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Understanding <u>Embedded - FPGAs (Field</u> <u>Programmable Gate Array)</u>

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

Applications of Embedded - FPGAs

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

Details

Product Status	Active
Number of LABs/CLBs	-
Number of Logic Elements/Cells	-
Total RAM Bits	36864
Number of I/O	97
Number of Gates	250000
Voltage - Supply	1.425V ~ 1.575V
Mounting Type	Surface Mount
Operating Temperature	-40°C ~ 100°C (TJ)
Package / Case	144-LBGA
Supplier Device Package	144-FPBGA (13x13)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/a3p250-1fg144i

Email: info@E-XFL.COM

Address: Room A, 16/F, Full Win Commercial Centre, 573 Nathan Road, Mongkok, Hong Kong



I/O Power-Up and Supply Voltage Thresholds for Power-On Reset (Commercial and Industrial)

Sophisticated power-up management circuitry is designed into every ProASIC[®]3 device. These circuits ensure easy transition from the powered-off state to the powered-up state of the device. The many different supplies can power up in any sequence with minimized current spikes or surges.

In addition, the I/O will be in a known state through the power-up sequence. The basic principle is shown in Figure 2-2 on page 2-5.

There are five regions to consider during power-up.

ProASIC3 I/Os are activated only if ALL of the following three conditions are met:

- 1. VCC and VCCI are above the minimum specified trip points (Figure 2-2 on page 2-5).
- 2. VCCI > VCC 0.75 V (typical)
- 3. Chip is in the operating mode.

VCCI Trip Point:

```
Ramping up: 0.6 V < trip_point_up < 1.2 V
Ramping down: 0.5 V < trip_point_down < 1.1 V
```

VCC Trip Point:

```
Ramping up: 0.6 V < trip_point_up < 1.1 V
Ramping down: 0.5 V < trip_point_down < 1 V
```

VCC and VCCI ramp-up trip points are about 100 mV higher than ramp-down trip points. This specifically built-in hysteresis prevents undesirable power-up oscillations and current surges. Note the following:

- During programming, I/Os become tristated and weakly pulled up to VCCI.
- JTAG supply, PLL power supplies, and charge pump VPUMP supply have no influence on I/O behavior.

PLL Behavior at Brownout Condition

Microsemi recommends using monotonic power supplies or voltage regulators to ensure proper power-up behavior. Power ramp-up should be monotonic at least until VCC and VCCPLLX exceed brownout activation levels. The VCC activation level is specified as 1.1 V worst-case (see Figure 2-2 on page 2-5 for more details).

When PLL power supply voltage and/or VCC levels drop below the VCC brownout levels (0.75 V \pm 0.25 V), the PLL output lock signal goes low and/or the output clock is lost. Refer to the "Power-Up/Down Behavior of Low Power Flash Devices" chapter of the *ProASIC3 FPGA Fabric User's Guide* for information on clock and lock recovery.

Internal Power-Up Activation Sequence

- 1. Core
- 2. Input buffers

Output buffers, after 200 ns delay from input buffer activation.

Thermal Characteristics

Introduction

The temperature variable in the Microsemi 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 to be higher than the ambient temperature.

EQ can be used to calculate junction temperature.

 T_J = Junction Temperature = 'T + T_A

where:

- T_A = Ambient Temperature
- 'T = Temperature gradient between junction (silicon) and ambient 'T = $T_a * P$
- T_a = Junction-to-ambient of the package. T_a numbers are located in Table 2-5 on page 2-6.
- P = Power dissipation



Output DDR Module



Figure 2-22 • Output DDR Timing Model

Table 2-103 • Parameter Definitions

Parameter Name	Parameter Definition	Measuring Nodes (from, to)
t _{DDROCLKQ}	Clock-to-Out	B, E
t _{DDROCLR2Q}	Asynchronous Clear-to-Out	C, E
t _{DDROREMCLR}	Clear Removal	С, В
t _{DDRORECCLR}	Clear Recovery	С, В
t _{DDROSUD1}	Data Setup Data_F	А, В
t _{DDROSUD2}	Data Setup Data_R	D, B
t _{DDROHD1}	Data Hold Data_F	А, В
t _{DDROHD2}	Data Hold Data_R	D, B

Global Resource Characteristics

A3P250 Clock Tree Topology

Clock delays are device-specific. Figure 2-28 is an example of a global tree used for clock routing. The global tree presented in Figure 2-28 is driven by a CCC located on the west side of the A3P250 device. It is used to drive all D-flip-flops in the device.



Figure 2-28 • Example of Global Tree Use in an A3P250 Device for Clock Routing

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 2-90. Table 2-108 to Table 2-114 on page 2-89 present minimum and maximum global clock delays within each device. Minimum and maximum delays are measured with minimum and maximum loading.



Timing Characteristics

Table 2-107 • A3P015 Global Resource

Commercial-Case Conditions: T_J = 70°C, VCC = 1.425 V

		-2		-1		Std.		
Parameter	Description	Min. ¹	Max. ²	Min. ¹	Max. ²	Min. ¹	Max. ²	Units
t _{RCKL}	Input Low Delay for Global Clock	0.66	0.81	0.75	0.92	0.88	1.08	ns
t _{RCKH}	Input High Delay for Global Clock	0.67	0.84	0.76	0.96	0.89	1.13	ns
t _{RCKMPWH}	Minimum Pulse Width High for Global Clock	0.75		0.85		1.00		ns
t _{RCKMPWL}	Minimum Pulse Width Low for Global Clock	0.85		0.96		1.13		ns
t _{RCKSW}	Maximum Skew for Global Clock		0.18		0.21		0.25	ns

Notes:

1. Value reflects minimum load. The delay is measured from the CCC output to the clock pin of a sequential element, located in a lightly loaded row (single element is connected to the global net).

2. Value reflects maximum load. The delay is measured on the clock pin of the farthest sequential element, located in a fully loaded row (all available flip-flops are connected to the global net in the row).

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

Table 2-108 • A3P030 Global Resource

Commercial-Case Conditions: T_J = 70°C, VCC = 1.425 V

		-2		-1		Std.		
Parameter	Description	Min. ¹	Max. ²	Min. ¹	Max. ²	Min. ¹	Max. ²	Units
t _{RCKL}	Input Low Delay for Global Clock	0.67	0.81	0.76	0.92	0.89	1.09	ns
^t _{RCKH}	Input High Delay for Global Clock	0.68	0.85	0.77	0.97	0.91	1.14	ns
t _{RCKMPWH}	Minimum Pulse Width High for Global Clock	0.75		0.85		1.00		ns
t _{RCKMPWL}	Minimum Pulse Width Low for Global Clock	0.85		0.96		1.13		ns
t _{RCKSW}	Maximum Skew for Global Clock		0.18		0.21		0.24	ns

Notes:

1. Value reflects minimum load. The delay is measured from the CCC output to the clock pin of a sequential element, located in a lightly loaded row (single element is connected to the global net).

2. Value reflects maximum load. The delay is measured on the clock pin of the farthest sequential element, located in a fully loaded row (all available flip-flops are connected to the global net in the row).

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



Embedded SRAM and FIFO Characteristics

SRAM



Figure 2-30 • RAM Models



A3P030 Function GND NC IO41RSB0 GND GDA0/IO37RSB0 NC GND IO33RSB0 IO30RSB0 IO27RSB0 IO24RSB0 GND IO21RSB0 IO19RSB0 GND IO16RSB0 IO13RSB0 GND IO08RSB0 IO05RSB0 IO03RSB1 IO00RSB1 NC IO78RSB1 GEA0/IO76RSB1 NC NC VCCIB1 IO69RSB1 IO66RSB1 IO65RSB1 IO62RSB1 NC NC IO55RSB1 VCCIB1

ON132			ON132	ON132			
Pin Number	A3P030 Function	Pin Number	A3P030 Function	Pin Number	Δ3P0		
		A 37		B25			
Δ2		Δ38	IO23RSB0	B26			
Δ3	NC	Δ39	NC	B27			
Δ4	IO80RSB1	A40	IO22RSB0	B28			
A5	GEC0/IO77RSB1	A41	IO20RSB0	B29	GDA		
A6	NC	A42	IO18RSB0	B30	00/1		
A7	GFB0/IO75RSB1	A43	VCC	B31			
A8	IO73RSB1	A44	IO15RSB0	B32	IC		
A9	NC	A45	IO12RSB0	B33	IC		
A10	VCC	A46	IO10RSB0	B34	IC		
A11	IO71RSB1	A47	IO09RSB0	B35	IC		
A12	IO68RSB1	A48	IO06RSB0	B36			
A13	IO63RSB1	B1	IO02RSB1	B37	IC		
A14	IO60RSB1	B2	IO82RSB1	B38	IC		
A15	NC	B3	GND	B39	1		
A16	IO59RSB1	B4	IO79RSB1	B40	IC		
A17	IO57RSB1	B5	NC	B41	IC		
A18	VCC	B6	GND	B42	<u> </u>		
A19	IO54RSB1	B7	IO74RSB1	B43	IC		
A20	IO52RSB1	B8	NC	B44	IC		
A21	IO49RSB1	B9	GND	C1	IC		
A22	IO48RSB1	B10	IO70RSB1	C2	IC		
A23	IO47RSB1	B11	IO67RSB1	C3			
A24	TDI	B12	IO64RSB1	C4	IC		
A25	TRST	B13	IO61RSB1	C5	GEA		
A26	IO44RSB0	B14	GND	C6			
A27	NC	B15	IO58RSB1	C7			
A28	IO43RSB0	B16	IO56RSB1	C8	\		
A29	IO42RSB0	B17	GND	C9	IC		
A30	IO40RSB0	B18	IO53RSB1	C10	IC		
A31	IO39RSB0	B19	IO50RSB1	C11	IC		
A32	GDC0/IO36RSB0	B20	GND	C12	IC		
A33	NC	B21	IO46RSB1	C13			
A34	VCC	B22	TMS	C14			
A35	IO34RSB0	B23	TDO	C15	IC		
A36	IO31RSB0	B24	IO45RSB0	C16	١		



Pin Number A3P400 Function Pin Number A3P400 Function 1 GND 37 IO141PSB3 73 IO112RSB2 2 GAA2/IO155UDB3 38 IO140NDB3 74 IO110RSB2 3 IO155VDB3 39 IO140NDB3 74 IO110RSB2 4 GAB2/IO154UDB3 40 VCCIB3 76 IO108RSB2 5 IO154VDB3 41 GND 77 IO168RSB2 6 GAC2/IO153UDB3 42 IO138NDB3 78 IO107RSB2 7 IO152VDB3 44 GEC1/IO137PDB3 80 IO104RSB2 9 IO152VDB3 44 GEC1/IO137PDB3 82 IO104RSB2 10 IO151VDB3 44 GEC1/IO137PDB3 83 IO104RSB2 11 IO159VDB3 47 GEB0/IO136NDB3 84 IO107RSB2 11 IO149PDB3 55 GEA//IO135PDB3 84 IO107RSB2 114 IO149PDB3 55 GEA//IO135NDB3 85 <th colspan="2">PQ208</th> <th>F</th> <th>Q208</th> <th colspan="3">PQ208</th>	PQ208		F	Q208	PQ208		
1 GND 37 IO141PSB3 73 IO112RSB2 2 GAA2/IO155UDB3 38 IO140PDB3 74 IO111RSB2 3 IO155VDB3 39 IO140PDB3 76 IO110RSB2 4 GAB2/IO154UDB3 40 VCCIB3 76 IO109RSB2 5 IO154VDB3 41 GND 77 IO109RSB2 6 GAC2/IO153UDB3 42 IO138PDB3 78 IO107RSB2 7 IO152VDB3 43 IO138NDB3 79 IO106RSB2 8 IO152VDB3 45 GEC0/IO137NDB3 81 GND 10 IO151UDB3 46 GEB0/IO136NDB3 83 IO101RSB2 11 IO150PDB3 44 GEA0/IO136NDB3 85 IO09RSB2 13 IO169PDB3 49 GEA0/IO136NDB3 85 IO09RSB2 14 IO149PDB3 51 GND 86 IO09RSB2 16 VCC 52 GND 88 IO09	Pin Number	A3P400 Function	Pin Number	A3P400 Function	Pin Number	A3P400 Function	
2 GAA2/IO155UDB3 38 IO140PDB3 74 IO111RSB2 3 IO155VDB3 39 IO140NDB3 75 IO110RSB2 4 GAB2/IO154UDB3 40 VCCIB3 76 IO109RSB2 5 IO154VDB3 41 GND 77 IO108RSB2 7 IO152UDB3 42 IO138NDB3 78 IO1008RSB2 9 IO152UDB3 44 GEC1/IO137PDB3 80 IO104RSB2 9 IO152VDB3 45 GEC0/IO137NDB3 81 GND 10 IO151VDB3 46 GEB1/IO136PDB3 82 IO100RSB2 11 IO150PDB3 48 GEA1/IO136PDB3 83 IO100RSB2 13 IO160NDB3 49 GEA0/IO135NDB3 85 IO99RSB2 14 IO149PDB3 50 VMV3 86 IO98RSB2 15 IO149NDB3 51 GNDQ 87 IO97RSB2 16 VCC 52 GND 88	1	GND	37	IO141PSB3	73	IO112RSB2	
3 IO155VDB3 39 IO140NDB3 75 IO110RSB2 4 GAB2/IO154UDB3 40 VCCIB3 76 IO109RSB2 5 IO154VDB3 41 GND 77 IO109RSB2 6 GAC2/IO153UDB3 42 IO138VDB3 78 IO100RSB2 7 IO153VDB3 43 IO138NDB3 79 IO106RSB2 9 IO152VDB3 44 GEC1/IO137PDB3 80 IO104RSB2 10 IO151UDB3 44 GEC1/IO137PDB3 81 GND 11 IO151VDB3 44 GEC1/IO137NDB3 81 IO102RSB2 11 IO150PDB3 44 GEA0/IO136NDB3 83 IO110RSB2 12 IO150PDB3 49 GEA0/IO137NDB3 85 IO98RSB2 13 IO150NDB3 50 VMV3 86 IO98RSB2 14 IO149PDB3 51 GND 87 IO97RSB2 14 IO148PDB3 51 GND 88	2	GAA2/IO155UDB3	38	IO140PDB3	74	IO111RSB2	
4 GAB2/IO154UDB3 40 VCCIB3 76 IO109RSB2 5 IO154VDB3 41 GND 77 IO108RSB2 6 GAC2/IO153UDB3 42 IO138PDB3 78 IO107RSB2 7 IO152VDB3 43 IO138PDB3 79 IO106RSB2 9 IO152VDB3 44 GEC1/IO137PDB3 80 IO104RSB2 10 IO151VDB3 44 GEC1/IO137PDB3 81 GND 10 IO151VDB3 446 GEB1/IO136PDB3 81 IO104RSB2 11 IO150VDB3 447 GEB0/IO136NDB3 83 IO100RSB2 13 IO150NDB3 49 GEA0/IO135NDB3 84 IO100RSB2 14 IO149NDB3 51 GNDQ 87 IO37RSB2 16 VCC 52 GND 88 VCC1B2 18 VCCIB3 54 NC 90 IO34RSB2 19 IO148PDB3 55 GEA2/IO134RSB2 91 <td< td=""><td>3</td><td>IO155VDB3</td><td>39</td><td>IO140NDB3</td><td>75</td><td>IO110RSB2</td></td<>	3	IO155VDB3	39	IO140NDB3	75	IO110RSB2	
5 IO154VDB3 41 GND 77 IO108RSB2 6 GAC2/IO153UDB3 42 IO138PDB3 78 IO107RSB2 7 IO153VDB3 43 IO138NDB3 79 IO106RSB2 8 IO152VDB3 44 GEC1/IO137PDB3 80 IO104RSB2 9 IO152VDB3 45 GEC0/IO137NDB3 81 GND 10 IO161UDB3 46 GEB1/IO136PDB3 82 IO102RSB2 11 IO150PDB3 47 GEB0/IO138NDB3 83 IO101RSB2 12 IO150PDB3 49 GEA/I/O135PDB3 84 IO100RSB2 13 IO150NB3 49 GEA/I/O135PDB3 85 IO99RSB2 14 IO149PDB3 51 GNDQ 87 IO97RSB2 16 VCC 52 GND 88 VCC 17 GND 53 VMV2 89 VCCIB2 19 IO148PDB3 56 GEA2/IO134RSB2 91 IO92RS	4	GAB2/IO154UDB3	40	VCCIB3	76	IO109RSB2	
6 GAC2/I0153UDB3 42 I0138PDB3 78 I0107RSB2 7 I0153VDB3 43 I0138NDB3 79 I0106RSB2 8 I0152UDB3 44 GEC1/I0137PDB3 80 I0104RSB2 9 I0151UDB3 45 GEC0/I0137NDB3 81 GND 10 I0151UDB3 46 GEB1/I0136DDB3 83 I0101RSB2 11 I0150NDB3 47 GEB0/I0136NDB3 83 I0101RSB2 12 I0160PDB3 49 GEA0/I0135NDB3 84 I0100RSB2 13 I0149NDB3 51 GNDQ 87 I097RSB2 16 VCC 52 GND 88 VCCIB2 18 VCCIB3 54 NC 90 I094RSB2 20 I0148NDB3 56 GEB2/I0133RSB2 93 I084RSB2 21 GFC1/I0147PDB3 57 GEC2/I0132RSB2 93 I084RSB2 22 GFD0/I0146NDB3 60 I0129RSB2 94<	5	IO154VDB3	41	GND	77	IO108RSB2	
7 IO153VDB3 43 IO138NDB3 79 IO106RSB2 8 IO152UDB3 44 GEC1//O137PDB3 80 IO104RSB2 9 IO152VDB3 45 GEC0//O137NDB3 81 GND 10 IO151UDB3 46 GEB1//O136PDB3 82 IO102RSB2 11 IO150PDB3 47 GEB0//O136NDB3 83 IO101RSB2 12 IO150PDB3 48 GEA1//O136PDB3 84 IO100RSB2 13 IO150NDB3 49 GEA0//O135NDB3 86 IO99RSB2 14 IO149PDB3 50 VMV3 86 IO98RSB2 16 VCC 52 GND 88 VCC 17 GND 53 VMV2 89 VCCB2 18 VCCIB3 54 NC 90 IO94RSB2 20 IO148NDB3 56 GE2//O133RSB2 91 IO92RSB2 21 GFC1//IO14PDB3 56 GEB2//IO13RSB2 93 IO88RS	6	GAC2/IO153UDB3	42	IO138PDB3	78	IO107RSB2	
8 IO152UDB3 44 GEC1/IO137PDB3 80 IO104RSE2 9 IO152VDB3 45 GEC0/IO137NDB3 81 GND 10 IO151UDB3 46 GEB1/IO136PDB3 82 IO102RSE2 11 IO150PDB3 47 GEB0/IO138NDB3 83 IO101RSE2 12 IO150PDB3 48 GEA1/IO135PDB3 84 IO100RSE2 13 IO150NDB3 49 GEA0/IO138NDB3 85 IO99RSE2 14 IO149NDB3 51 GNDQ 87 IO97RSE2 16 VCC 52 GND 88 VCC 17 GND 53 VMV2 89 VCCIB2 18 VCCIB3 54 NC 90 IO92RSE2 19 IO148NDB3 56 GEB2/IO133RSE2 93 IO88RSE2 22 GFC0/IO147NDB3 57 GEC2/IO132RSE2 93 IO88RSE2 23 GFB1/IO146PDB3 59 IO130RSE2 93 <td< td=""><td>7</td><td>IO153VDB3</td><td>43</td><td>IO138NDB3</td><td>79</td><td>IO106RSB2</td></td<>	7	IO153VDB3	43	IO138NDB3	79	IO106RSB2	
9 I0152VDB3 45 GEC0/I0137NDB3 81 GND 10 I0151UDB3 46 GEB1/I0136PDB3 82 I0102RSE2 11 I0151VDB3 47 GEB0/I0136NDB3 83 I0101RSE2 12 I0150PDB3 48 GEA1/I0135PDB3 84 I0100RSE2 13 I0150NDB3 49 GEA0/I0135NDB3 85 I099RSE2 14 I0149PDB3 50 VMV3 86 I098RSE2 16 VCC 52 GND 88 VCC 18 VCCIB3 54 NC 90 I094RSE2 19 I0148PDB3 55 GEA2/I0134RSE2 91 I092RSE2 20 I0148NDB3 56 GEB2/I0132RSE2 93 I088RSE2 21 GFC1/I0147PDB3 57 GEC2/I0132RSE2 93 I084RSE2 22 GFD0/I0146NDB3 60 I0130RSE2 93 I084RSE2 23 GFB1/I0146PDB3 64 I0128RSE2 9	8	IO152UDB3	44	GEC1/IO137PDB3	80	IO104RSB2	
10 IO151UDB3 46 GEB1/IO136PDB3 82 IO102RSE2 11 IO151VDB3 47 GEB0/IO136NDB3 83 IO101RSE2 12 IO150PDB3 48 GEA1/IO135PDB3 84 IO100RSE2 13 IO150NDB3 49 GEA0/IO135NDB3 85 IO99RSE2 14 IO149PDB3 50 VMV3 86 IO98RSE2 15 IO149NDB3 51 GNDQ 87 IO97RSE2 16 VCC 52 GND 88 VCCIB2 18 VCCIB3 54 NC 90 IO94RSB2 20 IO148NDB3 56 GEA2/IO134RSB2 91 IO92RSB2 21 GFC1/IO147PDB3 57 GEC2/IO132RSB2 93 IO88RSB2 22 GFC0/IO147NDB3 58 IO131RSB2 94 IO86RSB2 23 GFB1/IO146PDB3 60 IO122RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 64 IO123RSB2 97	9	IO152VDB3	45	GEC0/IO137NDB3	81	GND	
11 IO151VDB3 47 GEB0/IO136NDB3 83 IO101RSB2 12 IO150PDB3 48 GEA1/IO135PDB3 84 IO100RSB2 13 IO150NDB3 49 GEA0/IO135NDB3 85 IO99RSB2 14 IO149PDB3 50 VMV3 86 IO98RSB2 15 IO149NDB3 51 GNDQ 87 IO97RSB2 16 VCC 52 GND 88 VCC 17 GND 53 VMV2 89 VCCIB2 18 VCCIB3 54 NC 90 IO94RSB2 19 IO148PDB3 55 GEA2/IO134RSB2 91 IO92RSB2 20 IO148NDB3 56 GEB2/IO133RSB2 92 IO90RSB2 21 GFC1/IO147PDB3 57 GEC2/IO132RSB2 93 IO88RSB2 22 GFC0/IO147NDB3 58 IO130RSB2 94 IO86RSB2 23 GFB1/IO146PDB3 60 IO129RSB2 96 GD2/	10	IO151UDB3	46	GEB1/IO136PDB3	82	IO102RSB2	
12 IO150PDB3 48 GEA1/IO135PDB3 84 IO100RSE2 13 IO150NDB3 49 GEA0/IO135NDB3 85 IO99RSB2 14 IO149PDB3 50 VMV3 86 IO98RSB2 15 IO149NDB3 51 GNDQ 87 IO97RSB2 16 VCC 52 GND 88 VCC 17 GND 53 VMV2 89 VCCIB2 18 VCCIB3 54 NC 90 IO94RSB2 20 IO148NDB3 56 GEB2/IO133RSB2 91 IO92RSB2 21 GFC1/IO147PDB3 57 GEC2/IO132RSB2 93 IO88RSB2 22 GFC0/IO147NDB3 58 IO130RSB2 94 IO86RSB2 23 GFB1/IO146PDB3 59 IO130RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 60 IO129RSB2 96 GD2/IO82RSB2 25 VCOMPLF 61 IO128RSB2 97 GND	11	IO151VDB3	47	GEB0/IO136NDB3	83	IO101RSB2	
13 IO150NDB3 49 GEA0/IO135NDB3 85 IO99RSB2 14 IO149PDB3 50 VMV3 86 IO98RSB2 15 IO149NDB3 51 GNDQ 87 IO97RSB2 16 VCC 52 GND 88 VCC 17 GND 53 VMV2 89 VCCIB2 18 VCCIB3 54 NC 90 IO94RSB2 20 IO148DDB3 55 GEA2/IO133RSB2 91 IO92RSB2 21 GFC1/IO147PDB3 57 GEC2/IO133RSB2 93 IO88RSB2 22 GFC0/IO147NDB3 58 IO131RSB2 93 IO88RSB2 23 GFB1/IO146PDB3 59 IO130RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 60 IO129RSB2 96 GD2/IO82RSB2 25 VCOMPLF 61 IO128RSB2 97 GND 25 VCCPLF 63 IO125RSB2 99 GDA2/IO80RSB2	12	IO150PDB3	48	GEA1/IO135PDB3	84	IO100RSB2	
14 IO149PDB3 50 VMV3 86 IO98RSB2 15 IO149NDB3 51 GNDQ 87 IO97RSB2 16 VCC 52 GND 88 VCC 17 GND 53 VMV2 89 VCCIB2 18 VCCIB3 54 NC 90 IO94RSB2 19 IO148PDB3 55 GEA2/IO134RSB2 91 IO92RSB2 20 IO148NDB3 56 GEB2/IO133RSB2 92 IO90RSB2 21 GFC1/IO147PDB3 57 GEC2/IO132RSB2 93 IO86RSB2 22 GFC0/IO147NDB3 58 IO131RSB2 94 IO86RSB2 23 GFB1/IO146PDB3 59 IO130RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 60 IO129RSB2 97 GND 26 GFA0/IO145NPB3 62 VCCIB2 98 GDB2/IO81RSB2 27 VCCPLF 63 IO123RSB2 99 GDA2/IO80RSB2 <td>13</td> <td>IO150NDB3</td> <td>49</td> <td>GEA0/IO135NDB3</td> <td>85</td> <td>IO99RSB2</td>	13	IO150NDB3	49	GEA0/IO135NDB3	85	IO99RSB2	
15 IO149NDB3 51 GNDQ 87 IO97RSB2 16 VCC 52 GND 88 VCC 17 GND 53 VMV2 89 VCCIB2 18 VCCIB3 54 NC 90 IO94RSB2 19 IO148PDB3 55 GEA2/IO134RSB2 91 IO92RSB2 20 IO148NDB3 56 GEB2/IO133RSB2 92 IO90RSB2 21 GFC1/IO147PDB3 57 GEC2/IO132RSB2 93 IO88RSB2 22 GFC0/IO147NDB3 58 IO131RSB2 94 IO86RSB2 23 GFB1/IO146PDB3 59 IO130RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 60 IO129RSB2 96 GDC2/IO82RSB2 25 VCOMPLF 61 IO128RSB2 99 GDA2/IO80RSB2 28 GFA1/IO145PPB3 64 IO123RSB2 99 GDA2/IO80RSB2 30 GFA2/IO144PDB3 66 IO1121RSB2 100 <td>14</td> <td>IO149PDB3</td> <td>50</td> <td>VMV3</td> <td>86</td> <td>IO98RSB2</td>	14	IO149PDB3	50	VMV3	86	IO98RSB2	
16 VCC 52 GND 88 VCC 17 GND 53 VMV2 89 VCCIB2 18 VCCIB3 54 NC 90 I094RSB2 19 I0148PDB3 55 GEA2/I0134RSB2 91 I092RSB2 20 I0148NDB3 56 GEB2/I0133RSB2 92 I090RSB2 21 GFC1/I0147PDB3 57 GEC2/I0132RSB2 93 I088RSB2 22 GFC0/I0147NDB3 58 I0131RSB2 94 I086RSB2 23 GFB1/I0146PDB3 59 I0130RSB2 95 I084RSB2 24 GFB0/I0146NDB3 60 I0129RSB2 96 GDC2/I082RSB2 25 VCOMPLF 61 I0128RSB2 97 GND 26 GFA0/I0145NPB3 62 VCCIB2 98 GDB2/I081RSB2 27 VCCPLF 63 I0123RSB2 100 GND 30 GFA2/I0144PDB3 66 I0121RSB2 101 TC	15	IO149NDB3	51	GNDQ	87	IO97RSB2	
17 GND 53 VMV2 89 VCCIB2 18 VCCIB3 54 NC 90 I094RSB2 19 I0148PDB3 55 GEA2/I0134RSB2 91 I092RSB2 20 I0148NDB3 56 GEB2/I0133RSB2 92 I090RSB2 21 GFC1/I0147PDB3 57 GEC2/I0132RSB2 93 I088RSB2 22 GFC0/I0147NDB3 58 I0131RSB2 94 I086RSB2 23 GFB1/I0146PDB3 59 I0130RSB2 95 I084RSB2 24 GFB0/I0146NDB3 60 I0129RSB2 96 GD2/I082RSB2 25 VCOMPLF 61 I0128RSB2 97 GND 26 GFA0/I0145NPB3 62 VCCIB2 98 GDB2/I081RSB2 28 GFA1/I0145PPB3 64 I0123RSB2 100 GNDQ 29 GND 65 GND 101 TCK 30 GFA2/I0144PDB3 66 I0121RSB2 100	16	VCC	52	GND	88	VCC	
18 VCCIB3 54 NC 90 IO94RSB2 19 IO148PDB3 55 GEA2/IO134RSB2 91 IO92RSB2 20 IO148NDB3 56 GEB2/IO133RSB2 92 IO90RSB2 21 GFC1/IO147PDB3 57 GEC2/IO132RSB2 93 IO88RSB2 22 GFC0/IO147NDB3 58 IO131RSB2 94 IO86RSB2 23 GFB1/IO146PDB3 59 IO130RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 60 IO129RSB2 96 GD2/IO82RSB2 25 VCOMPLF 61 IO128RSB2 97 GND 26 GFA0/IO145NPB3 62 VCCIB2 98 GDB2/IO81RSB2 27 VCCPLF 63 IO128RSB2 100 GNDQ 28 GFA1/IO145PPB3 64 IO123RSB2 100 GNDQ 30 GFA2/IO144PDB3 66 IO121RSB2 101 TCK 33 IO144NDB3 67 IO119RSB2	17	GND	53	VMV2	89	VCCIB2	
19 IO148PDB3 55 GEA2/IO134RSB2 91 IO92RSB2 20 IO148NDB3 56 GEB2/IO133RSB2 92 IO90RSB2 21 GFC1/IO147PDB3 57 GEC2/IO132RSB2 93 IO88RSB2 22 GFC0/IO147NDB3 58 IO131RSB2 94 IO86RSB2 23 GFB1/IO146PDB3 59 IO130RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 60 IO129RSB2 96 GDC2/IO82RSB2 25 VCOMPLF 61 IO128RSB2 97 GND 26 GFA0/IO145NPB3 62 VCCIB2 98 GDB2/IO81RSB2 27 VCCPLF 63 IO123RSB2 99 GDA2/IO80RSB2 28 GFA1/IO145PPB3 64 IO123RSB2 100 GNDQ 30 GFA2/IO144PDB3 66 IO121RSB2 102 TDI 31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO	18	VCCIB3	54	NC	90	IO94RSB2	
20 IO148NDB3 56 GEB2/IO133RSB2 92 IO90RSB2 21 GFC1/IO147PDB3 57 GEC2/IO132RSB2 93 IO86RSB2 22 GFC0/IO147NDB3 58 IO131RSB2 94 IO86RSB2 23 GFB1/IO146PDB3 59 IO130RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 60 IO129RSB2 96 GDC2/IO82RSB2 25 VCOMPLF 61 IO128RSB2 97 GND 26 GFA0/IO145NPB3 62 VCCIB2 98 GDB2/IO81RSB2 27 VCCPLF 63 IO125RSB2 99 GDA2/IO80RSB2 28 GFA1/IO145PPB3 64 IO123RSB2 100 GNDQ 30 GFA2/IO144PDB3 66 IO121RSB2 100 GNDQ 31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO143NDB3 69 IO113RSB2	19	IO148PDB3	55	GEA2/IO134RSB2	91	IO92RSB2	
21 GFC1/I0147PDB3 57 GEC2/I0132RSB2 93 I088RSB2 22 GFC0/I0147NDB3 58 I0131RSB2 94 I086RSB2 23 GFB1/I0146PDB3 59 I0130RSB2 95 I084RSB2 24 GFB0/I0146NDB3 60 I0129RSB2 96 GDC2/I082RSB2 25 VCOMPLF 61 I0128RSB2 97 GND 26 GFA0/I0145NPB3 62 VCCIB2 98 GDB2/I081RSB2 27 VCCPLF 63 I0123RSB2 99 GDA2/I080RSB2 28 GFA1/I0145PPB3 64 I0123RSB2 100 GNDQ 29 GND 65 GND 101 TCK 30 GFA2/I0144PDB3 66 I0121RSB2 103 TMS 31 I0144NDB3 67 I0119RSB2 104 VMV2 33 I0143NDB3 69 I0115RSB2 105 GND 34 GFC2/I0142PDB3 71 VCC 107	20	IO148NDB3	56	GEB2/IO133RSB2	92	IO90RSB2	
22 GFC0/IO147NDB3 58 IO131RSB2 94 IO86RSB2 23 GFB1/IO146PDB3 59 IO130RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 60 IO129RSB2 96 GDC2/IO82RSB2 25 VCOMPLF 61 IO128RSB2 97 GND 26 GFA0/IO145NPB3 62 VCCIB2 98 GDB2/IO81RSB2 27 VCCPLF 63 IO123RSB2 99 GDA2/IO80RSB2 28 GFA1/IO145PPB3 64 IO123RSB2 99 GDA2/IO80RSB2 29 GND 65 GND 101 TCK 30 GFA2/IO144PDB3 66 IO121RSB2 100 GNDQ 31 IO144NDB3 67 IO119RSB2 103 TMS 33 IO143NDB3 69 IO115RSB2 104 VMV2 33 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	21	GFC1/IO147PDB3	57	GEC2/IO132RSB2	93	IO88RSB2	
23 GFB1/IO146PDB3 59 IO130RSB2 95 IO84RSB2 24 GFB0/IO146NDB3 60 IO129RSB2 96 GDC2/IO82RSB2 25 VCOMPLF 61 IO128RSB2 97 GND 26 GFA0/IO145NPB3 62 VCCIB2 98 GDB2/IO81RSB2 27 VCCPLF 63 IO123RSB2 99 GDA2/IO80RSB2 28 GFA1/IO145PPB3 64 IO123RSB2 100 GNDQ 29 GND 65 GND 101 TCK 30 GFA2/IO144PDB3 66 IO121RSB2 100 GNDQ 31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO142NDB3 69 IO113RSB2 105 GND 34 GFC2/IO142PDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO <td>22</td> <td>GFC0/IO147NDB3</td> <td>58</td> <td>IO131RSB2</td> <td>94</td> <td>IO86RSB2</td>	22	GFC0/IO147NDB3	58	IO131RSB2	94	IO86RSB2	
24 GFB0/IO146NDB3 60 IO129RSB2 96 GDC2/IO82RSB2 25 VCOMPLF 61 IO128RSB2 97 GND 26 GFA0/IO145NPB3 62 VCCIB2 98 GDB2/IO81RSB2 27 VCCPLF 63 IO125RSB2 99 GDA2/IO80RSB2 28 GFA1/IO145PPB3 64 IO123RSB2 100 GNDQ 29 GND 65 GND 101 TCK 30 GFA2/IO144PDB3 66 IO121RSB2 100 GNDQ 31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO143NDB3 69 IO113RSB2 106 VPUMP 34 GFC2/IO142PDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	23	GFB1/IO146PDB3	59	IO130RSB2	95	IO84RSB2	
25 VCOMPLF 61 IO128RSB2 97 GND 26 GFA0/IO145NPB3 62 VCCIB2 98 GDB2/IO81RSB2 27 VCCPLF 63 IO125RSB2 99 GDA2/IO80RSB2 28 GFA1/IO145PPB3 64 IO123RSB2 100 GNDQ 29 GND 65 GND 101 TCK 30 GFA2/IO144PDB3 66 IO121RSB2 103 TMS 31 IO144NDB3 67 IO119RSB2 104 VMV2 33 IO143NDB3 69 IO113RSB2 105 GND 34 GFC2/IO142PDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	24	GFB0/IO146NDB3	60	IO129RSB2	96	GDC2/IO82RSB2	
26 GFA0/IO145NPB3 62 VCCIB2 98 GDB2/IO81RSB2 27 VCCPLF 63 IO125RSB2 99 GDA2/IO80RSB2 28 GFA1/IO145PPB3 64 IO123RSB2 100 GNDQ 29 GND 65 GND 101 TCK 30 GFA2/IO144PDB3 66 IO121RSB2 102 TDI 31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO143NDB3 69 IO115RSB2 105 GND 34 GFC2/IO142PDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	25	VCOMPLF	61	IO128RSB2	97	GND	
27 VCCPLF 63 IO125RSB2 99 GDA2/IO80RSB2 28 GFA1/IO145PPB3 64 IO123RSB2 100 GNDQ 29 GND 65 GND 101 TCK 30 GFA2/IO144PDB3 66 IO121RSB2 102 TDI 31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO143NDB3 69 IO113RSB2 106 VPUMP 34 GFC2/IO142PDB3 70 IO113RSB2 106 VPUMP 35 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	26	GFA0/IO145NPB3	62	VCCIB2	98	GDB2/IO81RSB2	
28 GFA1/IO145PPB3 64 IO123RSB2 100 GNDQ 29 GND 65 GND 101 TCK 30 GFA2/IO144PDB3 66 IO121RSB2 102 TDI 31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO143NDB3 69 IO113RSB2 106 VPUMP 34 GFC2/IO142PDB3 70 IO113RSB2 106 VPUMP 35 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	27	VCCPLF	63	IO125RSB2	99	GDA2/IO80RSB2	
29 GND 65 GND 101 TCK 30 GFA2/IO144PDB3 66 IO121RSB2 102 TDI 31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO143NDB3 69 IO115RSB2 105 GND 34 GFC2/IO142PDB3 70 IO113RSB2 106 VPUMP 35 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	28	GFA1/IO145PPB3	64	IO123RSB2	100	GNDQ	
30 GFA2/IO144PDB3 66 IO121RSB2 102 TDI 31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO143NDB3 69 IO115RSB2 105 GND 34 GFC2/IO142PDB3 70 IO113RSB2 106 VPUMP 35 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	29	GND	65	GND	101	тск	
31 IO144NDB3 67 IO119RSB2 103 TMS 32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO143NDB3 69 IO115RSB2 105 GND 34 GFC2/IO142PDB3 70 IO113RSB2 106 VPUMP 35 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	30	GFA2/IO144PDB3	66	IO121RSB2	102	TDI	
32 GFB2/IO143PDB3 68 IO117RSB2 104 VMV2 33 IO143NDB3 69 IO115RSB2 105 GND 34 GFC2/IO142PDB3 70 IO113RSB2 106 VPUMP 35 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	31	IO144NDB3	67	IO119RSB2	103	TMS	
33 IO143NDB3 69 IO115RSB2 105 GND 34 GFC2/IO142PDB3 70 IO113RSB2 106 VPUMP 35 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	32	GFB2/IO143PDB3	68	IO117RSB2	104	VMV2	
34 GFC2/IO142PDB3 70 IO113RSB2 106 VPUMP 35 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	33	IO143NDB3	69	IO115RSB2	105	GND	
35 IO142NDB3 71 VCC 107 NC 36 NC 72 VCCIB2 108 TDO	34	GFC2/IO142PDB3	70	IO113RSB2	106	VPUMP	
36 NC 72 VCCIB2 108 TDO	35	IO142NDB3	71	VCC	107	NC	
	36	NC	72	VCCIB2	108	TDO	

Microsemi

Package Pin Assignments

FG144		FG144		FG144		
Pin Number	A3P250 Function	Pin Number	A3P250 Function	Pin Number	A3P250 Function	
A1	GNDQ	D1	IO112NDB3	G1	GFA1/IO108PPB3	
A2	VMV0	D2	IO112PDB3	G2	GND	
A3	GAB0/IO02RSB0	D3	IO116VDB3	G3	VCCPLF	
A4	GAB1/IO03RSB0	D4	GAA2/IO118UPB3	G4	GFA0/IO108NPB3	
A5	IO16RSB0	D5	GAC0/IO04RSB0	G5	GND	
A6	GND	D6	GAC1/IO05RSB0	G6	GND	
A7	IO29RSB0	D7	GBC0/IO35RSB0	G7	GND	
A8	VCC	D8	GBC1/IO36RSB0	G8	GDC1/IO58UPB1	
A9	IO33RSB0	D9	GBB2/IO42PDB1	G9	IO53NDB1	
A10	GBA0/IO39RSB0	D10	IO42NDB1	G10	GCC2/IO53PDB1	
A11	GBA1/IO40RSB0	D11	IO43NPB1	G11	IO52NDB1	
A12	GNDQ	D12	GCB1/IO49PPB1	G12	GCB2/IO52PDB1	
B1	GAB2/IO117UDB3	E1	VCC	H1	VCC	
B2	GND	E2	GFC0/IO110NDB3	H2	GFB2/IO106PDB3	
B3	GAA0/IO00RSB0	E3	GFC1/IO110PDB3	H3	GFC2/IO105PSB3	
B4	GAA1/IO01RSB0	E4	VCCIB3	H4	GEC1/IO100PDB3	
B5	IO14RSB0	E5	IO118VPB3	H5	VCC	
B6	IO19RSB0	E6	VCCIB0	H6	IO79RSB2	
B7	IO22RSB0	E7	VCCIB0	H7	IO65RSB2	
B8	IO30RSB0	E8	GCC1/IO48PDB1	H8	GDB2/IO62RSB2	
B9	GBB0/IO37RSB0	E9	VCCIB1	H9	GDC0/IO58VPB1	
B10	GBB1/IO38RSB0	E10	VCC	H10	VCCIB1	
B11	GND	E11	GCA0/IO50NDB1	H11	IO54PSB1	
B12	VMV1	E12	IO51NDB1	H12	VCC	
C1	IO117VDB3	F1	GFB0/IO109NPB3	J1	GEB1/IO99PDB3	
C2	GFA2/IO107PPB3	F2	VCOMPLF	J2	IO106NDB3	
C3	GAC2/IO116UDB3	F3	GFB1/IO109PPB3	J3	VCCIB3	
C4	VCC	F4	IO107NPB3	J4	GEC0/IO100NDB3	
C5	IO12RSB0	F5	GND	J5	IO88RSB2	
C6	IO17RSB0	F6	GND	J6	IO81RSB2	
C7	IO24RSB0	F7	GND	J7	VCC	
C8	IO31RSB0	F8	GCC0/IO48NDB1	J8	ТСК	
C9	IO34RSB0	F9	GCB0/IO49NPB1	J9	GDA2/IO61RSB2	
C10	GBA2/IO41PDB1	F10	GND	J10	TDO	
C11	IO41NDB1	F11	GCA1/IO50PDB1	J11	GDA1/IO60UDB1	
C12	GBC2/IO43PPB1	F12	GCA2/IO51PDB1	J12	GDB1/IO59UDB1	



FG144				
Pin Number	A3P1000 Function			
K1	GEB0/IO189NDB3			
K2	GEA1/IO188PDB3			
K3	GEA0/IO188NDB3			
K4	GEA2/IO187RSB2			
K5	IO169RSB2			
K6	IO152RSB2			
K7	GND			
K8	IO117RSB2			
K9	GDC2/IO116RSB2			
K10	GND			
K11	GDA0/IO113NDB1			
K12	GDB0/IO112NDB1			
L1	GND			
L2	VMV3			
L3	GEB2/IO186RSB2			
L4	IO172RSB2			
L5	VCCIB2			
L6	IO153RSB2			
L7	IO144RSB2			
L8	IO140RSB2			
L9	TMS			
L10	VJTAG			
L11	VMV2			
L12	TRST			
M1	GNDQ			
M2	GEC2/IO185RSB2			
M3	IO173RSB2			
M4	IO168RSB2			
M5	IO161RSB2			
M6	IO156RSB2			
M7	IO145RSB2			
M8	IO141RSB2			
M9	TDI			
M10	VCCIB2			
M11	VPUMP			
M12	GNDQ			