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#### **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	18144
Number of Logic Elements/Cells	-
Total RAM Bits	165888
Number of I/O	516
Number of Gates	1000000
Voltage - Supply	1.425V ~ 1.575V
Mounting Type	Surface Mount
Operating Temperature	-55°C ~ 125°C (TA)
Package / Case	896-BGA
Supplier Device Package	896-FBGA (31x31)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/ax1000-fg896m

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# **Thermal Characteristics**

## Introduction

The temperature variable in Microsemi's Designer software refers to the junction temperature, not the ambient temperature. This is an important distinction because dynamic and static power consumption cause the chip junction temperature to be higher than the ambient temperature. EQ 1 can be used to calculate junction temperature.

$$T_J = Junction Temperature = \Delta T + T_a$$

Where:

 $T_a$  = Ambient Temperature

 $\Delta T$  = Temperature gradient between junction (silicon) and ambient

 $\Delta T = \theta_{ia} * P$ 

Where:

- P = Power
- $\theta_{ia}$  = Junction to ambient of package.  $\theta_{ia}$  numbers are located under Table 2-6 on page 2-7.

## **Package Thermal Characteristics**

The device junction-to-case thermal characteristic is  $\theta_{jc}$ , and the junction-to-ambient air characteristic is  $\theta_{ja}$ . The thermal characteristics for  $\theta_{ja}$  are shown with two different air flow rates.  $\theta_{jc}$  values are provided for reference. The absolute maximum junction temperature is 125°C.

The maximum power dissipation allowed for commercial- and industrial-grade devices is a function of  $\theta_{ja}$ . A sample calculation of the absolute maximum power dissipation allowed for an 896-pin FBGA package at commercial temperature and still air is as follows:

Maximum Power Allowed = 
$$\frac{\text{Max. junction temp. } (^{\circ}\text{C}) - \text{Max. ambient temp. } (^{\circ}\text{C})}{\theta_{ja}(^{\circ}\text{C/W})} = \frac{125^{\circ}\text{C} - 70^{\circ}\text{C}}{13.6^{\circ}\text{C/W}} = 4.04 \text{ W}$$

EQ 2

EQ 1

The maximum power dissipation allowed for Military temperature and Mil-Std 883B devices is specified as a function of  $\theta_{\text{ic}}$ .

Package Type	Pin Count	$\theta_{jc}$	$\theta_{\text{ja}}\text{Still}\text{Air}$	$\theta_{ja}$ 1.0m/s	$\theta_{ja}$ 2.5m/s	Units
Chip Scale Package (CSP)	180	N/A	57.8	51.0	50	°C/W
Plastic Quad Flat Pack (PQFP)	208	8.0	26	23.5	20.9	°C/W
Plastic Ball Grid Array (PBGA)	729	2.2	13.7	10.6	9.6	°C/W
Fine Pitch Ball Grid Array (FBGA)	256	3.0	26.6	22.8	21.5	°C/W
Fine Pitch Ball Grid Array (FBGA)	324	3.0	25.8	22.1	20.9	°C/W
Fine Pitch Ball Grid Array (FBGA)	484	3.2	20.5	17.0	15.9	°C/W
Fine Pitch Ball Grid Array (FBGA)	676	3.2	16.4	13.0	12.0	°C/W
Fine Pitch Ball Grid Array (FBGA)	896	2.4	13.6	10.4	9.4	°C/W
Fine Pitch Ball Grid Array (FBGA)	1152	1.8	12.0	8.9	7.9	°C/W
Ceramic Quad Flat Pack (CQFP) <sup>1</sup>	208	2.0	22	19.8	18.0	°C/W
Ceramic Quad Flat Pack (CQFP) <sup>1</sup>	352	2.0	17.9	16.1	14.7	°C/W
Ceramic Column Grid Array (CCGA) <sup>2</sup>	624	6.5	8.9	8.5	8	°C/W

 Table 2-6 • Package Thermal Characteristics

Notes:

1.  $\theta_{jc}$  for the 208-pin and 352-pin CQFP refers to the thermal resistance between the junction and the bottom of the package.

2.  $\theta_{jc}$  for the 624-pin CCGA refers to the thermal resistance between the junction and the top surface of the package. Thermal resistance from junction to board ( $\theta_{ib}$ ) for CCGA 624 package is 3.4°C/W.

## **Timing Characteristics**

Axcelerator devices are manufactured in a CMOS process, therefore, device performance varies according to temperature, voltage, and process variations. Minimum timing parameters reflect maximum operating voltage, minimum operating temperature, and best-case processing. Maximum timing parameters reflect minimum operating voltage, maximum operating temperature, and worst-case processing. The derating factors shown in Table 2-7 should be applied to all timing data contained within this datasheet.

	Junction Temperature									
VCCA	–55°C	–40°C	0°C	25°C	70°C	85°C	125°C			
1.4 V	0.83	0.86	0.91	0.96	1.02	1.05	1.15			
1.425 V	0.82	0.84	0.90	0.94	1.00	1.04	1.13			
1.5 V	0.78	0.80	0.85	0.89	0.95	0.98	1.07			
1.575 V	0.74	0.76	0.81	0.85	0.90	0.94	1.02			
1.6 V	0.73	0.75	0.80	0.84	0.89	0.92	1.01			

Table 2-7 • Temperature and Voltage Timing Derating Factors(Normalized to Worst-Case Commercial, T<sub>J</sub> = 70°C, VCCA = 1.425V)

Notes:

1. The user can set the junction temperature in Designer software to be any integer value in the range of – 55°C to 175°C.

2. The user can set the core voltage in Designer software to be any value between 1.4V and 1.6V.

All timing numbers listed in this datasheet represent sample timing characteristics of Axcelerator devices. Actual timing delay values are design-specific and can be derived from the Timer tool in Microsemi's Designer software after place-and-route.

# I/O Specifications

## **Pin Descriptions**

**Supply Pins** 

GND

VCCA

Ground

Low supply voltage.

Supply Voltage

Supply voltage for array (1.5V). See "Operating Conditions" on page 2-1 for more information.

#### VCCIBx Supply Voltage

Supply voltage for I/Os. Bx is the I/O Bank ID – 0 to 7. See "Operating Conditions" on page 2-1 for more information.

#### VCCDA Supply Voltage

Supply voltage for the I/O differential amplifier and JTAG and probe interfaces. See "Operating Conditions" on page 2-1 for more information. VCCDA should be tied to 3.3V.

#### VCCPLA/B/C/D/E/F/G/H Supply Voltage

PLL analog power supply (1.5V) for internal PLL. There are eight in each device. VCCPLA supports the PLL associated with global resource HCLKA, VCCPLB supports the PLL associated with global resource HCLKB, etc. The PLL analog power supply pins should be connected to 1.5V whether PLL is used or not.

#### VCOMPLA/B/C/D/E/F/G/H Supply Voltage

Compensation reference signals for internal PLL. There are eight in each device. **VCOMPLA** supports the PLL associated with global resource HCLKA, VCOMPLE supports the PLL associated with global resource CLKE, etc. (see Figure 2-2 on page 2-9 for correct external connection to the supply). The VCOMPLX pins should be left floating if PLL is not used.

#### VPUMP Supply Voltage (External Pump)

In the low power mode, VPUMP will be used to access an external charge pump (if the user desires to bypass the internal charge pump to further reduce power). The device starts using the external charge pump when the voltage level on VPUMP reaches VIH<sup>1</sup>. In normal device operation, when using the internal charge pump, VPUMP should be tied to GND.



Figure 2-2 • VCCPLX and VCOMPLX Power Supply Connect

<sup>1.</sup> When  $V_{PUMP} = V_{IH}$ , it shuts off the internal charge pump. See "Low Power Mode" on page 2-106.



Table 2-13 summarizes the different combinations of voltages and I/O standards that can be used together in the same I/O bank.

#### Table 2-13 • Legal I/O Usage Matrix

I/O Standard	ראדדר 3.3 ע	LVCMOS 2.5 V	LVCMOS1.8 V	LVCMOS1.5 V (JESD8-11)	3.3V PCI/PCI-X	GTL + (3.3 V)	GTL + (2.5 V)	HSTL Class I (1. 5V)	SSTL2 Class I & II (2.5 V)	SSTL3 Class I & II (3.3 V)	LVDS (2.5 V)	LVPECL (3.3 V)
LVTTL 3.3 V (VREF=1.0 V)	$\checkmark$	I	I	-	$\checkmark$	$\checkmark$	-	-	Ι	-	-	$\checkmark$
LVTTL 3.3 V(VREF=1.5 V)	$\checkmark$	-	I	-	$\checkmark$	-	-	-	-	$\checkmark$	-	$\checkmark$
LVCMOS 2.5 V (VREF=1.0 V)	-	$\checkmark$	-	_	-	-	$\checkmark$	-	-	-	$\checkmark$	-
LVCMOS 2.5 V (VREF=1.25V)	-	$\checkmark$	-	_	-	-	-	-	$\checkmark$	-	$\checkmark$	-
LVCMOS1.8 V	-	-	$\checkmark$	_	-	-	-	-	-	-	-	-
LVCMOS1.5 V (VREF = 1.75 V) (JESD8-11)	-	-	-	$\checkmark$	-	-	-	$\checkmark$	-	-	-	-
3.3 V PCI/PCI-X (VREF = 1.0 V)	$\checkmark$	-	-	_	$\checkmark$	$\checkmark$	-	-	-	-	-	$\checkmark$
3.3 V PCI/PCI-X (VREF= 1.5 V)	$\checkmark$	-	-	_	$\checkmark$	-	-	-	-	$\checkmark$	-	$\checkmark$
GTL + (3.3 V)	$\checkmark$	-	-	_	$\checkmark$	$\checkmark$	-	-	-	-	-	$\checkmark$
GTL + (2.5 V)	-	$\checkmark$	-	_	-	-	$\checkmark$	-	-	-	-	-
HSTL Class I	-	-	-	$\checkmark$	-	-	-	$\checkmark$	-	-	-	-
SSTL2 Class I & II	-	$\checkmark$	-	-	-	-	-	-	$\checkmark$	-	$\checkmark$	-
SSTL3 Class I & II	$\checkmark$	-	-	-	$\checkmark$	-	-	-	-	$\checkmark$	-	$\checkmark$
LVDS (VREF = 1.0 V)	-	$\checkmark$	-	-	-	-	$\checkmark$	-	-	-	$\checkmark$	-
LVDS (VREF = 1.25 V)	-	$\checkmark$	-	-	-	-	-	-	$\checkmark$	-	$\checkmark$	-
LVPECL (VREF = 1.0 V)	$\checkmark$	_	_	_	$\checkmark$	$\checkmark$	-	-	-	-	-	$\checkmark$
LVPECL (VREF = 1.5 V)	$\checkmark$	-	-	_	$\checkmark$	-	-	-	-	$\checkmark$	-	$\checkmark$

Notes:

1. Note that GTL+ 2.5 V is not supported across the full military temperature range.

2. A "<" indicates whether standards can be used within a bank at the same time.

Examples:

a) LVTTL can be used with 3.3V PCI and GTL+ (3.3V), when  $V_{REF} = 1.0V$  (GTL+ requirement). b) LVTTL can be used with 3.3V PCI and SSTL3 Class I and II, when  $V_{REF} = 1.5V$  (SSTL3 requirement).

Note that two I/O standards are compatible if:

- Their VCCI values are identical. •
- Their VREF standards are identical (if applicable).

For example, if LVTTL 3.3 V (VREF= 1.0 V) is used, then the other available (i.e. compatible) I/O standards in the same bank are LVTTL 3.3 V PCI/PCI-X, GTL+, and LVPECL.

Also note that when multiple I/O standards are used within a bank, the voltage tolerance will be limited to the minimum tolerance of all I/O standards used in the bank.

Table 2-15, Table 2-16, and Table 2-17 list all the available macro names differentiated by I/O standard, type, slew rate, and drive strength.

Standard	VCCI	Macro Names
LVTTL	3.3 V	CLKBUF, HCLKBUF INBUF, OUTBUF, OUTBUF_S_8, OUTBUF_S_12, OUTBUF_S_16, OUTBUF_S_24, OUTBUF_H_8, OUTBUF_H_12, OUTBUF_H_16, OUTBUF_H_24, TRIBUF, TRIBUF_S_8, TRIBUF_S_12, TRIBUF_S_16, TRIBUF_S_24, TRIBUF_H_8, TRIBUF_H_12, TRIBUF_H_16, TRIBUF_H_24, BIBUF, BIBUF_S_8, BIBUF_S_12, BIBUF_S_16, BIBUF_S_24, BIBUF_H_8, BIBUF_H_12, BIBUF_H_16, BIBUF_H_24
3.3 V PCI	3.3 V	CLKBUF_PCI, HCLKBUF_PCI, INBUF_PCI, OUTBUF_PCI, TRIBUF_PCI, BIBUF_PCI
3.3 V PCI-X	3.3 V	CLKBUF_PCI-X, HCLKBUF_PCI-X, INBUF_PCI-X, OUTBUF_PCI-X, TRIBUF_PCI-X, BIBUF_PCI-X
LVCMOS25	2.5 V	CLKBUF_LVCMOS25, HCLKBUF_LVCMOS25, INBUF_LVCMOS25, OUTBUF_LVCMOS25, TRIBUF_LVCMOS25, BIBUF_LVCMOS25
LVCMOS18	1.8 V	CLKBUF_LVCMOS18, HCLKBUF_LVCMOS18, INBUF_LVCMOS18, OUTBUF_LVCMOS18, TRIBUF_LVCMOS18, BIBUF_LVCMOS18
LVCMOS15 (JESD8-11)	1.5 V	CLKBUF_LVCMOS15, HCLKBUF_LVCMOS15, INBUF_LVCMOS15, OUTBUF_LVCMOS15, TRIBUF_LVCMOS15, BIBUF_LVCMOS15

#### Table 2-16 • I/O Macros for Differential I/O Standards

Standard	VCCI	Macro Names
LVPECL	3.3 V	CLKBUF_LVPECL, HCLKBUF_LVPECL, INBUF_LVPECL, OUTBUF_LVPECL
LVDS	2.5 V	CLKBUF_LVDS, HCLKBUF_LVDS, INBUF_LVDS, OUTBUF_LVDS

#### Table 2-17 • I/O Macros for Voltage-Referenced I/O Standards

Standard	VCCI	VREF	Macro Names
GTL+	3.3 V	1.0 V	CLKBUF_GTP33, HCLKBUF_GTP33, INBUF_GTP33, OUTBUF_GTP33, TRIBUF_GTP33, BIBUF_GTP33
GTL+	2.5 V	1.0 V	CLKBUF_GTP25, HCLKBUF_GTP25, INBUF_GTP25, OUTBUF_GTP25, TRIBUF_GTP25, BIBUF_GTP25
SSTL2 Class I	2.5 V	1.25 V	CLKBUF_SSTL2_I, HCLKBUF_SSTL2_I, INBUF_SSTL2_I, OUTBUF_SSTL2_I, TRIBUF_SSTL2_I, BIBUF_SSTL2_I
SSTL2 Class II	2.5 V	1.25 V	CLKBUF_SSTL2_II, HCLKBUF_SSTL2_II, INBUF_SSTL2_II, OUTBUF_SSTL2_II, TRIBUF_SSTL2_II, BIBUF_SSTL2_II
SSTL3 Class I	3.3 V	1.5 V	CLKBUF_SSTL3_I, HCLKBUF_SSTL3_I, INBUF_SSTL3_I, OUTBUF_SSTL3_I, TRIBUF_SSTL3_I, BIBUF_SSTL3_I
SSTL3 Class II	3.3 V	1.5 V	CLKBUF_SSTL3_II, HCLKBUF_SSTL3_II, INBUF_SSTL3_II, OUTBUF_SSTL3_II, TRIBUF_SSTL3_II, BIBUF_SSTL3_II
HSTL Class I	1.5 V	0.75 V	CLKBUF_HSTL_I, HCLKBUF_HSTL_I, INBUF_HSTL_I, OUTBUF_HSTL_I, TRIBUF_HSTL_I, BIBUF_HSTL_I

## **Timing Characteristics**

## Table 2-32 • 1.5V LVCMOS I/O Module

## Worst-Case Commercial Conditions VCCA = 1.425 V, VCCI = 1.4 V, TJ = 70°C

		-2 Speed		–1 S	peed	Std Speed		
Parameter	Description	Min.	Max.	Min.	Max.	Min.	Max.	Units
LVCMOS15	JESD8-11) I/O Module Timing							
t <sub>DP</sub>	Input Buffer		3.59		4.09		4.81	ns
t <sub>PY</sub>	Output Buffer		6.05		6.89		8.10	ns
t <sub>ENZL</sub>	Enable to Pad Delay through the Output Buffer—Z to Low		3.31		3.34		3.34	ns
t <sub>ENZH</sub>	Enable to Pad Delay through the Output Buffer—Z to High		4.56		4.58		4.59	ns
t <sub>ENLZ</sub>	Enable to Pad Delay through the Output Buffer—Low to Z		6.37		7.25		8.52	ns
t <sub>ENHZ</sub>	Enable to Pad Delay through the Output Buffer—High to Z		6.94		7.90		9.29	ns
t <sub>IOCLKQ</sub>	Sequential Clock-to-Q for the I/O Input Register		0.67		0.77		0.90	ns
t <sub>IOCLKY</sub>	Clock-to-output Y for the I/O Output Register and the I/O Enable Register		0.67		0.77		0.90	ns
t <sub>SUD</sub>	Data Input Set-Up		0.23		0.27		0.31	ns
t <sub>SUE</sub>	Enable Input Set-Up		0.26		0.30		0.35	ns
t <sub>HD</sub>	Data Input Hold		0.00		0.00		0.00	ns
t <sub>HE</sub>	Enable Input Hold		0.00		0.00		0.00	ns
t <sub>CPWHL</sub>	Clock Pulse Width High to Low	0.39		0.39		0.39		ns
t <sub>CPWLH</sub>	Clock Pulse Width Low to High	0.39		0.39		0.39		ns
t <sub>WASYN</sub>	Asynchronous Pulse Width	0.37		0.37		0.37		ns
t <sub>REASYN</sub>	Asynchronous Recovery Time		0.13		0.15		0.17	ns
t <sub>HASYN</sub>	Asynchronous Removal Time		0.00		0.00		0.00	ns
t <sub>CLR</sub>	Asynchronous Clear-to-Q		0.23		0.27		0.31	ns
t <sub>PRESET</sub>	Asynchronous Preset-to-Q		0.23		0.27		0.31	ns



**Detailed Specifications** 

#### Table 2-36 • 3.3 V PCI-X I/O Module

Worst-Case Commercial Conditions VCCA = 1.425 V, VCCI = 3.0 V, T<sub>J</sub> =  $70^{\circ}$ C

	–2 S	peed	–1 S	peed	Std S	Speed		
Parameter	Description	Min.	Max.	Min.	Max.	Min.	Max.	Units
3.3 V PCI-X	Output Module Timing							
t <sub>DP</sub>	Input Buffer		1.57		1.79		2.10	ns
t <sub>PY</sub>	Output Buffer		2.10		2.40		2.82	ns
t <sub>ENZL</sub>	Enable to Pad Delay through the Output Buffer—Z to Low		1.61		1.62		1.63	ns
t <sub>ENZH</sub>	Enable to Pad Delay through the Output Buffer—Z to High		1.59		1.60		1.61	ns
t <sub>ENLZ</sub>	Enable to Pad Delay through the Output Buffer—Low to Z		2.65		3.02		3.55	ns
t <sub>ENHZ</sub>	Enable to Pad Delay through the Output Buffer—High to Z		3.11		3.55		4.17	ns
t <sub>IOCLKQ</sub>	Sequential Clock-to-Q for the I/O Input Register		0.67		0.77		0.90	ns
t <sub>ioclky</sub>	Clock-to-output Y for the I/O Output Register and the I/O Enable Register		0.67		0.77		0.90	ns
t <sub>SUD</sub>	Data Input Set-Up		0.23		0.27		0.31	ns
t <sub>SUE</sub>	Enable Input Set-Up		0.26		0.30		0.35	ns
t <sub>HD</sub>	Data Input Hold		0.00		0.00		0.00	ns
t <sub>HE</sub>	Enable Input Hold		0.00		0.00		0.00	ns
t <sub>CPWHL</sub>	Clock Pulse Width High to Low	0.39		0.39		0.39		ns
t <sub>CPWLH</sub>	Clock Pulse Width Low to High	0.39		0.39		0.39		ns
t <sub>WASYN</sub>	Asynchronous Pulse Width	0.37		0.37		0.37		ns
t <sub>REASYN</sub>	Asynchronous Recovery Time		0.13		0.15		0.17	ns
t <sub>HASYN</sub>	Asynchronous Removal Time		0.00		0.00		0.00	ns
t <sub>CLR</sub>	Asynchronous Clear-to-Q		0.23		0.27		0.31	ns
t <sub>PRESET</sub>	Asynchronous Preset-to-Q		0.23		0.27		0.31	ns

## Class II

Table 2-47 • DC Input and Output Levels

	VIL	VIH		VOL	VOH	IOL	ЮН
Min., V	Max., V	Min., V	Max., V	Max., V	Min,. V	mA	mA
-0.3	VREF – 0.2	VREF + 0.2	3.6	VREF – 0.8	VREF + 0.8	15.2	-15.2

## AC Loadings



#### Figure 2-22 • AC Test Loads

#### Table 2-48 • AC Waveforms, Measuring Points, and Capacitive Loads

Input Low (V)	Input High (V)	Measuring Point* (V)	VREF (typ) (V)	C <sub>load</sub> (pF)
VREF – 0.75	VREF + 0.75	VREF	1.25	30

Note: \* Measuring Point =  $V_{trip}$ 

## **Timing Characteristics**

#### Table 2-49 • 2.5 V SSTL2 Class II I/O Module

Worst-Case Commercial Conditions VCCA = 1.425 V, VCCI = 2.3 V, T<sub>J</sub> = 70°C

		-2 Speed		-1 Speed		Std Speed		
Parameter	Description	Min.	Max.	Min.	Max.	Min.	Max.	Units
2.5 V SSTL2 Class II I/O Module Timing								
t <sub>DP</sub>	Input Buffer		1.89		2.16		2.53	ns
t <sub>PY</sub>	Output Buffer		2.39		2.72		3.20	ns
t <sub>ICLKQ</sub>	Clock-to-Q for the I/O input register		0.67		0.77		0.90	ns
t <sub>oclkq</sub>	Clock-to-Q for the I/O output register and the I/O enable register		0.67		0.77		0.90	ns
t <sub>SUD</sub>	Data Input Set-Up		0.23		0.27		0.31	ns
t <sub>SUE</sub>	Enable Input Set-Up		0.26		0.30		0.35	ns
t <sub>HD</sub>	Data Input Hold		0.00		0.00		0.00	ns
t <sub>HE</sub>	Enable Input Hold		0.00		0.00		0.00	ns
t <sub>CPWHL</sub>	Clock Pulse Width High to Low	0.39		0.39		0.39		ns
t <sub>CPWLH</sub>	Clock Pulse Width Low to High	0.39		0.39		0.39		ns
t <sub>WASYN</sub>	Asynchronous Pulse Width	0.37		0.37		0.37		ns
t <sub>REASYN</sub>	Asynchronous Recovery Time		0.13		0.15		0.17	ns
t <sub>HASYN</sub>	Asynchronous Removal Time		0.00		0.00		0.00	ns
t <sub>CLR</sub>	Asynchronous Clear-to-Q		0.23		0.27		0.31	ns
t <sub>PRESET</sub>	Asynchronous Preset-to-Q		0.23		0.27		0.31	ns



# Axcelerator Clock Management System

## Introduction

Each member of the Axcelerator family<sup>6</sup> contains eight phase-locked loop (PLL) blocks which perform the following functions:

- Programmable Delay (32 steps of 250 ps)
- Clock Skew Minimization
- Clock Frequency Synthesis

Each PLL has the following key features:

- Input Frequency Range 14 to 200 MHz
- Output Frequency Range 20 MHz to 1 GHz
- Output Duty Cycle Range 45% to 55%
- Maximum Long-Term Jitter 1% or 100ps (whichever is greater)
- Maximum Short-Term Jitter 50ps + 1% of Output Frequency
- Maximum Acquisition Time (lock) 20µs

## **Physical Implementation**

The eight PLL blocks are arranged in two groups of four. One group is located in the center of the northern edge of the chip, while the second group is centered on the southern edge. The northern group is associated with the four HCLK networks (e.g. PLLA can drive HCLKA), while the southern group is associated with the four CLK networks (e.g. PLLE can drive CLKE).

Each PLL cell is connected to two I/O pads and a PLL Cluster that interfaces with the FPGA core. Figure 2-48 illustrates a PLL block. The VCCPLL pin should be connected to a 1.5V power supply through a 250  $\Omega$  resistor. Furthermore, 0.1  $\mu F$  and 10  $\mu F$  decoupling capacitors should be connected across the VCCPLL and VCOMPPLL pins.





Note: The VCOMPPLL pin should never be grounded (Figure 2-2 on page 2-9)!

The I/O pads associated with the PLL can also be configured for regular I/O functions except when it is used as a clock buffer. The I/O pads can be configured in all the modes available to the regular I/O pads in the same I/O bank. In particular, the [H]CLKxP pad can be configured as a differential pair,

<sup>6.</sup> AX2000-CQ256 does not support operation of the phase-locked loops. This is in order to support full pin compatibility with RTAX2000S/SL-CQ256.



**PLL Configurations** 

The following rules apply to the different PLL inputs and outputs:

### **Reference Clock**

The RefCLK can be driven by (Figure 2-50):

- 1. Global routed clocks (CLKE/F/G/H) or user-created clock network
- 2. CLK1 output of an adjacent PLL
- 3. [H]CLKxP (single-ended or voltage-referenced)
- 4. [H]CLKxP/[H]CLKxN pair (differential modes like LVPECL or LVDS)

## Feedback Clock

The feedback clock can be driven by (Figure 2-51 on page 2-78):

- 1. Global routed clocks (CLKE/F/G/H) or user-created clock network
- 2. External [H]CLKxP/N I/O pad(s) from the adjacent PLL cell
- 3. An internal signal from the PLL block





Any macro from the core, except HCLK nets





#### Figure 2-50 • Reference Clock Connections



Figure 2-51 • Feedback Clock Connections

## **Sample Implementations**

## Frequency Synthesis

Figure 2-53 illustrates an example where the PLL is used to multiply a 155.5 MHz external clock up to 622 MHz. Note that the same PLL schematic could use an external 350 MHz clock, which is divided down to 155 MHz by the FPGA internal logic.

Figure 2-54 illustrates the PLL using both dividers to synthesize a 133 MHz output clock from a 155 MHz input reference clock. The input frequency of 155 MHz is multiplied by 6 and divided by 7, giving a CLK1 output frequency of 132.86 MHz. When dividers are used, a given ratio can be generated in multiple ways, allowing the user to stay within the operating frequency ranges of the PLL.



Figure 2-53 • Using the PLL 155.5 MHz In, 622 MHz Out

## Adjustable Clock Delay

Figure 2-55 illustrates using the PLL to delay the reference clock by employing one of the adjustable delay lines. In this case, the output clock is delayed relative to the reference clock. Delaying the reference clock relative to the output clock is accomplished by using the delay line in the feedback path.





## Note

For Package Manufacturing and Environmental information, visit Resource center at http://www.microsemi.com/soc/products/rescenter/package/index.html.



Package Pin Assignments

FG896		FG896		FG896		
AX2000 Function	Pin Number	AX2000 Function	Pin Number	AX2000 Function	Pin Number	
GND	AK18	GND	M13	GND	T12	
GND	AK2	GND	M14	GND	T13	
GND	AK23	GND	M15	GND	T14	
GND	AK29	GND	M16	GND	T15	
GND	AK8	GND	M17	GND	T16	
GND	B1	GND	M18	GND	T17	
GND	B2	GND	M19	GND	T18	
GND	B22	GND	N1	GND	T19	
GND	B29	GND	N12	GND	T28	
GND	B30	GND	N13	GND	Т3	
GND	B9	GND	N14	GND	U12	
GND	C10	GND	N15	GND	U13	
GND	C15	GND	N16	GND	U14	
GND	C16	GND	N17	GND	U15	
GND	C21	GND	N18	GND	U16	
GND	C28	GND	N19	GND	U17	
GND	C3	GND	N30	GND	U18	
GND	D27	GND	P12	GND	U19	
GND	D28	GND	P13	GND	V1	
GND	D4	GND	P14	GND	V12	
GND	E26	GND	P15	GND	V13	
GND	E5	GND	P16	GND	V14	
GND	H1	GND	P17	GND	V15	
GND	H30	GND	P18	GND	V16	
GND	J2	GND	P19	GND	V17	
GND	J22	GND	R12	GND	V18	
GND	J29	GND	R13	GND	V19	
GND	J9	GND	R14	GND	V30	
GND	K10	GND	R15	GND	W12	
GND	K21	GND	R16	GND	W13	
GND	K28	GND	R17	GND	W14	
GND	K3	GND	R18	GND	W15	
GND	L11	GND	R19	GND	W16	
GND	L20	GND	R28	GND	W17	
GND	M12	GND	R3	GND	W18	



FG896		FG896		FG896		
AX2000 Function	Pin Number	AX2000 Function	Pin Number	AX2000 Function	Pin Number	
GND	W19	VCCA	U11	VCCDA	G16	
GND	Y11	VCCA	U20	VCCDA	T25	
GND	Y20	VCCA	V11	VCCDA	T4	
GND/LP	E4	VCCA	V20	VCCIB0	A3	
PRA	G15	VCCA	W11	VCCIB0	B3	
PRB	D16	VCCA	W20	VCCIB0	J10	
PRC	AB16	VCCA	Y12	VCCIB0	J11	
PRD	AF16	VCCA	Y13	VCCIB0	J12	
ТСК	G7	VCCA	Y14	VCCIB0	K11	
TDI	D5	VCCA	Y15	VCCIB0	K12	
TDO	J8	VCCA	Y16	VCCIB0	K13	
TMS	F6	VCCA	Y17	VCCIB0	K14	
TRST	C4	VCCA	Y18	VCCIB0	K15	
VCCA	AD6	VCCA	Y19	VCCIB1	A28	
VCCA	AH26	VCCDA	AD24	VCCIB1	B28	
VCCA	E28	VCCDA	AD7	VCCIB1	J19	
VCCA	E3	VCCDA	AE15	VCCIB1	J20	
VCCA	L12	VCCDA	AE16	VCCIB1	J21	
VCCA	L13	VCCDA	AF12	VCCIB1	K16	
VCCA	L14	VCCDA	AF13	VCCIB1	K17	
VCCA	L15	VCCDA	AF15	VCCIB1	K18	
VCCA	L16	VCCDA	AF18	VCCIB1	K19	
VCCA	L17	VCCDA	AF19	VCCIB1	K20	
VCCA	L18	VCCDA	AH27	VCCIB2	C29	
VCCA	L19	VCCDA	AH4	VCCIB2	C30	
VCCA	M11	VCCDA	C13	VCCIB2	K22	
VCCA	M20	VCCDA	C27	VCCIB2	L21	
VCCA	N11	VCCDA	C5	VCCIB2	L22	
VCCA	N20	VCCDA	D13	VCCIB2	M21	
VCCA	P11	VCCDA	D19	VCCIB2	M22	
VCCA	P20	VCCDA	D3	VCCIB2	N21	
VCCA	R11	VCCDA	E18	VCCIB2	P21	
VCCA	R20	VCCDA	F15	VCCIB2	R21	
VCCA	T11	VCCDA	F16	VCCIB3	AA22	
VCCA	T20	VCCDA	F26	VCCIB3	AH29	

Note: \*Not routed on the same package layer and to adjacent LGA pads as its differential pair complement. Recommended to be used as a single-ended I/O.



FG1152		FG1152		FG1152		
AX2000 Function	Pin Number	AX2000 Function	Pin Number	AX2000 Function	Pin Number	
IO259NB6F24	AF7	IO276PB6F25	AD2	IO294NB6F27	V10	
IO259PB6F24	AG7	IO277NB6F25	AC4	IO294PB6F27	V11	
IO260NB6F24	AH3	IO277PB6F25	AC3	IO295NB6F27	Y1	
IO260PB6F24	AH4	IO278NB6F26	AA8	IO295PB6F27	Y2	
IO261NB6F24	AH5	IO278PB6F26	AA9	IO296NB6F27	W1	
IO261PB6F24	AJ5	IO279NB6F26	AB5	IO296PB6F27	W2	
IO262NB6F24	AE6	IO279PB6F26	AB6	IO297NB6F27	V1	
IO262PB6F24	AF6	IO280NB6F26	Y10	IO297PB6F27	V2	
IO263NB6F24	AF5	IO280PB6F26	Y11	IO298NB6F27	V9	
IO263PB6F24	AG5	IO281NB6F26	AB3	IO298PB6F27	V8	
IO264NB6F24	AD8	IO281PB6F26	AB4	IO299NB6F27	U4	
IO264PB6F24	AE8	IO282NB6F26	Y7	IO299PB6F27	V4	
IO265NB6F24	AF3	IO282PB6F26	AA7	Bank 7		
IO265PB6F24	AG3	IO283NB6F26	AC2	IO300NB7F28	U10	
IO266NB6F24	AC10	IO283PB6F26	AC1	IO300PB7F28	U11	
IO266PB6F24	AD10	IO284NB6F26	Y9	IO301NB7F28	U2	
IO267NB6F25	AD7	IO284PB6F26	Y8	IO301PB7F28	U1	
IO267PB6F25	AE7	IO285NB6F26	AA5	IO302NB7F28	U6	
IO268NB6F25	AD5	IO285PB6F26	AA6	IO302PB7F28	U7	
IO268PB6F25	AE5	IO286NB6F26	W10	IO303NB7F28	Т3	
IO269NB6F25	AE4	IO286PB6F26	W11	IO303PB7F28	U3	
IO269PB6F25	AF4	IO287NB6F26	AA3	IO304NB7F28	U9	
IO270NB6F25	AB9	IO287PB6F26	AA4	IO304PB7F28	U8	
IO270PB6F25	AC9	IO288NB6F26	W9	IO305NB7F28	R2	
IO271NB6F25	AC6	IO288PB6F26	W8	IO305PB7F28	R1	
IO271PB6F25	AD6	IO289NB6F27	AA1	IO306NB7F28	R4	
IO272NB6F25	AB8	IO289PB6F27	AA2	IO306PB7F28	T4	
IO272PB6F25	AC8	IO290NB6F27	W6	IO307NB7F28	R5	
IO273NB6F25	AE1	IO290PB6F27	Y6	IO307PB7F28	T5	
IO273PB6F25	AE2	IO291NB6F27	W5	IO308NB7F28	T11	
IO274NB6F25	AA10	IO291PB6F27	Y5	IO308PB7F28	T10	
IO274PB6F25	AB10	IO292NB6F27	V7	IO309NB7F28	T6	
IO275NB6F25	AB7	IO292PB6F27	W7	IO309PB7F28	T7	
IO275PB6F25	AC7	IO293NB6F27	W4	IO310NB7F29	Т9	
IO276NB6F25	AD1	IO293PB6F27	Y4	IO310PB7F29	Т8	



AX250 Function         Pin Number         AX250 Function         Number         AX250 Function         Number           IO110PB7F7         19         GND         194         VCCIB0         200           IO112NB7F7         16         GND         201         VCCIB1         163           IO112PB7F7         17         GND         201         VCCIB1         163           IO117PB7F7         12         GND/LP         208         VCCIB2         144           IO119PB7F7         10         PRB         183         VCCIB3         112           IO119PB7F7         11         PRC         80         VCCIB4         98           IO122NB7F7         5         TCK         205         VCCIB4         98           IO122NB7F7         6         TDI         204         VCCIB4         98           IO122NB7F7         3         TDO         203         VCCIB4         98           IO123NB7F7         3         TDO         203         VCCIB6         45           GND         9         VCCA         2         VCCIB6         45           GND         15         VCCA         14         VCCIB7         8           GND	CQ208		CQ208		CQ208		
IO110PB7F7         19         GND         194         VCCIB0         200           IO112NB7F7         16         GND         196         VCCIB1         163           IO112PB7F7         17         GND         201         VCCIB1         172           IO117PB7F7         12         GNDLP         208         VCCIB2         149           IO117PB7F7         10         PRA         184         VCCIB3         112           IO112PB7F7         10         PRB         183         VCCIB3         124           IO12PB7F7         7         PRD         79         VCCIB4         89           IO122NB7F7         5         TCK         205         VCCIB4         98           IO122PB7F7         6         TDI         204         VCCIB5         68           IO123PB7F7         3         TDO         203         VCCIB6         45           GND         9         VCCA         2         VCCIB6         45           GND         9         VCCA         14         VCCIB7         8           GND         15         VCCA         14         VCCIB7         18           GND         32         VCCA	AX250 Function	Pin Number	AX250 Function	Pin Number	AX250 Function	Pin Numbe	
IO112NB7F7         16         GND         196         VCCIB1         163           IO112PB7F7         17         GND/LP         208         VCCIB1         172           IO117NB7F7         12         GND/LP         208         VCCIB1         172           IO117PB7F7         13         PRA         184         VCCIB2         135           IO119NB7F7         10         PRB         183         VCCIB3         112           IO12PB7F7         11         PRC         80         VCCIB3         124           IO12PB7F7         7         PRD         79         VCCIB4         98           IO122PB7F7         6         TDI         204         VCCIB5         68           IO122PB7F7         6         TDI         204         VCCIB6         31           Dedicated I/O         TRST         207         VCCIB6         45           GND         15         VCCA         14         VCCIB7         8           GND         32         VCCA         52         VCCIB7         8           GND         32         VCCA         52         VCCPLD         176           GND         34         VCCA         184<	IO110PB7F7	19	GND	194	VCCIB0	200	
IO112PB7F7         17         GND         201         VCCIB1         172           IO117NB7F7         12         GND/LP         208         VCCIB2         135           IO117PB7F7         13         PRA         184         VCCIB2         149           IO119PB7F7         10         PRB         183         VCCIB2         149           IO119PB7F7         11         PRC         80         VCCIB3         112           IO12PB7F7         7         PRD         79         VCCIB4         89           IO122PB7F7         6         TDI         204         VCCIB5         58           IO123PB7F7         3         TDO         203         VCCIB6         48           IO123PB7F7         4         TMS         206         VCCIB5         58           GND         9         VCCA         2         VCCIB6         45           GND         15         VCCA         14         VCCIB7         20           GND         32         VCCA         52         VCCIB7         8           GND         39         VCCA         64         VCCPL0         176           GND         59         VCCA	IO112NB7F7	16	GND	196	VCCIB1	163	
IO117NB7F7         12         GND/LP         208         VCCIB2         135           IO117PB7F7         13         PRA         184         VCCIB2         149           IO119PB7F7         10         PRB         183         VCCIB2         149           IO119PB7F7         11         PRC         80         VCCIB3         112           IO12PB7F7         7         PRD         79         VCCIB4         89           IO122PB7F7         6         TDI         204         VCCIB5         58           IO123PB7F7         4         TMS         206         VCCIB5         58           IO123PB7F7         4         TMS         206         VCCIB6         31           Dedicated IO         TRST         207         VCCIB5         58           GND         9         VCCA         2         VCCIB6         31           GND         15         VCCA         14         VCCIB7         20           GND         39         VCCA         2         VCCIB7         8           GND         39         VCCA         18         VCCPLE         185           GND         59         VCCA         184 <t< td=""><td>IO112PB7F7</td><td>17</td><td>GND</td><td>201</td><td>VCCIB1</td><td>172</td></t<>	IO112PB7F7	17	GND	201	VCCIB1	172	
IO117PB7F7         13         PRA         184         VCCIB2         149           IO119NB7F7         10         PRB         183         VCCIB3         112           IO119PB7F7         11         PRC         80         VCCIB3         124           IO12PB7F7         7         PRD         79         VCCIB4         89           IO122PB7F7         6         TDI         204         VCCIB5         58           IO122PB7F7         6         TDI         204         VCCIB5         58           IO123PB7F7         4         TMS         206         VCCIB5         68           IO123PB7F7         4         TMS         206         VCCIB5         68           GND         15         VCCA         2         VCCIB6         45           GND         15         VCCA         14         VCCIB7         8           GND         32         VCCA         52         VCCIB7         8           GND         51         VCCA         14         VCCIB7         8           GND         51         VCCA         189         VCCPLD         176           GND         51         VCCA         168	IO117NB7F7	12	GND/LP	208	VCCIB2	135	
IO119NB7F7         10         PRB         183         VCCIB3         112           IO119PB7F7         11         PRC         80         VCCIB3         124           IO121PB7F7         7         PRD         79         VCCIB4         89           IO122NB7F7         6         TDI         204         VCCIB5         58           IO122NB7F7         3         TDO         203         VCCIB5         58           IO123PB7F7         4         TMS         206         VCCIB5         58           IO123PB7F7         4         TMS         206         VCCIB5         68           IO123PB7F7         4         TMS         206         VCCIB5         68           IO123PB7F7         4         TMS         206         VCCIB5         68           IO123PB7F7         4         TMS         207         VCCIB5         88           GND         15         VCCA         14         VCCIB7         20           GND         32         VCCA         52         VCCIB7         8           GND         39         VCCA         142         VCCPLC         178           GND         59         VCCA <td< td=""><td>IO117PB7F7</td><td>13</td><td>PRA</td><td>184</td><td>VCCIB2</td><td>149</td></td<>	IO117PB7F7	13	PRA	184	VCCIB2	149	
IO119PB7F7         11         PRC         80         VCCIB3         124           IO121PB7F7         7         PRD         79         VCCIB4         89           IO122PB7F7         6         TDI         204         VCCIB5         58           IO123PB7F7         4         TMS         206         VCCIB5         68           IO123PB7F7         4         TMS         206         VCCIB5         68           GND         9         VCCA         2         VCCIB6         31           GND         9         VCCA         2         VCCIB6         31           GND         15         VCCA         14         VCCIB7         8           GND         32         VCCA         52         VCCIB7         8           GND         39         VCCA         18         VCCPLC         178           GND         46         VCCA         93         VCCPLC         178           GND         46         VCCA         142         VCCPLC         178           GND         59         VCCA         142         VCCPLC         178           GND         90         VCCA         142         VCCPLE	IO119NB7F7	10	PRB	183	VCCIB3	112	
IO121PB7F7         7         PRD         79         VCCIB4         89           IO122NB7F7         5         TCK         205         VCCIB4         98           IO122PB7F7         6         TDI         204         VCCIB5         58           IO123NB7F7         3         TDO         203         VCCIB5         68           IO123PB7F7         4         TMS         206         VCCIB6         31           Dedicated I/O         TRST         207         VCCIB6         45           GND         9         VCCA         2         VCCIB7         8           GND         21         VCCA         14         VCCIB7         20           GND         32         VCCA         52         VCCPLA         189           GND         39         VCCA         64         VCCPLC         178           GND         59         VCCA         184         VCCPLC         178           GND         65         VCCA         142         VCCPLE         85           GND         90         VCCA         188         VCCPLE         83           GND         90         VCCA         195         VCOMPLA	IO119PB7F7	11	PRC	80	VCCIB3	124	
IO122NB7F7         5         TCK         205           IO122PB7F7         6         TDI         204         VCCIB5         58           IO123NB7F7         3         TDO         203         VCCIB5         68           IO123NB7F7         4         TMS         206         VCCIB5         68           GND         9         VCCA         2         VCCIB6         31           GND         15         VCCA         2         VCCIB6         45           GND         15         VCCA         14         VCCIB7         20           GND         32         VCCA         38         VCCPLA         189           GND         32         VCCA         64         VCCPLC         178           GND         39         VCCA         142         VCCPLC         178           GND         51         VCCA         142         VCCPLE         85           GND         59         VCCA         142         VCCPLE         85           GND         69         VCCA         168         VCCPLF         83           GND         90         VCCA         168         VCOMPLA         190	IO121PB7F7	7	PRD	79	VCCIB4	89	
IO122PB7F7         6         TDI         204           IO123NB7F7         3         TDO         203           IO123PB7F7         4         TMS         206           Dedicated I/O         TRST         207         VCCIB6         31           GND         9         VCCA         2         VCCIB6         45           GND         9         VCCA         2         VCCIB7         8           GND         21         VCCA         38         VCCPLB         189           GND         32         VCCA         52         VCCPLB         189           GND         32         VCCA         64         VCCPLD         178           GND         46         VCCA         93         VCCPLC         178           GND         59         VCCA         142         VCCPLC         178           GND         69         VCCA         168         VCCPLC         178           GND         90         VCCA         195         VCOPLD         176           GND         94         VCCDA         18         VCOPLB         188           GND         104         VCCDA         78         VCOMPLE <td>IO122NB7F7</td> <td>5</td> <td>ТСК</td> <td>205</td> <td>VCCIB4</td> <td>98</td>	IO122NB7F7	5	ТСК	205	VCCIB4	98	
IO123NB7F7         3         TDO         203           IO123PB7F7         4         TMS         206           Dedicated I/O         TRST         207         VCCIB6         31           GND         9         VCCA         2         VCCIB6         45           GND         15         VCCA         2         VCCIB7         8           GND         21         VCCA         38         VCCIB7         8           GND         32         VCCA         52         VCCPLA         189           GND         32         VCCA         64         VCCPLA         189           GND         32         VCCA         52         VCCPLA         189           GND         46         VCCA         93         VCCPLC         178           GND         51         VCCA         142         VCCPLC         178           GND         59         VCCA         168         VCCPLE         85           GND         90         VCCA         195         VCOPLE         190           GND         94         VCCDA         168         VCOPLE         190           GND         104         VCCDA	IO122PB7F7	6	TDI	204	VCCIB5	58	
IO123PB7F7         4         TMS         206           Dedicated I/O         TRST         207         VCCIB6         31           GND         9         VCCA         2         VCCIB6         45           GND         15         VCCA         2         VCCIB7         8           GND         21         VCCA         38         VCCIB7         20           GND         32         VCCA         52         VCCPLA         189           GND         39         VCCA         64         VCCPLC         178           GND         46         VCCA         93         VCCPLC         178           GND         51         VCCA         142         VCCPLC         176           GND         59         VCCA         142         VCCPLC         176           GND         69         VCCA         168         VCCPLF         83           GND         90         VCCA         195         VCCPLF         83           GND         90         VCCA         195         VCOMPLA         190           GND         104         VCCDA         53         VCOMPLB         188           GND	IO123NB7F7	3	TDO	203	VCCIB5	68	
Dedicated I/O         TRST         207         VCCIB6         45           GND         9         VCCA         2         VCCIB7         8           GND         21         VCCA         38         VCCIB7         20           GND         32         VCCA         52         VCCIB7         189           GND         32         VCCA         52         VCCPLB         187           GND         39         VCCA         64         VCCPLD         176           GND         51         VCCA         93         VCCPLE         185           GND         59         VCCA         142         VCCPLE         85           GND         65         VCCA         142         VCCPLE         83           GND         69         VCCA         168         VCCPLF         83           GND         90         VCCA         195         VCCPLF         83           GND         90         VCCA         195         VCCPLF         190           GND         90         VCCDA         16         VCOMPLA         190           GND         104         VCCDA         53         VCOMPLE         86 </td <td>IO123PB7F7</td> <td>4</td> <td>TMS</td> <td>206</td> <td>VCCIB6</td> <td>31</td>	IO123PB7F7	4	TMS	206	VCCIB6	31	
GND         9         VCCA         2           GND         15         VCCA         14           GND         21         VCCA         38           GND         21         VCCA         38           GND         32         VCCA         52           GND         39         VCCA         64           GND         46         VCCA         93           GND         51         VCCA         148           GND         59         VCCA         142           GND         59         VCCA         142           GND         65         VCCA         142           GND         65         VCCA         168           GND         69         VCCA         168           GND         90         VCCA         195           GND         94         VCCDA         168           GND         94         VCCDA         168           GND         94         VCCDA         179           GND         104         VCCDA         53           GND         113         VCCDA         78           GND         125         VCCDA         163 </td <td>Dedicated I/O</td> <td></td> <td>TRST</td> <td>207</td> <td>VCCIB6</td> <td>45</td>	Dedicated I/O		TRST	207	VCCIB6	45	
GND         15         VCCA         14           GND         21         VCCA         38           GND         32         VCCA         52           GND         39         VCCA         64           GND         39         VCCA         64           GND         46         VCCA         93           GND         46         VCCA         93           GND         51         VCCA         118           GND         59         VCCA         142           GND         65         VCCA         156           GND         69         VCCA         168           GND         90         VCCA         168           GND         90         VCCA         195           GND         90         VCCA         195           GND         94         VCCDA         105           GND         104         VCCDA         53           GND         113         VCCDA         63           GND         125         VCCDA         75           GND         136         VCCDA         167           GND         164         VCCDA         16	GND	9	VCCA	2	VCCIB7	8	
GND         21         VCCA         38           GND         32         VCCA         52           GND         39         VCCA         64           GND         46         VCCA         93           GND         46         VCCA         93           GND         51         VCCA         118           GND         59         VCCA         118           GND         65         VCCA         142           GND         69         VCCA         168           GND         90         VCCA         168           GND         90         VCCA         168           GND         90         VCCA         168           GND         94         VCCDA         168           GND         99         VCCDA         16           GND         104         VCCDA         53           VCOMPLB         188         VCOMPLB         188           GND         113         VCCDA         63           GND         113         VCCDA         75           GND         136         VCCDA         130           GND         164         VCCDA	GND	15	VCCA	14	VCCIB7	20	
GND         32         VCCA         52         VCCPLB         187           GND         39         VCCA         64         VCCPLC         178           GND         46         VCCA         93         VCCPLD         176           GND         51         VCCA         118         VCCPLC         178           GND         59         VCCA         142         VCCPLE         85           GND         65         VCCA         156         VCCPLE         83           GND         69         VCCA         168         VCCPLF         83           GND         90         VCCA         168         VCCPLF         190           GND         90         VCCA         168         VCCPLH         72           GND         90         VCCA         195         VCOMPLA         190           GND         94         VCCDA         13         VCOMPLA         190           GND         104         VCCDA         53         VCOMPLB         188           GND         113         VCCDA         63         VCOMPLE         86           GND         136         VCCDA         157         VCOMPLF	GND	21	VCCA	38	VCCPLA	189	
GND         39         VCCA         64           GND         46         VCCA         93           GND         51         VCCA         118           GND         59         VCCA         142           GND         65         VCCA         168           GND         69         VCCA         168           GND         90         VCCA         168           GND         90         VCCA         168           GND         90         VCCA         168           GND         90         VCCA         195           GND         90         VCCA         195           GND         94         VCCDA         168           GND         94         VCCDA         1           VCOMPLB         188         VCOMPLB         188           GND         104         VCCDA         53           VCOMPLE         86         VCOMPLE         86           GND         113         VCCDA         75           GND         136         VCCDA         130           VCOMPLE         167         VCOMPLH         73           GND         164         V	GND	32	VCCA	52	VCCPLB	187	
GND         46         VCCA         93           GND         51         VCCA         118           GND         59         VCCA         142           GND         65         VCCA         168           GND         69         VCCA         168           GND         90         VCCA         168           GND         90         VCCA         168           GND         90         VCCA         195           GND         90         VCCA         195           GND         94         VCCDA         1           GND         94         VCCDA         1           VCOMPLB         188           GND         104         VCCDA         53           VCOMPLC         179           GND         113         VCCDA         63           GND         113         VCCDA         78           VCOMPLF         84           GND         136         VCCDA         157           GND         136         VCCDA         157           GND         164         VCCDA         182           GND         169         VCCDA         202 <td>GND</td> <td>39</td> <td>VCCA</td> <td>64</td> <td>VCCPLC</td> <td>178</td>	GND	39	VCCA	64	VCCPLC	178	
GND         51         VCCA         118         VCCPLE         85           GND         59         VCCA         142         VCCPLF         83           GND         65         VCCA         156         VCCPLF         83           GND         69         VCCA         168         VCCPLF         83           GND         69         VCCA         168         VCCPLF         83           GND         90         VCCA         195         VCCPLH         72           GND         90         VCCA         195         VCCMPLA         190           GND         94         VCCDA         1         VCOMPLA         190           GND         99         VCCDA         26         VCOMPLB         188           GND         104         VCCDA         53         VCOMPLD         177           GND         113         VCCDA         78         VCOMPLE         86           GND         125         VCCDA         130         VCOMPLF         84           GND         136         VCCDA         130         VPUMP         158           GND         155         VCCDA         182         QND	GND	46	VCCA	93	VCCPLD	176	
GND         59         VCCA         142         VCCPLF         83           GND         65         VCCA         156         VCCPLF         83           GND         69         VCCA         168         VCCPLF         83           GND         69         VCCA         168         VCCPLH         72           GND         90         VCCA         195         VCOMPLA         190           GND         94         VCCDA         1         VCOMPLB         188           GND         99         VCCDA         26         VCOMPLB         188           GND         104         VCCDA         53         VCOMPLC         179           GND         113         VCCDA         63         VCOMPLE         86           GND         119         VCCDA         78         VCOMPLE         86           GND         125         VCCDA         105         VCOMPLH         73           GND         143         VCCDA         130         VPUMP         158           GND         150         VCCDA         167         VPUMP         158           GND         169         VCCDA         202         VCOB <td>GND</td> <td>51</td> <td>VCCA</td> <td>118</td> <td>VCCPLE</td> <td>85</td>	GND	51	VCCA	118	VCCPLE	85	
GND         65         VCCA         156         VCCPLG         74           GND         69         VCCA         168         VCCPLH         72           GND         90         VCCA         195         VCOMPLA         190           GND         94         VCCDA         1         VCOMPLA         190           GND         94         VCCDA         26         VCOMPLB         188           GND         104         VCCDA         53         VCOMPLD         177           GND         113         VCCDA         63         VCOMPLE         86           GND         119         VCCDA         78         VCOMPLF         84           GND         125         VCCDA         105         VCOMPLF         84           GND         136         VCCDA         130         VPUMP         158           GND         143         VCCDA         167         VPUMP         158           GND         164         VCCDA         182         VPUMP         158           GND         169         VCCDA         202         193         193	GND	59	VCCA	142	VCCPLF	83	
GND         69         VCCA         168         VCCPLH         72           GND         90         VCCA         195         VCOMPLA         190           GND         94         VCCDA         1         VCOMPLA         190           GND         94         VCCDA         1         VCOMPLB         188           GND         99         VCCDA         26         VCOMPLB         188           GND         104         VCCDA         53         VCOMPLC         179           GND         113         VCCDA         63         VCOMPLE         86           GND         119         VCCDA         78         VCOMPLF         84           GND         125         VCCDA         105         VCOMPLF         84           GND         136         VCCDA         105         VCOMPLH         73           GND         143         VCCDA         130         VPUMP         158           GND         164         VCCDA         182         VPUMP         158           GND         169         VCCDA         202         193         193	GND	65	VCCA	156	VCCPLG	74	
GND         90         VCCA         195         VCOMPLA         190           GND         94         VCCDA         1         VCOMPLB         188           GND         99         VCCDA         26         VCOMPLB         188           GND         104         VCCDA         26         VCOMPLC         179           GND         104         VCCDA         53         VCOMPLD         177           GND         113         VCCDA         63         VCOMPLE         86           GND         119         VCCDA         78         VCOMPLF         84           GND         125         VCCDA         105         VCOMPLF         84           GND         136         VCCDA         105         VCOMPLH         73           GND         143         VCCDA         157         VCOMPLH         73           GND         155         VCCDA         167         VPUMP         158           GND         164         VCCDA         182         193         193	GND	69	VCCA	168	VCCPLH	72	
GND         94         VCCDA         1         VCOMPLB         188           GND         99         VCCDA         26         VCOMPLC         179           GND         104         VCCDA         53         VCOMPLD         177           GND         113         VCCDA         63         VCOMPLD         177           GND         119         VCCDA         78         VCOMPLE         86           GND         125         VCCDA         95         VCOMPLF         84           GND         136         VCCDA         105         VCOMPLH         73           GND         143         VCCDA         130         VPUMP         158           GND         150         VCCDA         167         VPUMP         158           GND         164         VCCDA         182         VPUMP         158           GND         169         VCCDA         202         193         193	GND	90	VCCA	195	VCOMPLA	190	
GND         99         VCCDA         26         VCOMPLC         179           GND         104         VCCDA         53         VCOMPLC         179           GND         104         VCCDA         53         VCOMPLD         177           GND         113         VCCDA         63         VCOMPLE         86           GND         119         VCCDA         78         VCOMPLF         84           GND         125         VCCDA         95         VCOMPLG         75           GND         136         VCCDA         105         VCOMPLH         73           GND         143         VCCDA         150         VCOMPLH         73           GND         150         VCCDA         167         VPUMP         158           GND         164         VCCDA         182         VCMPL         173           GND         169         VCCDA         202         193         193	GND	94	VCCDA	1	VCOMPLB	188	
GND         104         VCCDA         53         VCOMPLD         177           GND         113         VCCDA         63         VCOMPLE         86           GND         119         VCCDA         78         VCOMPLE         86           GND         125         VCCDA         95         VCOMPLG         75           GND         136         VCCDA         105         VCOMPLG         75           GND         143         VCCDA         130         VPUMP         158           GND         150         VCCDA         167         VPUMP         158           GND         164         VCCDA         182         VCOMPL         193	GND	99	VCCDA	26	VCOMPLC	179	
GND         113         VCCDA         63         VCOMPLE         86           GND         119         VCCDA         78         VCOMPLF         84           GND         125         VCCDA         95         VCOMPLF         84           GND         136         VCCDA         105         VCOMPLF         84           GND         136         VCCDA         105         VCOMPLF         117           GND         143         VCCDA         130         VCOMPLH         73           GND         150         VCCDA         157         VPUMP         158           GND         164         VCCDA         182         VCOMPL         193           GND         173         VCCIB0         193         193         193	GND	104	VCCDA	53	VCOMPLD	177	
GND         119         VCCDA         78         VCOMPLF         84           GND         125         VCCDA         95         VCOMPLG         75           GND         136         VCCDA         105         VCOMPLH         73           GND         143         VCCDA         130         VCOMPLH         73           GND         143         VCCDA         130         VPUMP         158           GND         150         VCCDA         167         VPUMP         158           GND         164         VCCDA         182         VCOM         193           GND         173         VCCIB0         193         193         193	GND	113	VCCDA	63	VCOMPLE	86	
GND         125         VCCDA         95         VCOMPLG         75           GND         136         VCCDA         105         VCOMPLG         73           GND         143         VCCDA         130         VCOMPLH         73           GND         143         VCCDA         130         VPUMP         158           GND         150         VCCDA         167         VPUMP         158           GND         164         VCCDA         182         VCOM         164           GND         169         VCCDA         202         193         193	GND	119	VCCDA	78	VCOMPLF	84	
GND         136         VCCDA         105           GND         143         VCCDA         130           GND         143         VCCDA         130           GND         150         VCCDA         157           GND         155         VCCDA         167           GND         164         VCCDA         182           GND         169         VCCIB0         193	GND	125	VCCDA	95	VCOMPLG	75	
GND         143         VCCDA         130         VPUMP         158           GND         150         VCCDA         157           GND         155         VCCDA         167           GND         164         VCCDA         182           GND         169         VCCDA         202           GND         173         VCCIB0         193	GND	136	VCCDA	105	VCOMPLH	73	
GND         150         VCCDA         157           GND         155         VCCDA         167           GND         164         VCCDA         182           GND         169         VCCDA         202           GND         173         VCCIB0         193	GND	143	VCCDA	130	VPUMP	158	
GND         155         VCCDA         167           GND         164         VCCDA         182           GND         169         VCCDA         202           GND         173         VCCIB0         193	GND	150	VCCDA	157			
GND         164         VCCDA         182           GND         169         VCCDA         202           GND         173         VCCIB0         193	GND	155	VCCDA	167			
GND         169         VCCDA         202           GND         173         VCCIB0         193	GND	164	VCCDA	182			
GND 173 VCCIB0 193	GND	169	VCCDA	202			
	GND	173	VCCIB0	193			



Package Pin Assignments

CQ256



## Note

For Package Manufacturing and Environmental information, visit the Resource center at http://www.microsemi.com/soc/products/solutions/package/docs.aspx.



Package Pin Assignments

CQ352				
AX1000 Function	Pin Number			
VCCDA	346			
VCCIB0	321			
VCCIB0	333			
VCCIB0	344			
VCCIB1	273			
VCCIB1	285			
VCCIB1	297			
VCCIB2	227			
VCCIB2	239			
VCCIB2	245			
VCCIB2	257			
VCCIB3	185			
VCCIB3	197			
VCCIB3	203			
VCCIB3	215			
VCCIB4	144			
VCCIB4	156			
VCCIB4	168			
VCCIB5	96			
VCCIB5	108			
VCCIB5	120			
VCCIB6	50			
VCCIB6	62			
VCCIB6	68			
VCCIB6	80			
VCCIB7	8			
VCCIB7	20			
VCCIB7	26			
VCCIB7	38			
VCCPLA	317			
VCCPLB	315			
VCCPLC	303			
VCCPLD	301			
VCCPLE	140			
VCCPLF	138			

CQ352				
AX1000 Function	Pin Number			
VCCPLG	126			
VCCPLH	124			
VCOMPLA	318			
VCOMPLB	316			
VCOMPLC	304			
VCOMPLD	302			
VCOMPLE	141			
VCOMPLF	139			
VCOMPLG	127			
VCOMPLH	125			
VPUMP	267			



Revision	Changes	Page
Revision 12 (v2.4)	Revised ordering information and timing data to reflect phase out of $-3$ speed grade options.	
	Table 2-3 was updated.	2
Revision 11 (v2.3)	The "Packaging Data" section is new.	iv
	Table 2-2 was updated.	2-1
	"VCCDA Supply Voltage" was updated.	2-9
	"PRA/B/C/D Probe A, B, C and D" was updated.	2-10
	The "User I/Os" was updated.	2-11
Revision 10	Figure 1-3 was updated.	1-2
(v2.2)	Table 2-2 was updated.	2-1
	The "Power-Up/Down Sequence" section was updated.	2-1
	Table 2-4 was updated.	2-3
	Table 2-5 was updated.	2-4
	The "Timing Characteristics" section was added.	2-7
	Table 2-7 was updated.	2-7
	Figure 2-1 was updated.	2-8
	The External Setup and Clock-to-Out (Pad-to-Pad) equations in the "Hardwired Clock – Using LVTTL 24 mA High Slew Clock I/O" section were updated.	2-8
	The External Setup and Clock-to-Out (Pad-to-Pad) in the "Routed Clock – Using LVTTL 24 mA High Slew Clock I/O" section were updated.	2-8
	The "Global Pins" section was updated.	2-10
	The "User I/Os" section was updated.	2-11
	Table 2-17 was updated.	2-19
	Figure 2-8 was updated.	2-20
	Figure 2-13 and Figure 2-14 were updated.	2-24
	The following timing parameters were renamed in I/O timing characteristic tables from Table 2-22 to Table 2-60:	2-26 to 2-52
	t <sub>IOCLKQ</sub> > t <sub>ICLKQ</sub>	
	tioclky > toclkq	
	Timing numbers were updated from Table 2-22 to Table 2-78.	2-26 to 2-69
	The "R-Cell" section was updated.	2-58
	Figure 2-59 was updated.	2-89
	Figure 2-60 was updated.	2-89
	Figure 2-67 was updated.	2-100
	Figure 2-68 was updated.	2-101
	Table 2-89 to Table 2-93 were updated.	2-90 to 2-94
	Table 2-98 to Table 2-102 were updated.	2-102 to 2-106



Datasheet Information

Revision	Changes	Page		
Revision 3 (continued)	The timing characteristics tables from pages 2-26 to 2-60 were updated.	2-26 to 2-60		
The "Global Resources" section was updated.				
	The timing characteristics tables from pages 2-102 to 2-103 were updated.	2-102 to 2-103		
	The "PQ208", "FG256", and "FG324" tables are new.	3-9,3-16, 3-84		