

## ••••• Combining Performance, Density, and Embedded RAM

### Device Highlights

#### Flexible Programmable Logic

- .25  $\mu\text{m}$ , Five layer metal CMOS Process
- 2.5 V  $V_{CC}$ , 2.5 V/3.3 V Drive Capable I/O
- 1,536 Logic Cells
- 320,640 Max System Gates
- Up to 313 I/O Pins

#### Embedded Dual Port SRAM

- Twenty four 2,304-bit Dual Port High Performance SRAM Blocks
- 55,300 RAM Bits
- RAM/ROM/FIFO Wizard for Automatic Configuration
- Configurable and Cascadable

#### Programmable I/O

- High performance Enhanced I/O (EIO): Less than 3 ns  $T_{CO}$
- Programmable Slew Rate Control
- Programmable I/O Standards:
  - LVTTTL, LVCMOS, PCI, GTL+, SSTL2, and SSTL3
- Eight Independent I/O Banks
- Three Register Configurations: Input, Output, and Output Enable

### Advanced Clock Network

- Nine Global Clock Networks:
  - One Dedicated
  - Eight Programmable
- 20 Quad-Net Networks: Five per Quadrant
- 16 I/O Controls: Two per I/O Bank

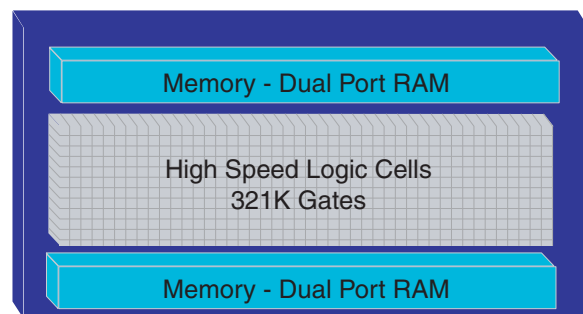


Figure 1: Eclipse Block Diagram

## Electrical Specifications

### AC Characteristics at $V_{CC} = 2.5\text{ V}$ , $T_A = 25^\circ\text{ C}$ ( $K = 0.74$ )

The AC Specifications are provided from **Table 1** to **Table 10**. Logic Cell diagrams and waveforms are provided from **Figure 2** to **Figure 15**.

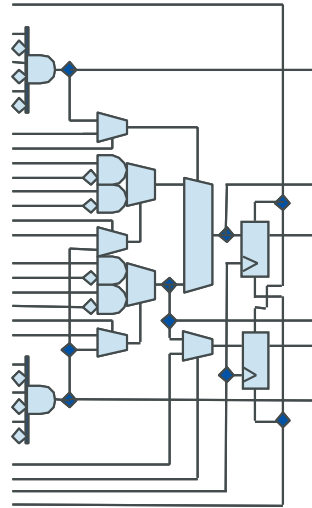


Figure 2: Eclipse Logic Cell

Table 1: Logic Cells

Symbol Logic Cells	Parameter	Value (ns)	
		Min	Max
$t_{PD}$	Combinatorial Delay of the longest path: time taken by the combinatorial circuit to output	-	0.257
$t_{SU}$	Setup time: time the synchronous input of the flip flop must be stable before the active clock edge	0.22	-
$t_{HL}$	Hold time: time the synchronous input of the flip flop must be stable after the active clock edge	0	-
$t_{CO}$	Clock-to-out delay: the amount of time taken by the flip flop to output after the active clock edge.	-	0.255
$t_{CWHI}$	Clock High Time: required minimum time the clock stays high	0.46	-
$t_{CWLO}$	Clock Low Time: required minimum time that the clock stays low	0.46	-
$t_{SET}$	Set Delay: time between when the flip flop is "set" (high) and when the output is consequently "set" (high)	-	0.18
$t_{RESET}$	Reset Delay: time between when the flip flop is "reset" (low) and when the output is consequently "reset" (low)	-	0.09
$t_{SW}$	Set Width: time that the SET signal remains high/low	0.3	-
$t_{RW}$	Reset Width: time that the RESET signal remains high/low	0.3	-

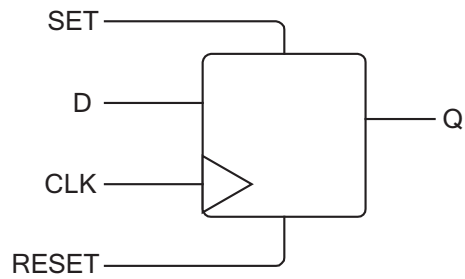


Figure 3: Logic Cell Flip Flop

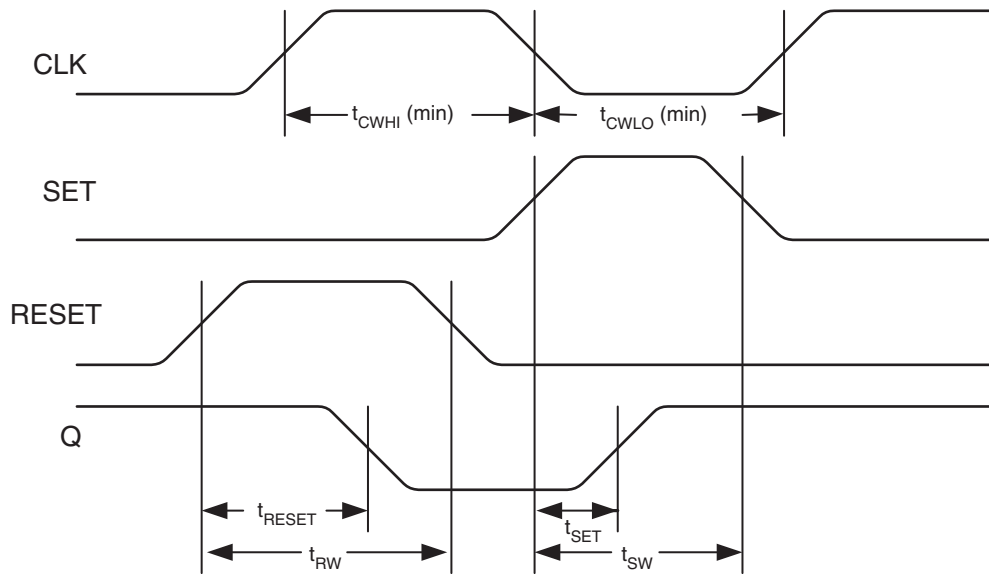


Figure 4: Logic Cell Flip Flop Timings - First Waveform

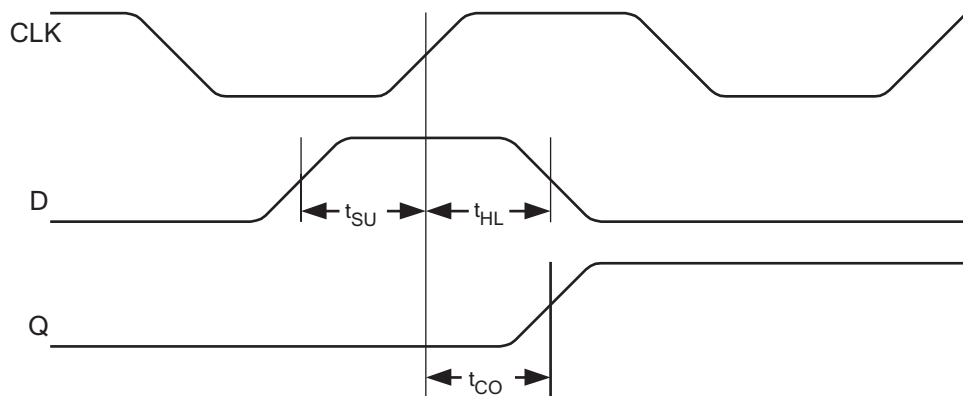


Figure 5: Logic Cell Flip Flop Timings - Second Waveform

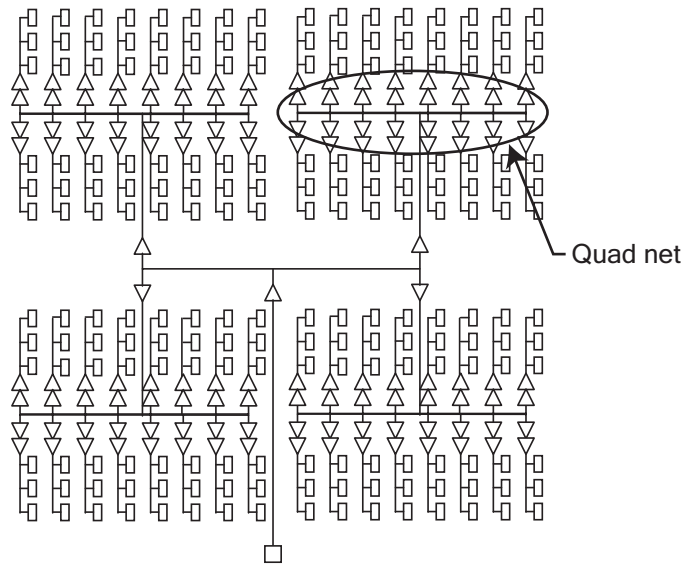


Figure 6: Eclipse Global Clock Structure

Table 2: Eclipse Clock Performance

Clock	Parameters	Clock Performance	
		Global	Dedicated
Logic Cells (Internal)	Clock signal generated internally	1.51 ns (max)	1.59 ns (max)
I/O's (External)	Clock signal generated externally	2.06 ns (max)	1.73 ns (max)

Table 3: Eclipse Global Clock Performance

Clock Segment	Parameter	Value (ns)	
		Min	Max
$t_{PGCK}$	Global clock pin delay to quad net	-	1.34
$t_{BGCK}$	Global clock buffer delay (quad net to flip flop)	-	0.56

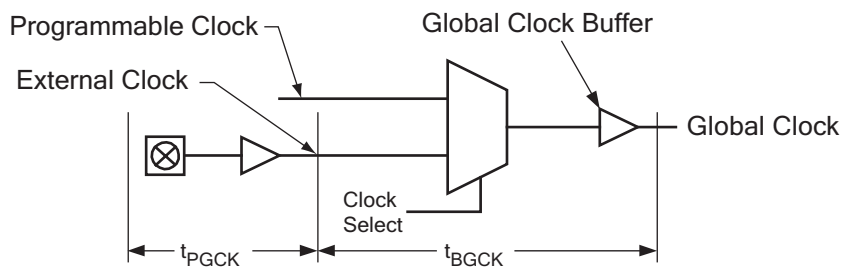


Figure 7: Global Clock Structure Schematic

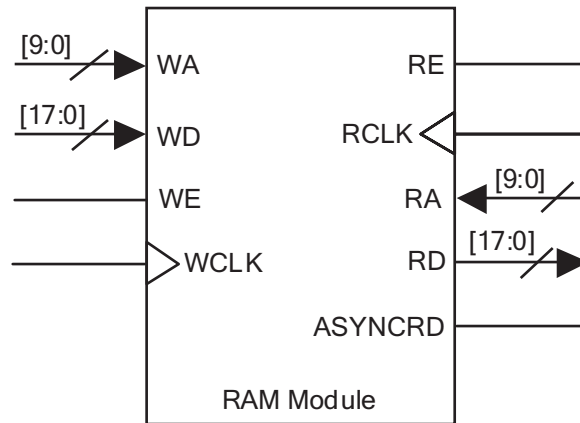


Figure 8: RAM Module

Table 4: RAM Cell Synchronous Write Timing

Symbol	Parameter	Value (ns)	
		Min	Max
<b>RAM Cell Synchronous Write Timing</b>			
$t_{SWA}$	WA setup time to WCLK: time the WRITE ADDRESS must be stable before the active edge of the WRITE CLOCK	0.675	-
$t_{HWA}$	WA hold time to WCLK: time the WRITE ADDRESS must be stable after the active edge of the WRITE CLOCK	0	-
$t_{SWD}$	WD setup time to WCLK: time the WRITE DATA must be stable before the active edge of the WRITE CLOCK	0.654	-
$t_{HWD}$	WD hold time to WCLK: time the WRITE DATA must be stable after the active edge of the WRITE CLOCK	0	-
$t_{SWE}$	WE setup time to WCLK: time the WRITE ENABLE must be stable before the active edge of the WRITE CLOCK	0.623	-
$t_{HWE}$	WE hold time to WCLK: time the WRITE ENABLE must be stable after the active edge of the WRITE CLOCK	0	-
$t_{WCRD}$	WCLK to RD (WA = RA): time between the active WRITE CLOCK edge and the time when the data is available at RD	-	4.38



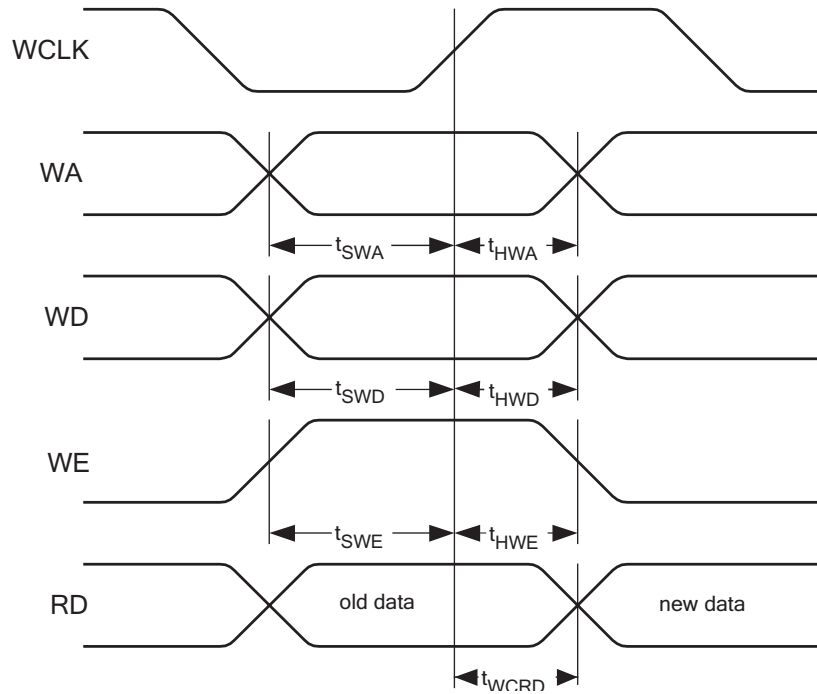


Figure 9: RAM Cell Synchronous Write Timing

Table 5: RAM Cell Synchronous & Asynchronous Read Timing

Symbol	Parameter	Value (ns)	
		Min	Max
<b>RAM Cell Synchronous Read Timing</b>			
$t_{SRA}$	RA setup time to RCLK: time the READ ADDRESS must be stable before the active edge of the READ CLOCK	0.686	-
$t_{HRA}$	RA hold time to RCLK: time the READ ADDRESS must be stable after the active edge of the READ CLOCK	0	-
$t_{SRE}$	RE setup time to WCLK: time the READ ENABLE must be stable before the active edge of the READ CLOCK	0.243	-
$t_{HRE}$	RE hold time to WCLK: time the READ ENABLE must be stable after the active edge of the READ CLOCK	0	-
$t_{RCRD}$	RCLK to RD: time between the active READ CLOCK edge and the time when the data is available at RD	-	4.38
<b>RAM Cell Asynchronous Read Timing</b>			
$t_{PDRD}$	RA to RD: time between when the READ ADDRESS is input and when the DATA is output	-	2.06

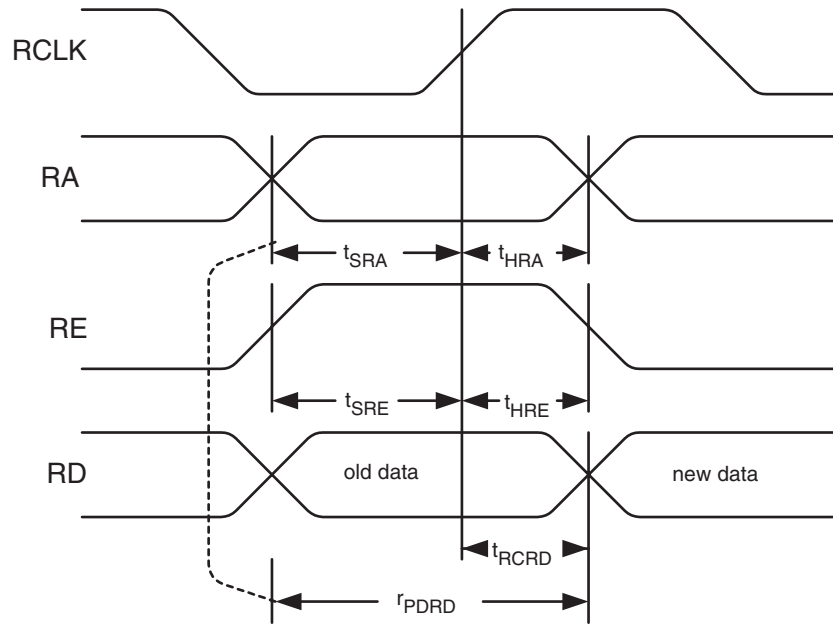


Figure 10: RAM Cell Synchronous & Asynchronous Read Timing

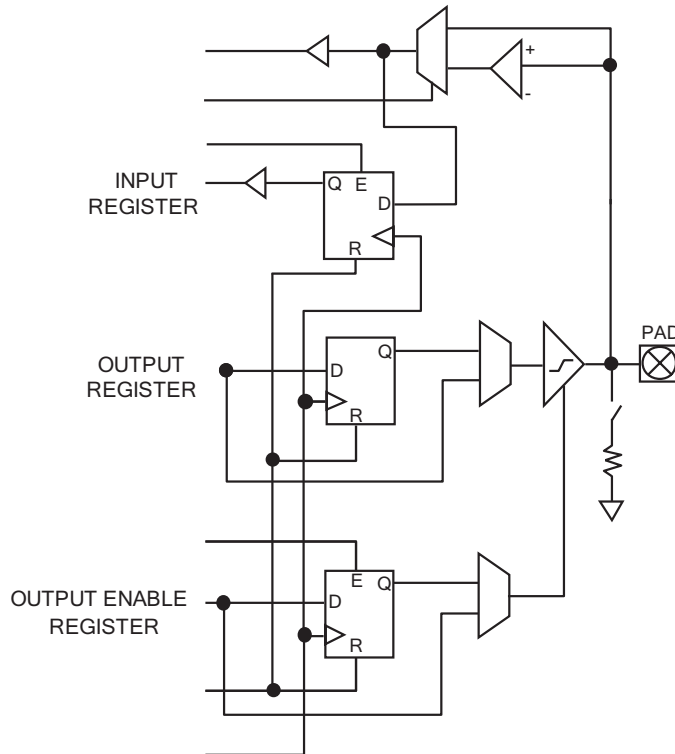


Figure 11: Eclipse Cell I/O

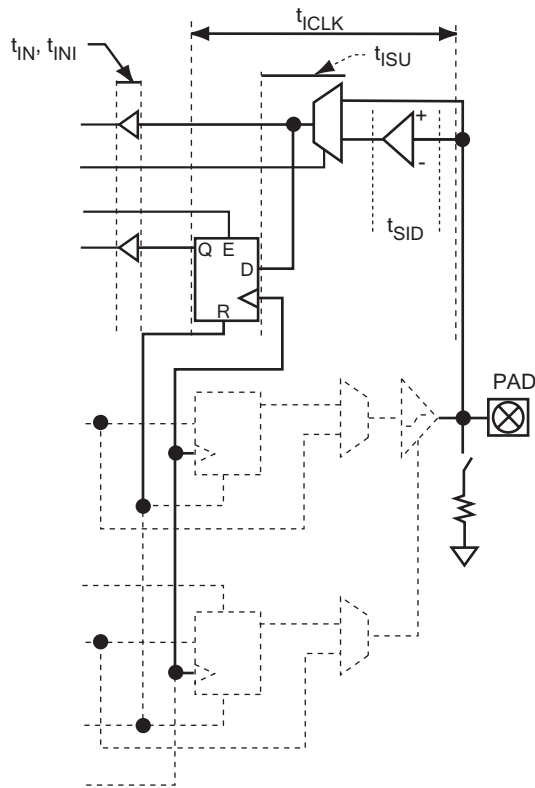


Figure 12: Eclipse Input Register Cell

Table 6: Input Register Cell

Symbol	Parameter	Value (ns)	
		Min	Max
<b>Input Register Cell Only</b>			
$t_{ISU}$	Input register setup time: time the synchronous input of the flip-flop must be stable before the active clock edge	3.12	-
$t_{IHL}$	Input register hold time: time the synchronous input of the flip-flop must be stable after the active clock edge	0	-
$t_{ICO}$	Input register clock to out: time taken by the flip-flop to output after the active clock edge	-	1.08
$t_{IRST}$	Input register reset delay: time between when the flip-flop is “reset”(low) and when the output is consequently “reset” (low)	-	0.99
$t_{IESU}$	Input register clock enable setup time: time “enable” must be stable before the active clock edge	0.37	-
$t_{IEH}$	Input register clock enable hold time: time “enable” must be stable after the active clock edge	0	-



Table 7: Standard Input Delays

Symbol	Parameter	Value (ns)	
		Min	Max
$t_{SID}$ (LVTTTL)	LVTTTL input delay: Low Voltage TTL for 3.3 V applications	-	0.34
$t_{SID}$ (LVCMOS2)	LVCMOS2 input delay: Low Voltage CMOS for 2.5 V and lower applications	-	0.42
$t_{SID}$ (GTL+)	GTL+ input delay: Gunning Transceiver Logic	-	0.68
$t_{SID}$ (SSTL3)	SSTL3 input delay: Stub Series Terminated Logic for 3.3 V	-	0.55
$t_{SID}$ (SSTL2)	SSTL2 input delay: Stub Series Terminated Logic for 2.5 V	-	0.61

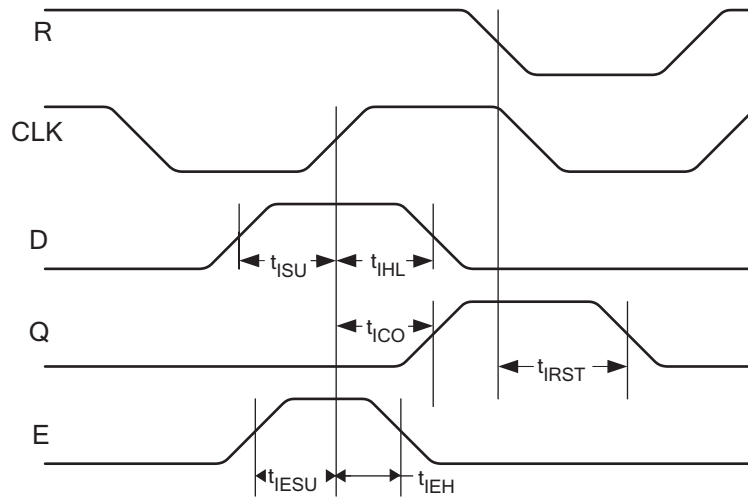


Figure 13: Eclipse Input Register Cell Timing

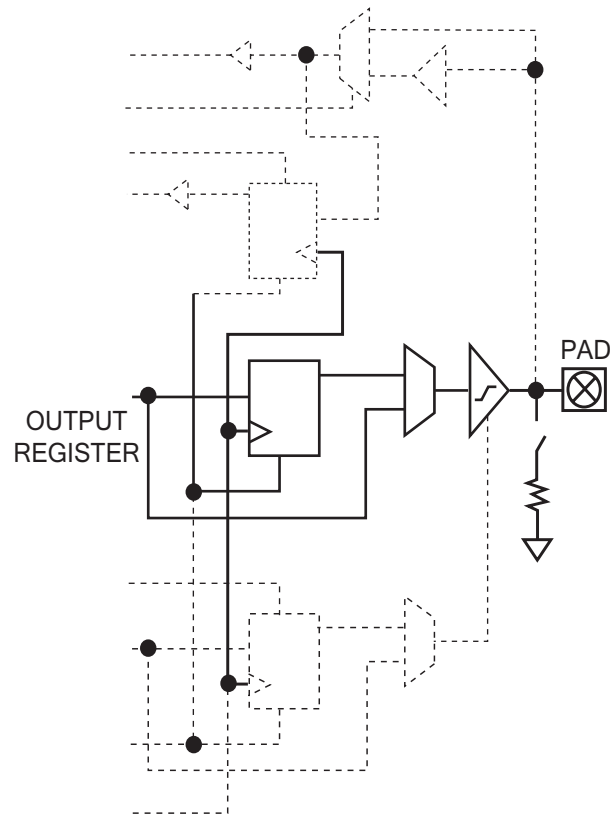


Figure 14: Eclipse Output Register Cell

Table 8: Eclipse Output Register Cell

Symbol	Parameter	Value (ns)	
		Min	Max
<b>Output Register Cell Only</b>			
$t_{OUTLH}$	Output Delay low to high (90% of H)	-	0.40
$t_{OUTHl}$	Output Delay high to low (10% of L)	-	0.55
$t_{PZH}$	Output Delay tri-state to high (90% of H)	-	2.94
$t_{PZL}$	Output Delay tri-state to low (10% of L)	-	2.34
$t_{PHZ}$	Output Delay high to tri-State	-	3.07
$t_{PLZ}$	Output Delay low to tri-State	-	2.53
$t_{COP}$	Clock to out delay (does not include clock tree delays)	-	3.15 (fast slew) 10.2 (slow slew)

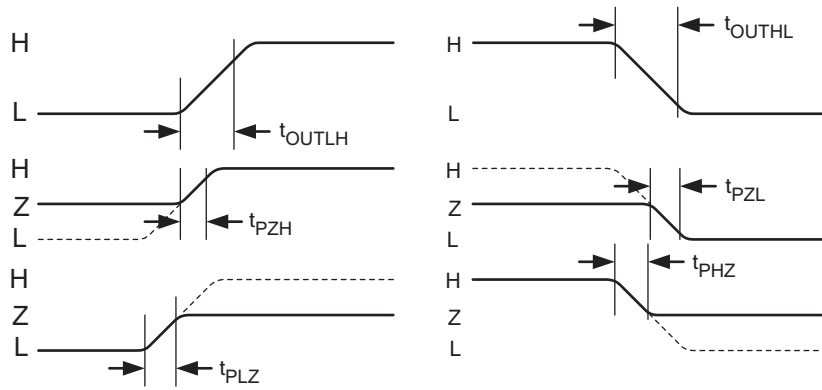


Figure 15: Eclipse Output Register Cell Timing

Table 9: Output Slew Rates @  $V_{CCIO} = 3.3\text{ V}$

	Fast Slew	Slow Slew
Rising Edge	2.8 V/ns	1.0 V/ns
Falling Edge	2.86 V/ns	1.0 V/ns

Table 10: Output Slew Rates @  $V_{CCIO} = 2.5\text{ V}$

	Fast Slew	Slow Slew
Rising Edge	1.7 V/ns	0.6 V/ns
Falling Edge	1.9 V/ns	0.6 V/ns



## DC Characteristics

The DC Specifications are provided in **Table 11** through **Table 13**.

Table 11: Absolute Maximum Ratings

Parameter	Value	Parameter	Value
V <sub>CC</sub> Voltage	-0.5 V to 3.6 V	DC Input Current	±20 mA
V <sub>CCIO</sub> Voltage	-0.5 V to 4.6 V	ESD Pad Protection	±2000 V
INREF Voltage	2.7 V	Leaded Package Storage Temperature	-65° C to + 150° C
Input Voltage	-0.5 V to V <sub>CCIO</sub> + 0.5 V	Laminate Package (BGA) Storage Temperature	-55° C to + 125° C
Latch-up Immunity	±100 mA		

Table 12: Operating Range

Symbol	Parameter	Military		Industrial		Commercial		Unit	
		Min	Max	Min	Max	Min	Max		
V <sub>CC</sub>	Supply Voltage	2.3	2.7	2.3	2.7	2.3	2.7	V	
V <sub>CCIO</sub>	I/O Input Tolerance Voltage	2.3	3.6	2.3	3.6	2.3	3.6	V	
TA	Ambient Temperature	-55		-40	85	0	70	°C	
TC	Case Temperature	-	125	-	-	-	-	°C	
K	Delay Factor	-4 Speed Grade	0.42	2.3	0.43	2.16	0.47	2.11	n/a
		-5 Speed Grade	0.42	1.92	0.43	1.80	0.46	1.76	n/a
		-6 Speed Grade	0.42	1.35	0.43	1.26	0.46	1.23	n/a
		-7 Speed Grade	0.42	1.27	0.43	1.19	0.46	1.16	n/a

Table 13: DC Characteristics

Symbol	Parameter	Conditions	Min	Max	Units
I <sub>I</sub>	I or I/O Input Leakage Current	V <sub>I</sub> = V <sub>CCIO</sub> or GND	-10	10	µA
I <sub>OZ</sub>	3-State Output Leakage Current	V <sub>I</sub> = V <sub>CCIO</sub> or GND	-10	10	µA
C <sub>I</sub>	Input Capacitance <sup>a</sup>	-	-	8	pF
I <sub>OS</sub>	Output Short Circuit Current <sup>b</sup>	V <sub>o</sub> = GND V <sub>o</sub> = V <sub>CC</sub>	-15 40	-180 210	mA mA
I <sub>CC</sub>	D.C. Supply Current <sup>c</sup>	V <sub>I</sub> , V <sub>o</sub> = V <sub>CCIO</sub> or GND	0.50 (typ)	2	mA
I <sub>CCIO</sub>	D.C. Supply Current on V <sub>CCIO</sub>	-	0	2	mA
I <sub>CCIO(DIF)</sub>	D.C. Supply Current on V <sub>CCIO</sub> for Differential I/O	-	-	-	mA
I <sub>REF</sub>	D.C. Supply Current on INREF	-	-10	10	µA
I <sub>PD</sub>	Pad Pull-down (programmable)	V <sub>CCIO</sub> = 3.6 V	-	150	µA

- a. Capacitance is sample tested only. Clock pins are 12 pF maximum.  
 b. Only one output at a time. Duration should not exceed 30 seconds.  
 c. For -4/-5/-6/-7 commercial grade devices only. Maximum I<sub>CC</sub> is 3 mA for -0 commercial grade and all industrial grade devices, and 5 mA for all military grade devices.

## I/O Characteristics

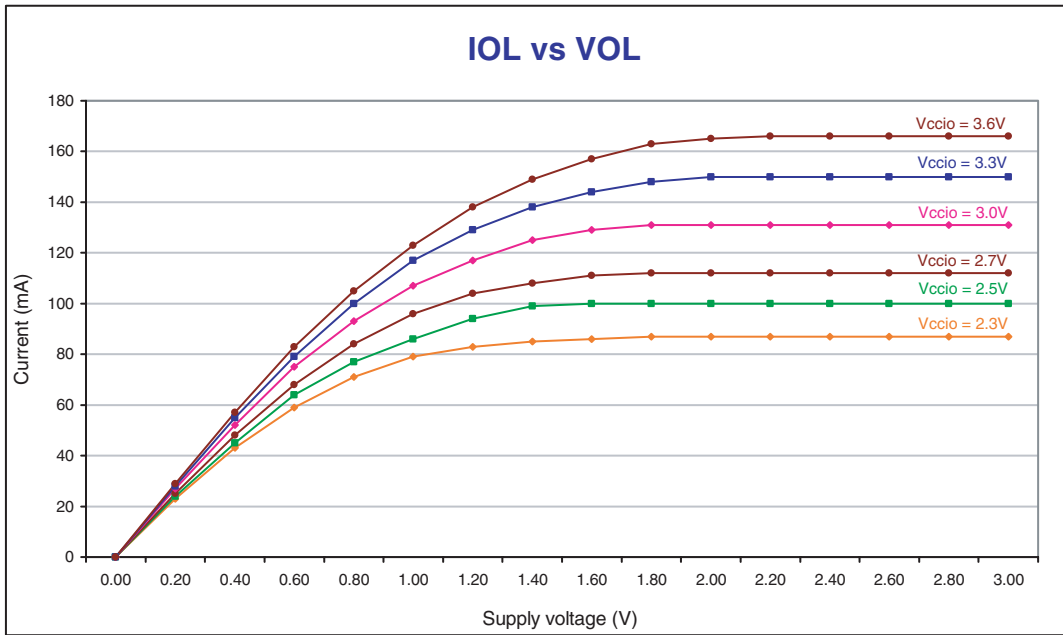


Figure 16: IOL vs. VOL

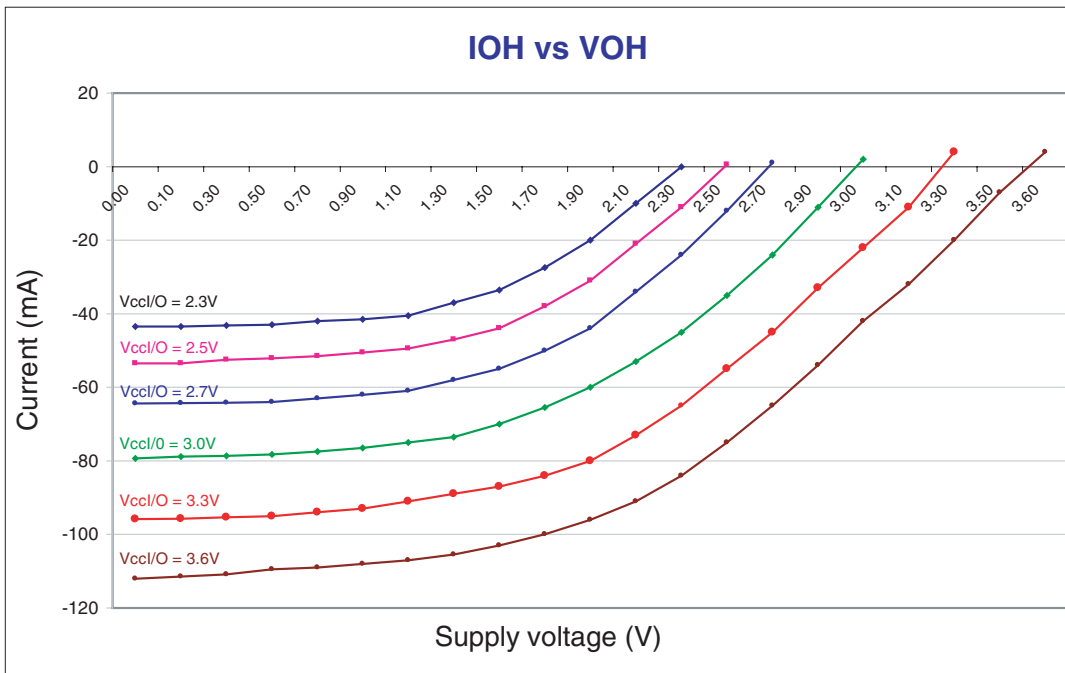


Figure 17: IOH vs. VOH

Table 14: DC Input and Output Levels

	INREF		$V_{IL}$		$V_{IH}$		$V_{OL}$	$V_{OH}$	$I_{OL}$	$I_{OH}$
	$V_{MIN}$	$V_{MAX}$	$V_{MIN}$	$V_{MAX}$	$V_{MIN}$	$V_{MAX}$	$V_{MAX}$	$V_{MIN}$	mA	mA
LVTTTL	n/a	n/a	-0.3	0.8	2.0	$V_{CCIO} + 0.3$	0.4	2.4	2.0	-2.0
LVC MOS2	n/a	n/a	-0.3	0.7	1.7	$V_{CCIO} + 0.3$	0.7	1.7	2.0	-2.0
GTL+	0.88	1.12	-0.3	INREF - 0.2	INREF + 0.2	$V_{CCIO} + 0.3$	0.6	n/a	40	n/a
PCI	n/a	n/a	-0.3	$0.3 \times V_{CCIO}$	$0.5 \times V_{CCIO}$	$V_{CCIO} + 0.5$	$0.1 \times V_{CCIO}$	$0.9 \times V_{CCIO}$	1.5	-0.5
SSTL2	1.15	1.35	-0.3	INREF - 0.18	INREF + 0.18	$V_{CCIO} + 0.3$	0.74	1.76	7.6	-7.6
SSTL3	1.3	1.7	-0.3	INREF - 0.2	INREF + 0.2	$V_{CCIO} + 0.3$	1.10	1.90	8	-8

**NOTE:** The data provided in **Table 14** are JEDEC and PCI Specifications. QuickLogic® devices either meet or exceed these requirements. See preceding **Table 1** through **Table 13** and **Figure 1** through **Figure 17** for data specific to QuickLogic I/Os.

**NOTE:** All CLK and INREF pins are clamped to the  $V_{CC}$  rail, not the  $V_{CCIO}$ . Therefore, these pins can only be driven up to  $V_{CC} + 0.3$  V.

## Package Thermal Characteristics

Thermal Resistance Equations:

$$\theta_{JC} = (T_J - T_C) / P$$

$$\theta_{JA} = (T_J - T_A) / P$$

$$P_{MAX} = (T_{JMAX} - T_{AMAX}) / \theta_{JA}$$

Parameter Description:

$\theta_{JC}$ : Junction-to-case thermal resistance

$\theta_{JA}$ : Junction-to-ambient thermal resistance

$T_J$ : Junction temperature

$T_A$ : Ambient temperature

P: Power dissipated by the device while operating

$P_{MAX}$ : The maximum power dissipation for the device

$T_{JMAX}$ : Maximum junction temperature

$T_{AMAX}$ : Maximum ambient temperature

**NOTE:** Maximum junction temperature ( $T_{JMAX}$ ) is 150° C. To calculate the maximum power dissipation for a device package look up  $\theta_{JA}$  from **Table 15**, pick an appropriate  $T_{AMAX}$  and use:

$$P_{MAX} = (150^\circ \text{ C} - T_{AMAX}) / \theta_{JA}$$

Table 15: Package Thermal Characteristics

Package Description		$\theta_{JA}$ (° C/W) @ various flow rates (m/sec)				$\theta_{JC}$ (° C/W)
Pin Count	Package Type	0	0.5	1	2	
516	PBGA	20.0	19.0	17.5	16.0	7.0
484	PBGA	28.0	26.0	25.0	23.0	9.0
280	LF-PBGA	18.5	17.0	15.5	14.0	7.0
208	PQFP	26.0	24.5	23.0	22.0	11.0



## Kv and Kt Graphs

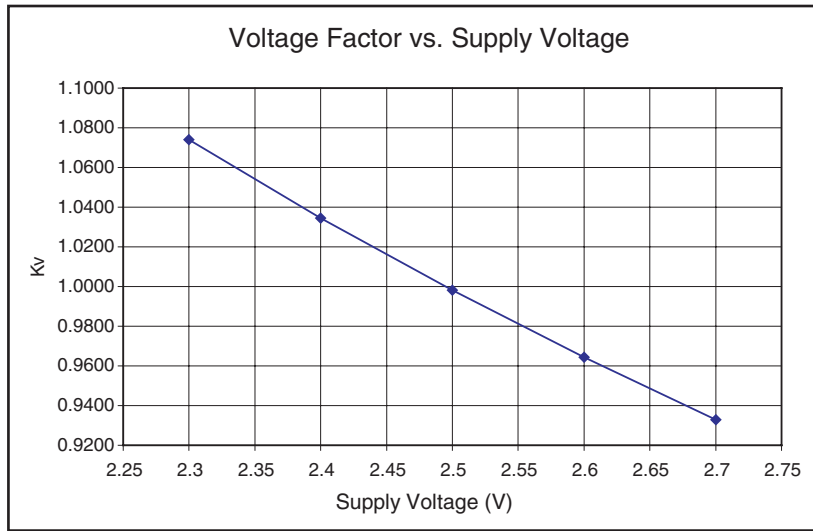


Figure 18: Voltage Factor vs. Supply Voltage

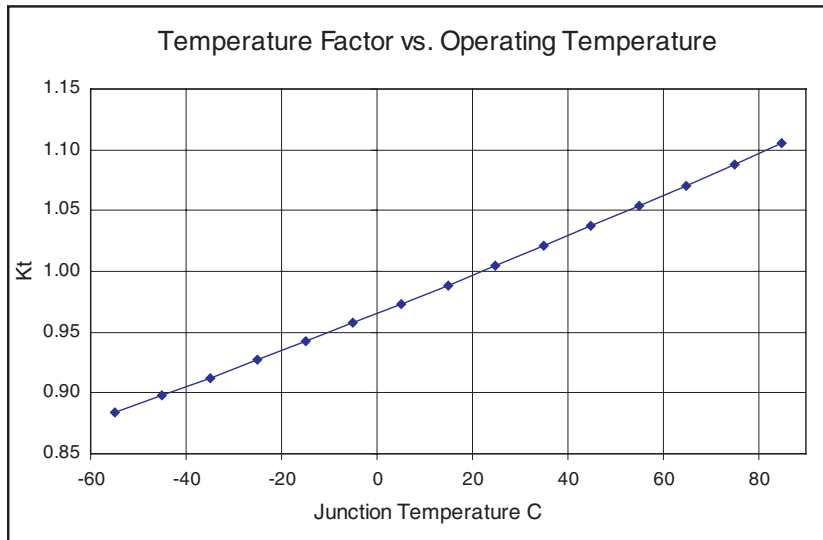


Figure 19: Temperature Factor vs. Operating Temperature



## Power vs. Operating Frequency

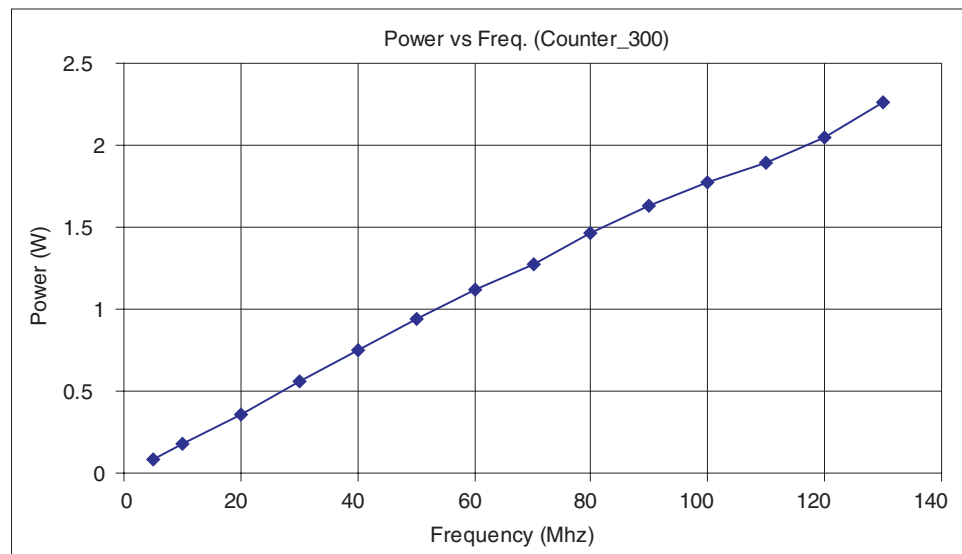
The basic power equation which best models power consumption is given below:

$$P_{\text{TOTAL}} = 0.350 + f[0.0031 \eta_{\text{LC}} + 0.0948 \eta_{\text{CKBF}} + 0.01 \eta_{\text{CLBF}} + 0.0263 \eta_{\text{CKLD}} + 0.543 \eta_{\text{RAM}} + 0.20 \eta_{\text{PLL}} + 0.0035 \eta_{\text{INP}} + 0.0257 \eta_{\text{OUTP}}] \text{ (mW)}$$

Where

- $\eta_{\text{LC}}$  is the total number of logic cells in the design
- $\eta_{\text{CKBF}}$  = # of clock buffers
- $\eta_{\text{CLBF}}$  = # of column clock buffers
- $\eta_{\text{CKLD}}$  = # of loads connected to the column clock buffers
- $\eta_{\text{RAM}}$  = # of RAM blocks
- $\eta_{\text{PLL}}$  = # of PLLs
- $\eta_{\text{INP}}$  is the number of input pins
- $\eta_{\text{OUTP}}$  is the number of output pins

**Figure 20** exhibits the power consumption in an Eclipse QL6325 device. The chip was filled with (300) 8-bit counters—approximately 76% logic cell utilization.



*Figure 20: Power Consumption*

**Figure 21** illustrates the theoretical worst-case scenarios for 50%, 70%, and 90% utilizations of the 6600-516 package. The resources of the device are divided exactly in half; meaning, for 50% utilization, exactly 50% of the I/Os, Logic Cells, RAM blocks, clock network, etc are utilized. These situations may never occur in a real design, but they do provide a very rough quantitative measure of power consumption when talking in terms of 50% or 70% utilization of an Eclipse device.

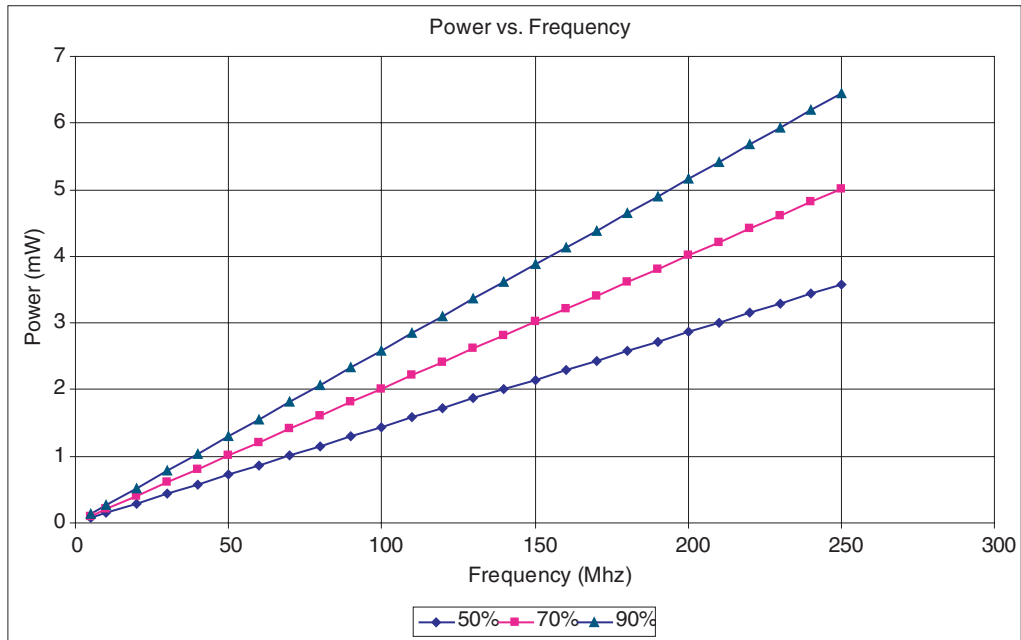


Figure 21: Power vs. Frequency (Absolute 50%, 70%, and 90% of the Available Resources on Chip)

To learn more about power consumption, please refer to application note #60 which is located at [www.quicklogic.com](http://www.quicklogic.com).

## Power-up Sequencing

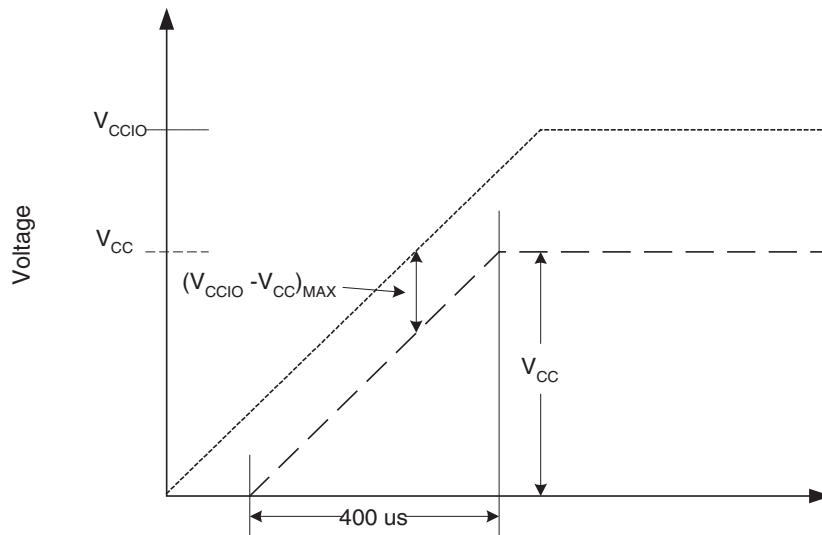


Figure 22: Power-up Requirements

The following requirements must be met when powering up a device (refer to **Figure 22**):

- When ramping up the power supplies keep  $(V_{CCIO} - V_{CC})_{MAX} \leq 500$  mV. Deviation from this recommendation can cause permanent damage to the device.
- $V_{CCIO}$  must lead  $V_{CC}$  when ramping the device.
- The power supply must be greater than or equal to  $400 \mu s$  to reach  $V_{CC}$ . Ramping to  $V_{CC}/V_{CCIO}$  before reaching  $400 \mu s$  can cause the device to behave improperly.

A diode is present in-between  $V_{CC}$  and  $V_{CCIO}$ , as shown in **Figure 23**.

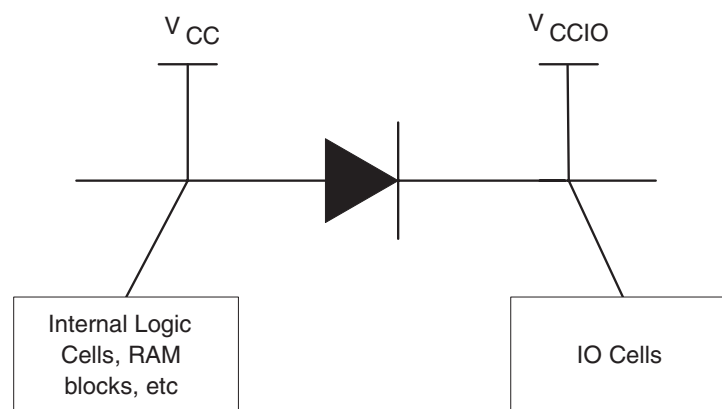


Figure 23: Internal Diode Between  $V_{CC}$  and  $V_{CCIO}$



# JTAG

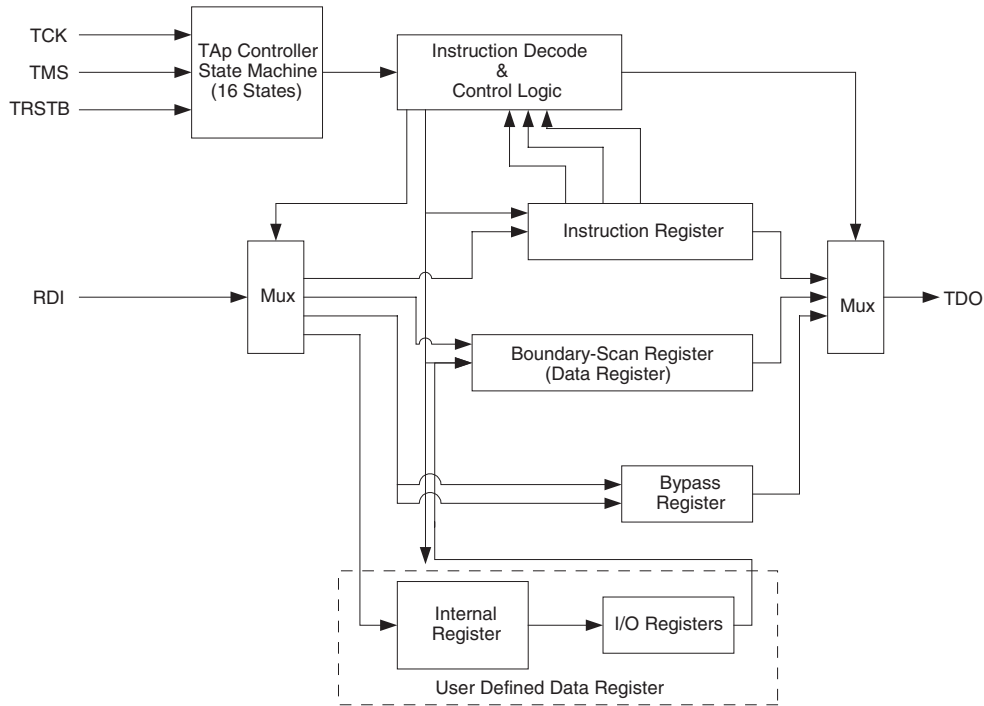


Figure 24: JTAG Block Diagram

Microprocessors and Application Specific Integrated Circuits (ASICs) pose many design challenges, not in the least of which concerns the accessibility of test points. The Joint Test Access Group (JTAG) formed in response to this challenge, resulting in IEEE standard 1149.1, the Standard Test Access Port and Boundary Scan Architecture.

The JTAG boundary scan test methodology allows complete observation and control of the boundary pins of a JTAG-compatible device through JTAG software. A Test Access Port (TAP) controller works in concert with the Instruction Register (IR), which allow users to run three required tests along with several user-defined tests.

JTAG tests allow users to reduce system debug time, reuse test platforms and tools, and reuse subsystem tests for fuller verification of higher level system elements.

The 1149.1 standard requires the following three tests:

- **Extest Instruction.** The Extest instruction performs a PCB interconnect test. This test places a device into an external boundary test mode, selecting the boundary scan register to be connected between the TAP's Test Data In (TDI) and Test Data Out (TDO) pins. Boundary scan cells are preloaded with test patterns (via the Sample/Preload Instruction), and input boundary cells capture the input data for analysis.
- **Sample/Preload Instruction.** This instruction allows a device to remain in its functional mode, while selecting the boundary scan register to be connected between the TDI and TDO pins. For this test, the boundary scan register can be accessed via a data scan operation, allowing users to sample the functional data entering and leaving the device.
- **Bypass Instruction.** The Bypass instruction allows data to skip a device's boundary scan entirely, so the data passes through the bypass register. The Bypass instruction allows users to test a device without passing through other devices. The bypass register is connected between the TDI and TDO pins, allowing serial data to be transferred through a device without affecting the operation of the device.

# Pin Descriptions

Table 16: JTAG Pin Descriptions

Pin	Function	Description
TDI/RSI	Test Data In for JTAG/RAM init. Serial Data In	Hold HIGH during normal operation. Connects to serial PROM data in for RAM initialization. Connect to V <sub>CC</sub> if unused
TRSTB/RRO	Active low Reset for JTAG/RAM init. reset out	Hold LOW during normal operation. Connects to serial PROM reset for RAM initialization. Connect to GND if unused
TMS	Test Mode Select for JTAG	Hold HIGH during normal operation. Connect to V <sub>CC</sub> if not used for JTAG
TCK	Test Clock for JTAG	Hold HIGH or LOW during normal operation. Connect to V <sub>CC</sub> or ground if not used for JTAG
TDO/RCO	Test data out for JTAG/RAM init. clock out	Connect to serial PROM clock for RAM initialization. Must be left unconnected if not used for JTAG or RAM initialization

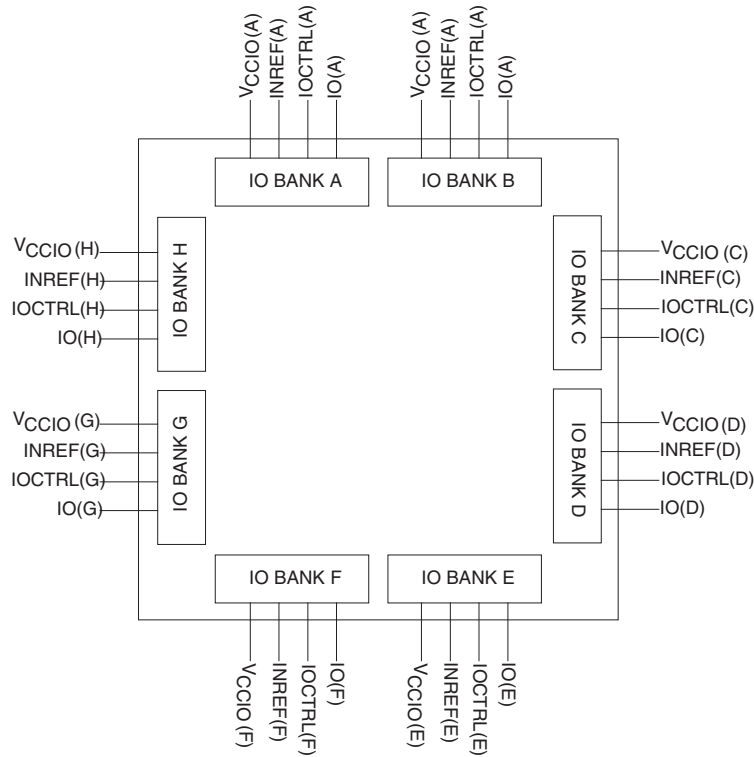


Figure 25: I/O Banks with Relevant Pins

Table 17: Dedicated Pin Descriptions

Pin	Function	Description
CLK	High-drive input and/or global clock network driver	Can be configured as either input or global clock
I/O(A)	Input/Output pin	The I/O pin is a bi-directional pin, configurable to either an input-only, output-only, or bi-directional pin. The A inside the parenthesis means that the I/O is located in Bank A. If an I/O is not used, SpDE (QuickWorks Tool) provides the option of tying that pin to GND, $V_{CC}$ , or TriState during programming.
$V_{CC}$	Power supply pin	Connect to 2.5 V supply
$V_{CCIO}(A)$	Input voltage tolerance pin	This pin provides the flexibility to interface the device with either a 3.3 V device or a 2.5 V device. The A inside the parenthesis means that $V_{CCIO}$ is located in BANK A. Every I/O pin in Bank A will be tolerant of $V_{CCIO}$ input signals and will output $V_{CCIO}$ level signals. This pin must be connected to either 3.3 V or $V_{CC}$ .
GND	Ground pin	Connect to ground
PLLIN	PLL clock input	Clock input for PLL
DEDCLK	Dedicated clock pin	Low skew global clock
GNDPLL	Ground pin for PLL	Connect to GND
INREF(A)	Differential reference voltage	The INREF is the reference voltage pin for GTL+, SSTL2, and STTL3 standards. Follow the recommendations provided in <a href="#">Table 14</a> for the appropriate standard. The A inside the parenthesis means that INREF is located in BANK A. This pin should be tied to GND if not needed.
PLLOUT	PLL output pin	Dedicated PLL output pin; otherwise, may be left unconnected
IOCTRL(A)	Highdrive input	This pin provides fast RESET, SET, CLOCK, and ENABLE access to the I/O cell flip-flops, providing fast clock-to-out and fast I/O response times. This pin can also double as a high-drive pin to the internal logic cells. The A inside the parenthesis means that IOCTRL is located in Bank A. This pin should be tied to GND or $V_{CC}$ if it is not used.

## Recommended Unused Pin Terminations for the Eclipse devices

All unused, general purpose I/O pins can be tied to  $V_{CC}$ , GND, or HIZ (high impedance) internally using the Configuration Editor. This option is given in the bottom-right corner of the placement window. To use the Placement Editor, choose **Constraint** → **Fix Placement** in the Option pull-down menu of SpDE.

The rest of the pins should be terminated at the board level in the manner presented in **Table 18**.

Table 18: Recommended Unused Pin Terminations

Signal Name	Recommended Termination
PLLOUT<x>	Unused PLL output pins must be connected to either $V_{CC}$ or GND so that their associated input buffer never floats. Utilized PLL output pins that route the PLL clock outside of the chip should not be tied to either $V_{CC}$ or GND.
IOCTRL<y>	Any unused pins of this type must be connected to either $V_{CC}$ or GND.
CLK/PLLIN<x>	Any unused clock pins should be connected to $V_{CC}$ or GND.
PLL_RST<x>	If a PLL module is not used, then the associated PLL_RST<x> must be connected to $V_{CC}$ , under normal operation use it as needed.
INREF<y>	If an I/O bank does not require the use of INREF signal the pin should be connected to GND.

**NOTE:** x -> number, y -> alphabetical character.

## Ordering Information

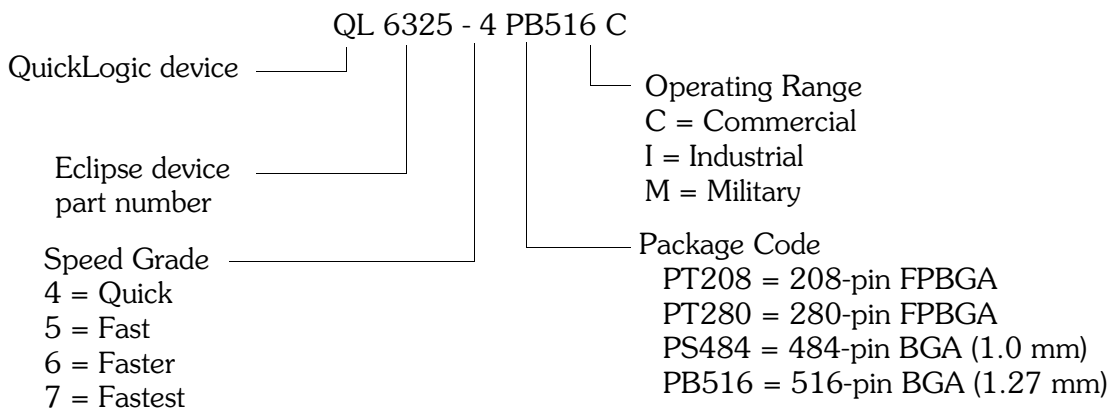


Figure 26: Ordering Information



## 208 PQFP Pinout Diagram



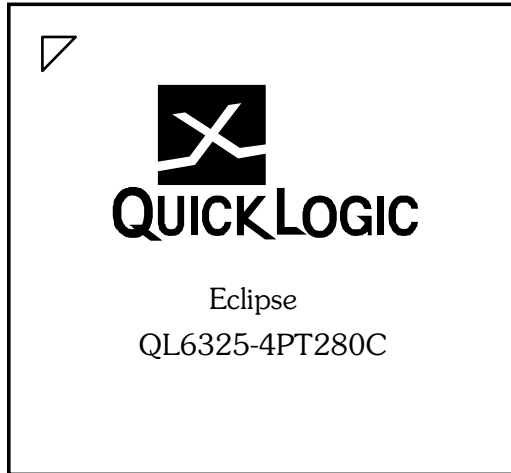
## 208 PQFP Pinout Table

Table 19: 208 PQFP Pinout Table

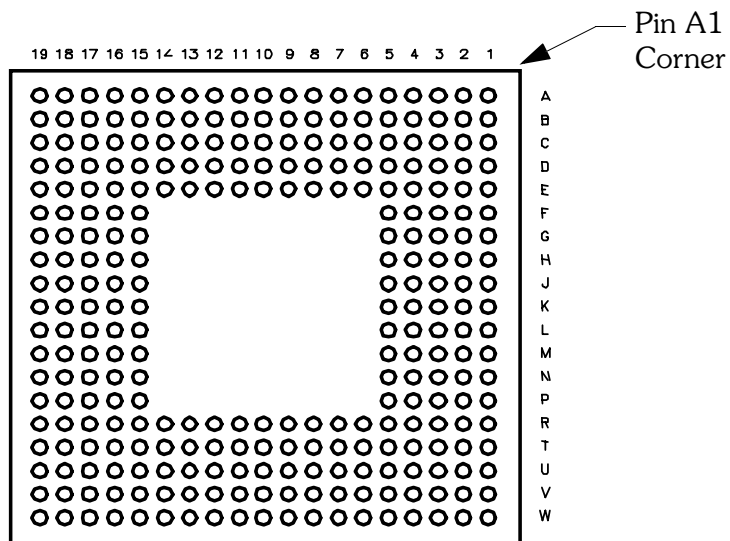
208 PQFP	Function	208 PQFP	Function	208 PQFP	Function	208 PQFP	Function	208 PQFP	Function
1	PLLST(3)	43	IO(B)	85	IO(D)	127	CLK(5),PLLIN(3)	169	IOCTRL(G)
2	V <sub>CCPLL</sub> (3)	44	V <sub>CCIO</sub> (B)	86	V <sub>CC</sub>	128	CLK(6)	170	INREF(G)
3	GND	45	IO(B)	87	IO(D)	129	V <sub>CC</sub>	171	IOCTRL(G)
4	GND	46	V <sub>CC</sub>	88	IO(D)	130	CLK(7)	172	IO(G)
5	IO(A)	47	IO(B)	89	V <sub>CC</sub>	131	V <sub>CC</sub>	173	IO(G)
6	IO(A)	48	IO(B)	90	IO(D)	132	CLK(8)	174	IO(V)
7	IO(A)	49	GND	91	IO(D)	133	TMS	175	V <sub>CC</sub>
8	V <sub>CCIO</sub> (A)	50	TDO	92	IOCTRL(D)	134	IO(F)	176	IO(G)
9	IO(A)	51	PLLOUT(1)	93	INREF(D)	135	IO(F)	177	V <sub>CCIO</sub> (G)
10	IO(A)	52	GNDPLL(2)	94	IOCTRL(D)	136	IO(F)	178	GND
11	IOCTRL(A)	53	GND	95	IO(D)	137	GND	179	IO(G)
12	V <sub>CC</sub>	54	V <sub>CCPLL</sub> (2)	96	IO(D)	138	V <sub>CCIO</sub> (F)	180	IO(G)
13	INREF(A)	55	PLLST(2)	97	IO(D)	139	IO(F)	181	IO(G)
14	IOCTRL(A)	56	V <sub>CC</sub>	98	V <sub>CCIO</sub> (D)	140	IO(F)	182	V <sub>CC</sub>
15	IO(A)	57	IO(C)	99	IO(D)	141	IO(F)	183	TCK
16	IO(A)	58	GND	100	IO(D)	142	IO(F)	184	V <sub>CC</sub>
17	IO(A)	59	IO(C)	101	GND	143	IO(F)	185	IO(H)
18	IO(A)	60	V <sub>CCIO</sub> (C)	102	PLLOUT(0)	144	IOCTRL(F)	186	IO(H)
19	V <sub>CCIO</sub> (A)	61	IO(C)	103	GND	145	INREF(F)	187	IO(H)
20	IO(A)	62	IO(C)	104	GNDPLL(1)	146	V <sub>CC</sub>	188	GND
21	GND	63	IO(C)	105	PLLST(1)	147	IOCTRL(F)	189	V <sub>CCIO</sub> (H)
22	IO(A)	64	IO(C)	106	V <sub>CCPLL</sub> (1)	148	IO(F)	190	IO(H)
23	TDI	65	IO(C)	107	IO(E)	149	IO(F)	191	IO(H)
24	CLK(0)	66	IO(C)	108	GND	150	V <sub>CCIO</sub> (F)	192	IOCTRL(H)
25	CLK(1)	67	IOCTRL(C)	109	IO(E)	151	IO(F)	193	IO(H)
26	V <sub>CC</sub>	68	INREF(C)	110	IO(E)	152	IO(F)	194	INREF(H)
27	CLK(2),PLLIN(2)	69	IOCTRL(C)	111	V <sub>CCIO</sub> (E)	153	GND	195	V <sub>CC</sub>
28	CLK(3),PLLIN(1)	70	IO(C)	112	IO(E)	154	IO(F)	196	IOCTRL(H)
29	V <sub>CC</sub>	71	IO(C)	113	V <sub>CC</sub>	155	PLLOUT(3)	197	IO(H)
30	CLK(4), DEDCLK,PLLIN(0)	72	V <sub>CCIO</sub> (C)	114	IO(E)	156	GNDPLL(0)	198	IO(H)
31	IO(B)	73	IO(C)	115	IO(E)	157	GND	199	IO(H)
32	IO(B)	74	IO(C)	116	IO(E)	158	V <sub>CCPLL</sub> (0)	200	IO(H)
33	GND	75	GND	117	IOCTRL(E)	159	PLLST(0)	201	IO(H)
34	V <sub>CCIO</sub> (B)	76	V <sub>CC</sub>	118	INREF(E)	160	GND	202	IO(H)
35	IO(B)	77	IO(C)	119	IOCTRL(E)	161	IO(G)	203	V <sub>CCIO</sub> (H)
36	IO(B)	78	TRSTB	120	IO(E)	162	V <sub>CCIO</sub> (G)	204	GND
37	IO(B)	79	V <sub>CC</sub>	121	IO(E)	163	IO(G)	205	IO(H)
38	IO(B)	80	IO(D)	122	V <sub>CCIO</sub> (E)	164	IO(G)	206	PLLOUT(2)
39	IOCTRL(B)	81	IO(D)	123	GND	165	V <sub>CC</sub>	207	GND
40	INREF(B)	82	IO(D)	124	IO(E)	166	IO(G)	208	GNDPLL(3)
41	IOCTRL(B)	83	GND	125	IO(E)	167	IO(G)		
42	IO(B)	84	V <sub>CCIO</sub> (D)	126	IO(E)	168	IO(G)		

## 280 PBGA Pinout Diagram

### Top



### Bottom



# 280 PBGA Pinout Table

Table 20: 280 PBGA Pinout Table

280 PBGA	Function	280 PBGA	Function	280 PBGA	Function	280 PBGA	Function	280 PBGA	Function	280 PBGA	Function
A1	PLLOUT<3>	C10	CLK<5>/PLLIN<3>	E19	IOCTRL<D>	K16	I/O<C>	R4	I/O<H>	U13	I/O<B>
A2	GNDPLL<0>	C11	V <sub>CCIO&lt;E&gt;</sub>	F1	INREF<G>	K17	I/O<D>	R5	GND	U14	IOCTRL<B>
A3	I/O<F>	C12	I/O<E>	F2	IOCTRL<G>	K18	I/O<C>	R6	GND	U15	V <sub>CCIO&lt;B&gt;</sub>
A4	I/O<F>	C13	I/O<E>	F3	I/O<G>	K19	TRSTB	R7	V <sub>CC</sub>	U16	I/O<B>
A5	I/O<F>	C14	I/O<E>	F4	I/O<G>	L1	I/O<H>	R8	V <sub>CC</sub>	U17	TDO
A6	IOCTRL<F>	C15	V <sub>CCIO&lt;E&gt;</sub>	F5	GND	L2	I/O<H>	R9	GND	U18	PLLRST<2>
A7	I/O<F>	C16	I/O<E>	F15	V <sub>CC</sub>	L3	V <sub>CCIO&lt;H&gt;</sub>	R10	GND	U19	I/O<B>
A8	I/O<F>	C17	I/O<E>	F16	IOCTRL<D>	L4	I/O<H>	R11	V <sub>CC</sub>	V1	PLLOUT<2>
A9	I/O<F>	C18	I/O<E>	F17	I/O<D>	L5	V <sub>CC</sub>	R12	V <sub>CC</sub>	V2	GNDPLL<3>
A10	CLK<7>	C19	I/O<E>	F18	I/O<D>	L15	GND	R13	V <sub>CC</sub>	V3	GND
A11	I/O<E>	D1	I/O<G>	F19	I/O<D>	L16	I/O<C>	R14	V <sub>CC</sub>	V4	I/O<A>
A12	I/O<E>	D2	I/O<G>	G1	I/O<G>	L17	V <sub>CCIO&lt;C&gt;</sub>	R15	GND	V5	I/O<A>
A13	I/O<E>	D3	I/O<F>	G2	I/O<G>	L18	I/O<C>	R16	I/O<C>	V6	IOCTRL<A>
A14	IOCTRL<E>	D4	I/O<F>	G3	IOCTRL<G>	L19	I/O<C>	R17	V <sub>CCIO&lt;C&gt;</sub>	V7	I/O<A>
A15	I/O<E>	D5	I/O<F>	G4	I/O<G>	M1	I/O<H>	R18	I/O<C>	V8	I/O<A>
A16	I/O<E>	D6	I/O<F>	G5	V <sub>CC</sub>	M2	I/O<H>	R19	I/O<C>	V9	I/O<A>
A17	I/O<E>	D7	I/O<F>	G15	V <sub>CC</sub>	M3	I/O<H>	T1	I/O<H>	V10	CLK<1>
A18	PLLRST<1>	D8	I/O<F>	G16	I/O<D>	M4	I/O<H>	T2	I/O<H>	V11	CLK<4>/DEDCLK/PLLIN<0>
A19	GND	D9	CLK<8>	G17	I/O<D>	M5	V <sub>CC</sub>	T3	I/O<A>	V12	I/O<B>
B1	PLLRST<0>	D10	I/O<E>	G18	I/O<D>	M15	V <sub>CC</sub>	T4	I/O<A>	V13	I/O<B>
B2	GND	D11	I/O<E>	G19	I/O<D>	M16	INREF<C>	T5	I/O<A>	V14	INREF<B>
B3	I/O<F>	D12	I/O<E>	H1	I/O<G>	M17	I/O<C>	T6	IOCTRL<A>	V15	I/O<B>
B4	I/O<F>	D13	INREF<E>	H2	I/O<G>	M18	I/O<C>	T7	I/O<A>	V16	I/O<B>
B5	I/O<F>	D14	I/O<E>	H3	I/O<G>	M19	I/O<C>	T8	I/O<A>	V17	I/O<B>
B6	INREF<F>	D15	I/O<E>	H4	I/O<G>	N1	IOCTRL<H>	T9	I/O<A>	V18	GNDPLL<2>
B7	I/O<F>	D16	I/O<D>	H5	V <sub>CC</sub>	N2	I/O<H>	T10	I/O<A>	V19	GND
B8	I/O<F>	D17	I/O<D>	H15	V <sub>CC</sub>	N3	I/O<H>	T11	CLK<3>/PLLIN<1>	W1	GND
B9	TMS	D18	I/O<D>	H16	V <sub>CC</sub>	N4	I/O<H>	T12	I/O<B>	W2	PLLRST<3>
B10	CLK<6>	D19	I/O<D>	H17	I/O<D>	N5	V <sub>CC</sub>	T13	I/O<B>	W3	I/O<A>
B11	I/O<E>	E1	I/O<G>	H18	I/O<D>	N15	V <sub>CC</sub>	T14	I/O<B>	W4	I/O<A>
B12	I/O<E>	E2	I/O<G>	H19	I/O<D>	N16	I/O<C>	T15	I/O<B>	W5	I/O<A>
B13	IOCTRL<E>	E3	V <sub>CCIO&lt;G&gt;</sub>	J1	I/O<G>	N17	I/O<C>	T16	I/O<B>	W6	I/O<A>
B14	I/O<E>	E4	I/O<F>	J2	I/O<G>	N18	IOCTRL<C>	T17	V <sub>CCPLL&lt;2&gt;</sub>	W7	I/O<A>
B15	I/O<E>	E5	GND	J3	V <sub>CCIO&lt;G&gt;</sub>	N19	IOCTRL<C>	T18	I/O<B>	W8	I/O<A>
B16	I/O<E>	E6	V <sub>CC</sub>	J4	I/O<G>	P1	I/O<H>	T19	I/O<B>	W9	TDI
B17	V <sub>CCPLL&lt;1&gt;</sub>	E7	V <sub>CC</sub>	J5	GND	P2	I/O<H>	U1	I/O<A>	W10	CLK<2>/PLLIN<2>
B18	GNDPLL<1>	E8	V <sub>CC</sub>	J15	V <sub>CC</sub>	P3	IOCTRL<H>	U2	I/O<A>	W11	I/O<B>
B19	PLLOUT<0>	E9	V <sub>CC</sub>	J16	I/O<C>	P4	INREF<H>	U3	V <sub>CCPLL&lt;3&gt;</sub>	W12	I/O<B>
C1	I/O<F>	E10	GND	J17	V <sub>CCIO&lt;D&gt;</sub>	P5	V <sub>CC</sub>	U4	I/O<A>	W13	I/O<B>
C2	V <sub>CCPLL&lt;0&gt;</sub>	E11	GND	J18	I/O<D>	P15	GND	U5	V <sub>CCIO&lt;A&gt;</sub>	W14	IOCTRL<B>
C3	I/O<F>	E12	V <sub>CC</sub>	J19	I/O<D>	P16	I/O<C>	U6	INREF<A>	W15	I/O<B>
C4	I/O<F>	E13	V <sub>CC</sub>	K1	V <sub>CC</sub>	P17	I/O<C>	U7	I/O<A>	W16	I/O<B>
C5	V <sub>CCIO&lt;F&gt;</sub>	E14	GND	K2	TCK	P18	I/O<C>	U8	I/O<A>	W17	I/O<B>
C6	IOCTRL<F>	E15	GND	K3	I/O<G>	P19	I/O<C>	U9	V <sub>CCIO&lt;A&gt;</sub>	W18	I/O<B>
C7	I/O<F>	E16	I/O<D>	K4	I/O<G>	R1	I/O<H>	U10	CLK<0>	W19	PLLOUT<1>
C8	I/O<F>	E17	V <sub>CCIO&lt;D&gt;</sub>	K5	GND	R2	I/O<H>	U11	V <sub>CCIO&lt;B&gt;</sub>		
C9	V <sub>CCIO&lt;F&gt;</sub>	E18	INREF<D>	K15	GND	R3	V <sub>CCIO&lt;H&gt;</sub>	U12	I/O<B>		

# 280 PBGA Packaging Drawing

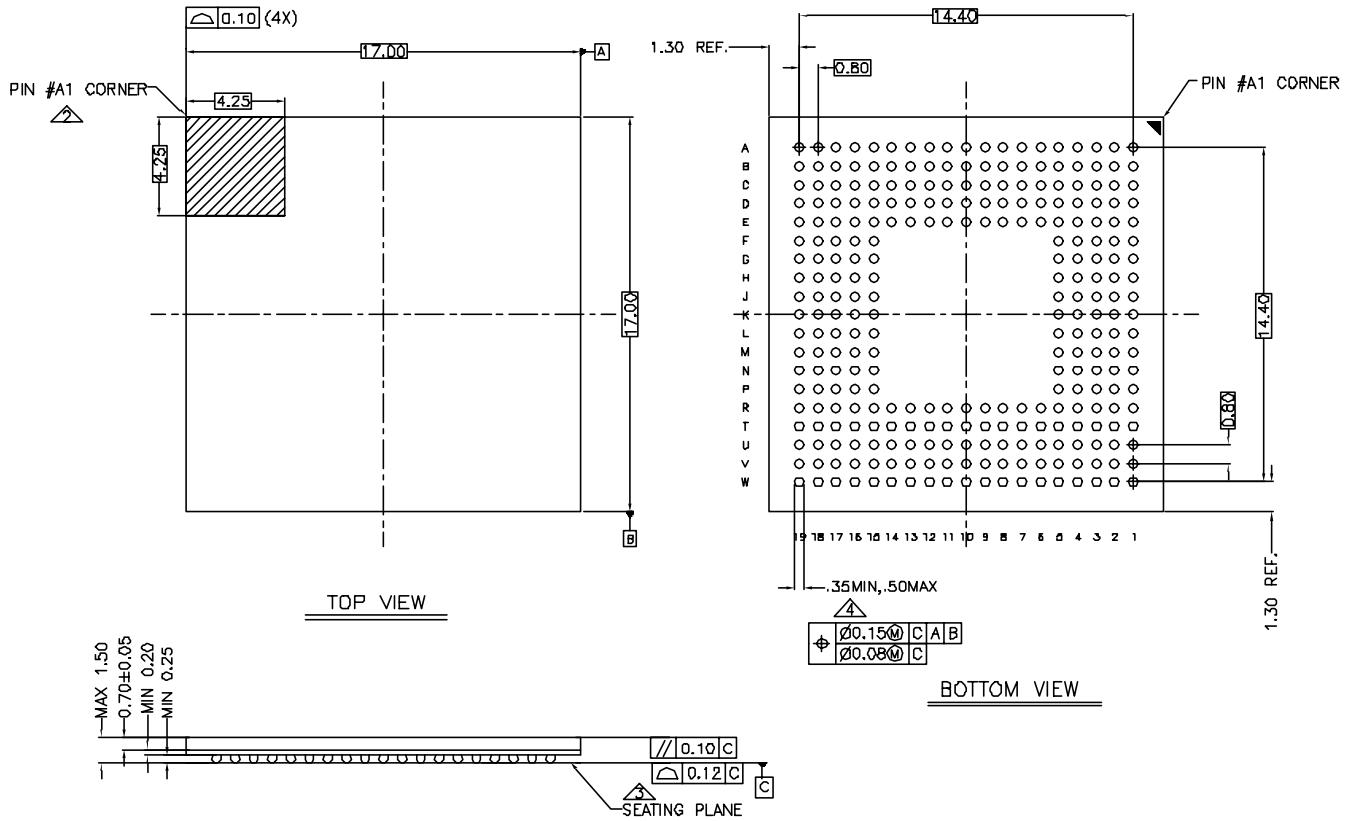
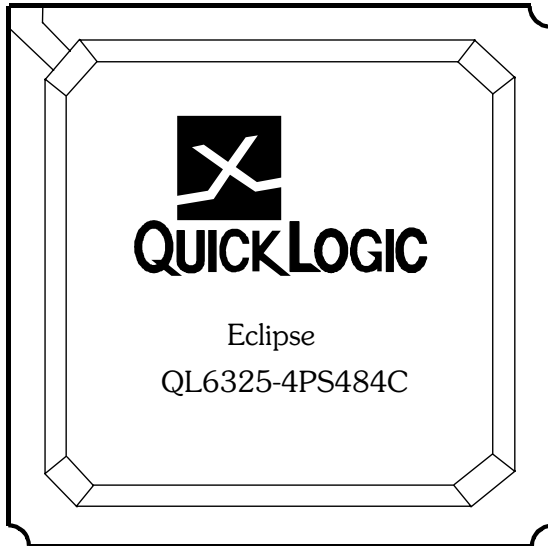


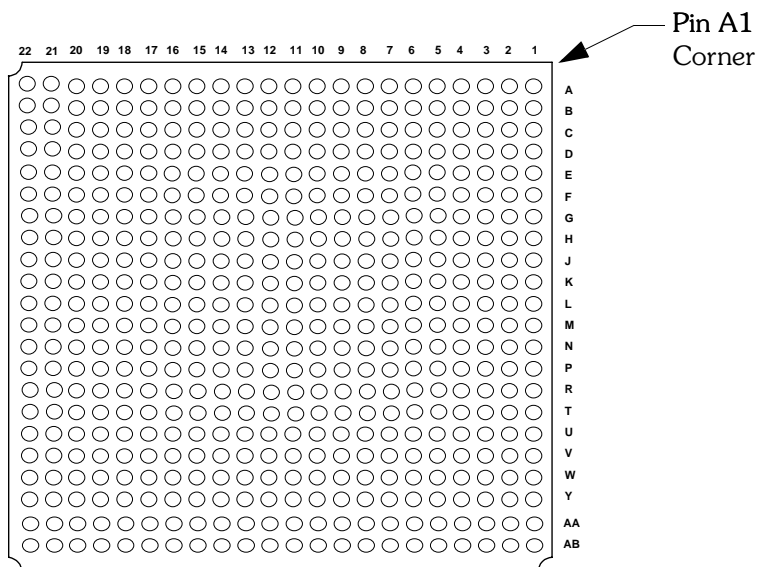
Figure 27: 280 PBGA Packaging Drawing

# 484 PBGA Pinout Diagram

## Top



## Bottom



# 484 PBGA Pinout Table

Table 21: 484 PBGA Pinout Table

484 PBGA	Function	484 PBGA	Function	484 PBGA	Function	484 PBGA	Function	484 PBGA	Function	484 PBGA	Function
A1	I/O<A>	C1	I/O<A>	E1	IOCTRL<A>	G1	I/O<A>	J1	I/O<A>	L1	CLK<4> DEDCLK/PLLIN<0>
A2	PLLST<3>	C2	I/O<A>	E2	I/O<A>	G2	I/O<A>	J2	I/O<A>	L2	CLK<0>
A3	I/O<A>	C3	V <sub>CCPLL&lt;3&gt;</sub>	E3	I/O<A>	G3	I/O<A>	J3	I/O<A>	L3	CLK<2>/PLLIN<2>
A4	I/O<A>	C4	PLLOUT<2>	E4	I/O<A>	G4	I/O<A>	J4	I/O<A>	L4	I/O<A>
A5	I/O<A>	C5	I/O<A>	E5	I/O<A>	G5	I/O<A>	J5	I/O<A>	L5	I/O<A>
A6	I/O<H>	C6	I/O<H>	E6	I/O<H>	G6	I/O<A>	J6	I/O<A>	L6	I/O<A>
A7	I/O<H>	C7	I/O<H>	E7	N/C	G7	GND	J7	I/O<A>	L7	GND
A8	IOCTRL<H>	C8	I/O<H>	E8	I/O<H>	G8	I/O<H>	J8	V <sub>CC</sub>	L8	GND
A9	I/O<H>	C9	IOCTRL<H>	E9	I/O<H>	G9	I/O<H>	J9	GND	L9	GND
A10	N/C	C10	I/O<H>	E10	I/O<H>	G10	I/O<H>	J10	V <sub>CC</sub>	L10	GND
A11	N/C	C11	I/O<H>	E11	V <sub>CC</sub>	G11	I/O<G>	J11	V <sub>CC</sub>	L11	GND
A12	TCK	C12	I/O<H>	E12	I/O<G>	G12	GND	J12	GND	L12	GND
A13	I/O<G>	C13	I/O<G>	E13	I/O<G>	G13	I/O<G>	J13	V <sub>CC</sub>	L13	GND
A14	I/O<G>	C14	I/O<G>	E14	I/O<G>	G14	I/O<G>	J14	GND	L14	V <sub>CC</sub>
A15	I/O<G>	C15	I/O<G>	E15	IOCTRL<G>	G15	I/O<G>	J15	V <sub>CC</sub>	L15	V <sub>CC</sub>
A16	I/O<G>	C16	I/O<G>	E16	I/O<G>	G16	GND	J16	I/O<F>	L16	CLK<6>
A17	I/O<G>	C17	I/O<G>	E17	INREF<G>	G17	V <sub>CCIO&lt;F&gt;</sub>	J17	V <sub>CCIO&lt;F&gt;</sub>	L17	V <sub>CCIO&lt;F&gt;</sub>
A18	I/O<G>	C18	I/O<G>	E18	I/O<G>	G18	I/O<F>	J18	I/O<F>	L18	I/O<F>
A19	I/O<F>	C19	I/O<F>	E19	I/O<F>	G19	I/O<F>	J19	I/O<F>	L19	CLK<8>
A20	GND	C20	GNDPLL<0>	E20	I/O<F>	G20	I/O<F>	J20	I/O<F>	L20	I/O<F>
A21	PLLOUT<3>	C21	I/O<F>	E21	I/O<F>	G21	INREF<F>	J21	I/O<F>	L21	I/O<F>
A22	I/O<F>	C22	I/O<F>	E22	I/O<F>	G22	I/O<F>	J22	I/O<F>	L22	I/O<F>
B1	I/O<A>	D1	I/O<A>	F1	I/O<A>	H1	I/O<A>	K1	TDI	M1	I/O<B>
B2	GND	D2	I/O<A>	F2	INREF<A>	H2	I/O<A>	K2	I/O<A>	M2	I/O<B>
B3	GNDPLL<3>	D3	I/O<A>	F3	I/O<A>	H3	I/O<A>	K3	I/O<A>	M3	I/O<B>
B4	GND	D4	I/O<A>	F4	I/O<A>	H4	I/O<A>	K4	I/O<A>	M4	CLK<3>/PLLIN<1>
B5	I/O<A>	D5	I/O<A>	F5	I/O<A>	H5	IOCTRL<A>	K5	I/O<A>	M5	I/O<B>
B6	I/O<H>	D6	I/O<H>	F6	V <sub>CCIO&lt;A&gt;</sub>	H6	V <sub>CCIO&lt;A&gt;</sub>	K6	V <sub>CCIO&lt;A&gt;</sub>	M6	V <sub>CCIO&lt;B&gt;</sub>
B7	I/O<H>	D7	I/O<H>	F7	V <sub>CCIO&lt;H&gt;</sub>	H7	I/O<H>	K7	I/O<A>	M7	CLK<1>
B8	INREF<H>	D8	I/O<H>	F8	I/O<H>	H8	GND	K8	V <sub>CC</sub>	M8	V <sub>CC</sub>
B9	I/O<H>	D9	I/O<H>	F9	V <sub>CCIO&lt;H&gt;</sub>	H9	V <sub>CC</sub>	K9	V <sub>CC</sub>	M9	V <sub>CC</sub>
B10	I/O<H>	D10	I/O<H>	F10	I/O<H>	H10	V <sub>CC</sub>	K10	GND	M10	GND
B11	I/O<H>	D11	I/O<H>	F11	V <sub>CCIO&lt;H&gt;</sub>	H11	V <sub>CC</sub>	K11	GND	M11	GND
B12	N/C	D12	I/O<G>	F12	V <sub>CCIO&lt;G&gt;</sub>	H12	GND	K12	GND	M12	GND
B13	N/C	D13	I/O<G>	F13	I/O<G>	H13	V <sub>CC</sub>	K13	GND	M13	GND
B14	N/C	D14	I/O<G>	F14	V <sub>CCIO&lt;G&gt;</sub>	H14	V <sub>CC</sub>	K14	V <sub>CC</sub>	M14	GND
B15	I/O<G>	D15	IOCTRL<G>	F15	N/C	H15	GND	K15	V <sub>CC</sub>	M15	GND
B16	I/O<G>	D16	I/O<G>	F16	V <sub>CCIO&lt;G&gt;</sub>	H16	I/O<F>	K16	I/O<F>	M16	GND
B17	I/O<G>	D17	I/O<G>	F17	N/C	H17	I/O<F>	K17	I/O<F>	M17	I/O<E>
B18	I/O<G>	D18	I/O<F>	F18	I/O<F>	H18	I/O<F>	K18	I/O<F>	M18	I/O<E>
B19	PLLST<0>	D19	V <sub>CCPLL&lt;0&gt;</sub>	F19	I/O<F>	H19	I/O<F>	K19	I/O<F>	M19	I/O<E>
B20	I/O<F>	D20	I/O<F>	F20	IOCTRL<F>	H20	I/O<F>	K20	I/O<F>	M20	CLK<7>
B21	I/O<F>	D21	I/O<F>	F21	I/O<F>	H21	I/O<F>	K21	I/O<F>	M21	CLK<5>/PLLIN<3>
B22	I/O<F>	D22	I/O<F>	F22	IOCTRL<F>	H22	I/O<F>	K22	I/O<F>	M22	TMS

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Table 21: 484 PBGA Pinout Table (Continued)

484 PBGA	Function	484 PBGA	Function	484 PBGA	Function	484 PBGA	Function	484 PBGA	Function	484 PBGA	Function
N1	I/O<B>	P16	I/O<E>	T9	N/C	V2	I/O<B>	W17	I/O<D>	AA10	I/O<C>
N2	I/O<B>	P17	I/O<E>	T10	TRSTB	V3	I/O<B>	W18	I/O<E>	AA11	I/O<C>
N3	I/O<B>	P18	I/O<E>	T11	GND	V4	I/O<B>	W19	I/O<E>	AA12	I/O<D>
N4	I/O<B>	P19	I/O<E>	T12	N/C	V5	I/O<B>	W20	I/O<E>	AA13	I/O<D>
N5	I/O<B>	P20	I/O<E>	T13	I/O<D>	V6	I/O<C>	W21	I/O<E>	AA14	I/O<D>
N6	I/O<B>	P21	I/O<E>	T14	N/C	V7	I/O<C>	W22	I/O<E>	AA15	I/O<D>
N7	I/O<B>	P22	I/O<E>	T15	I/O<D>	V8	I/O<C>	Y1	I/O<B>	AA16	I/O<D>
N8	V <sub>CC</sub>	R1	I/O<B>	T16	GND	V9	N/C	Y2	I/O<B>	AA17	I/O<D>
N9	V <sub>CC</sub>	R2	INREF<B>	T17	I/O<E>	V10	I/O<C>	Y3	V <sub>CCPLL&lt;2&gt;</sub>	AA18	I/O<D>
N10	GND	R3	I/O<B>	T18	I/O<E>	V11	I/O<C>	Y4	I/O<C>	AA19	I/O<E>
N11	GND	R4	I/O<B>	T19	I/O<E>	V12	V <sub>CC</sub>	Y5	I/O<C>	AA20	GNDPLL<1>
N12	GND	R5	I/O<B>	T20	I/O<E>	V13	N/C	Y6	I/O<C>	AA21	I/O<E>
N13	GND	R6	I/O<B>	T21	IOCTRL<E>	V14	I/O<D>	Y7	I/O<C>	AA22	I/O<E>
N14	V <sub>CC</sub>	R7	I/O<B>	T22	I/O<E>	V15	I/O<D>	Y8	IOCTRL<C>	AB1	I/O<B>
N15	V <sub>CC</sub>	R8	GND	U1	IOCTRL<B>	V16	INREF<D>	Y9	I/O<C>	AB2	GNDPLL<2>
N16	I/O<E>	R9	V <sub>CC</sub>	U2	I/O<B>	V17	I/O<D>	Y10	I/O<C>	AB3	PLLST<2>
N17	V <sub>CCIO&lt;E&gt;</sub>	R10	V <sub>CC</sub>	U3	IOCTRL<B>	V18	I/O<E>	Y11	I/O<D>	AB4	I/O<B>
N18	I/O<E>	R11	GND	U4	I/O<B>	V19	I/O<E>	Y12	I/O<D>	AB5	I/O<B>
N19	I/O<E>	R12	V <sub>CC</sub>	U5	I/O<B>	V20	I/O<E>	Y13	I/O<D>	AB6	I/O<C>
N20	I/O<E>	R13	V <sub>CC</sub>	U6	I/O<C>	V21	I/O<E>	Y14	I/O<D>	AB7	I/O<C>
N21	I/O<E>	R14	V <sub>CC</sub>	U7	V <sub>CCIO&lt;C&gt;</sub>	V22	I/O<E>	Y15	IOCTRL<D>	AB8	IOCTRL<C>
N22	I/O<E>	R15	GND	U8	N/C	W1	I/O<B>	Y16	I/O<D>	AB9	I/O<C>
P1	I/O<B>	R16	I/O<D>	U9	V <sub>CCIO&lt;C&gt;</sub>	W2	I/O<B>	Y17	I/O<D>	AB10	I/O<C>
P2	I/O<B>	R17	V <sub>CCIO&lt;E&gt;</sub>	U10	I/O<C>	W3	I/O<B>	Y18	I/O<E>	AB11	I/O<C>
P3	I/O<B>	R18	I/O<E>	U11	V <sub>CCIO&lt;C&gt;</sub>	W4	I/O<B>	Y19	PLLOUT<0>	AB12	I/O<D>
P4	I/O<B>	R19	I/O<E>	U12	V <sub>CCIO&lt;D&gt;</sub>	W5	I/O<B>	Y20	PLLST<1>	AB13	I/O<D>
P5	I/O<B>	R20	I/O<E>	U13	I/O<D>	W6	I/O<C>	Y21	I/O<E>	AB14	I/O<D>
P6	V <sub>CCIO&lt;B&gt;</sub>	R21	I/O<E>	U14	V <sub>CCIO&lt;D&gt;</sub>	W7	N/C	Y22	I/O<E>	AB15	I/O<D>
P7	I/O<B>	R22	I/O<E>	U15	N/C	W8	I/O<C>	AA1	TDO	AB16	IOCTRL<D>
P8	V <sub>CC</sub>	T1	I/O<B>	U16	V <sub>CCIO&lt;D&gt;</sub>	W9	I/O<C>	AA2	PLLOUT<1>	AB17	I/O<D>
P9	GND	T2	I/O<B>	U17	V <sub>CCIO&lt;E&gt;</sub>	W10	I/O<C>	AA3	GND	AB18	I/O<D>
P10	V <sub>CC</sub>	T3	I/O<B>	U18	I/O<E>	W11	I/O<C>	AA4	I/O<B>	AB19	I/O<E>
P11	GND	T4	I/O<B>	U19	I/O<E>	W12	I/O<D>	AA5	I/O<C>	AB20	GND
P12	V <sub>CC</sub>	T5	I/O<B>	U20	IOCTRL<E>	W13	I/O<D>	AA6	I/O<C>	AB21	V <sub>CCPLL&lt;1&gt;</sub>
P13	V <sub>CC</sub>	T6	V <sub>CCIO&lt;B&gt;</sub>	U21	I/O<E>	W14	I/O<D>	AA7	I/O<C>	AB22	I/O<E>
P14	GND	T7	GND	U22	INREF<E>	W15	I/O<D>	AA8	INREF<C>		
P15	V <sub>CC</sub>	T8	I/O<C>	V1	I/O<B>	W16	N/C	AA9	I/O<C>		

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# 484 PBGA Packaging Drawing

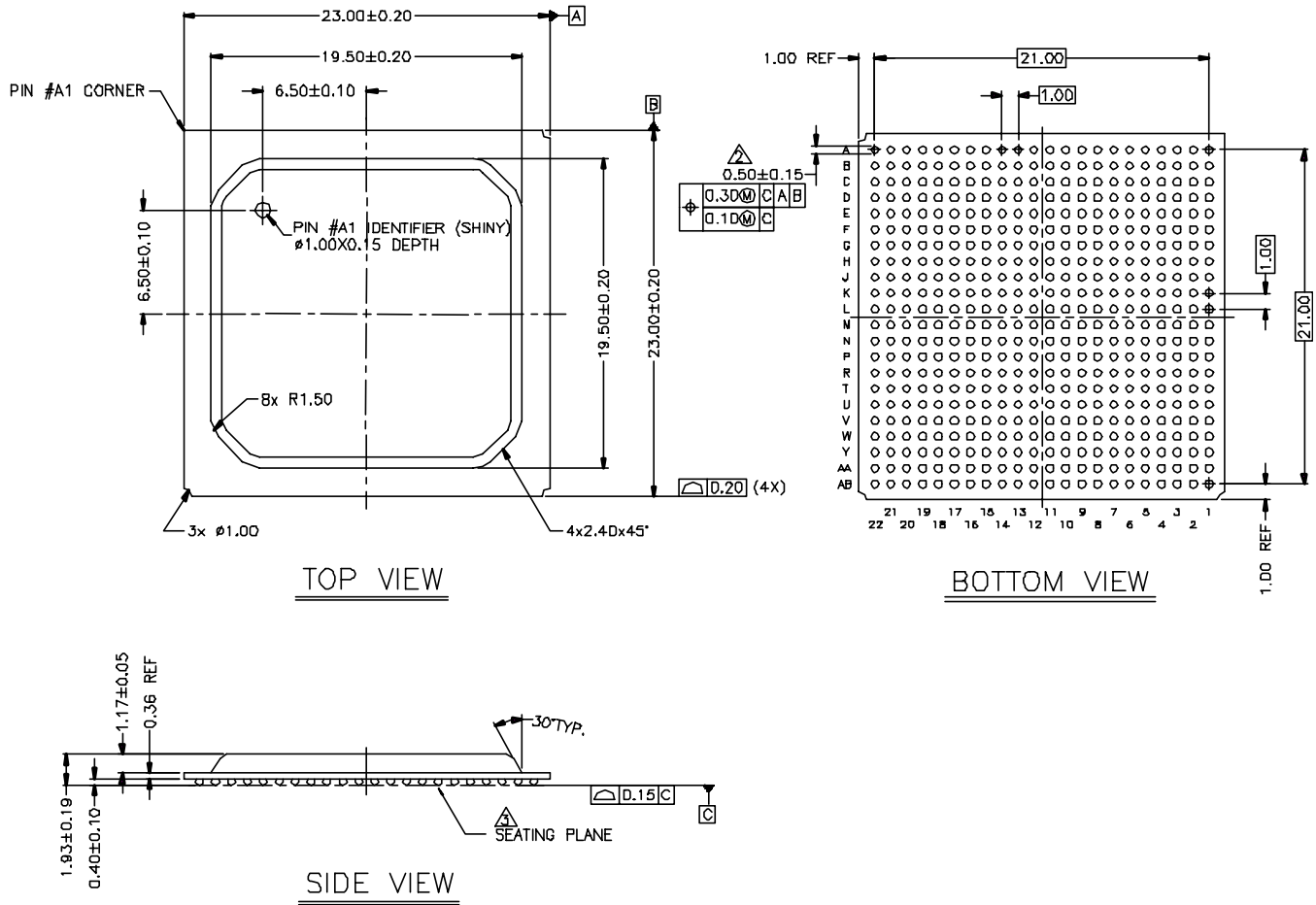
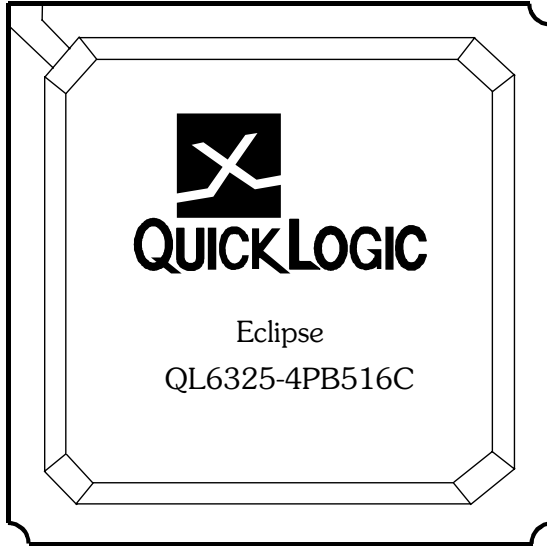


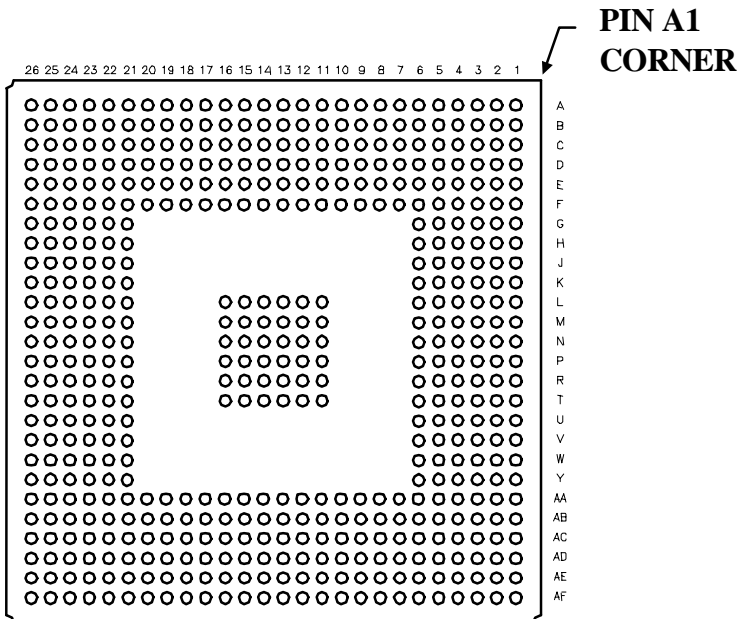
Figure 28: 484 PBGA Packaging Drawing

# 516 PBGA Pinout Diagram

## Top



## Bottom



# 516 PBGA Pinout Table

Table 22: 516 PBGA Pinout Table

516 PBGA	Function	516 PBGA	Function	516 PBGA	Function	516 PBGA	Function	516 PBGA	Function	516 PBGA	Function
A1	GND	C1	I/O<F>	E1	I/O<G>	G1	I/O<G>	L5	V <sub>CC</sub>	P3	I/O<H>
A2	I/O<F>	C2	N/C	E2	I/O<G>	G2	INREF<G>	L6	V <sub>CC</sub>	P4	V <sub>CC</sub>
A3	I/O<F>	C3	I/O<F>	E3	N/C	G3	I/O<G>	L11	GND	P5	I/O<H>
A4	I/O<F>	C4	PLLOUT<3>	E4	V <sub>CCPLL&lt;0&gt;</sub>	G4	I/O<G>	L12	GND	P6	V <sub>CCIO&lt;H&gt;</sub>
A5	I/O<F>	C5	I/O<F>	E5	I/O<F>	G5	I/O<G>	L13	GND	P11	GND
A6	I/O<F>	C6	I/O<F>	E6	I/O<F>	G6	V <sub>CCIO&lt;G&gt;</sub>	L14	GND	P12	GND
A7	IOCTRL<F>	C7	I/O<F>	E7	I/O<F>	G21	V <sub>CCIO&lt;D&gt;</sub>	L15	GND	P13	GND
A8	I/O<F>	C8	INREF<F>	E8	V <sub>CC</sub>	G22	I/O<D>	L16	GND	P14	GND
A9	I/O<F>	C9	I/O<F>	E9	I/O<F>	G23	I/O<D>	L21	V <sub>CC</sub>	P15	GND
A10	I/O<F>	C10	I/O<F>	E10	I/O<F>	G24	I/O<D>	L22	I/O<D>	P16	GND
A11	I/O<F>	C11	I/O<F>	E11	I/O<F>	G25	I/O<D>	L23	I/O<D>	P21	V <sub>CCIO&lt;C&gt;</sub>
A12	I/O<F>	C12	I/O<F>	E12	V <sub>CC</sub>	G26	INREF<D>	L24	I/O<D>	P22	I/O<C>
A13	I/O<E>	C13	CLK<7>	E13	I/O<F>	H1	I/O<G>	L25	I/O<D>	P23	V <sub>CC</sub>
A14	N/C	C14	I/O<E>	E14	I/O<F>	H2	I/O<G>	L26	I/O<D>	P24	N/C
A15	I/O<E>	C15	I/O<E>	E15	I/O<E>	H3	IOCTRL<G>	M1	N/C	P25	N/C
A16	I/O<E>	C16	I/O<E>	E16	V <sub>CC</sub>	H4	I/O<G>	M2	N/C	P26	TRSTB
A17	I/O<E>	C17	I/O<E>	E17	CLK<6>	H5	I/O<G>	M3	I/O<G>	R1	I/O<H>
A18	IOCTRL<E>	C18	I/O<E>	E18	I/O<E>	H6	V <sub>CC</sub>	M4	I/O<G>	R2	I/O<H>
A19	IOCTRL<E>	C19	I/O<E>	E19	I/O<E>	H21	V <sub>CC</sub>	M5	I/O<G>	R3	I/O<H>
A20	I/O<E>	C20	I/O<E>	E20	I/O<E>	H22	V <sub>CC</sub>	M6	V <sub>CCIO&lt;G&gt;</sub>	R4	I/O<H>
A21	I/O<E>	C21	I/O<E>	E21	I/O<E>	H23	I/O<D>	M11	GND	R5	V <sub>CC</sub>
A22	I/O<E>	C22	I/O<E>	E22	I/O<E>	H24	IOCTRL<D>	M12	GND	R6	V <sub>CC</sub>
A23	I/O<E>	C23	I/O<E>	E23	GNDPLL<1>	H25	IOCTRL<D>	M13	GND	R11	GND
A24	I/O<E>	C24	I/O<E>	E24	I/O<E>	H26	I/O<D>	M14	GND	R12	GND
A25	PLL <sub>RST&lt;1&gt;</sub>	C25	I/O<E>	E25	I/O<D>	J1	N/C	M15	GND	R13	GND
A26	GND	C26	I/O<E>	E26	I/O<D>	J2	I/O<G>	M16	GND	R14	GND
B1	I/O<F>	D1	I/O<G>	F1	IOCTRL<G>	J3	I/O<G>	M21	V <sub>CCIO&lt;D&gt;</sub>	R15	GND
B2	PLL <sub>RST&lt;0&gt;</sub>	D2	I/O<G>	F2	N/C	J4	I/O<G>	M22	V <sub>CC</sub>	R16	GND
B3	I/O<F>	D3	I/O<F>	F3	I/O<G>	J5	I/O<G>	M23	N/C	R21	V <sub>CC</sub>
B4	I/O<F>	D4	I/O<F>	F4	I/O<G>	J6	V <sub>CCIO&lt;G&gt;</sub>	M24	I/O<D>	R22	I/O<C>
B5	I/O<F>	D5	GNDPLL<0>	F5	I/O<F>	J21	V <sub>CCIO&lt;D&gt;</sub>	M25	I/O<D>	R23	I/O<C>
B6	I/O<F>	D6	I/O<F>	F6	GND	J22	I/O<D>	M26	I/O<D>	R24	I/O<C>
B7	IOCTRL<F>	D7	I/O<F>	F7	V <sub>CCIO&lt;F&gt;</sub>	J23	I/O<D>	N1	TCK	R25	I/O<C>
B8	I/O<F>	D8	N/C	F8	V <sub>CC</sub>	J24	N/C	N2	N/C	R26	I/O<C>
B9	I/O<F>	D9	I/O<F>	F9	V <sub>CCIO&lt;F&gt;</sub>	J25	I/O<D>	N3	I/O<G>	T1	N/C
B10	I/O<F>	D10	I/O<F>	F10	GND	J26	I/O<D>	N4	I/O<G>	T2	I/O<H>
B11	I/O<F>	D11	I/O<F>	F11	V <sub>CC</sub>	K1	I/O<G>	N5	I/O<G>	T3	I/O<H>
B12	I/O<F>	D12	I/O<F>	F12	V <sub>CCIO&lt;F&gt;</sub>	K2	I/O<G>	N6	GND	T4	I/O<H>
B13	CLK<5> /PLL <sub>LIN&lt;3&gt;</sub>	D13	TMS	F13	GND	K3	I/O<G>	N11	GND	T5	I/O<H>
B14	I/O<E>	D14	I/O<E>	F14	V <sub>CCIO&lt;E&gt;</sub>	K4	I/O<G>	N12	GND	T6	V <sub>CC</sub>
B15	I/O<E>	D15	I/O<E>	F15	V <sub>CC</sub>	K5	N/C	N13	GND	T11	GND
B16	I/O<E>	D16	N/C	F16	V <sub>CC</sub>	K6	GND	N14	GND	T12	GND
B17	I/O<E>	D17	I/O<E>	F17	GND	K21	GND	N15	GND	T13	GND
B18	INREF<E>	D18	I/O<F>	F18	V <sub>CCIO&lt;E&gt;</sub>	K22	I/O<D>	N16	GND	T14	GND
B19	I/O<E>	D19	CLK<8>	F19	V <sub>CC</sub>	K23	I/O<D>	N21	GND	T15	GND
B20	I/O<E>	D20	I/O<E>	F20	V <sub>CCIO&lt;E&gt;</sub>	K24	N/C	N22	I/O<D>	T16	GND
B21	I/O<E>	D21	I/O<E>	F21	GND	K25	I/O<D>	N23	I/O<D>	T21	V <sub>CC</sub>
B22	I/O<E>	D22	I/O<E>	F22	N/C	K26	I/O<D>	N24	N/C	T22	V <sub>CC</sub>
B23	I/O<E>	D23	V <sub>CCPLL&lt;1&gt;</sub>	F23	N/C	L1	I/O<G>	N25	I/O<D>	T23	N/C
B24	I/O<E>	D24	I/O<E>	F24	I/O<D>	L2	N/C	N26	I/O<D>	T24	I/O<C>
B25	I/O<E>	D25	I/O<E>	F25	N/C	L3	I/O<G>	P1	N/C	T25	N/C
B26	PLLOUT<0>	D26	I/O<D>	F26	I/O<D>	L4	I/O<G>	P2	I/O<H>	T26	I/O<C>

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Table 22: 516 PBGA Pinout Table (Continued)

516 PBGA	Function	516 PBGA	Function	516 PBGA	Function	516 PBGA	Function	516 PBGA	Function	516 PBGA	Function
U1	I/O<H>	W25	INREF<C>	AA21	GND	AC3	I/O<A>	AD11	I/O<A>	AE19	I/O<B>
U2	I/O<H>	W26	I/O<C>	AA22	V <sub>CCPLL&lt;2&gt;</sub>	AC4	I/O<A>	AD12	TDI	AE20	I/O<B>
U3	I/O<H>	Y1	I/O<H>	AA23	I/O<C>	AC5	I/O<A>	AD13	CLK<4> DEDCLK/PLLIN<0>	AE21	I/O<B>
U4	I/O<H>	Y2	I/O<H>	AA24	I/O<C>	AC6	I/O<A>	AD14	I/O<A>	AE22	I/O<B>
U5	I/O<H>	Y3	I/O<H>	AA25	I/O<C>	AC7	I/O<A>	AD15	I/O<B>	AE23	I/O<B>
U6	GND	Y4	I/O<H>	AA26	I/O<C>	AC8	I/O<A>	AD16	I/O<B>	AE24	I/O<B>
U21	GND	Y5	I/O<H>	AB1	I/O<H>	AC9	I/O<A>	AD17	I/O<B>	AE25	PLL <sub>RST&lt;2&gt;</sub>
U22	N/C	Y6	V <sub>CCIO&lt;H&gt;</sub>	AB2	N/C	AC10	I/O<A>	AD18	INREF<B>	AE26	I/O<B>
U23	I/O<C>	Y21	V <sub>CCIO&lt;C&gt;</sub>	AB3	I/O<A>	AC11	I/O<A>	AD19	I/O<B>	AF1	I/O<A>
U24	I/O<C>	Y22	N/C	AB4	GNDPLL<3>	AC12	I/O<A>	AD20	I/O<B>	AF2	I/O<A>
U25	I/O<C>	Y23	I/O<C>	AB5	V <sub>CCPLL&lt;3&gt;</sub>	AC13	N/C	AD21	I/O<B>	AF3	I/O<A>
U26	I/O<C>	Y24	I/O<C>	AB6	I/O<A>	AC14	CLK<1>	AD22	I/O<B>	AF4	I/O<A>
V1	I/O<H>	Y25	I/O<C>	AB7	I/O<A>	AC15	I/O<B>	AD23	I/O<B>	AF5	I/O<A>
V2	IOCTRL<H>	Y26	IOCTRL<C>	AB8	I/O<A>	AC16	I/O<B>	AD24	GND	AF6	IOCTRL<A>
V3	IOCTRL<H>	AA1	I/O<H>	AB9	I/O<A>	AC17	I/O<B>	AD25	I/O<B>	AF7	I/O<A>
V4	I/O<H>	AA2	I/O<H>	AB10	I/O<A>	AC18	I/O<B>	AD26	I/O<B>	AF8	I/O<A>
V5	N/C	AA3	I/O<H>	AB11	V <sub>CC</sub>	AC19	I/O<B>	AE1	GND	AF9	I/O<A>
V6	V <sub>CCIO&lt;H&gt;</sub>	AA4	I/O<A>	AB12	I/O<A>	AC20	I/O<B>	AE2	GND	AF10	I/O<A>
V21	V <sub>CCIO&lt;C&gt;</sub>	AA5	I/O<A>	AB13	I/O<A>	AC21	I/O<B>	AE3	I/O<A>	AF11	I/O<A>
V22	I/O<C>	AA6	GND	AB14	CLK<3>/PLLIN<1>	AC22	TDO	AE4	I/O<A>	AF12	CLK<2> /PLLIN<2>
V23	I/O<C>	AA7	V <sub>CCIO&lt;A&gt;</sub>	AB15	V <sub>CC</sub>	AC23	PLL <sub>OUT&lt;1&gt;</sub>	AE5	I/O<A>	AF13	N/C
V24	IOCTRL<C>	AA8	V <sub>CC</sub>	AB16	I/O<B>	AC24	I/O<B>	AE6	I/O<A>	AF14	I/O<B>
V25	I/O<C>	AA9	V <sub>CCIO&lt;A&gt;</sub>	AB17	I/O<B>	AC25	N/C	AE7	INREF<A>	AF15	I/O<B>
V26	I/O<C>	AA10	GND	AB18	I/O<B>	AC26	I/O<C>	AE8	I/O<A>	AF16	I/O<B>
W1	INREF<H>	AA11	V <sub>CC</sub>	AB19	V <sub>CC</sub>	AD1	I/O<A>	AE9	I/O<A>	AF17	I/O<B>
W2	I/O<H>	AA12	V <sub>CCIO&lt;A&gt;</sub>	AB20	I/O<B>	AD2	PLL <sub>OUT&lt;2&gt;</sub>	AE10	I/O<A>	AF18	I/O<B>
W3	I/O<H>	AA13	GND	AB21	I/O<B>	AD3	PLL <sub>RST&lt;3&gt;</sub>	AE11	I/O<A>	AF19	IOCTRL<B>
W4	I/O<H>	AA14	V <sub>CCIO&lt;B&gt;</sub>	AB22	GNDPLL<2>	AD4	I/O<A>	AE12	CLK<0>	AF20	IOCTRL<B>
W5	V <sub>CC</sub>	AA15	V <sub>CC</sub>	AB23	I/O<B>	AD5	I/O<A>	AE13	I/O<B>	AF21	I/O<B>
W6	V <sub>CC</sub>	AA16	V <sub>CC</sub>	AB24	I/O<C>	AD6	I/O<A>	AE14	I/O<B>	AF22	I/O<B>
W21	V <sub>CC</sub>	AA17	GND	AB25	I/O<C>	AD7	I/O<A>	AE15	I/O<B>	AF23	I/O<B>
W22	N/C	AA18	V <sub>CCIO&lt;B&gt;</sub>	AB26	I/O<C>	AD8	IOCTRL<A>	AE16	I/O<B>	AF24	I/O<B>
W23	I/O<C>	AA19	V <sub>CC</sub>	AC1	N/C	AD9	I/O<A>	AE17	I/O<B>	AF25	I/O<B>
W24	I/O<C>	AA20	V <sub>CCIO&lt;B&gt;</sub>	AC2	I/O<A>	AD10	I/O<A>	AE18	I/O<B>	AF26	I/O<B>

(Sheet 2 of 2)

# 516 PBGA Packaging Drawing

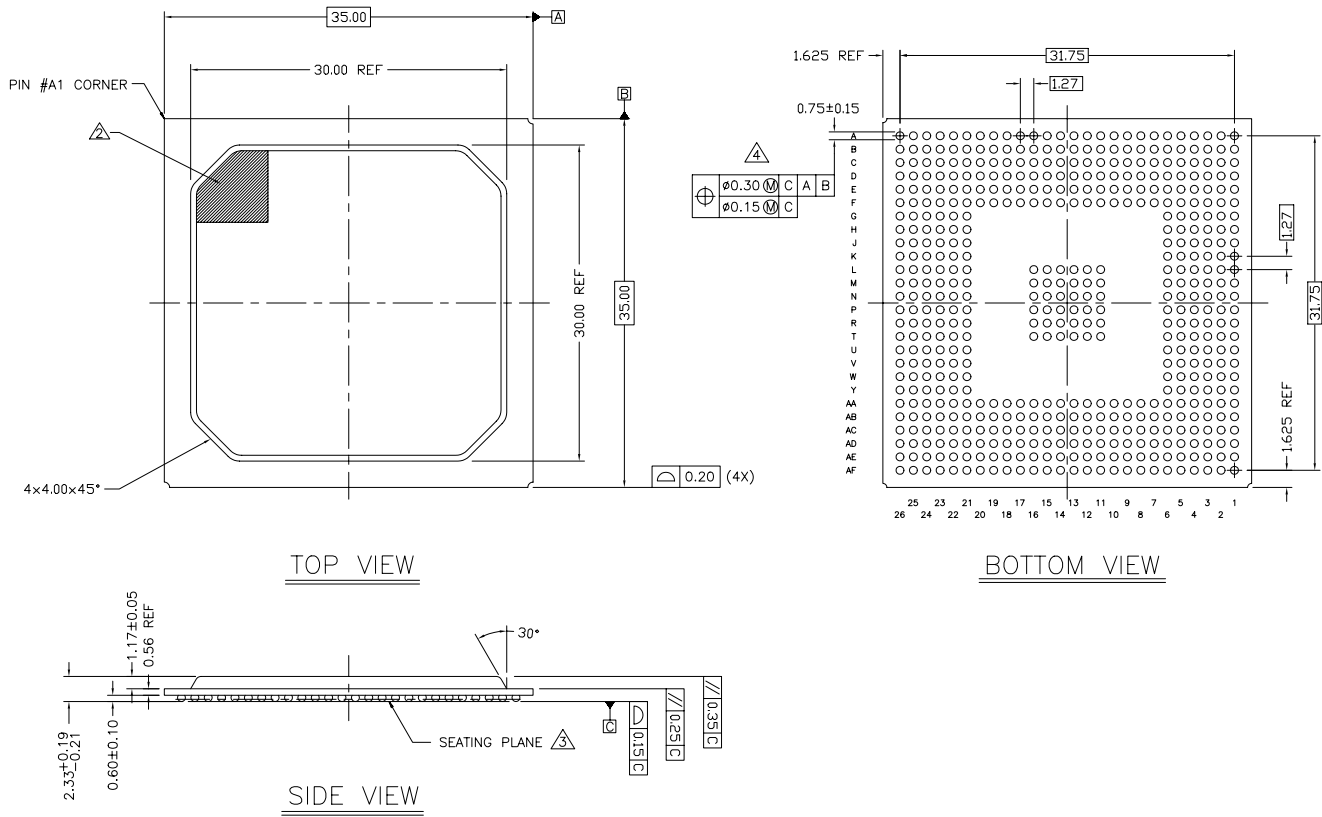


Figure 29: 516 PBGA Packaging Drawing

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## Revision History

Table 23: Revision History

Revision	Date	Comments
A	April 2001	First release.
B	Jan 2002	Re-evaluation of AC/DC Specs and reformat
C	June 2002	Added Kfactor, Power-up, JTAG and mechanical drawing information.

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