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Understanding Embedded - FPGAs (Field Programmable Gate Array)

Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling customized functionality tailored to specific applications. This reprogrammability allows developers to iterate designs quickly and implement complex functions without the need for custom hardware.

Applications of Embedded - FPGAs

The versatility of Embedded - FPGAs makes them indispensable in numerous fields. In telecommunications.

Details	
Product Status	Obsolete
Number of LABs/CLBs	4224
Number of Logic Elements/Cells	-
Total RAM Bits	55296
Number of I/O	115
Number of Gates	250000
Voltage - Supply	1.425V ~ 1.575V
Mounting Type	Surface Mount
Operating Temperature	0°C ~ 70°C (TA)
Package / Case	208-BFQFP
Supplier Device Package	208-PQFP (28x28)
Purchase URL	https://www.e-xfl.com/product-detail/microsemi/ax250-1pqg208

Table 2-8 • **I/O Standards Supported by the Axcelerator Family**

I/O Standard	Input/Output Supply Voltage (VCCI)	Input Reference Voltage (VREF)	Board Termination Voltage (VTT)
LVTTL	3.3	N/A	N/A
LVCMOS 2.5 V	2.5	N/A	N/A
LVCMOS 1.8 V	1.8	N/A	N/A
LVCMOS 1.5 V (JDEC8-11)	1.5	N/A	N/A
3.3V PCI/PCI-X	3.3	N/A	N/A
GTL+ 3.3 V	3.3	1.0	1.2
GTL+ 2.5 V*	2.5	1.0	1.2
HSTL Class 1	1.5	0.75	0.75
SSTL3 Class 1 and II	3.3	1.5	1.5
SSTL2 Class1 and II	2.5	1.25	1.25
LVDS	2.5	N/A	N/A
LVPECL	3.3	N/A	N/A

*Note: *2.5 V GTL+ is not supported across the full military temperature range.*

Table 2-9 • **Supply Voltages**

VCCA	VCCI	Input Tolerance	Output Drive Level
1.5 V	1.5 V	3.3 V	1.5 V
1.5 V	1.8 V	3.3 V	1.8 V
1.5 V	2.5 V	3.3 V	2.5 V
1.5 V	3.3 V	3.3 V	3.3 V

Table 2-10 • **I/O Features Comparison**

I/O Assignment	Clamp Diode	Hot Insertion	5 V Tolerance	Input Buffer	Output Buffer
LVTTL	No	Yes	Yes[1]	Enabled/Disabled	
3.3 V PCI, 3.3 V PCI-X	Yes	No	Yes[1, 2]	Enabled/Disabled	
LVCMOS 2.5 V	No	Yes	No	Enabled/Disabled	
LVCMOS 1.8 V	No	Yes	No	Enabled/Disabled	
LVCMOS 1.5 V (JESD8-11)	No	Yes	No	Enabled/Disabled	
Voltage-Referenced Input Buffer	No	Yes	No	Enabled/Disabled	
Differential, LVDS/LVPECL, Input	No	Yes	No	Enabled	Disabled[3]
Differential, LVDS/LVPECL, Output	No	Yes	No	Disabled	Enabled[4]

Notes:

1. *Can be implemented with an IDT bus switch.*
2. *Can be implemented with an external resistor.*
3. *The OE input of the output buffer must be deasserted permanently (handled by software).*
4. *The OE input of the output buffer must be asserted permanently (handled by software).*

5 V Tolerance

There are two schemes to achieve 5 V tolerance:

1. 3.3 V PCI and 3.3 V PCI-X are the only I/O standards that directly allow 5 V tolerance. To implement this, an internal clamp diode between the input pad and the VCCI pad is enabled so that the voltage at the input pin is clamped, as shown in EQ 3:

Vinput = VCCI + Vdiode = 3.3 V + 0.7 V = 4.0 V

EQ 3

The internal VCCI clamp diode is only enabled while the device is powered on, so the voltage at the input will not be clamped if the VCCI or VCCA are powered off. An external series resistor (~100 Ω) is required between the input pin and the 5 V signal source to limit the current to less than 20 mA (Figure 2-3). The 100 Ω resistor was chosen to meet the input Tr/Tf requirement (Table 2-19 on page 2-21). The GND clamp diode is available for all I/O standards and always enabled.

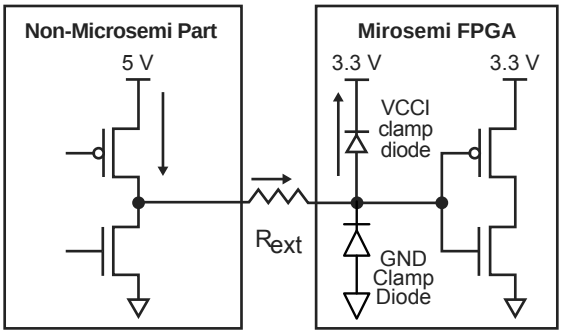

Figure 2-3 • **Use of an External Resistor for 5 V Tolerance**

2. 5 V tolerance can also be achieved with 3.3 V I/O standards (3.3 V PCI, 3.3 V PCI-X, and LVTTL) using a bus-switch product (e.g. IDTQS32X2384). This will convert the 5 V signal to a 3.3 V signal with minimum delay (Figure 2-4).

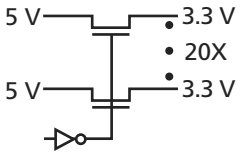

Figure 2-4 • **Bus Switch IDTQS32X2384**

Simultaneous Switching Outputs (SSO)

When multiple output drivers switch simultaneously, they induce a voltage drop in the chip/package power distribution. This simultaneous switching momentarily raises the ground voltage within the device relative to the system ground. This apparent shift in the ground potential to a non-zero value is known as simultaneous switching noise (SSN) or more commonly, ground bounce.

SSN becomes more of an issue in high pin count packages and when using high performance devices such as the Axcelerator family. Based upon testing, Microsemi recommends that users not exceed eight simultaneous switching outputs (SSO) per each VCCI/GND pair. To ease this potential burden on designers, Microsemi has designed all of the Axcelerator BGAs[3] to not exceed this limit with the exception of the CS180, which has an I/O to VCCI/GND pair ratio of nine to one.

Please refer to the *Simultaneous Switching Noise and Signal Integrity* application note for more information.

3. The user should note that in Bank 8 of both AX1000-FG484 and AX500-FG484, there are local violations of this 8:1 ratio.

I/O Banks and Compatibility

Since each I/O bank has its own user-assigned input reference voltage (VREF) and an input/output supply voltage (VCCI), only I/Os with compatible standards can be assigned to the same bank.

Table 2-11 shows the compatible I/O standards for a common VREF (for voltage-referenced standards). Similarly, Table 2-12 shows compatible standards for a common VCCI.

Table 2-11 • **Compatible I/O Standards for Different VREF Values**

VREF	Compatible Standards
1.5 V	SSTL 3 (Class I and II)
1.25 V	SSTL 2 (Class I and II)
1.0 V	GTL+ (2.5V and 3.3V Outputs)
0.75 V	HSTL (Class I)

Table 2-12 • **Compatible I/O Standards for Different VCCI Values**

VCCI[1]	Compatible Standards	VREF
3.3 V	LVTTL, PCI, PCI-X, LVPECL, GTL+ 3.3 V	1.0
3.3 V	SSTL 3 (Class I and II), LVTTL, PCI, LVPECL	1.5
2.5 V	LVCMOS 2.5 V, GTL+ 2.5 V, LVDS[2]	1.0
2.5 V	LVCMOS 2.5 V, SSTL 2 (Classes I and II), LVDS[2]	1.25
1.8 V	LVCMOS 1.8 V	N/A
1.5 V	LVCMOS 1.5 V, HSTL Class I	0.75

Notes:

1. *VCCI is used for both inputs and outputs*
2. *VCCI tolerance is* ±5%

I/O Module Timing Characteristics

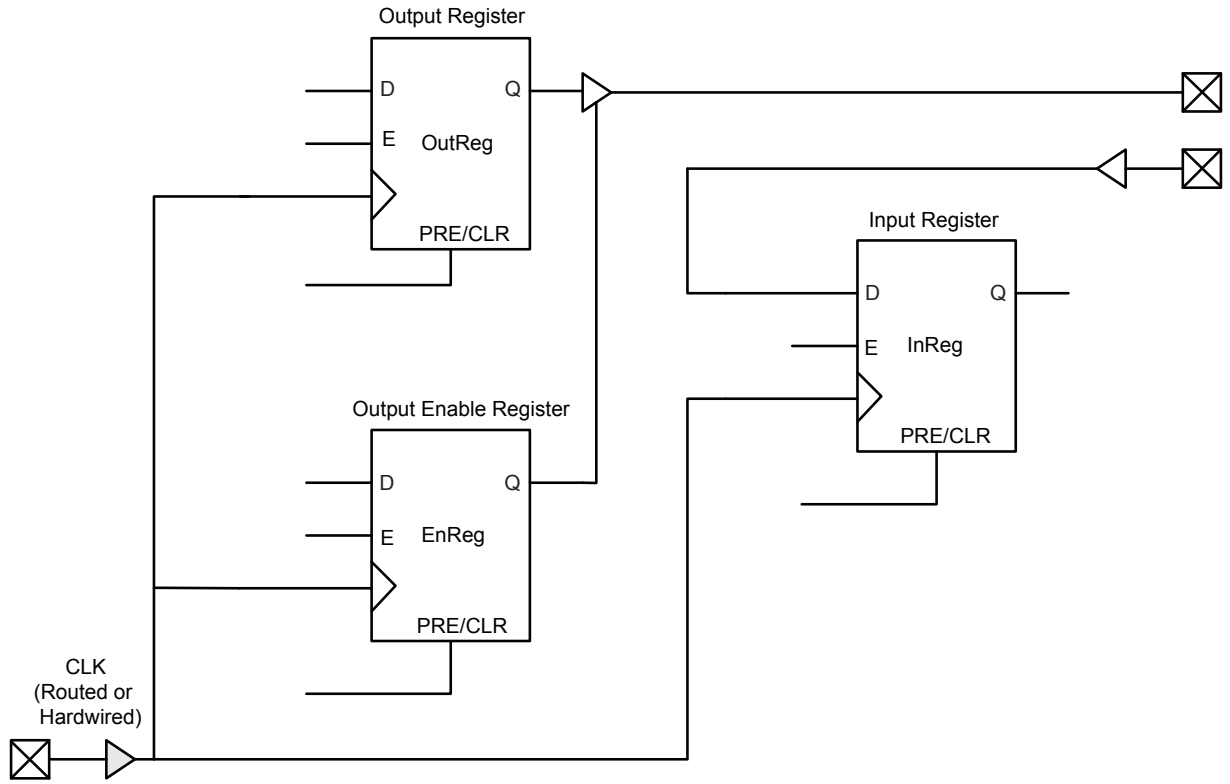

Figure 2-11 • **Timing Model**

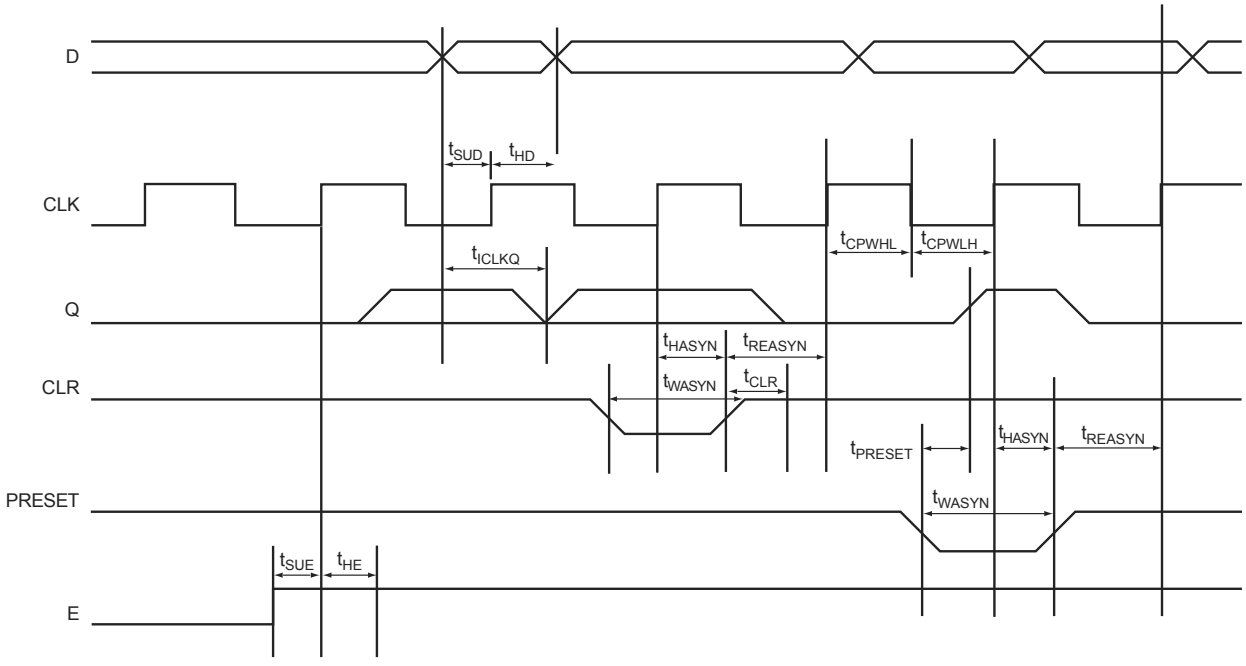

Figure 2-12 • **Input Register Timing Characteristics**

***Table 2-22* • 3.3 V LVTTL I/O Module**
Worst-Case Commercial Conditions VCCA = 1.425 V, VCCI = 3.0 V, T_J = 70°C (continued)

		–2 Speed		–1 Speed		Std Speed		
Parameter	**Description**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Units**
LVTTL Output Drive Strength = 1 (8 mA) / High Slew Rate								
t_{DP}	Input Buffer		1.68		1.92		2.26	ns
t_{PY}	Output Buffer		4.23		4.81		5.66	ns
t_{ENZL}	Enable to Pad Delay through the Output Buffer—Z to Low		4.64		5.28		6.21	ns
t_{ENZH}	Enable to Pad Delay through the Output Buffer—Z to High		4.23		4.81		5.66	ns
t_{ENLZ}	Enable to Pad Delay through the Output Buffer—Low to Z		1.89		1.91		1.91	ns
t_{ENHZ}	Enable to Pad Delay through the Output Buffer—High to Z		2.01		2.02		2.03	ns
t_{IOCLKQ}	Sequential Clock-to-Q for the I/O Input Register		0.67		0.77		0.90	ns
t_{IOCLKY}	Clock-to-output Y for the I/O Output Register and the I/O Enable Register		0.67		0.77		0.90	ns
t_{SUD}	Data Input Set-Up		0.23		0.27		0.31	ns
t_{SUE}	Enable Input Set-Up		0.26		0.30		0.35	ns
t_{HD}	Data Input Hold		0.00		0.00		0.00	ns
t_{HE}	Enable Input Hold		0.00		0.00		0.00	ns
t_{CPWHL}	Clock Pulse Width High to Low	0.39		0.39		0.39		ns
t_{CPWLH}	Clock Pulse Width Low to High	0.39		0.39		0.39		ns
t_{WASYN}	Asynchronous Pulse Width	0.37		0.37		0.37		ns
t_{REASYN}	Asynchronous Recovery Time		0.13		0.15		0.17	ns
t_{HASYN}	Asynchronous Removal Time		0.00		0.00		0.00	ns
t_{CLR}	Asynchronous Clear-to-Q		0.23		0.27		0.31	ns
t_{PRESET}	Asynchronous Preset-to-Q		0.23		0.27		0.31	ns

1.5 V LVCMOS (JESD8-11)

Low-Voltage Complementary Metal-Oxide Semiconductor for 1.5 V is an extension of the LVCMOS standard (JESD8-5) used for general-purpose 1.5 V applications. It uses a 3.3 V tolerant CMOS input buffer and a push-pull output buffer.

***Table 2-29* • DC Input and Output Levels**

VIL		VIH		VOL	VOH	IOL	IOH
Min., V	**Max., V**	**Min., V**	**Max., V**	**Max., V**	**Min., V**	**mA**	**mA**
–0.3	0.35 VCCI	0.65 VCCI	3.6	0.4	VCCI – 0.4	8 mA	–8 mA

AC Loadings

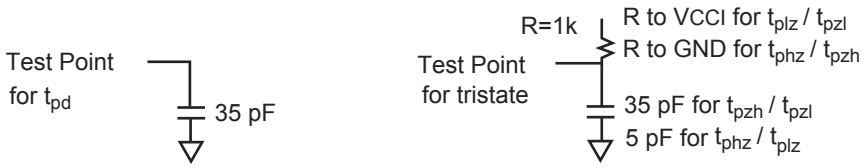

***Table 2-30* • AC Test Loads**

***Table 2-31* • AC Waveforms, Measuring Points, and Capacitive Loads**

Input Low (V)	Input High (V)	Measuring Point* (V)	VREF (typ) (V)	C_{load} (pF)
0	1.5	$0.5V_{CCI}$	N/A	35

*Note: * Measuring Point = VTRIP*

***Table 2-57* • AC Waveforms, Measuring Points, and Capacitive Loads**

Input Low (V)	Input High (V)	Measuring Point* (V)
1.2 – 0.125	1.2 + 0.125	1.2

*Note: * Measuring Point = VTRIP*

Timing Characteristics

***Table 2-58* • LVDS I/O Module**
Worst-Case Commercial Conditions VCCA = 1.425 V, VCCI = 2.3 V, T_J = 70°C

		–2 Speed		–1 Speed		Std Speed		
Parameter	**Description**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Units**
LVDS Output Module Timing								
t_{DP}	Input Buffer		1.80		2.05		2.41	ns
t_{PY}	Output Buffer		2.32		2.64		3.11	ns
t_{ICLKQ}	Clock-to-Q for the I/O input register		0.67		0.77		0.90	ns
t_{OCLKQ}	Clock-to-Q for the I/O output register and the I/O enable register		0.67		0.77		0.90	ns
t_{SUD}	Data Input Set-Up		0.23		0.27		0.31	ns
t_{SUE}	Enable Input Set-Up		0.26		0.30		0.35	ns
t_{HD}	Data Input Hold		0.00		0.00		0.00	ns
t_{HE}	Enable Input Hold		0.00		0.00		0.00	ns
t_{CPWHL}	Clock Pulse Width High to Low	0.39		0.39		0.39		ns
t_{CPWLH}	Clock Pulse Width Low to High	0.39		0.39		0.39		ns
t_{WASYN}	Asynchronous Pulse Width	0.37		0.37		0.37		ns
t_{REASYN}	Asynchronous Recovery Time		0.13		0.15		0.17	ns
t_{HASYN}	Asynchronous Removal Time		0.00		0.00		0.00	ns
t_{CLR}	Asynchronous Clear-to-Q		0.23		0.27		0.31	ns
t_{PRESET}	Asynchronous Preset-to-Q		0.23		0.27		0.31	ns

***Table 2-90* • Two RAM Blocks Cascaded**
Worst-Case Commercial Conditions VCCA = 1.425 V, VCCI = 3.0 V, T_J = 70°C

		–2 Speed		–1 Speed		Std Speed		
Parameter	**Description**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Units**
Write Mode								
t_{WDASU}	Write Data Setup vs. WCLK		1.39		1.59		1.87	ns
t_{WDAHD}	Write Data Hold vs. WCLK		0.00		0.00		0.00	ns
t_{WADSU}	Write Address Setup vs. WCLK		1.39		1.59		1.87	ns
t_{WADHD}	Write Address Hold vs. WCLK		0.00		0.00		0.00	ns
t_{WENSU}	Write Enable Setup vs. WCLK		1.39		1.59		1.87	ns
t_{WENHD}	Write Enable Hold vs. WCLK		0.00		0.00		0.00	ns
t_{WCKH}	WCLK Minimum High Pulse Width	0.75		0.75		0.75		ns
t_{WCLK}	WCLK Minimum Low Pulse Width	1.76		1.76		1.76		ns
t_{WCKP}	WCLK Minimum Period	2.51		2.51		2.51		ns
Read Mode								
t_{RADSU}	Read Address Setup vs. RCLK		1.71		1.94		2.28	ns
t_{RADHD}	Read Address Hold vs. RCLK		0.00		0.00		0.00	ns
t_{RENSU}	Read Enable Setup vs. RCLK		1.71		1.94		2.28	ns
t_{RENHD}	Read Enable Hold vs. RCLK		0.00		0.00		0.00	ns
$t_{RCK2RD1}$	RCLK-To-OUT (Pipelined)		1.43		1.63		1.92	ns
$t_{RCK2RD2}$	RCLK-To-OUT (Non-Pipelined)		2.26		2.58		3.03	ns
t_{RCLKH}	RCLK Minimum High Pulse Width	0.73		0.73		0.73		ns
t_{RCLKL}	RCLK Minimum Low Pulse Width	1.89		1.89		1.89		ns
t_{RCKP}	RCLK Minimum Period	2.62		2.62		2.62		ns

Note: Timing data for these two cascaded RAM blocks uses a depth of 8,192. For all other combinations, use Microsemi's timing software.

FG256	
AX250 Function	**Pin Number**
Bank 6	
IO91NB6F6	L4
IO91PB6F6	M4
IO92NB6F6	L3
IO92PB6F6	M3
IO94NB6F6	P2
IO94PB6F6	N2
IO97NB6F6	J4
IO97PB6F6	K4
IO98NB6F6	N1
IO98PB6F6	P1
IO100NB6F6	L2
IO100PB6F6	M2
IO102NB6F6	L1
IO102PB6F6	M1
IO103NB6F6	J3
IO103PB6F6	K3
IO104NB6F6	J2
IO104PB6F6	K2
Bank 7	
IO107NB7F7	J1
IO107PB7F7	K1
IO108NB7F7	G2
IO108PB7F7	H2
IO111NB7F7	G3
IO111PB7F7	H3
IO112NB7F7	E1
IO112PB7F7	F1
IO113NB7F7	G1
IO114NB7F7	E2
IO114PB7F7	F2
IO115NB7F7	G4
IO115PB7F7	H4
IO116NB7F7	C1
IO116PB7F7	D1

FG256	
AX250 Function	**Pin Number**
IO117NB7F7	C2
IO117PB7F7	B1
IO118NB7F7	D2
IO118PB7F7	D3
IO119NB7F7	E3
IO119PB7F7	F3
Dedicated I/O	
VCCDA	E4
GND	A1
GND	A16
GND	B15
GND	B2
GND	D15
GND	E12
GND	E5
GND	F11
GND	F6
GND	G10
GND	G7
GND	G8
GND	G9
GND	H10
GND	H7
GND	H8
GND	H9
GND	J10
GND	J7
GND	J8
GND	J9
GND	K10
GND	K7
GND	K8
GND	K9
GND	L11
GND	L6

FG256	
AX250 Function	**Pin Number**
GND	M12
GND	M5
GND	P13
GND	P3
GND	R15
GND	R2
GND	T1
GND	T16
GND/LP	D4
PRA	D8
PRB	C8
PRC	N9
PRD	P9
TCK	D5
TDI	C6
TDO	C4
TMS	C3
TRST	C5
VCCA	D14
VCCA	F10
VCCA	F4
VCCA	F7
VCCA	F8
VCCA	F9
VCCA	G11
VCCA	G6
VCCA	H11
VCCA	H6
VCCA	J11
VCCA	J6
VCCA	K11
VCCA	K6
VCCA	L10
VCCA	L7
VCCA	L8

FG484	
AX500 Function	Pin Number
IO54PB2F5	H22
IO55NB2F5	L17
IO55PB2F5	K17
IO56NB2F5	K21
IO56PB2F5	K22
IO58NB2F5	L20
IO58PB2F5	K20
IO59NB2F5	L18
IO59PB2F5	K18
IO60NB2F5	M21
IO60PB2F5	L21
IO61NB2F5	L16
IO61PB2F5	K16
IO62NB2F5	M19
IO62PB2F5	L19
Bank 3	
IO63NB3F6	N16
IO63PB3F6	M16
IO64NB3F6	P22
IO64PB3F6	N22
IO65NB3F6	N20
IO65PB3F6	M20
IO66NB3F6	P21
IO66PB3F6	N21
IO67NB3F6	N18
IO67PB3F6	N19
IO68NB3F6	T22
IO68PB3F6	R22
IO69NB3F6	N17
IO69PB3F6	M17
IO70NB3F6	T21
IO70PB3F6	R21
IO71NB3F6	P18
IO71PB3F6	P19
IO72NB3F6	R20

FG484	
AX500 Function	Pin Number
IO72PB3F6	P20
IO73PB3F6	R19
IO74NB3F7	V21
IO74PB3F7	U21
IO75NB3F7	V22
IO75PB3F7	U22
IO76NB3F7	U20
IO76PB3F7	T20
IO77NB3F7	R17
IO77PB3F7	P17
IO78NB3F7	W21
IO78PB3F7	W22
IO79NB3F7	T18
IO79PB3F7	R18
IO80NB3F7	W20
IO80PB3F7	V20
IO81NB3F7	U19
IO81PB3F7	T19
IO82NB3F7	U18
IO82PB3F7	V19
IO83NB3F7	R16
IO83PB3F7	P16
Bank 4	
IO84NB4F8	AB18
IO84PB4F8	AB19
IO85NB4F8	T15
IO85PB4F8	T16
IO86NB4F8	AA18
IO86PB4F8	AA19
IO87NB4F8	W17
IO87PB4F8	V17
IO88NB4F8	Y19
IO88PB4F8	W18
IO89NB4F8	U14
IO89PB4F8	U15

FG484	
AX500 Function	Pin Number
IO90NB4F8	Y17
IO90PB4F8	Y18
IO91NB4F8	V15
IO91PB4F8	V16
IO92PB4F8	AB17
IO93NB4F8	Y15
IO93PB4F8	Y16
IO94NB4F9	AA16
IO94PB4F9	AA17
IO95NB4F9	AB14
IO95PB4F9	AB15
IO96NB4F9	W15
IO96PB4F9	W16
IO97NB4F9	AA13
IO97PB4F9	AB13
IO98NB4F9	AA14
IO98PB4F9	AA15
IO100NB4F9	Y14
IO100PB4F9	W14
IO101NB4F9	Y12
IO101PB4F9	Y13
IO102NB4F9	AA11
IO102PB4F9	AA12
IO103NB4F9/CLKEN	V12
IO103PB4F9/CLKEP	V13
IO104NB4F9/CLKFN	W11
IO104PB4F9/CLKFP	W12
Bank 5	
IO105NB5F10/CLKGN	U10
IO105PB5F10/CLKGP	U11
IO106NB5F10/CLKHN	V9
IO106PB5F10/CLKHP	V10
IO107NB5F10	Y10
IO107PB5F10	Y11
IO108NB5F10	AA9

FG484	
AX500 Function	**Pin Number**
IO108PB5F10	AA10
IO110NB5F10	AB9
IO110PB5F10	AB10
IO111NB5F10	Y8
IO111PB5F10	Y9
IO112NB5F10	AB7
IO113NB5F10	W8
IO113PB5F10	W9
IO114NB5F11	AA7
IO114PB5F11	AA8
IO115NB5F11	AB5
IO115PB5F11	AB6
IO116NB5F11	Y6
IO116PB5F11	Y7
IO117NB5F11	U8
IO117PB5F11	U9
IO118NB5F11	AA5
IO118PB5F11	AA6
IO119NB5F11	AA4
IO119PB5F11	AB4
IO120NB5F11	Y4
IO120PB5F11	Y5
IO121NB5F11	W6
IO121PB5F11	W7
IO122NB5F11	V3
IO122PB5F11	W3
IO123NB5F11	T7
IO123PB5F11	T8
IO124NB5F11	V4
IO124PB5F11	W5
IO125NB5F11	V6
IO125PB5F11	V7
Bank 6	
IO126NB6F12	V2
IO126PB6F12	W2

FG484	
AX500 Function	**Pin Number**
IO127NB6F12	P7
IO127PB6F12	R7
IO128NB6F12	V1
IO128PB6F12	W1
IO129NB6F12	U5
IO129PB6F12	T5
IO130NB6F12	T1
IO130PB6F12	U1
IO131NB6F12	P6
IO131PB6F12	R6
IO132NB6F12	T4
IO132PB6F12	U4
IO133NB6F12	U2
IO134NB6F12	T3
IO134PB6F12	U3
IO135NB6F12	P5
IO135PB6F12	R5
IO136NB6F13	R2
IO136PB6F13	T2
IO138NB6F13	P4
IO138PB6F13	R4
IO139NB6F13	N2
IO139PB6F13	P2
IO140NB6F13	P3
IO140PB6F13	R3
IO141NB6F13	M6
IO141PB6F13	N6
IO142NB6F13	P1
IO142PB6F13	R1
IO143NB6F13	M5
IO143PB6F13	N5
IO144NB6F13	M4
IO144PB6F13	N4
IO145NB6F13	M7
IO145PB6F13	N7

FG484	
AX500 Function	**Pin Number**
IO146NB6F13	M3
IO146PB6F13	N3
Bank 7	
IO147NB7F14	K7
IO147PB7F14	L7
IO148NB7F14	M2
IO148PB7F14	N1
IO149NB7F14	K5
IO149PB7F14	L5
IO150NB7F14	L3
IO150PB7F14	L2
IO151NB7F14	K6
IO151PB7F14	L6
IO152NB7F14	K2
IO152PB7F14	K1
IO153NB7F14	K4
IO153PB7F14	K3
IO154NB7F14	H3
IO154PB7F14	J3
IO155NB7F14	H5
IO155PB7F14	J5
IO156NB7F14	H4
IO156PB7F14	J4
IO157NB7F14	H2
IO157PB7F14	J2
IO158NB7F15	H1
IO158PB7F15	J1
IO159NB7F15	F1
IO159PB7F15	G1
IO160NB7F15	F2
IO160PB7F15	G2
IO161NB7F15	H6
IO161PB7F15	J6
IO162NB7F15	F3
IO162PB7F15	G3

FG484	
AX1000 Function	**Pin Number**
VCCPLA	F10
VCCPLB	G9
VCCPLC	D13
VCCPLD	G13
VCCPLE	U13
VCCPLF	T14
VCCPLG	W10
VCCPLH	T10
VCCDA	AB16
VCCDA	AB8
VCCDA	C10
VCCDA	C11
VCCDA	C14
VCCDA	D14
VCCDA	D5
VCCDA	F16
VCCDA	G12
VCCDA	L4
VCCDA	M18
VCCDA	T11
VCCDA	T17
VCCDA	U7
VCCDA	V14
VCCDA	V8
VCCIB0	A3
VCCIB0	B3
VCCIB0	H10
VCCIB0	H11
VCCIB0	H9
VCCIB1	A20
VCCIB1	B20
VCCIB1	H12
VCCIB1	H13
VCCIB1	H14
VCCIB2	C21

FG484	
AX1000 Function	**Pin Number**
VCCIB2	C22
VCCIB2	J15
VCCIB2	K15
VCCIB2	L15
VCCIB3	M15
VCCIB3	N15
VCCIB3	P15
VCCIB3	Y21
VCCIB3	Y22
VCCIB4	AA20
VCCIB4	AB20
VCCIB4	R12
VCCIB4	R13
VCCIB4	R14
VCCIB5	AA3
VCCIB5	AB3
VCCIB5	R10
VCCIB5	R11
VCCIB5	R9
VCCIB6	M8
VCCIB6	N8
VCCIB6	P8
VCCIB6	Y1
VCCIB6	Y2
VCCIB7	C1
VCCIB7	C2
VCCIB7	J8
VCCIB7	K8
VCCIB7	L8
VCOMPLA	D10
VCOMPLB	G10
VCOMPLC	E12
VCOMPLD	G14
VCOMPLE	W13
VCOMPLF	T13

FG484	
AX1000 Function	**Pin Number**
VCOMPLG	V11
VCOMPLH	T9
VPUMP	D17

FG676	
AX500 Function	Pin Number
IO51NB2F4	L20
IO51PB2F4	L21
IO52NB2F5	K26
IO52PB2F5	J26
IO53NB2F5	L23
IO53PB2F5	L22
IO54NB2F5	L24
IO54PB2F5	K24
IO55NB2F5	M20
IO55PB2F5	M21
IO56NB2F5	L26
IO56PB2F5	L25
IO57NB2F5	M23
IO57PB2F5	M22
IO58NB2F5	M26
IO58PB2F5	M25
IO59NB2F5	N22
IO59PB2F5	N23
IO60NB2F5	N24
IO60PB2F5	M24
IO61NB2F5	N20
IO61PB2F5	N21
IO62NB2F5	P25
IO62PB2F5	N25
Bank 3	
IO63NB3F6	T26
IO63PB3F6	R26
IO64NB3F6	R24
IO64PB3F6	P24
IO65NB3F6	P20
IO65PB3F6	P21
IO66NB3F6	T25
IO66PB3F6	R25
IO67NB3F6	T23
IO67PB3F6	R23

FG676	
AX500 Function	Pin Number
IO68NB3F6	V26
IO68PB3F6	U26
IO69NB3F6	V25
IO69PB3F6	U25
IO70NB3F6	Y25
IO70PB3F6	W25
IO71NB3F6	W24
IO71PB3F6	V24
IO72NB3F6	V23
IO72PB3F6	U23
IO73NB3F6	T21
IO73PB3F6	T20
IO74NB3F7	AA26
IO74PB3F7	Y26
IO75NB3F7	AA24
IO75PB3F7	Y24
IO76NB3F7	Y23
IO76PB3F7	W23
IO77NB3F7	V21
IO77PB3F7	U21
IO78NB3F7	AB25
IO78PB3F7	AA25
IO79NB3F7	AC26
IO79PB3F7	AB26
IO80NB3F7	AC24
IO80PB3F7	AB24
IO81NB3F7	AB23
IO81PB3F7	AA23
IO82NB3F7	AA22
IO82PB3F7	Y22
IO83NB3F7	AE26
IO83PB3F7	AD26
Bank 4	
IO84NB4F8	AB21
IO84PB4F8	AA21

FG676	
AX500 Function	Pin Number
IO85NB4F8	AE23
IO85PB4F8	AE24
IO86NB4F8	AC21
IO86PB4F8	AC22
IO87NB4F8	AF22
IO87PB4F8	AF23
IO88NB4F8	AD22
IO88PB4F8	AD23
IO89NB4F8	AC19
IO89PB4F8	AC20
IO90NB4F8	AE21
IO90PB4F8	AE22
IO91NB4F8	AA17
IO91PB4F8	AA18
IO92NB4F8	AD20
IO92PB4F8	AD21
IO93NB4F8	AF20
IO93PB4F8	AF21
IO94NB4F9	AE19
IO94PB4F9	AE20
IO95NB4F9	AC17
IO95PB4F9	AC18
IO96NB4F9	AD18
IO96PB4F9	AD19
IO97NB4F9	AA16
IO97PB4F9	Y16
IO98NB4F9	AE17
IO98PB4F9	AE18
IO99NB4F9	AC16
IO99PB4F9	AB16
IO100NB4F9	AF17
IO100PB4F9	AF18
IO101NB4F9	AA15
IO101PB4F9	Y15
IO102NB4F9	AC15

FG676	
AX500 Function	Pin Number
IO102PB4F9	AB15
IO103NB4F9/CLKEN	AE16
IO103PB4F9/CLKEP	AF16
IO104NB4F9/CLKFN	AE14
IO104PB4F9/CLKFP	AE15
Bank 5	
IO105NB5F10/CLKGN	AE12
IO105PB5F10/CLKGP	AE13
IO106NB5F10/CLKHN	AE11
IO106PB5F10/CLKHP	AF11
IO107NB5F10	Y12
IO107PB5F10	AA13
IO108NB5F10	AC12
IO108PB5F10	AB12
IO109NB5F10	AC10
IO109PB5F10	AC11
IO110NB5F10	AF9
IO110PB5F10	AF10
IO111NB5F10	Y11
IO111PB5F10	AA12
IO112NB5F10	AE9
IO112PB5F10	AE10
IO113NB5F10	AC9
IO113PB5F10	AD9
IO114NB5F11	AF6
IO114PB5F11	AF7
IO115NB5F11	AA10
IO115PB5F11	AB10
IO116NB5F11	AE7
IO116PB5F11	AE8
IO117NB5F11	AD7
IO117PB5F11	AD8
IO118NB5F11	AC7
IO118PB5F11	AC8
IO119NB5F11	AD6

FG676	
AX500 Function	Pin Number
IO119PB5F11	AE6
IO120NB5F11	AE5
IO120PB5F11	AF5
IO121NB5F11	AF4
IO121PB5F11	AE4
IO122NB5F11	AC5
IO122PB5F11	AC6
IO123NB5F11	AD4
IO123PB5F11	AD5
IO124NB5F11	AB6
IO124PB5F11	AB7
IO125NB5F11	AE3
IO125PB5F11	AF3
Bank 6	
IO126NB6F12	AB3
IO126PB6F12	AC3
IO127NB6F12	AA2
IO127PB6F12	AB2
IO128NB6F12	AC2
IO128PB6F12	AD2
IO129NB6F12	Y1
IO129PB6F12	AA1
IO130NB6F12	Y3
IO130PB6F12	AA3
IO131NB6F12	U6
IO131PB6F12	V6
IO132NB6F12	W2
IO132PB6F12	Y2
IO133NB6F12	V4
IO133PB6F12	W4
IO134NB6F12	V3
IO134PB6F12	W3
IO135NB6F12	V1
IO135PB6F12	V2
IO136NB6F13	U4

FG676	
AX500 Function	Pin Number
IO136PB6F13	U5
IO137NB6F13	T6
IO137PB6F13	T7
IO138NB6F13	T5
IO138PB6F13	T4
IO139NB6F13	R6
IO139PB6F13	R7
IO140NB6F13	T3
IO140PB6F13	U3
IO141NB6F13	U1
IO141PB6F13	U2
IO142NB6F13	R2
IO142PB6F13	T2
IO143NB6F13	P3
IO143PB6F13	R3
IO144NB6F13	P5
IO144PB6F13	P4
IO145NB6F13	P6
IO145PB6F13	P7
IO146NB6F13	R1
IO146PB6F13	T1
Bank 7	
IO147NB7F14	N6
IO147PB7F14	N7
IO148NB7F14	N5
IO148PB7F14	N4
IO149NB7F14	N2
IO149PB7F14	N3
IO150NB7F14	L1
IO150PB7F14	M1
IO151NB7F14	M2
IO151PB7F14	M3
IO152NB7F14	M5
IO152PB7F14	M4
IO153NB7F14	M7

FG896	
AX1000 Function	Pin Number
IO206PB6F19	AB4
IO207NB6F19	W6
IO207PB6F19	W7
IO208NB6F19	AB3
IO208PB6F19	AC3
IO209NB6F19	V8
IO209PB6F19	V9
IO210NB6F19	AA2
IO210PB6F19	AA1
IO211NB6F19	V5
IO211PB6F19	W5
IO212NB6F19	Y3
IO212PB6F19	Y4
IO213NB6F19	V7
IO213PB6F19	V6
IO214NB6F20	W3
IO214PB6F20	W4
IO215NB6F20	U8
IO215PB6F20	U9
IO216NB6F20	W1
IO216PB6F20	W2
IO217NB6F20	U7
IO217PB6F20	U6
IO218NB6F20	U4
IO218PB6F20	V4
IO219NB6F20	T5
IO219PB6F20	U5
IO220NB6F20	U3
IO220PB6F20	V3
IO221NB6F20	T8
IO221PB6F20	T9
IO222NB6F20	U2
IO222PB6F20	V2
IO223NB6F20	T7
IO223PB6F20	T6

FG896	
AX1000 Function	Pin Number
IO224NB6F20	R2
IO224PB6F20	T2
Bank 7	
IO225NB7F21	R7
IO225PB7F21	R6
IO226NB7F21	R4
IO226PB7F21	R5
IO227NB7F21	R8
IO227PB7F21	R9
IO228NB7F21	P1
IO228PB7F21	R1
IO229NB7F21	P9
IO229PB7F21	P8
IO230NB7F21	N2
IO230PB7F21	P2
IO231NB7F21	P7
IO231PB7F21	P6
IO232NB7F21	N3
IO232PB7F21	P3
IO233NB7F21	P4
IO233PB7F21	P5
IO234NB7F21	L1
IO234PB7F21	M1
IO235NB7F21	M4
IO235PB7F21	N4
IO236NB7F22	N7
IO236PB7F22	N6
IO237NB7F22	N8
IO237PB7F22	N9
IO238NB7F22	M5
IO238PB7F22	N5
IO239NB7F22	L2
IO239PB7F22	M2
IO240NB7F22	L3
IO240PB7F22	M3

FG896	
AX1000 Function	Pin Number
IO241NB7F22	M8
IO241PB7F22	M7
IO242NB7F22	K4
IO242PB7F22	L4
IO243NB7F22	L6
IO243PB7F22	M6
IO244NB7F22	K5
IO244PB7F22	L5
IO245NB7F22	J4
IO245PB7F22	J3
IO246NB7F22	G2
IO246PB7F22	H2
IO247NB7F23	L8
IO247PB7F23	L7
IO248NB7F23	G3
IO248PB7F23	H3
IO249NB7F23	G4
IO249PB7F23	H4
IO250NB7F23	J6
IO250PB7F23	K6
IO251NB7F23	H5
IO251PB7F23	J5
IO252NB7F23	F2
IO252PB7F23	F1
IO253NB7F23	K8
IO253PB7F23	K7
IO254NB7F23	F4
IO254PB7F23	F3
IO255NB7F23	G6
IO255PB7F23	H6
IO256NB7F23	F5
IO256PB7F23	G5
IO257NB7F23	H7
IO257PB7F23	J7
Dedicated I/O	

FG896	
AX1000 Function	**Pin Number**
VCCIB2	L22
VCCIB2	M21
VCCIB2	M22
VCCIB2	N21
VCCIB2	P21
VCCIB2	R21
VCCIB3	AA22
VCCIB3	AH29
VCCIB3	AH30
VCCIB3	T21
VCCIB3	U21
VCCIB3	V21
VCCIB3	W21
VCCIB3	W22
VCCIB3	Y21
VCCIB3	Y22
VCCIB4	AA16
VCCIB4	AA17
VCCIB4	AA18
VCCIB4	AA19
VCCIB4	AA20
VCCIB4	AB19
VCCIB4	AB20
VCCIB4	AB21
VCCIB4	AJ28
VCCIB4	AK28
VCCIB5	AA11
VCCIB5	AA12
VCCIB5	AA13
VCCIB5	AA14
VCCIB5	AA15
VCCIB5	AB10
VCCIB5	AB11
VCCIB5	AB12
VCCIB5	AJ3

FG896	
AX1000 Function	**Pin Number**
VCCIB5	AK3
VCCIB6	AA9
VCCIB6	AH1
VCCIB6	AH2
VCCIB6	T10
VCCIB6	U10
VCCIB6	V10
VCCIB6	W10
VCCIB6	W9
VCCIB6	Y10
VCCIB6	Y9
VCCIB7	C1
VCCIB7	C2
VCCIB7	K9
VCCIB7	L10
VCCIB7	L9
VCCIB7	M10
VCCIB7	M9
VCCIB7	N10
VCCIB7	P10
VCCIB7	R10
VCOMPLA	F14
VCOMPLB	J15
VCOMPLC	F17
VCOMPLD	H16
VCOMPLE	AF17
VCOMPLF	AD16
VCOMPLG	AF14
VCOMPLH	AB15
VPUMP	G24

FG1152	
AX2000 Function	Pin Number
IO103PB2F9	M28
IO104NB2F9	M34
IO104PB2F9	L34
IO105NB2F9	P27
IO105PB2F9	N27
IO106NB2F9	M32
IO106PB2F9	M31
IO107NB2F10	P25
IO107PB2F10	P26
IO108NB2F10	N33
IO108PB2F10	M33
IO109NB2F10	P29
IO109PB2F10	N29
IO110NB2F10	P30
IO110PB2F10	N30
IO111NB2F10	R24
IO111PB2F10	R25
IO112NB2F10	P31
IO112PB2F10	N31
IO113NB2F10	R28
IO113PB2F10	P28
IO114NB2F10	P32
IO114PB2F10	N32
IO115NB2F10	R30
IO115PB2F10	R29
IO116NB2F10	P34
IO116PB2F10	P33
IO117NB2F10	R27
IO117PB2F10	R26
IO118NB2F11	R34
IO118PB2F11	R33
IO119NB2F11	T24
IO119PB2F11	T25
IO120NB2F11	T33
IO120PB2F11	T34

FG1152	
AX2000 Function	Pin Number
IO121NB2F11	T27
IO121PB2F11	T26
IO122NB2F11	T30
IO122PB2F11	T29
IO123NB2F11	U28
IO123PB2F11	T28
IO124NB2F11	T31
IO124PB2F11	T32
IO125NB2F11	U24
IO125PB2F11	U25
IO126NB2F11	U33
IO126PB2F11	U34
IO127NB2F11	U26
IO127PB2F11	U27
IO128NB2F11	U31
IO128PB2F11	U32
Bank 3	
IO129NB3F12	V29
IO129PB3F12	U29
IO130NB3F12	V31
IO130PB3F12	V32
IO131NB3F12	V24
IO131PB3F12	V25
IO132NB3F12	W28
IO132PB3F12	V28
IO133NB3F12	W26
IO133PB3F12	V26
IO134NB3F12	W33
IO134PB3F12	V33
IO135NB3F12	W25
IO135PB3F12	W24
IO136NB3F12	W31
IO136PB3F12	W32
IO137NB3F12	Y30
IO137PB3F12	W30

FG1152	
AX2000 Function	Pin Number
IO138NB3F12	Y29
IO138PB3F12	W29
IO139NB3F13	Y27
IO139PB3F13	W27
IO140NB3F13	AA33
IO140PB3F13	Y33
IO141NB3F13	Y25
IO141PB3F13	Y24
IO142NB3F13	AA31
IO142PB3F13	Y31
IO143NB3F13	AA28
IO143PB3F13	Y28
IO144NB3F13	AA34
IO144PB3F13	Y34
IO145NB3F13	AA26
IO145PB3F13	Y26
IO146NB3F13	AA29
IO146PB3F13	AA30
IO147NB3F13	AB30
IO147PB3F13	AB29
IO148NB3F13	AB32
IO148PB3F13	AA32
IO149NB3F13	AB27
IO149PB3F13	AA27
IO150NB3F14	AC31
IO150PB3F14	AB31
IO151NB3F14	AD33
IO151PB3F14	AC33
IO152NB3F14	AC28
IO152PB3F14	AB28
IO153NB3F14	AB25
IO153PB3F14	AA25
IO154NB3F14	AD32
IO154PB3F14	AC32
IO155NB3F14	AD29

CQ352	
AX500 Function	Pin Number
Bank 0	
IO00PB0F0	343
IO03NB0F0	341
IO03PB0F0	342
IO05NB0F0	337
IO05PB0F0	338
IO07NB0F0	335
IO07PB0F0	336
IO09NB0F0	331
IO09PB0F0	332
IO15NB0F1	325
IO15PB0F1	326
IO17NB0F1	323
IO17PB0F1	324
IO19NB0F1/HCLKAN	319
IO19PB0F1/HCLKAP	320
IO20NB0F1/HCLKBN	313
IO20PB0F1/HCLKBP	314
Bank 1	
IO21NB1F2/HCLKCN	305
IO21PB1F2/HCLKCP	306
IO22NB1F2/HCLKDN	299
IO22PB1F2/HCLKDP	300
IO23NB1F2	289
IO23PB1F2	290
IO24NB1F2	295
IO24PB1F2	296
IO25NB1F2	287
IO25PB1F2	288
IO27NB1F2	283
IO27PB1F2	284
IO29NB1F2	281
IO29PB1F2	282
IO31NB1F2	277
IO31PB1F2	278

CQ352	
AX500 Function	Pin Number
IO35NB1F3	275
IO35PB1F3	276
IO37NB1F3	271
IO37PB1F3	272
IO41NB1F3	269
IO41PB1F3	270
Bank 2	
IO43NB2F4	261
IO43PB2F4	262
IO45NB2F4	259
IO45PB2F4	260
IO47NB2F4	255
IO47PB2F4	256
IO49NB2F4	253
IO49PB2F4	254
IO50NB2F4	247
IO50PB2F4	248
IO51NB2F4	249
IO51PB2F4	250
IO53NB2F5	243
IO53PB2F5	244
IO54NB2F5	241
IO54PB2F5	242
IO55NB2F5	237
IO55PB2F5	238
IO57NB2F5	235
IO57PB2F5	236
IO58NB2F5	231
IO58PB2F5	232
IO59NB2F5	229
IO59PB2F5	230
IO61NB2F5	225
IO61PB2F5	226
IO62NB2F5	223
IO62PB2F5	224

CQ352	
AX500 Function	Pin Number
Bank 3	
IO63NB3F6	217
IO63PB3F6	218
IO64NB3F6	219
IO64PB3F6	220
IO65NB3F6	213
IO65PB3F6	214
IO67NB3F6	207
IO67PB3F6	208
IO68NB3F6	211
IO68PB3F6	212
IO69NB3F6	205
IO69PB3F6	206
IO71NB3F6	201
IO71PB3F6	202
IO73NB3F6	199
IO73PB3F6	200
IO75NB3F7	193
IO75PB3F7	194
IO76NB3F7	195
IO76PB3F7	196
IO77NB3F7	189
IO77PB3F7	190
IO79NB3F7	187
IO79PB3F7	188
IO80NB3F7	183
IO80PB3F7	184
IO81NB3F7	181
IO81PB3F7	182
IO83NB3F7	179
IO83PB3F7	180
Bank 4	
IO85NB4F8	172
IO85PB4F8	173
IO87NB4F8	170

CQ352	
AX2000 Function	Pin Number
Bank 0	
IO01NB0F0	341
IO01PB0F0	342
IO02PB0F0	343
IO04NB0F0	337
IO04PB0F0	338
IO05NB0F0	335
IO05PB0F0	336
IO08NB0F0	331
IO08PB0F0	332
IO37NB0F3	325
IO37PB0F3	326
IO38NB0F3	323
IO38PB0F3	324
IO41NB0F3/HCLKAN	319
IO41PB0F3/HCLKAP	320
IO42NB0F3/HCLKBN	313
IO42PB0F3/HCLKBP	314
Bank 1	
IO43NB1F4/HCLKCN	305
IO43PB1F4/HCLKCP	306
IO44NB1F4/HCLKDN	299
IO44PB1F4/HCLKDP	300
IO48NB1F4	295
IO48PB1F4	296
IO65NB1F6	283
IO65PB1F6	284
IO66NB1F6	289
IO66PB1F6	290
IO68NB1F6	287
IO68PB1F6	288
IO69NB1F6	275
IO69PB1F6	276
IO70NB1F6	281
IO70PB1F6	282

CQ352	
AX2000 Function	Pin Number
IO71NB1F6	277
IO71PB1F6	278
IO73NB1F6	269
IO73PB1F6	270
IO74NB1F6	271
IO74PB1F6	272
Bank 2	
IO87NB2F8	261
IO87PB2F8	262
IO88NB2F8	255
IO88PB2F8	256
IO89NB2F8	259
IO89PB2F8	260
IO91NB2F8	253
IO91PB2F8	254
IO99NB2F9	249
IO99PB2F9	250
IO100NB2F9	247
IO100PB2F9	248
IO107NB2F10	243
IO107PB2F10	244
IO110NB2F10	241
IO110PB2F10	242
IO111NB2F10	237
IO111PB2F10	238
IO112NB2F10	235
IO112PB2F10	236
IO113NB2F10	231
IO113PB2F10	232
IO114NB2F10	229
IO114PB2F10	230
IO115NB2F10	225
IO115PB2F10	226
IO117NB2F10	223
IO117PB2F10	224

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AX2000 Function	Pin Number
Bank 3	
IO129NB3F12	219
IO129PB3F12	220
IO132NB3F12	217
IO132PB3F12	218
IO137NB3F12	213
IO137PB3F12	214
IO139NB3F13	211
IO139PB3F13	212
IO141NB3F13	205
IO141PB3F13	206
IO142NB3F13	207
IO142PB3F13	208
IO145NB3F13	199
IO145PB3F13	200
IO146NB3F13	201
IO146PB3F13	202
IO147NB3F13	193
IO147PB3F13	194
IO148NB3F13	195
IO148PB3F13	196
IO149NB3F13	189
IO149PB3F13	190
IO161NB3F15	183
IO161PB3F15	184
IO163NB3F15	187
IO163PB3F15	188
IO165NB3F15	181
IO165PB3F15	182
IO167NB3F15	179
IO167PB3F15	180
Bank 4	
IO181NB4F17	172
IO181PB4F17	173
IO182NB4F17	170