----------|-------|
| 2 mA           | Std.        | 1.55       | 6.13     | 0.26      | 1.08     | 1.10       | 6.24     | 5.79     | 2.08     | 1.78     | ns    |
| 4 mA           | Std.        | 1.55       | 5.17     | 0.26      | 1.08     | 1.10       | 5.26     | 4.98     | 2.38     | 2.54     | ns    |

Note: For specific junction temperature and voltage supply levels, refer to Table 2-7 on page 2-7 for derating values.

**Table 2-110 • 1.8 V LVCMOS High Slew – Applies to 1.2 V DC Core Voltage****Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ , Worst-Case VCC = 1.14 V, Worst-Case VCCI = 1.7 V****Applicable to Standard Banks**

| Drive Strength | Speed Grade | $t_{DOUT}$ | $t_{DP}$ | $t_{DIN}$ | $t_{PY}$ | $t_{EOUT}$ | $t_{ZL}$ | $t_{ZH}$ | $t_{LZ}$ | $t_{HZ}$ | Units |
|----------------|-------------|------------|----------|-----------|----------|------------|----------|----------|----------|----------|-------|
| 2 mA           | Std.        | 3.06       | 0.26     | 1.08      | 1.10     | 3.10       | 3.01     | 2.08     | 1.83     | 3.06     | ns    |
| 4 mA           | Std.        | 2.60       | 0.26     | 1.08      | 1.10     | 2.64       | 2.33     | 2.38     | 2.62     | 2.60     | ns    |

Notes:

1. Software default selection highlighted in gray.
2. For specific junction temperature and voltage supply levels, refer to Table 2-7 on page 2-7 for derating values.

**1.5 V LVCMOS (JESD8-11)**

Low-Voltage CMOS for 1.5 V is an extension of the LVCMOS standard (JESD8-5) used for general-purpose 1.5 V applications. It uses a 1.5 V input buffer and a push-pull output buffer.

**Table 2-111 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Advanced I/O Banks

| 1.5 V LVCMOS   | VIL    |             | VIH         |        | VOL         | VOH         | IOL | IOH | IOSH                 | IOSL                 | 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 | 1.575  | 0.25 * VCCI | 0.75 * VCCI | 2   | 2   | 13                   | 16                   | 10               | 10               |
| 4 mA           | −0.3   | 0.35 * VCCI | 0.65 * VCCI | 1.575  | 0.25 * VCCI | 0.75 * VCCI | 4   | 4   | 25                   | 33                   | 10               | 10               |
| 6 mA           | −0.3   | 0.35 * VCCI | 0.65 * VCCI | 1.575  | 0.25 * VCCI | 0.75 * VCCI | 6   | 6   | 32                   | 39                   | 10               | 10               |
| 8 mA           | −0.3   | 0.35 * VCCI | 0.65 * VCCI | 1.575  | 0.25 * VCCI | 0.75 * VCCI | 8   | 8   | 66                   | 55                   | 10               | 10               |
| 12 mA          | −0.3   | 0.35 * VCCI | 0.65 * VCCI | 1.575  | 0.25 * VCCI | 0.75 * VCCI | 12  | 12  | 66                   | 55                   | 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 2-112 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Standard Plus I/O Banks

| 1.5 V LVCMOS   | VIL    |             | VIH         |        | VOL         | VOH         | IOL | IOH | IOSH                 | IOSL                 | 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 | 1.575  | 0.25 * VCCI | 0.75 * VCCI | 2   | 2   | 13                   | 16                   | 10               | 10               |
| 4 mA           | −0.3   | 0.35 * VCCI | 0.65 * VCCI | 1.575  | 0.25 * VCCI | 0.75 * VCCI | 4   | 4   | 25                   | 33                   | 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.

I/O Register Specifications

Fully Registered I/O Buffers with Synchronous Enable and Asynchronous Preset

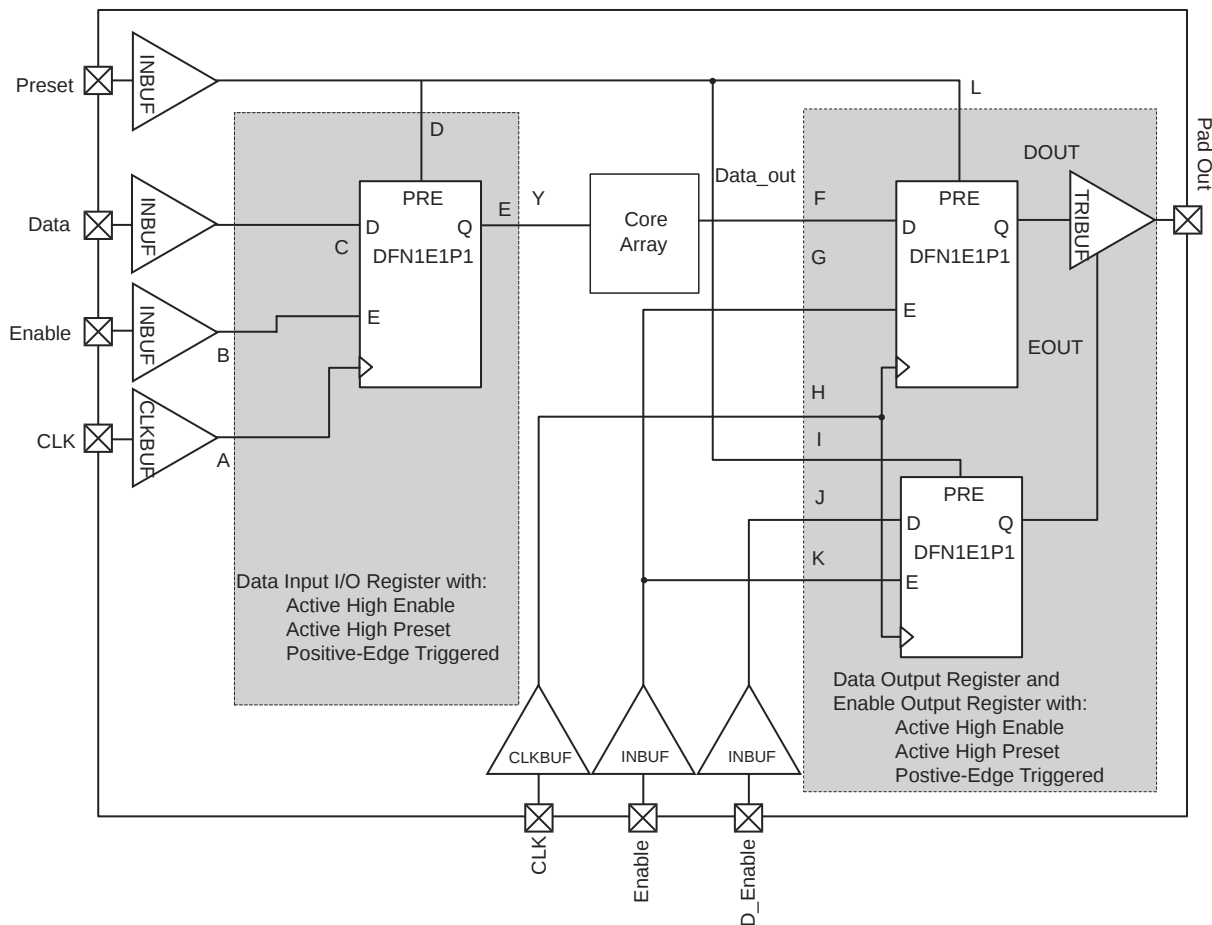
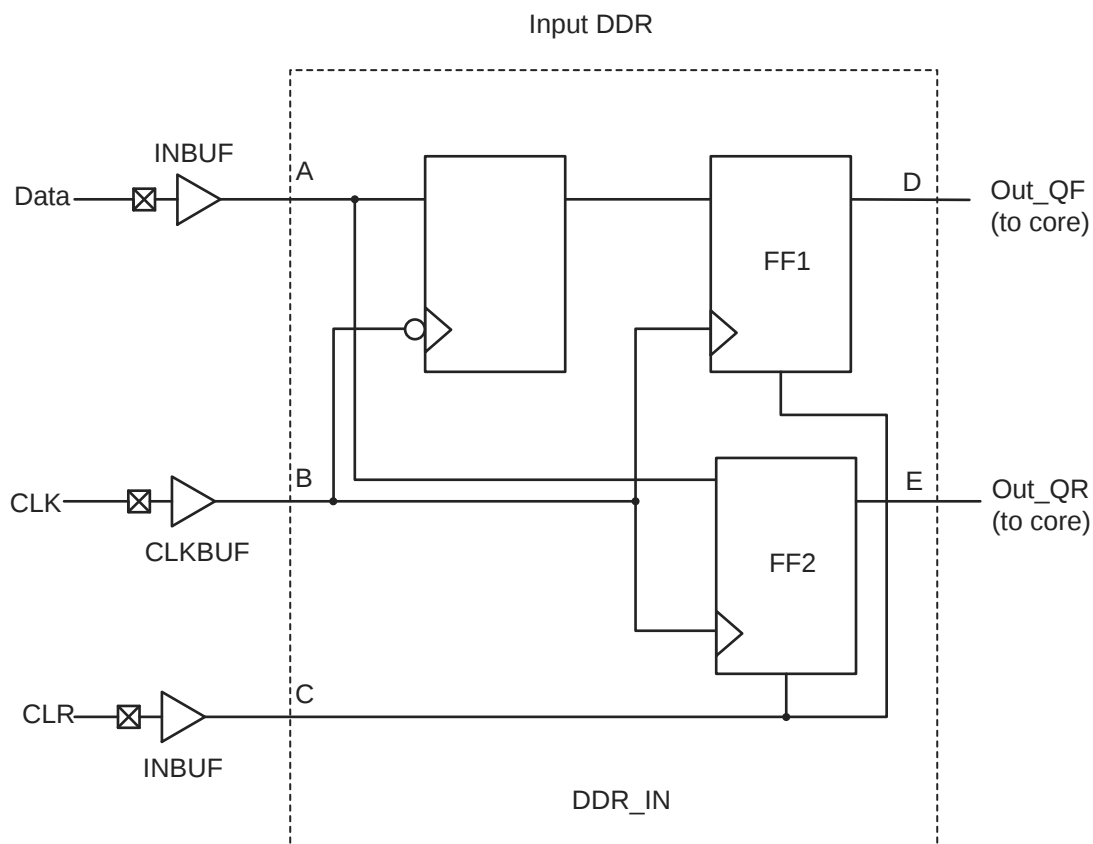


Figure 2-16 • Timing Model of Registered I/O Buffers with Synchronous Enable and Asynchronous Preset

## DDR Module Specifications

### Input DDR Module



**Figure 2-21 • Input DDR Timing Model**

**Table 2-163 • Parameter Definitions**

| Parameter Name          | Parameter Definition         | Measuring Nodes (from, to) |
|-------------------------|------------------------------|----------------------------|
| $t_{\text{DDRICKQ1}}$   | Clock-to-Out Out_QR          | B, D                       |
| $t_{\text{DDRICKQ2}}$   | Clock-to-Out Out_QF          | B, E                       |
| $t_{\text{DDRISUD}}$    | Data Setup Time of DDR input | A, B                       |
| $t_{\text{DDRIRD}}$     | Data Hold Time of DDR input  | A, B                       |
| $t_{\text{DDRICLR2Q1}}$ | Clear-to-Out Out_QR          | C, D                       |
| $t_{\text{DDRICLR2Q2}}$ | Clear-to-Out Out_QF          | C, E                       |
| $t_{\text{DDRIREMCLR}}$ | Clear Removal                | C, B                       |
| $t_{\text{DDRIRECCLR}}$ | Clear Recovery               | C, B                       |

## Global Tree Timing Characteristics

Global clock delays include the central rib delay, the spine delay, and the row delay. Delays do not include I/O input buffer clock delays, as these are I/O standard-dependent, and the clock may be driven and conditioned internally by the CCC module. For more details on clock conditioning capabilities, refer to the "Clock Conditioning Circuits" section on page 2-115. Table 2-173 to Table 2-188 on page 2-114 present minimum and maximum global clock delays within each device. Minimum and maximum delays are measured with minimum and maximum loading.

### Timing Characteristics

#### 1.5 V DC Core Voltage

**Table 2-173 • AGL015 Global Resource**

Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ ,  $V_{CC} = 1.425\text{ V}$

| Parameter     | Description                               | Std.              |                   | Units |
|---------------|-------------------------------------------|-------------------|-------------------|-------|
|               |                                           | Min. <sup>1</sup> | Max. <sup>2</sup> |       |
| $t_{RCKL}$    | Input Low Delay for Global Clock          | 1.21              | 1.42              | ns    |
| $t_{RCKH}$    | Input High Delay for Global Clock         | 1.23              | 1.49              | ns    |
| $t_{RCKMPWH}$ | Minimum Pulse Width High for Global Clock | 1.18              |                   | ns    |
| $t_{RCKMPWL}$ | Minimum Pulse Width Low for Global Clock  | 1.15              |                   | ns    |
| $t_{RCKSW}$   | Maximum Skew for Global Clock             |                   | 0.27              | 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 2-7 for derating values.

**Table 2-174 • AGL030 Global Resource**

Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ ,  $V_{CC} = 1.425\text{ V}$

| Parameter     | Description                               | Std.              |                   | Units |
|---------------|-------------------------------------------|-------------------|-------------------|-------|
|               |                                           | Min. <sup>1</sup> | Max. <sup>2</sup> |       |
| $t_{RCKL}$    | Input Low Delay for Global Clock          | 1.21              | 1.42              | ns    |
| $t_{RCKH}$    | Input High Delay for Global Clock         | 1.23              | 1.49              | ns    |
| $t_{RCKMPWH}$ | Minimum Pulse Width High for Global Clock | 1.18              |                   | ns    |
| $t_{RCKMPWL}$ | Minimum Pulse Width Low for Global Clock  | 1.15              |                   | ns    |
| $t_{RCKSW}$   | Maximum Skew for Global Clock             |                   | 0.27              | 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 2-7 for derating values.

**Table 2-183 • AGL060 Global Resource****Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ ,  $V_{CC} = 1.14\text{ V}$** 

| Parameter     | Description                               | Std.              |                   | Units |
|---------------|-------------------------------------------|-------------------|-------------------|-------|
|               |                                           | Min. <sup>1</sup> | Max. <sup>2</sup> |       |
| $t_{RCKL}$    | Input Low Delay for Global Clock          | 2.04              | 2.33              | ns    |
| $t_{RCKH}$    | Input High Delay for Global Clock         | 2.10              | 2.51              | ns    |
| $t_{RCKMPWH}$ | Minimum Pulse Width High for Global Clock | 1.40              |                   | ns    |
| $t_{RCKMPWL}$ | Minimum Pulse Width Low for Global Clock  | 1.65              |                   | ns    |
| $t_{RCKSW}$   | Maximum Skew for Global Clock             |                   | 0.40              | 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 2-7 for derating values.

**Table 2-184 • AGL125 Global Resource****Commercial-Case Conditions:  $T_J = 70^\circ\text{C}$ ,  $V_{CC} = 1.14\text{ V}$** 

| Parameter     | Description                               | Std.              |                   | Units |
|---------------|-------------------------------------------|-------------------|-------------------|-------|
|               |                                           | Min. <sup>1</sup> | Max. <sup>2</sup> |       |
| $t_{RCKL}$    | Input Low Delay for Global Clock          | 2.08              | 2.54              | ns    |
| $t_{RCKH}$    | Input High Delay for Global Clock         | 2.15              | 2.77              | ns    |
| $t_{RCKMPWH}$ | Minimum Pulse Width High for Global Clock | 1.40              |                   | ns    |
| $t_{RCKMPWL}$ | Minimum Pulse Width Low for Global Clock  | 1.65              |                   | ns    |
| $t_{RCKSW}$   | Maximum Skew for Global Clock             |                   | 0.62              | 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 2-7 for derating values.

| QN132      |                 |
|------------|-----------------|
| Pin Number | AGL030 Function |
| A1         | IO80RSB1        |
| A2         | IO77RSB1        |
| A3         | NC              |
| A4         | IO76RSB1        |
| A5         | GEC0/IO73RSB1   |
| A6         | NC              |
| A7         | GEB0/IO71RSB1   |
| A8         | IO69RSB1        |
| A9         | NC              |
| A10        | VCC             |
| A11        | IO67RSB1        |
| A12        | IO64RSB1        |
| A13        | IO59RSB1        |
| A14        | IO56RSB1        |
| A15        | NC              |
| A16        | IO55RSB1        |
| A17        | IO53RSB1        |
| A18        | VCC             |
| A19        | IO50RSB1        |
| A20        | IO48RSB1        |
| A21        | IO45RSB1        |
| A22        | IO44RSB1        |
| A23        | IO43RSB1        |
| A24        | TDI             |
| A25        | TRST            |
| A26        | IO40RSB0        |
| A27        | NC              |
| A28        | IO39RSB0        |
| A29        | IO38RSB0        |
| A30        | IO36RSB0        |
| A31        | IO35RSB0        |
| A32        | GDC0/IO32RSB0   |
| A33        | NC              |
| A34        | VCC             |
| A35        | IO30RSB0        |
| A36        | IO27RSB0        |

| QN132      |                 |
|------------|-----------------|
| Pin Number | AGL030 Function |
| A37        | IO22RSB0        |
| A38        | IO19RSB0        |
| A39        | NC              |
| A40        | IO18RSB0        |
| A41        | IO16RSB0        |
| A42        | IO14RSB0        |
| A43        | VCC             |
| A44        | IO11RSB0        |
| A45        | IO08RSB0        |
| A46        | IO06RSB0        |
| A47        | IO05RSB0        |
| A48        | IO02RSB0        |
| B1         | IO81RSB1        |
| B2         | IO78RSB1        |
| B3         | GND             |
| B4         | IO75RSB1        |
| B5         | NC              |
| B6         | GND             |
| B7         | IO70RSB1        |
| B8         | NC              |
| B9         | GND             |
| B10        | IO66RSB1        |
| B11        | IO63RSB1        |
| B12        | FF/IO60RSB1     |
| B13        | IO57RSB1        |
| B14        | GND             |
| B15        | IO54RSB1        |
| B16        | IO52RSB1        |
| B17        | GND             |
| B18        | IO49RSB1        |
| B19        | IO46RSB1        |
| B20        | GND             |
| B21        | IO42RSB1        |
| B22        | TMS             |
| B23        | TDO             |
| B24        | IO41RSB0        |

| QN132      |                 |
|------------|-----------------|
| Pin Number | AGL030 Function |
| B25        | GND             |
| B26        | NC              |
| B27        | IO37RSB0        |
| B28        | GND             |
| B29        | GDA0/IO33RSB0   |
| B30        | NC              |
| B31        | GND             |
| B32        | IO29RSB0        |
| B33        | IO26RSB0        |
| B34        | IO23RSB0        |
| B35        | IO20RSB0        |
| B36        | GND             |
| B37        | IO17RSB0        |
| B38        | IO15RSB0        |
| B39        | GND             |
| B40        | IO12RSB0        |
| B41        | IO09RSB0        |
| B42        | GND             |
| B43        | IO04RSB0        |
| B44        | IO01RSB0        |
| C1         | IO82RSB1        |
| C2         | IO79RSB1        |
| C3         | NC              |
| C4         | IO74RSB1        |
| C5         | GEA0/IO72RSB1   |
| C6         | NC              |
| C7         | NC              |
| C8         | VCCIB1          |
| C9         | IO65RSB1        |
| C10        | IO62RSB1        |
| C11        | IO61RSB1        |
| C12        | IO58RSB1        |
| C13        | NC              |
| C14        | NC              |
| C15        | IO51RSB1        |
| C16        | VCCIB1          |

| VQ100      |                 |
|------------|-----------------|
| Pin Number | AGL250 Function |
| 1          | GND             |
| 2          | GAA2/IO118UDB3  |
| 3          | IO118VDB3       |
| 4          | GAB2/IO117UDB3  |
| 5          | IO117VDB3       |
| 6          | GAC2/IO116UDB3  |
| 7          | IO116VDB3       |
| 8          | IO112PSB3       |
| 9          | GND             |
| 10         | GFB1/IO109PDB3  |
| 11         | GFB0/IO109NDB3  |
| 12         | VCOMPLF         |
| 13         | GFA0/IO108NPB3  |
| 14         | VCCPLF          |
| 15         | GFA1/IO108PPB3  |
| 16         | GFA2/IO107PSB3  |
| 17         | VCC             |
| 18         | VCCIB3          |
| 19         | GFC2/IO105PSB3  |
| 20         | GEC1/IO100PDB3  |
| 21         | GEC0/IO100NDB3  |
| 22         | GEA1/IO98PDB3   |
| 23         | GEA0/IO98NDB3   |
| 24         | VMV3            |
| 25         | GNDQ            |
| 26         | GEA2/IO97RSB2   |
| 27         | FF/GE2/IO96RSB2 |
| 28         | GEC2/IO95RSB2   |
| 29         | IO93RSB2        |
| 30         | IO92RSB2        |
| 31         | IO91RSB2        |
| 32         | IO90RSB2        |
| 33         | IO88RSB2        |
| 34         | IO86RSB2        |
| 35         | IO85RSB2        |
| 36         | IO84RSB2        |

| VQ100      |                 |
|------------|-----------------|
| Pin Number | AGL250 Function |
| 37         | VCC             |
| 38         | GND             |
| 39         | VCCIB2          |
| 40         | IO77RSB2        |
| 41         | IO74RSB2        |
| 42         | IO71RSB2        |
| 43         | GDC2/IO63RSB2   |
| 44         | GDB2/IO62RSB2   |
| 45         | GDA2/IO61RSB2   |
| 46         | GNDQ            |
| 47         | TCK             |
| 48         | TDI             |
| 49         | TMS             |
| 50         | VMV2            |
| 51         | GND             |
| 52         | VPUMP           |
| 53         | NC              |
| 54         | TDO             |
| 55         | TRST            |
| 56         | VJTAG           |
| 57         | GDA1/IO60USB1   |
| 58         | GDC0/IO58VDB1   |
| 59         | GDC1/IO58UDB1   |
| 60         | IO52NDB1        |
| 61         | GCB2/IO52PDB1   |
| 62         | GCA1/IO50PDB1   |
| 63         | GCA0/IO50NDB1   |
| 64         | GCC0/IO48NDB1   |
| 65         | GCC1/IO48PDB1   |
| 66         | VCCIB1          |
| 67         | GND             |
| 68         | VCC             |
| 69         | IO43NDB1        |
| 70         | GBC2/IO43PDB1   |
| 71         | GGB2/IO42PSB1   |
| 72         | IO41NDB1        |

| VQ100      |                 |
|------------|-----------------|
| Pin Number | AGL250 Function |
| 73         | GBA2/IO41PDB1   |
| 74         | VMV1            |
| 75         | GNDQ            |
| 76         | GBA1/IO40RSB0   |
| 77         | GBA0/IO39RSB0   |
| 78         | GGB1/IO38RSB0   |
| 79         | GGB0/IO37RSB0   |
| 80         | GBC1/IO36RSB0   |
| 81         | GBC0/IO35RSB0   |
| 82         | IO29RSB0        |
| 83         | IO27RSB0        |
| 84         | IO25RSB0        |
| 85         | IO23RSB0        |
| 86         | IO21RSB0        |
| 87         | VCCIB0          |
| 88         | GND             |
| 89         | VCC             |
| 90         | IO15RSB0        |
| 91         | IO13RSB0        |
| 92         | IO11RSB0        |
| 93         | GAC1/IO05RSB0   |
| 94         | GAC0/IO04RSB0   |
| 95         | GAB1/IO03RSB0   |
| 96         | GAB0/IO02RSB0   |
| 97         | GAA1/IO01RSB0   |
| 98         | GAA0/IO00RSB0   |
| 99         | GNDQ            |
| 100        | VMV0            |

| FG256      |                 |
|------------|-----------------|
| Pin Number | AGL400 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        |
| C5         | GAC0/IO04RSB0   |
| C6         | GAC1/IO05RSB0   |

| FG256      |                 |
|------------|-----------------|
| Pin Number | AGL400 Function |
| 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        |
| E9         | IO31RSB0        |
| E10        | VCCIB0          |
| E11        | VCCIB0          |
| E12        | VMV1            |

| FG256      |                 |
|------------|-----------------|
| Pin Number | AGL400 Function |
| 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          |
| G13        | GCC1/IO67PPB1   |
| G14        | IO64NPB1        |
| G15        | IO73PDB1        |
| G16        | IO73NDB1        |
| H1         | GFB0/IO146NPB3  |
| H2         | GFA0/IO145NDB3  |

| FG256      |                  |
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| Pin Number | AGL1000 Function |
| H3         | GFB1/IO208PPB3   |
| H4         | VCOMPLF          |
| H5         | GFC0/IO209NPB3   |
| H6         | VCC              |
| H7         | GND              |
| H8         | GND              |
| H9         | GND              |
| H10        | GND              |
| H11        | VCC              |
| H12        | GCC0/IO91NPB1    |
| H13        | GCB1/IO92PPB1    |
| H14        | GCA0/IO93NPB1    |
| H15        | IO96NPB1         |
| H16        | GCB0/IO92NPB1    |
| J1         | GFA2/IO206PSB3   |
| J2         | GFA1/IO207PDB3   |
| J3         | VCCPLF           |
| J4         | IO205NDB3        |
| J5         | GFB2/IO205PDB3   |
| J6         | VCC              |
| J7         | GND              |
| J8         | GND              |
| J9         | GND              |
| J10        | GND              |
| J11        | VCC              |
| J12        | GCB2/IO95PPB1    |
| J13        | GCA1/IO93PPB1    |
| J14        | GCC2/IO96PPB1    |
| J15        | IO100PPB1        |
| J16        | GCA2/IO94PSB1    |
| K1         | GFC2/IO204PDB3   |
| K2         | IO204NDB3        |
| K3         | IO203NDB3        |
| K4         | IO203PDB3        |
| K5         | VCCIB3           |
| K6         | VCC              |
| K7         | GND              |
| K8         | GND              |

| FG256      |                  |
|------------|------------------|
| Pin Number | AGL1000 Function |
| K9         | GND              |
| K10        | GND              |
| K11        | VCC              |
| K12        | VCCIB1           |
| K13        | IO95NPB1         |
| K14        | IO100NPB1        |
| K15        | IO102NDB1        |
| K16        | IO102PDB1        |
| L1         | IO202NDB3        |
| L2         | IO202PDB3        |
| L3         | IO196PPB3        |
| L4         | IO193PPB3        |
| L5         | VCCIB3           |
| L6         | GND              |
| L7         | VCC              |
| L8         | VCC              |
| L9         | VCC              |
| L10        | VCC              |
| L11        | GND              |
| L12        | VCCIB1           |
| L13        | GDB0/IO112NPB1   |
| L14        | IO106NDB1        |
| L15        | IO106PDB1        |
| L16        | IO107PDB1        |
| M1         | IO197NSB3        |
| M2         | IO196NPB3        |
| M3         | IO193NPB3        |
| M4         | GEC0/IO190NPB3   |
| M5         | VMV3             |
| M6         | VCCIB2           |
| M7         | VCCIB2           |
| M8         | IO147RSB2        |
| M9         | IO136RSB2        |
| M10        | VCCIB2           |
| M11        | VCCIB2           |
| M12        | VMV2             |
| M13        | IO110NDB1        |
| M14        | GDB1/IO112PPB1   |

| FG256      |                  |
|------------|------------------|
| Pin Number | AGL1000 Function |
| M15        | GDC1/IO111PDB1   |
| M16        | IO107NDB1        |
| N1         | IO194PSB3        |
| N2         | IO192PPB3        |
| N3         | GEC1/IO190PPB3   |
| N4         | IO192NPB3        |
| N5         | GNDQ             |
| N6         | GEA2/IO187RSB2   |
| N7         | IO161RSB2        |
| N8         | IO155RSB2        |
| N9         | IO141RSB2        |
| N10        | IO129RSB2        |
| N11        | IO124RSB2        |
| N12        | GNDQ             |
| N13        | IO110PDB1        |
| N14        | VJTAG            |
| N15        | GDC0/IO111NDB1   |
| N16        | GDA1/IO113PDB1   |
| P1         | GEB1/IO189PDB3   |
| P2         | GEB0/IO189NDB3   |
| P3         | VMV2             |
| P4         | IO179RSB2        |
| P5         | IO171RSB2        |
| P6         | IO165RSB2        |
| P7         | IO159RSB2        |
| P8         | IO151RSB2        |
| P9         | IO137RSB2        |
| P10        | IO134RSB2        |
| P11        | IO128RSB2        |
| P12        | VMV1             |
| P13        | TCK              |
| P14        | VPUMP            |
| P15        | TRST             |
| P16        | GDA0/IO113NDB1   |
| R1         | GEA1/IO188PDB3   |
| R2         | GEA0/IO188NDB3   |
| R3         | IO184RSB2        |
| R4         | GEC2/IO185RSB2   |

| FG484      |                 |
|------------|-----------------|
| Pin Number | AGL400 Function |
| N17        | IO74RSB1        |
| N18        | IO72NPB1        |
| N19        | IO70NDB1        |
| N20        | NC              |
| N21        | NC              |
| N22        | NC              |
| P1         | NC              |
| P2         | NC              |
| P3         | NC              |
| P4         | IO142NDB3       |
| P5         | IO141NPB3       |
| P6         | IO125RSB2       |
| P7         | IO139RSB3       |
| P8         | VCCIB3          |
| P9         | GND             |
| P10        | VCC             |
| P11        | VCC             |
| P12        | VCC             |
| P13        | VCC             |
| P14        | GND             |
| P15        | VCCIB1          |
| P16        | GDB0/IO78VPB1   |
| P17        | IO76VDB1        |
| P18        | IO76UDB1        |
| P19        | IO75PDB1        |
| P20        | NC              |
| P21        | NC              |
| P22        | NC              |
| R1         | NC              |
| R2         | NC              |
| R3         | VCC             |
| R4         | IO140PDB3       |
| R5         | IO130RSB2       |
| R6         | IO138NPB3       |
| R7         | GEC0/IO137NPB3  |
| R8         | VMV3            |

| FG484      |                 |
|------------|-----------------|
| Pin Number | AGL600 Function |
| U1         | IO149PDB3       |
| U2         | IO149NDB3       |
| U3         | NC              |
| U4         | GEB1/IO145PDB3  |
| U5         | GEB0/IO145NDB3  |
| U6         | VMV2            |
| U7         | IO138RSB2       |
| U8         | IO136RSB2       |
| 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        |

| FG484      |                  |
|------------|------------------|
| Pin Number | AGL1000 Function |
| B7         | IO15RSB0         |
| B8         | IO19RSB0         |
| B9         | IO24RSB0         |
| B10        | IO31RSB0         |
| B11        | IO39RSB0         |
| B12        | IO48RSB0         |
| B13        | IO54RSB0         |
| B14        | IO58RSB0         |
| B15        | IO63RSB0         |
| B16        | IO66RSB0         |
| B17        | IO68RSB0         |
| B18        | IO70RSB0         |
| B19        | NC               |
| B20        | NC               |
| B21        | VCCIB1           |
| B22        | GND              |
| C1         | VCCIB3           |
| C2         | IO220PDB3        |
| C3         | NC               |
| C4         | NC               |
| C5         | GND              |
| C6         | IO10RSB0         |
| C7         | IO14RSB0         |
| C8         | VCC              |
| C9         | VCC              |
| C10        | IO30RSB0         |
| C11        | IO37RSB0         |
| C12        | IO43RSB0         |
| C13        | NC               |
| C14        | VCC              |
| C15        | VCC              |
| C16        | NC               |
| C17        | NC               |
| C18        | GND              |
| C19        | NC               |
| C20        | NC               |