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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.

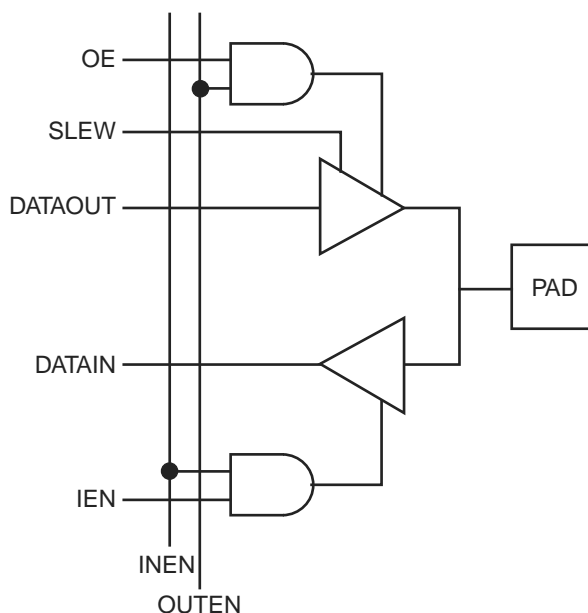
#### Details

Product Status	Obsolete
Number of LABs/CLBs	310
Number of Logic Elements/Cells	-
Total RAM Bits	-
Number of I/O	70
Number of Gates	2500
Voltage - Supply	4.5V ~ 5.5V
Mounting Type	Surface Mount
Operating Temperature	-40°C ~ 85°C (TA)
Package / Case	84-LCC (J-Lead)
Supplier Device Package	84-PLCC (29.31x29.31)
Purchase URL	<a href="https://www.e-xfl.com/product-detail/microsemi/a1425a-1plg84i">https://www.e-xfl.com/product-detail/microsemi/a1425a-1plg84i</a>

The I/O module output Y is used to bring Pad signals into the array or to feed the output register back into the array. This allows the output register to be used in high-speed state machine applications. Side I/O modules have a dedicated output segment for Y extending into the routing channels above and below (similar to logic modules). Top/Bottom I/O modules have no dedicated output segment. Signals coming into the chip from the top or bottom are routed using F-fuses and LVTs (F-fuses and LVTs are explained in detail in the routing section).

## I/O Pad Drivers

All pad drivers are capable of being tristate. Each buffer connects to an associated I/O module with four signals: OE (Output Enable), IE (Input Enable), DataOut, and DataIn. Certain special signals used only during programming and test also connect to the pad drivers: OUTEN (global output enable), INEN (global input enable), and SLEW (individual slew selection). See Figure 2-5.



**Figure 2-5 • Function Diagram for I/O Pad Driver**

## Special I/Os

The special I/Os are of two types: temporary and permanent. Temporary special I/Os are used during programming and testing. They function as normal I/Os when the MODE pin is inactive. Permanent special I/Os are user programmed as either normal I/Os or special I/Os. Their function does not change once the device has been programmed. The permanent special I/Os consist of the array clock input buffers (CLKA and CLKB), the hard-wired array clock input buffer (HCLK), the hard-wired I/O clock input buffer (IOCLK), and the hard-wired I/O register preset/clear input buffer (IOPCL). Their function is determined by the I/O macros selected.

## Clock Networks

The ACT 3 architecture contains four clock networks: two high-performance dedicated clock networks and two general purpose routed networks. The high-performance networks function up to 200 MHz, while the general purpose routed networks function up to 150 MHz.

## 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.

Maximum junction temperature is 150°C.

A sample calculation of the absolute maximum power dissipation allowed for a CPGA 175-pin package at commercial temperature and still air is as follows:

$$\frac{\text{Max. junction temp. (°C)} - \text{Max. ambient temp. (°C)}}{\theta_{ja} \text{ °C/W}} = \frac{150\text{°C} - 70\text{°C}}{25\text{°C/W}} = 3.2 \text{ W}$$

EQ 2

**Table 2-8 • Package Thermal Characteristics**

Package Type*	Pin Count	$\theta_{jc}$	$\theta_{ja}$ Still Air	$\theta_{ja}$ 300 ft./min.	Units
Ceramic Pin Grid Array	100	20	35	17	°C/W
	133	20	30	15	°C/W
	175	20	25	14	°C/W
	207	20	22	13	°C/W
	257	20	15	8	°C/W
Ceramic Quad Flatpack	132	13	55	30	°C/W
	196	13	36	24	°C/W
	256	13	30	18	°C/W
Plastic Quad Flatpack	100	13	51	40	°C/W
	160	10	33	26	°C/W
	208	10	33	26	°C/W
Very Thin Quad Flatpack	100	12	43	35	°C/W
Thin Quad Flatpack	176	11	32	25	°C/W
Power Quad Flatpack	208	0.4	17	13	°C/W
Plastic Leaded Chip Carrier	84	12	37	28	°C/W
Plastic Ball Grid Array	225	10	25	19	°C/W
	313	10	23	17	°C/W

Note: Maximum power dissipation in still air:

PQ160 = 2.4 W

PQ208 = 2.4 W

PQ100 = 1.6 W

VQ100 = 1.9 W

TQ176 = 2.5 W

PL84 = 2.2 W

RQ208 = 4.7 W

BG225 = 3.2 W

BG313 = 3.5 W

## Tightest Delay Distributions

Propagation delay between logic modules depends on the resistive and capacitive loading of the routing tracks, the interconnect elements, and the module inputs being driven. Propagation delay increases as the length of routing tracks, the number of interconnect elements, or the number of inputs increases.

From a design perspective, the propagation delay can be statistically correlated or modeled by the fanout (number of loads) driven by a module. Higher fanout usually requires some paths to have longer lengths of routing track. The ACT 3 family delivers the tightest fanout delay distribution of any FPGA. This tight distribution is achieved in two ways: by decreasing the delay of the interconnect elements and by decreasing the number of interconnect elements per path.

Microsemi's patented PLICE antifuse offers a very low resistive/capacitive interconnect. The ACT 3 family's antifuses, fabricated in 0.8 micron m lithography, offer nominal levels of 200Ω resistance and 6 femtofarad (fF) capacitance per antifuse. The ACT 3 fanout distribution is also tighter than alternative devices due to the low number of antifuses required per interconnect path. The ACT 3 family's proprietary architecture limits the number of antifuses per path to only four, with 90% of interconnects using only two antifuses.

The ACT 3 family's tight fanout delay distribution offers an FPGA design environment in which fanout can be traded for the increased performance of reduced logic level designs. This also simplifies performance estimates when designing with ACT 3 devices.

**Table 2-14 • Logic Module and Routing Delay by Fanout (ns); Worst-Case Commercial Conditions**

Speed Grade	FO = 1	FO = 2	FO = 3	FO = 4	FO = 8
ACT 3 –3	2.9	3.2	3.4	3.7	4.8
ACT 3 –2	3.3	3.7	3.9	4.2	5.5
ACT 3 –1	3.7	4.2	4.4	4.8	6.2
ACT 3 STD	4.3	4.8	5.1	5.5	7.2

Notes:

1. Obtained by added  $t_{RD(x=FO)}$  to  $t_{PD}$  from the Logic Module Timing Characteristics Tables found in this datasheet.
2. The –2 and –3 speed grades have been discontinued. Refer to PDN 0104, PDN 0203, PDN 0604, and PDN 1004 at <http://www.microsemi.com/soc/support/notifications/default.aspx#pdn>.

## Timing Characteristics

Timing characteristics for ACT 3 devices fall into three categories: family dependent, device dependent, and design dependent. The input and output buffer characteristics are common to all ACT 3 family members. Internal routing delays are device dependent. Design dependency means actual delays are not determined until after placement and routing of the user's design is complete. Delay values may then be determined by using the ALS Timer utility or performing simulation with post-layout delays.

### Critical Nets and Typical Nets

Propagation delays are expressed only for typical nets, which are used for initial design performance evaluation. Critical net delays can then be applied to the most time-critical paths. Critical nets are determined by net property assignment prior to placement and routing. Up to 6% of the nets in a design may be designated as critical, while 90% of the nets in a design are typical.

### Long Tracks

Some nets in the design use long tracks. Long tracks are special routing resources that span multiple rows, columns, or modules. Long tracks employ three and sometimes four antifuse connections. This increases capacitance and resistance, resulting in longer net delays for macros connected to long tracks. Typically up to 6% of nets in a fully utilized device require long tracks. Long tracks contribute approximately 4 ns to 14 ns delay. This additional delay is represented statistically in higher fanout (FO = 8) routing delays in the datasheet specifications section.

## A1415A, A14V15A Timing Characteristics (continued)

Table 2-20 • A1415A, A14V15A Worst-Case Commercial Conditions, VCC = 4.75 V, T<sub>J</sub> = 70°C

I/O Module – TTL Output Timing <sup>1</sup>		–3 Speed <sup>2</sup>		–2 Speed <sup>2</sup>		–1 Speed		Std. Speed		3.3 V Speed <sup>1</sup>		Units
Parameter/Description		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>DHS</sub>	Data to Pad, High Slew		5.0		5.6		6.4		7.5		9.8	ns
t <sub>DLS</sub>	Data to Pad, Low Slew		8.0		9.0		10.2		12.0		15.6	ns
t <sub>ENZHS</sub>	Enable to Pad, Z to H/L, High Slew		4.0		4.5		5.1		6.0		7.8	ns
t <sub>ENZLS</sub>	Enable to Pad, Z to H/L, Low Slew		7.4		8.3		9.4		11.0		14.3	ns
t <sub>ENHSZ</sub>	Enable to Pad, H/L to Z, High Slew		6.5		7.5		8.5		10.0		13.0	ns
t <sub>ENLSZ</sub>	Enable to Pad, H/L to Z, Low Slew		6.5		7.5		8.5		10.0		13.0	ns
t <sub>CKHS</sub>	IOCLK Pad to Pad H/L, High Slew		7.5		7.5		9.0		10.0		13.0	ns
t <sub>CKLS</sub>	IOCLK Pad to Pad H/L, Low Slew		11.3		11.3		13.5		15.0		19.5	ns
d <sub>TLHHS</sub>	Delta Low to High, High Slew		0.02		0.02		0.03		0.03		0.04	ns/pF
d <sub>TLHLS</sub>	Delta Low to High, Low Slew		0.05		0.05		0.06		0.07		0.09	ns/pF
d <sub>THLHS</sub>	Delta High to Low, High Slew		0.04		0.04		0.04		0.05		0.07	ns/pF
d <sub>THLLS</sub>	Delta High to Low, Low Slew		0.05		0.05		0.06		0.07		0.09	ns/pF
I/O Module – CMOS Output Timing <sup>1</sup>												
t <sub>DHS</sub>	Data to Pad, High Slew		6.2		7.0		7.9		9.3		12.1	ns
t <sub>DLS</sub>	Data to Pad, Low Slew		11.7		13.1		14.9		17.5		22.8	ns
t <sub>ENZHS</sub>	Enable to Pad, Z to H/L, High Slew		5.2		5.9		6.6		7.8		10.1	ns
t <sub>ENZLS</sub>	Enable to Pad, Z to H/L, Low Slew		8.9		10.0		11.3		13.3		17.3	ns
t <sub>ENHSZ</sub>	Enable to Pad, H/L to Z, High Slew		6.7		7.5		8.5		10.0		13.0	ns
t <sub>ENLSZ</sub>	Enable to Pad, H/L to Z, Low Slew		6.7		7.5		9.0		10.0		13.0	ns
t <sub>CKHS</sub>	IOCLK Pad to Pad H/L, High Slew		8.9		8.9		10.7		11.8		15.3	ns
t <sub>CKLS</sub>	IOCLK Pad to Pad H/L, Low Slew		13.0		13.0		15.6		17.3		22.5	ns
d <sub>TLHHS</sub>	Delta Low to High, High Slew		0.04		0.04		0.05		0.06		0.08	ns/pF
d <sub>TLHLS</sub>	Delta Low to High, Low Slew		0.07		0.08		0.09		0.11		0.14	ns/pF
d <sub>THLHS</sub>	Delta High to Low, High Slew		0.03		0.03		0.03		0.04		0.05	ns/pF
d <sub>THLLS</sub>	Delta High to Low, Low Slew		0.04		0.04		0.04		0.05		0.07	ns/pF

**Notes:**

1. Delays based on 35 pF loading.
2. The –2 and –3 speed grades have been discontinued. Please refer to the Product Discontinuation Notices (PDNs) listed below:

PDN March 2001  
PDN 0104  
PDN 0203  
PDN 0604  
PDN 1004

## A1415A, A14V15A Timing Characteristics (continued)

**Table 2-21 • A1415A, A14V15A Worst-Case Commercial Conditions, VCC = 4.75 V, T<sub>J</sub> = 70°C**

Dedicated (hardwired) I/O Clock Network		–3 Speed		–2 Speed		–1 Speed		Std. Speed		3.3 V Speed <sup>1</sup>		Units
Parameter/Description		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>IOCKH</sub>	Input Low to High (pad to I/O module input)		2.0		2.3		2.6		3.0		3.5	ns
t <sub>IOPWH</sub>	Minimum Pulse Width High	1.9		2.4		3.3		3.8		4.8		ns
t <sub>IPOWL</sub>	Minimum Pulse Width Low	1.9		2.4		3.3		3.8		4.8		ns
t <sub>IOSAPW</sub>	Minimum Asynchronous Pulse Width	1.9		2.4		3.3		3.8		4.8		ns
t <sub>IOCKSW</sub>	Maximum Skew		0.4		0.4		0.4		0.4		0.4	ns
t <sub>IOP</sub>	Minimum Period	4.0		5.0		6.8		8.0		10.0		ns
f <sub>IOMAX</sub>	Maximum Frequency		250		200		150		125		100	MHz
<b>Dedicated (hardwired) Array Clock</b>												
t <sub>HCKH</sub>	Input Low to High (pad to S-module input)		3.0		3.4		3.9		4.5		5.5	ns
t <sub>HCKL</sub>	Input High to Low (pad to S-module input)		3.0		3.4		3.9		4.5		5.5	ns
t <sub>HPWH</sub>	Minimum Pulse Width High	1.9		2.4		3.3		3.8		4.8		ns
t <sub>HPWL</sub>	Minimum Pulse Width Low	1.9		2.4		3.3		3.8		4.8		ns
t <sub>HCKSW</sub>	Delta High to Low, Low Slew		0.3		0.3		0.3		0.3		0.3	ns
t <sub>HP</sub>	Minimum Period	4.0		5.0		6.8		8.0		10.0		ns
f <sub>HMAX</sub>	Maximum Frequency		250		200		150		125		100	MHz
<b>Routed Array Clock Networks</b>												
t <sub>RCKH</sub>	Input Low to High (FO = 64)		3.7		4.1		4.7		5.5		9.0	ns
t <sub>RCKL</sub>	Input High to Low (FO = 64)		4.0		4.5		5.1		6.0		9.0	ns
t <sub>RPWH</sub>	Min. Pulse Width High (FO = 64)	3.3		3.8		4.2		4.9		6.5		ns
t <sub>RPWL</sub>	Min. Pulse Width Low (FO = 64)	3.3		3.8		4.2		4.9		6.5		ns
t <sub>RCKSW</sub>	Maximum Skew (FO = 128)		0.7		0.8		0.9		1.0		1.0	ns
t <sub>RP</sub>	Minimum Period (FO = 64)	6.8		8.0		8.7		10.0		13.4		ns
f <sub>RMAX</sub>	Maximum Frequency (FO = 64)		150		125		115		100		75	MHz
<b>Clock-to-Clock Skews</b>												
t <sub>IOHCKSW</sub>	I/O Clock to H-Clock Skew	0.0	1.7	0.0	1.8	0.0	2.0	0.0	2.2	0.0	3.0	ns
t <sub>IORCKSW</sub>	I/O Clock to R-Clock Skew (FO = 64)	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	3.0	ns
t <sub>HRCKSW</sub>	H-Clock to R-Clock Skew (FO = 64) (FO = 50% maximum)	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	3.0	ns

Notes:

- Delays based on 35 pF loading.
- The –2 and –3 speed grades have been discontinued. Refer to PDN 0104, PDN 0203, PDN 0604, and PDN 1004 at <http://www.microsemi.com/soc/support/notifications/default.aspx#pdn>.

## A1425A, A14V25A Timing Characteristics

**Table 2-22 • A1425A, A14V25A Worst-Case Commercial Conditions, VCC = 4.75 V, T<sub>J</sub> = 70°C<sup>1</sup>**

Logic Module Propagation Delays <sup>2</sup>		–3 Speed <sup>3</sup>		–2 Speed <sup>3</sup>		–1 Speed		Std. Speed		3.3 V Speed <sup>1</sup>		Units
Parameter/Description		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>PD</sub>	Internal Array Module		2.0		2.3		2.6		3.0		3.9	ns
t <sub>CO</sub>	Sequential Clock to Q		2.0		2.3		2.6		3.0		3.9	ns
t <sub>CLR</sub>	Asynchronous Clear to Q		2.0		2.3		2.6		3.0		3.9	ns
<b>Predicted Routing Delays<sup>4</sup></b>												
t <sub>RD1</sub>	FO = 1 Routing Delay		0.9		1.0		1.1		1.3		1.7	ns
t <sub>RD2</sub>	FO = 2 Routing Delay		1.2		1.4		1.6		1.8		2.4	ns
t <sub>RD3</sub>	FO = 3 Routing Delay		1.4		1.6		1.8		2.1		2.8	ns
t <sub>RD4</sub>	FO = 4 Routing Delay		1.7		1.9		2.2		2.5		3.3	ns
t <sub>RD8</sub>	FO = 8 Routing Delay		2.8		3.2		3.6		4.2		5.5	ns
<b>Logic Module Sequential Timing</b>												
t <sub>SUD</sub>	Flip-Flop Data Input Setup	0.5		0.6		0.7		0.8		0.8		ns
t <sub>HD</sub>	Flip-Flop Data Input Hold	0.0		0.0		0.0		0.0		0.0		ns
t <sub>SUD</sub>	Latch Data Input Setup	0.5		0.6		0.7		0.8		0.8		ns
t <sub>HD</sub>	Latch Data Input Hold	0.0		0.0		0.0		0.0		0.0		ns
t <sub>WASYN</sub>	Asynchronous Pulse Width	1.9		2.4		3.2		3.8		4.8		ns
t <sub>WCLKA</sub>	Flip-Flop Clock Pulse Width	1.9		2.4		3.2		3.8		4.8		ns
t <sub>A</sub>	Flip-Flop Clock Input Period	4.0		5.0		6.8		8.0		10.0		ns
f <sub>MAX</sub>	Flip-Flop Clock Frequency		250		200		150		125		100	MHz

**Notes:**

1. VCC = 3.0 V for 3.3 V specifications.
2. For dual-module macros, use t<sub>PD</sub> + t<sub>RD1</sub> + t<sub>PDn</sub> + t<sub>CO</sub> + t<sub>RD1</sub> + t<sub>PDn</sub> or t<sub>PD1</sub> + t<sub>RD1</sub> + t<sub>SUD</sub>, whichever is appropriate.
3. The –2 and –3 speed grades have been discontinued. Refer to PDN 0104, PDN 0203, PDN 0604, and PDN 1004 at <http://www.microsemi.com/soc/support/notifications/default.aspx#pdn>.
4. Routing delays are for typical designs across worst-case operating conditions. These parameters should be used for estimating device performance. Post-route timing analysis or simulation is required to determine actual worst-case performance. Post-route timing is based on actual routing delay measurements performed on the device prior to shipment.

## A1440A, A14V40A Timing Characteristics (continued)

**Table 2-27 • A1440A, A14V40A Worst-Case Commercial Conditions, VCC = 4.75 V, T<sub>J</sub> = 70°C**

I/O Module Input Propagation Delays		–3 Speed <sup>1</sup>		–2 Speed <sup>1</sup>		–1 Speed		Std. Speed		3.3 V Speed <sup>1</sup>		Units
Parameter/Description		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>INY</sub>	Input Data Pad to Y		2.8		3.2		3.6		4.2		5.5	ns
t <sub>ICKY</sub>	Input Reg IOCLK Pad to Y		4.7		5.3		6.0		7.0		9.2	ns
t <sub>OCKY</sub>	Output Reg IOCLK Pad to Y		4.7		5.3		6.0		7.0		9.2	ns
t <sub>ICLRY</sub>	Input Asynchronous Clear to Y		4.7		5.3		6.0		7.0		9.2	ns
t <sub>OCLRY</sub>	Output Asynchronous Clear to Y		4.7		5.3		6.0		7.0		9.2	ns
<b>Predicted Input Routing Delays<sup>2</sup></b>												
t <sub>RD1</sub>	FO = 1 Routing Delay		0.9		1.0		1.1		1.3		1.7	ns
t <sub>RD2</sub>	FO = 2 Routing Delay		1.2		1.4		1.6		1.8		2.4	ns
t <sub>RD3</sub>	FO = 3 Routing Delay		1.4		1.6		1.8		2.1		2.8	ns
t <sub>RD4</sub>	FO = 4 Routing Delay		1.7		1.9		2.2		2.5		3.3	ns
t <sub>RD8</sub>	FO = 8 Routing Delay		2.8		3.2		3.6		4.2		5.5	ns
<b>I/O Module Sequential Timing (wrt IOCLK pad)</b>												
t <sub>INH</sub>	Input F-F Data Hold	0.0		0.0		0.0		0.0		0.0		ns
t <sub>INSU</sub>	Input F-F Data Setup	1.8		1.7		2.0		2.3		2.3		ns
t <sub>IDEH</sub>	Input Data Enable Hold	0.0		0.0		0.0		0.0		0.0		ns
t <sub>IDESU</sub>	Input Data Enable Setup	5.8		6.5		7.5		8.6		8.6		ns
t <sub>OUTH</sub>	Output F-F Data hold	0.7		0.8		0.9		1.0		1.0		ns
t <sub>OUTSU</sub>	Output F-F Data Setup	0.7		0.8		0.9		1.0		1.0		ns
t <sub>ODEH</sub>	Output Data Enable Hold	0.3		0.4		0.4		0.5		0.5		ns
f <sub>ODESU</sub>	Output Data Enable Setup	1.3		1.5		1.7		2.0		2.0		ns

**Notes:**

1. The –2 and –3 speed grades have been discontinued. Refer to PDN 0104, PDN 0203, PDN 0604, and PDN 1004 at <http://www.microsemi.com/soc/support/notifications/default.aspx#pdn>.
2. Routing delays are for typical designs across worst-case operating conditions. These parameters should be used for estimating device performance. Post-route timing analysis or simulation is required to determine actual worst-case performance. Post-route timing is based on actual routing delay measurements performed on the device prior to shipment.

## A1440A, A14V40A Timing Characteristics (continued)

Table 2-28 • A1440A, A14V40A Worst-Case Commercial Conditions, VCC = 4.75 V, T<sub>J</sub> = 70°C

I/O Module – TTL Output Timing <sup>1</sup>		–3 Speed <sup>2</sup>		–2 Speed <sup>2</sup>		–1 Speed		Std. Speed		3.3 V Speed <sup>1</sup>		Units
Parameter/Description		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>DHS</sub>	Data to Pad, High Slew		5.0		5.6		6.4		7.5		9.8	ns
t <sub>DLS</sub>	Data to Pad, Low Slew		8.0		9.0		10.2		12.0		15.6	ns
t <sub>ENZHS</sub>	Enable to Pad, Z to H/L, High Slew		4.0		4.5		5.1		6.0		7.8	ns
t <sub>ENZLS</sub>	Enable to Pad, Z to H/L, Low Slew		7.4		8.3		9.4		11.0		14.3	ns
t <sub>ENHSZ</sub>	Enable to Pad, H/L to Z, High Slew		7.4		8.3		9.4		11.0		14.3	ns
t <sub>ENLSZ</sub>	Enable to Pad, H/L to Z, Low Slew		7.4		8.3		9.4		11.0		14.3	ns
t <sub>CKHS</sub>	IOCLK Pad to Pad H/L, High Slew		8.5		8.5		9.5		11.0		14.3	ns
t <sub>CKLS</sub>	IOCLK Pad to Pad H/L, Low Slew		11.3		11.3		13.5		15.0		19.5	ns
d <sub>TLHHS</sub>	Delta Low to High, High Slew		0.02		0.02		0.03		0.03		0.04	ns/pF
d <sub>TLHLS</sub>	Delta Low to High, Low Slew		0.05		0.05		0.06		0.07		0.09	ns/pF
d <sub>THLHS</sub>	Delta High to Low, High Slew		0.04		0.04		0.04		0.05		0.07	ns/pF
d <sub>THLLS</sub>	Delta High to Low, Low Slew		0.05		0.05		0.06		0.07		0.09	ns/pF
I/O Module – CMOS Output Timing <sup>1</sup>												
t <sub>DHS</sub>	Data to Pad, High Slew		6.2		7.0		7.9		9.3		12.1	ns
t <sub>DLS</sub>	Data to Pad, Low Slew		11.7		13.1		14.9		17.5		22.8	ns
t <sub>ENZHS</sub>	Enable to Pad, Z to H/L, High Slew		5.2		5.9		6.6		7.8		10.1	ns
t <sub>ENZLS</sub>	Enable to Pad, Z to H/L, Low Slew		8.9		10.0		11.3		13.3		17.3	ns
t <sub>ENHSZ</sub>	Enable to Pad, H/L to Z, High Slew		7.4		8.3		9.4		11.0		14.3	ns
t <sub>ENLSZ</sub>	Enable to Pad, H/L to Z, Low Slew		7.4		8.3		9.4		11.0		14.3	ns
t <sub>CKHS</sub>	IOCLK Pad to Pad H/L, High Slew		9.0		9.0		10.1		11.8		14.3	ns
t <sub>CKLS</sub>	IOCLK Pad to Pad H/L, Low Slew		13.0		13.0		15.6		17.3		22.5	ns
d <sub>TLHHS</sub>	Delta Low to High, High Slew		0.04		0.04		0.05		0.06		0.08	ns/pF
d <sub>TLHLS</sub>	Delta Low to High, Low Slew		0.07		0.08		0.09		0.11		0.14	ns/pF
d <sub>THLHS</sub>	Delta High to Low, High Slew		0.03		0.03		0.03		0.04		0.05	ns/pF
d <sub>THLLS</sub>	Delta High to Low, Low Slew		0.04		0.04		0.04		0.05		0.07	ns/pF

**Notes:**

1. Delays based on 35 pF loading.
2. The –2 and –3 speed grades have been discontinued. Refer to PDN 0104, PDN 0203, PDN 0604, and PDN 1004 at <http://www.microsemi.com/soc/support/notifications/default.aspx#pdn>.

## A14100A, A14V100A Timing Characteristics

**Table 2-34 • A14100A, A14V100A Worst-Case Commercial Conditions, VCC = 4.75 V, T<sub>J</sub> = 70°C<sup>1</sup>**

Logic Module Propagation Delays <sup>2</sup>		–3 Speed <sup>3</sup>		–2 Speed <sup>3</sup>		–1 Speed		Std. Speed		3.3 V Speed <sup>1</sup>		Units
Parameter/Description		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>PD</sub>	Internal Array Module		2.0		2.3		2.6		3.0		3.9	ns
t <sub>CO</sub>	Sequential Clock to Q		2.0		2.3		2.6		3.0		3.9	ns
t <sub>CLR</sub>	Asynchronous Clear to Q		2.0		2.3		2.6		3.0		3.9	ns
<b>Predicted Routing Delays<sup>4</sup></b>												
t <sub>RD1</sub>	FO = 1 Routing Delay		0.9		1.0		1.1		1.3		1.7	ns
t <sub>RD2</sub>	FO = 2 Routing Delay		1.2		1.4		1.6		1.8		2.4	ns
t <sub>RD3</sub>	FO = 3 Routing Delay		1.4		1.6		1.8		2.1		2.8	ns
t <sub>RD4</sub>	FO = 4 Routing Delay		1.7		1.9		2.2		2.5		3.3	ns
t <sub>RD8</sub>	FO = 8 Routing Delay		2.8		3.2		3.6		4.2		5.5	ns
<b>Logic Module Sequential Timing</b>												
t <sub>SUD</sub>	Flip-Flop Data Input Setup	0.5		0.6		0.8		0.8		0.8		ns
t <sub>HD</sub>	Flip-Flop Data Input Hold	0.0		0.0		0.5		0.5		0.5		ns
t <sub>SUD</sub>	Latch Data Input Setup	0.5		0.6		0.8		0.8		0.8		ns
t <sub>HD</sub>	Latch Data Input Hold	0.0		0.0		0.5		0.5		0.5		ns
t <sub>WASYN</sub>	Asynchronous Pulse Width	2.4		3.2		3.8		4.8		6.5		ns
t <sub>WCLKA</sub>	Flip-Flop Clock Pulse Width	2.4		3.2		3.8		4.8		6.5		ns
t <sub>A</sub>	Flip-Flop Clock Input Period	5.0		6.8		8.0		10.0		13.4		ns
f <sub>MAX</sub>	Flip-Flop Clock Frequency		200		150		125		100		75	MHz

**Notes:**

1. VCC = 3.0 V for 3.3 V specifications.
2. For dual-module macros, use t<sub>PD</sub> + t<sub>RD1</sub> + t<sub>PDn</sub> + t<sub>CO</sub> + t<sub>RD1</sub> + t<sub>PDn</sub> or t<sub>PD1</sub> + t<sub>RD1</sub> + t<sub>SUD</sub>, whichever is appropriate.
3. The –2 and –3 speed grades have been discontinued. Refer to PDN 0104, PDN 0203, PDN 0604, and PDN 1004 at <http://www.microsemi.com/soc/support/notifications/default.aspx#pdn>.
4. Routing delays are for typical designs across worst-case operating conditions. These parameters should be used for estimating device performance. Post-route timing analysis or simulation is required to determine actual worst-case performance. Post-route timing is based on actual routing delay measurements performed on the device prior to shipment.

**SDO                      Serial Data Output (Output)**

Serial data output for diagnostic probe. SDO is active when the MODE pin is High. This pin functions as an I/O when the MODE pin is Low.

**DCLK                      Diagnostic Clock (Input)**

Clock input for diagnostic probe and device programming. DCLK is active when the MODE pin is HIGH. This pin functions as an I/O when the MODE pin is LOW.

**VCC                      5 V Supply Voltage**

HIGH supply voltage.

PQ160			
Pin Number	A1425, A14V25 Function	A1440, A14V40 Function	A1460, A14V60 Function
92	NC	I/O	I/O
93	NC	I/O	I/O
98	GND	GND	GND
99	VCC	VCC	VCC
100	NC	I/O	I/O
103	GND	GND	GND
107	NC	I/O	I/O
109	NC	I/O	I/O
110	VCC	VCC	VCC
111	GND	GND	GND
112	VCC	VCC	VCC
113	NC	I/O	I/O
119	NC	I/O	I/O
120	IOCLK, I/O	IOCLK, I/O	IOCLK, I/O
121	GND	GND	GND
124	NC	I/O	I/O
127	NC	I/O	I/O
136	CLKA, I/O	CLKA, I/O	CLKA, I/O
137	CLKB, I/O	CLKB, I/O	CLKB, I/O
138	VCC	VCC	VCC
139	GND	GND	GND
140	VCC	VCC	VCC
141	GND	GND	GND
142	PRA, I/O	PRA, I/O	PRA, I/O
143	NC	I/O	I/O
145	NC	I/O	I/O
147	NC	I/O	I/O
149	NC	I/O	I/O
151	NC	I/O	I/O
153	NC	I/O	I/O
154	VCC	VCC	VCC
160	DCLK, I/O	DCLK, I/O	DCLK, I/O

**Notes:**

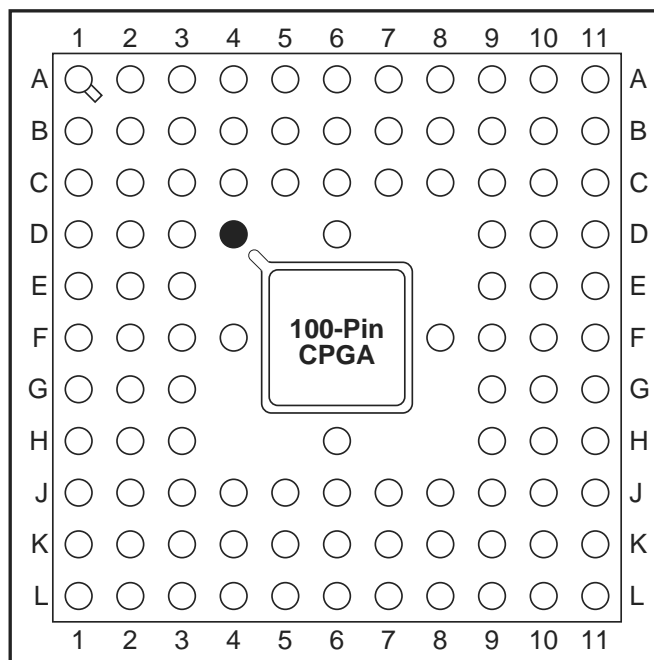
1. All unlisted pin numbers are user I/Os.
2. NC denotes no connection.
3. MODE should be terminated to GND through a 10K resistor to enable Actionprobe usage; otherwise it can be terminated directly to GND.

BG225	
A1460 Function	Location
CLKA or I/O	C8
CLKB or I/O	B8
DCLK or I/O	B2
GND	A1, A15, D15, F8, G7, G8, G9, H6, H7, H8, H9, H10, J7, J8, J9, K8, P2, R15
HCLK or I/O	P9
IOCLK or I/O	B14
IOPCL or I/O	P14
MODE	D1
NC	A11, B5, B7, D8, D12, F6, F11, H1, H12, H14, K11, L1, L13, N8, P5, R1, R8, R11, R14
PRA or I/O	A7
PRB or I/O	L7
SDI or I/O	D4
SDO	N13
VCC	A8, B12, D5, D14, E3, E8, E13, H2, H3, H11, H15, K4, L2, L12, M8, M15, P4, P8, R13

*Notes:*

1. All unlisted pin numbers are user I/Os.
2. NC denotes no connection.
3. MODE should be terminated to GND through a 10K resistor to enable Actionprobe usage; otherwise it can be terminated directly to GND.
4. The BG225 package has been discontinued.

## PG100



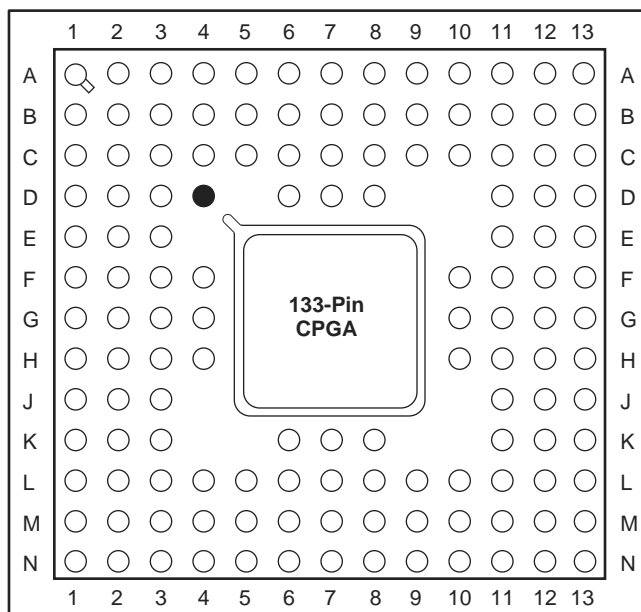
● Orientation Pin

*Note:* This is the top view.

### Note

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

## PG133



*Note: This is the top view.*

### Note

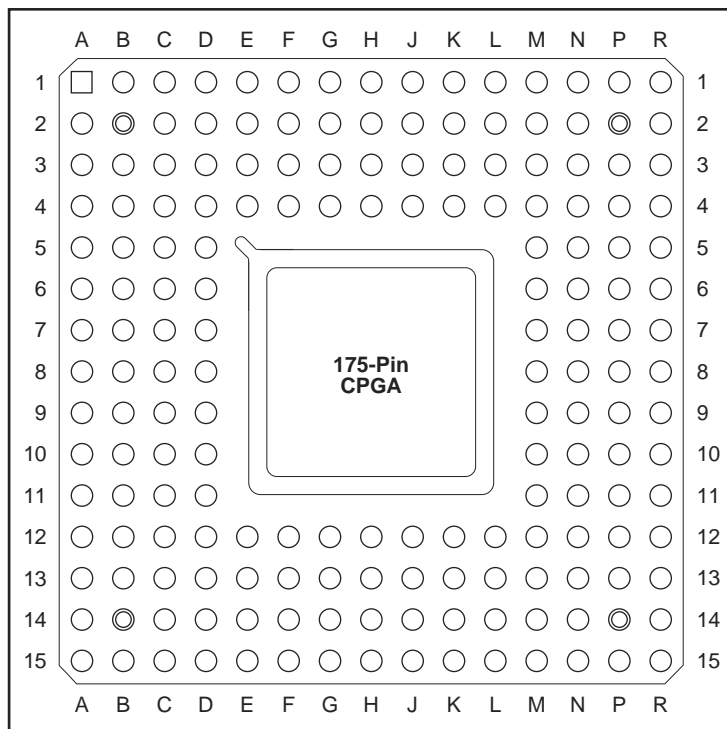
For Package Manufacturing and Environmental information, visit the Resource Center at <http://www.microsemi.com/soc/products/solutions/package/docs.aspx>

PG133	
A1425 Function	Location
CLKA or I/O	D7
CLKB or I/O	B6
DCLK or I/O	D4
GND	A2, C3, C7, C11, C12, F10, G3, G11, L3, L7, L11, M3, N12
HCLK or I/O	K7
IOCLK or I/O	C10
IOPCL or I/O	L10
MODE	E3
NC	A1, A7, A13, G1, G13, N1, N7, N13
PRA or I/O	A6
PRB or I/O	L6
SDI or I/O	C2
SDO	M11
VCC	B2, B7, B12, E11, G2, G12, J2, J12, M2, M7, M12

*Notes:*

1. All unlisted pin numbers are user I/Os.
2. NC denotes no connection.
3. MODE should be terminated to GND through a 10K resistor to enable Actionprobe usage; otherwise it can be terminated directly to GND.
4. The PG133 package has been discontinued.

## PG175

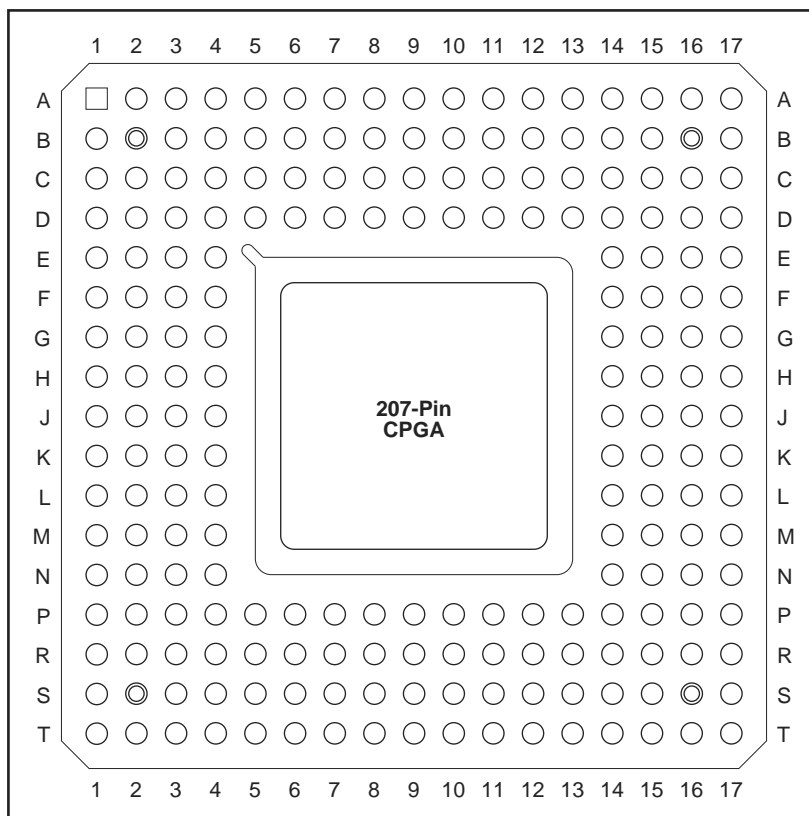


*Note: This is the top view.*

### **Note**

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

## PG207



*Note: This is the top view.*

### Note

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

PG207	
A1460 Function	Location
CLKA or I/O	K1
CLKB or I/O	J3
DCLK or I/O	E4
GND	C14, D4, D5, D9, D14, J4, J14, P3, P4, P7, P9, P14, R15
HCLK or I/O	J15
IOCLK or I/O	P5
IOPCL or I/O	N14
MODE	D7
NC	A1, A2, A16, A17, B1, B17, C1, C2, S1, S3, S17, T1, T2, T16, T17
PRA or I/O	H1
PRB or I/O	K16
SDI or I/O	C3
SDO	P15
VCC	B2, B9, B16, D11, J2, J16, P12, S2, S9, S16, T5

**Notes:**

1. All unlisted pin numbers are user I/Os.
2. NC denotes no connection.
3. MODE should be terminated to GND through a 10K resistor to enable Actionprobe usage; otherwise it can be terminated directly to GND.

## 4 – Datasheet Information

### List of Changes

The following table lists critical changes that were made in each version of the datasheet.

Revision	Changes	Page
Revision 3 (January 2012)	The description for SDO pins had earlier been removed from the datasheet and has now been included again, in the "Pin Descriptions" section (SAR 35820).	2-21
	SDO pin numbers had earlier been removed from package pin assignment tables in the datasheet, and have now been restored to the pin tables (SAR 35820).	3-1
Revision 2 (September 2011)	The ACT 3 datasheet was formatted newly in the style used for current datasheets. The same information is present (other than noted in the list of changes for this revision) but divided into chapters.	N/A
	The datasheet was revised to note in multiple places that speed grades –2 and –3 have been discontinued. The following device/package combinations have been discontinued for all speed grades and temperatures (SAR 33872): A1415 PG100 A1425 PG133 A1440 PG175 A1460 BG225 Refer to PDN 0104, PDN 0203, PDN 0604, and PDN 1004.	I and others
	The "Features" section was revised to state the clock-to-output time and on-chip performance for –1 speed grade as 9.0 ns and 186 MHz. The "General Description" section was revised in accordance (SAR 33872).	I
	The maximum performance values were updated in Table 1 • ACT 3 Family Product Information, and now reflect worst-case commercial for the –1 speed grade (SAR 33872).	I
	The "Product Plan" table was updated as follows to conform to current offerings (SAR 33872): The A1415A device is offered in PL84, PG100, and VQ100 packages for Military application. The A1440A device is offered in TQ176 and VQ100 packages for Industrial application.	III
	Table 1-1 • Chip-to-Chip Performance (worst-case commercial) was updated to include data for all speed grades instead of only –3 (SAR 33872).	1-2
	Figure 1-1 • Predictable Performance (worst-case commercial, –1 speed grade) was revised to reflect values for the –1 speed grade (SAR 33872).	1-1
	Figure 2-10 • Timing Model was updated to show data for the –1 speed grade instead of –3 (SAR 33872).	2-16
	Table 2-14 • Logic Module and Routing Delay by Fanout (ns); Worst-Case Commercial Conditions was updated to include data for all speed grades instead of only –3 (SAR 33872).	2-20
	Package names used in the "Package Pin Assignments" section and throughout the document were revised to match standards given in <i>Package Mechanical Drawings</i> (SAR 27395).	3-1



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