# QL3040
## 40,000 Usable PLD Gate pASIC®3 FPGA
## Combining High Performance *and* High Density

*April, 1999*



**pASIC 3 HIGHLIGHTS**

***... 40,000 usable PLD gates, 252 I/O pins***

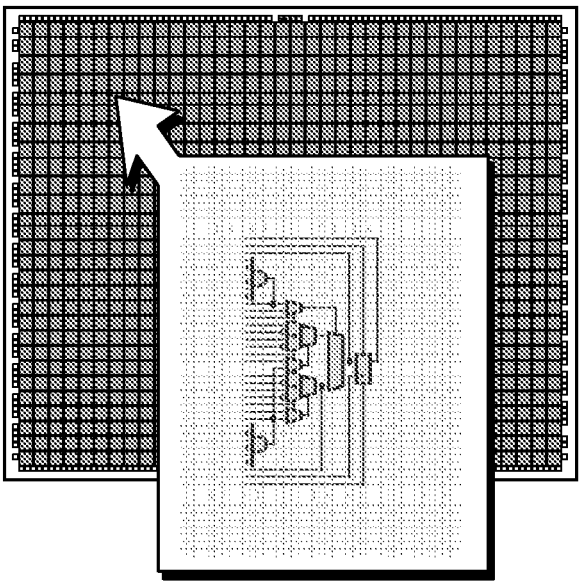
***1,008 Logic Cells***

### High Performance and High Density
-40,000 Usable PLD Gates with 252 I/Os
-16-bit counter speeds over 300 MHz, data path speeds over 400 MHz
-0.35µm four-layer metal non-volatile CMOS process for smallest die sizes

### Easy to Use / Fast Development Cycles
-100% routable with 100% utilization and complete pin-out stability
-Variable-grain logic cells provide high performance and 100% utilization
-Comprehensive design tools include high quality Verilog/VHDL synthesis

### Advanced I/O Capabilities
-Interfaces with both 3.3 volt and 5.0 volt devices
-PCI compliant with 3.3V and 5.0V buses for -1/-2/-3/-4 speed grades
-Full JTAG boundary scan
-Registered I/O cells with individually controlled clocks and output enables

**QL3040 Block Diagram**



QUICKLOGIC

## PRODUCT SUMMARY

The QL3040 is a 40,000 usable PLD gate member of the pASIC 3 family of FPGAs. pASIC 3 FPGAs are fabricated on a 0.35µm four-layer metal process using QuickLogic's patented ViaLink technology to provide a unique combination of high performance, high density, low cost, and extreme ease-of-use.

The QL3040 contains 1,008 logic cells. With a maximum of 252 I/Os, the QL3040 is available in 208-PQFP and 456-pin PBGA packages.

Software support for the complete pASIC 3 family, including the QL3040, is available through three basic packages. The turnkey Quick*Works* package provides the most complete FPGA software solution from design entry to logic synthesis, to place and route, to simulation. The QuickWorks-Lite Quick*Tools*™ packages provide a solution for designers who use Cadence, Exemplar, Mentor, Synopsys, Synplicity, Viewlogic, Veribest, or other third-party tools for design entry, synthesis, or simulation.

## FEATURES

### Total of 252 I/O Pins

- 244 bidirectional input/output pins, PCI-compliant for 5.0 volt and 3.3 volt buses for -1/-2/-3/-4 speed grades
- 8 high-drive input/distributed network pins

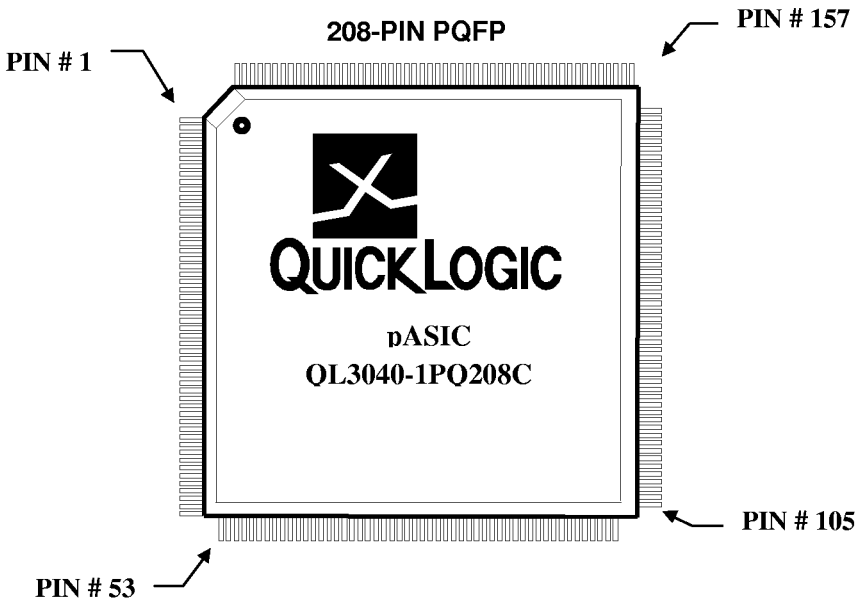
### Eight Low-Skew Distributed Networks

- Two array clock/control networks available to the logic cell flip-flop clock, set and reset inputs - each driven by an input-only pin
- Six global clock/control networks available to the logic cell F1, clock, set and reset inputs and the input and I/O register clock, reset and enable inputs as well as the output enable control - each driven by an input-only or I/O pin, or any logic cell output or I/O cell feedback

### High Performance

- Input + logic cell + output total delays under 6 ns
- Data path speeds exceeding 400 MHz
- Counter speeds over 300 MHz

## PINOUT DIAGRAMS



## PQFP 208 Pinout Table

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

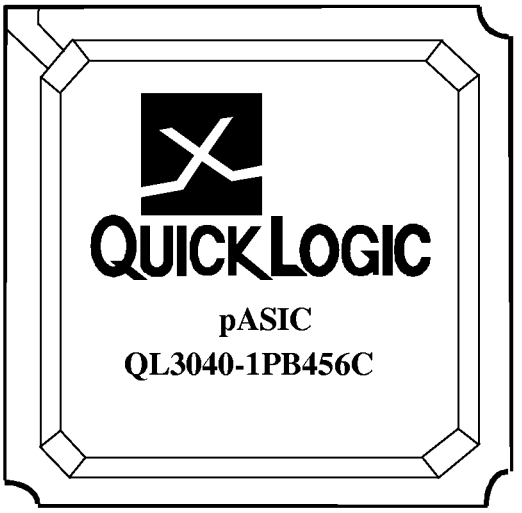
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 42 | I/O | 83 | VCCIO | 124 | I/O | 167 | I/O |

QL3040-rev. B

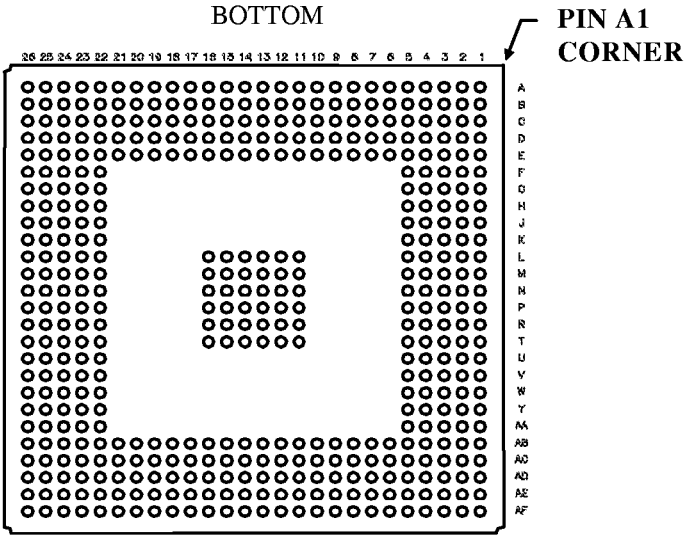
## PINOUT DIAGRAM

### 456-PIN PBGA

TOP




BOTTOM



## PBGA 456 Pinout Table

| 456 | Function | 456 | Function | 456 | Function | 456 | Function | 456 | Function |
|---|---|---|---|---|---|---|---|---|---|
| A1 | I/O | B26 | STM | D25 | I/O | H4 | I/O | M14 | GND/THERM |
| A2 | I/O | C1 | I/O | D26 | I/O | H5 | NC | M15 | GND/THERM |
| A3 | I/O | C2 | I/O | E1 | I/O | H22 | NC | M16 | GND/THERM |
| A4 | I/O | C3 | I/O | E2 | I/O | H23 | NC | M22 | NC |
| A5 | I/O | C4 | TDO | E3 | I/O | H24 | I/O | M23 | NC |
| A6 | I/O | C5 | I/O | E4 | I/O | H25 | NC | M24 | I/O |
| A7 | I/O | C6 | I/O | E5 | GND | H26 | I/O | M25 | I/O |
| A8 | I/O | C7 | I/O | E6 | VCC | J1 | I/O | M26 | I/O |
| A9 | NC | C8 | I/O | E7 | GND | J2 | I/O | N1 | GCLK/I |
| A10 | I/O | C9 | I/O | E8 | NC | J3 | I/O | N2 | I/O |
| A11 | I/O | C10 | I/O | E9 | GND | J4 | NC | N3 | I/O |
| A12 | VCCIO | C11 | I/O | E10 | I/O | J5 | GND | N4 | GCLK/I |
| A13 | I/O | C12 | I/O | E11 | GND | J22 | NC | N5 | VCC |
| A14 | I/O | C13 | I/O | E12 | GND | J23 | NC | N11 | GND/THERM |
| A15 | NC | C14 | I/O | E13 | VCC | J24 | I/O | N12 | GND/THERM |
| A16 | I/O | C15 | I/O | E14 | GND | J25 | I/O | N13 | GND/THERM |
| A17 | NC | C16 | I/O | E15 | GND | J26 | I/O | N14 | GND/THERM |
| A18 | I/O | C17 | NC | E16 | GND | K1 | NC | N15 | GND/THERM |
| A19 | I/O | C18 | NC | E17 | NC | K2 | NC | N16 | GND/THERM |
| A20 | I/O | C19 | I/O | E18 | GND | K3 | I/O | N22 | GND |
| A21 | NC | C20 | I/O | E19 | NC | K4 | I/O | N23 | I/O |
| A22 | I/O | C21 | I/O | E20 | GND | K5 | VCC | N24 | I/O |
| A23 | NC | C22 | I/O | E21 | VCC | K22 | GND | N25 | NC |
| A24 | I/O | C23 | I/O | E22 | GND | K23 | I/O | N26 | I/O |
| A25 | I/O | C24 | I/O | E23 | I/O | K24 | I/O | P1 | I/O |
| A26 | I/O | C25 | TCK | E24 | I/O | K25 | NC | P2 | I/O |
| B1 | I/O | C26 | NC | E25 | I/O | K26 | I/O | P3 | NC |
| B2 | NC | D1 | I/O | E26 | I/O | L1 | I/O | P4 | I/O |
| B3 | I/O | D2 | I/O | F1 | I/O | L2 | I/O | P5 | NC |
| B4 | NC | D3 | I/O | F2 | I/O | L3 | I/O | P11 | GND/THERM |
| B5 | NC | D4 | GND | F3 | NC | L4 | I/O | P12 | GND/THERM |
| B6 | NC | D5 | NC | F4 | NC | L5 | NC | P13 | GND/THERM |
| B7 | NC | D6 | NC | F5 | VCC | L11 | GND/THERM | P14 | GND/THERM |
| B8 | NC | D7 | I/O | F22 | VCC | L12 | GND/THERM | P15 | GND/THERM |
| B9 | I/O | D8 | I/O | F23 | NC | L13 | GND/THERM | P16 | GND/THERM |
| B10 | NC | D9 | GND | F24 | I/O | L14 | GND/THERM | P22 | NC |
| B11 | NC | D10 | I/O | F25 | I/O | L15 | GND/THERM | P23 | GCLK / I |
| B12 | I/O | D11 | I/O | F26 | I/O | L16 | GND/THERM | P24 | GCLK / I |
| B13 | I/O | D12 | GND | G1 | I/O | L22 | NC | P25 | NC |
| B14 | NC | D13 | I/O | G2 | I/O | L23 | I/O | P26 | ACLK / I |
| B15 | I/O | D14 | I/O | G3 | I/O | L24 | I/O | R1 | NC |
| B16 | I/O | D15 | GND | G4 | I/O | L25 | NC | R2 | I/O |
| B17 | I/O | D16 | I/O | G5 | NC | L26 | I/O | R3 | I/O |
| B18 | I/O | D17 | I/O | G22 | GND | M1 | ACLK / I | R4 | NC |
| B19 | I/O | D18 | GND | G23 | NC | M2 | GCLK/I | R5 | NC |
| B20 | I/O | D19 | I/O | G24 | I/O | M3 | I/O | R11 | GND/THERM |
| B21 | I/O | D20 | NC | G25 | I/O | M4 | NC | R12 | GND/THERM |
| B22 | I/O | D21 | NC | G26 | I/O | M5 | GND | R13 | GND/THERM |
| B23 | NC | D22 | I/O | H1 | NC | M11 | GND/THERM | R14 | GND/THERM |
| B24 | I/O | D23 | GND | H2 | I/O | M12 | GND/THERM | R15 | GND/THERM |
| B25 | I/O | D24 | I/O | H3 | NC | M13 | GND/THERM | R16 | GND/THERM |

*(continued next page)*

## PBGA 456 Pinout Table

*(continued from previous page)*

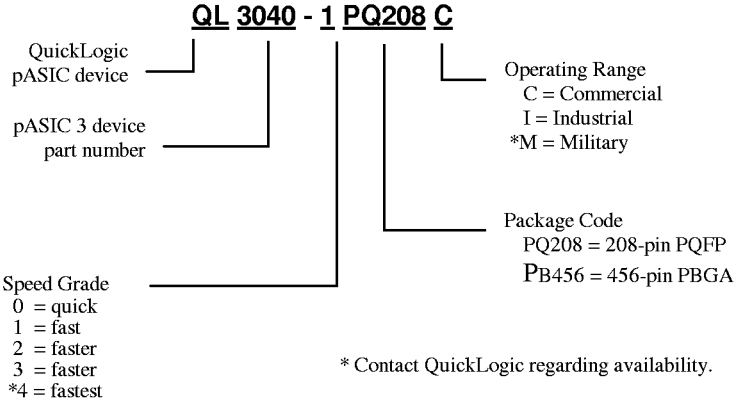
| 456 | Function | 456 | Function | 456 | Function | 456 | Function |
|---|---|---|---|---|---|---|---|
| R22 | VCC | Y1 | NC | AC6 | NC | AE5 | I/O |
| R23 | NC | Y2 | I/O | AC7 | NC | AE6 | I/O |
| R24 | NC | Y3 | NC | AC8 | NC | AE7 | I/O |
| R25 | I/O | Y4 | I/O | AC9 | NC | AE8 | I/O |
| R26 | GCLK / I | Y5 | I/O | AC10 | NC | AE9 | I/O |
| T1 | I/O | Y22 | GND | AC11 | I/O | AE10 | I/O |
| T2 | I/O | Y23 | I/O | AC12 | NC | AE11 | I/O |
| T3 | I/O | Y24 | NC | AC13 | I/O | AE12 | I/O |
| T4 | I/O | Y25 | I/O | AC14 | VCCIO | AE13 | I/O |
| T5 | VCC | Y26 | I/O | AC15 | NC | AE14 | I/O |
| T11 | GND/THERM | AA1 | I/O | AC16 | NC | AE15 | I/O |
| T12 | GND/THERM | AA2 | I/O | AC17 | NC | AE16 | I/O |
| T13 | GND/THERM | AA3 | NC | AC18 | NC | AE17 | I/O |
| T14 | GND/THERM | AA4 | NC | AC19 | I/O | AE18 | I/O |
| T15 | GND/THERM | AA5 | VCC | AC20 | I/O | AE19 | I/O |
| T16 | GND/THERM | AA22 | VCC | AC21 | I/O | AE20 | I/O |
| T22 | GND | AA23 | NC | AC22 | NC | AE21 | I/O |
| T23 | I/O | AA24 | I/O | AC23 | GND | AE22 | NC |
| T24 | I/O | AA25 | I/O | AC24 | NC | AE23 | NC |
| T25 | NC | AA26 | I/O | AC25 | I/O | AE24 | TMS |
| T26 | I/O | AB1 | NC | AC26 | I/O | AE25 | I/O |
| U1 | NC | AB2 | I/O | AD1 | I/O | AE26 | I/O |
| U2 | I/O | AB3 | I/O | AD2 | NC | AF1 | I/O |
| U3 | I/O | AB4 | I/O | AD3 | I/O | AF2 | NC |
| U4 | I/O | AB5 | GND | AD4 | I/O | AF3 | I/O |
| U5 | GND | AB6 | VCC | AD5 | I/O | AF4 | NC |
| U22 | NC | AB7 | NC | AD6 | I/O | AF5 | I/O |
| U23 | I/O | AB8 | NC | AD7 | I/O | AF6 | I/O |
| U24 | I/O | AB9 | NC | AD8 | I/O | AF7 | I/O |
| U25 | I/O | AB10 | VCC | AD9 | NC | AF8 | I/O |
| U26 | I/O | AB11 | GND | AD10 | I/O | AF9 | I/O |
| V1 | I/O | AB12 | NC | AD11 | NC | AF10 | I/O |
| V2 | I/O | AB13 | I/O | AD12 | I/O | AF11 | NC |
| V3 | NC | AB14 | GND | AD13 | I/O | AF12 | I/O |
| V4 | NC | AB15 | VCC | AD14 | I/O | AF13 | I/O |
| V5 | NC | AB16 | I/O | AD15 | I/O | AF14 | NC |
| V22 | GND | AB17 | NC | AD16 | I/O | AF15 | NC |
| V23 | NC | AB18 | VCC | AD17 | I/O | AF16 | I/O |
| V24 | I/O | AB19 | GND | AD18 | I/O | AF17 | I/O |
| V25 | NC | AB20 | NC | AD19 | NC | AF18 | I/O |
| V26 | I/O | AB21 | VCC | AD20 | NC | AF19 | NC |
| W1 | I/O | AB22 | GND | AD21 | I/O | AF20 | I/O |
| W2 | I/O | AB23 | I/O | AD22 | I/O | AF21 | I/O |
| W3 | I/O | AB24 | NC | AD23 | TRSTB | AF22 | I/O |
| W4 | I/O | AB25 | I/O | AD24 | NC | AF23 | I/O |
| W5 | NC | AB26 | I/O | AD25 | I/O | AF24 | I/O |
| W22 | NC | AC1 | I/O | AD26 | I/O | AF25 | I/O |
| W23 | I/O | AC2 | I/O | AE1 | TDI | AF26 | I/O |
| W24 | I/O | AC3 | NC | AE2 | I/O | | |
| W25 | I/O | AC4 | GND | AE3 | I/O | | |
| W26 | NC | AC5 | NC | AE4 | I/O | | |

Note: NC pins must be left unconnected on printed circuit board.

## PIN DESCRIPTIONS

| Pin | Function | Description |
|---|---|---|
| TDI | Test Data In for JTAG | Hold HIGH during normal operation. Connect to VCC if not used for JTAG. |
| TRSTB | Active low Reset for JTAG | Hold LOW during normal operation. Connect to ground if not used for JTAG. |
| TMS | Test Mode Select for JTAG | Hold HIGH during normal operation. Connect to VCC if not used for JTAG. |
| TCK | Test Clock for JTAG | Hold HIGH or LOW during normal operation. Connect to VCC or ground if not used for JTAG. |
| TDO | Test data out for JTAG | Output that must be left unconnected if not used for JTAG. |
| STM | Special Test Mode | Must be grounded during normal operation. |
| I/ACLK | High-drive input and/or array network driver | Can be configured as either or both. |
| I/GCLK | High-drive input and/or global network driver | Can be configured as either or both. |
| I | High-drive input | Use for input signals with high fanout. |
| I/O | Input/Output pin | Can be configured as an input and/or output. |
| VCC | Power supply pin | Connect to 3.3V supply. |
| VCCIO | Input voltage tolerance pin | Connect to 5.0 volt supply if 5 volt input tolerance is required, otherwise connect to 3.3V supply. |
| GND | Ground pin | Connect to ground. |
| GND/THERM | Ground/Thermal pin | Available on 456-PBGA only. Connect to ground plane on PCB if heat sinking desired. Otherwise may be left unconnected. |

## ORDERING INFORMATION



## ABSOLUTE MAXIMUM RATINGS

VCC Voltage …….. -0.5 to 4.6V
VCCIO Voltage……-0.5 to 7.0V
Input Voltage …….…. -0.5 to VCCIO +0.5V
Latch-up Immunity ……. ±200 mA

DC Input Current ……..±20 mA
ESD Pad Protection ……..±2000V
Storage Temperature……..……-65°C to + 150°C
Lead Temperature ……..……300°C

## OPERATING RANGE

| Symbol | Parameter | | Military | | Industrial | | Commercial | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Max | Min | Max | Min | Max | |
| VCC | Supply Voltage | | 3.0 | 3.6 | 3.0 | 3.6 | 3.0 | 3.6 | V |
| VCCIO | I/O Input Tolerance Voltage | | 3.0 | 5.5 | 3.0 | 5.5 | 3.0 | 5.25 | V |
| TA | Ambient Temperature | | -55 | | -40 | 85 | 0 | 70 | °C |
| TC | Case Temperature | | | 125 | | | | | °C |
| K | Delay Factor | -0 Speed Grade | | | 0.42 | 1.92 | 0.46 | 1.85 | |
| | | -1 Speed Grade | 0.41 | 1.69 | 0.42 | 1.55 | 0.46 | 1.50 | |
| | | -2 Speed Grade | 0.41 | 1.41 | 0.42 | 1.29 | 0.46 | 1.25 | |
| | | -3 Speed Grade | | | 0.42 | 1.14 | 0.46 | 1.10 | |
| | | -4 Speed Grade | | | 0.42 | 1.02 | 0.46 | 1.00 | |

## DC CHARACTERISTICS

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| VIH | Input HIGH Voltage | | 0.5VCC | VCCIO+0.5 | V |
| VIL | Input LOW Voltage | | -0.5 | 0.3VCC | V |
| VOH | Output HIGH Voltage | IOH = -12 mA | 2.4 | | V |
| | | IOH = -500 µA | 0.9VCC | | V |
| VOL | Output LOW Voltage | IOL = 16 mA [1] | | 0.45 | V |
| | | IOL = 1.5 mA | | 0.1VCC | V |
| II | I or I/O Input Leakage Current | VI = VCCIO or GND | -10 | 10 | µA |
| IOZ | 3-State Output Leakage Current | VI = VCCIO or GND | -10 | 10 | µA |
| CI | Input Capacitance [2] | | | 10 | pF |
| IOS | Output Short Circuit Current [3] | VO = GND | -15 | -180 | mA |
| | | VO = VCC | 40 | 210 | mA |
| ICC | D.C. Supply Current [4] | VI, VIO = VCCIO or GND | 0.50 (typ) | 2 | mA |
| ICCIO | D.C. Supply Current on VCCIO | | 0 | 100 | µA |

Notes:

[1] Applies only to -1/-2/-3/-4 commercial grade devices. These speed grades are also PCI-compliant. All other devices have 8 mA IOL specifications.
[2] Capacitance is sample tested only. Clock pins are 12 pF maximum.
[3] Only one output at a time. Duration should not exceed 30 seconds.
[4] For -1/-2/-3/-4 commercial grade devices only. Maximum ICC is 3 mA for -0 commercial grade and all industrial grade devices, and 5 mA for all military grade devices. For AC conditions, contact QuickLogic customer engineering.

## AC CHARACTERISTICS at VCC = 3.3V, TA = 25°C (K = 1.00)

(To calculate delays, multiply the appropriate K factor in the "Operating Range" section by the following numbers.)

### Logic Cells

| Symbol | Parameter | Propagation Delays (ns) Fanout [5] | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 8 |
| tPD | Combinatorial Delay [6] | 1.4 | 1.7 | 1.9 | 2.2 | 3.2 |
| tSU | Setup Time [6] | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| tH | Hold Time | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| tCLK | Clock to Q Delay | 0.7 | 1.0 | 1.2 | 1.5 | 2.5 |
| tCWHI | Clock High Time | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| tCWLO | Clock Low Time | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| tSET | Set Delay | 1.0 | 1.3 | 1.5 | 1.8 | 2.8 |
| tRESET | Reset Delay | 0.8 | 1.1 | 1.3 | 1.6 | 2.6 |
| tSW | Set Width | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 |
| tRW | Reset Width | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |

### Input-Only/Clock Cells

| Symbol | Parameter | Propagation Delays (ns) Fanout [5] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 8 | 12 | 24 |
| tIN | High Drive Input Delay | 1.5 | 1.6 | 1.8 | 1.9 | 2.4 | 2.9 | 4.4 |
| tINI | High Drive Input, Inverting Delay | 1.6 | 1.7 | 1.9 | 2.0 | 2.5 | 3.0 | 4.5 |
| tISU | Input Register Set-Up Time | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 |
| tIH | Input Register Hold Time | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| tICLK | Input Register Clock To Q | 0.7 | 0.8 | 1.0 | 1.1 | 1.6 | 2.1 | 3.6 |
| tIRST | Input Register Reset Delay | 0.6 | 0.7 | 0.9 | 1.0 | 1.5 | 2.0 | 3.5 |
| tIESU | Input Register clock Enable Set-Up Time | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |
| tIEH | Input Register Clock Enable Hold Time | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Notes:

[5] Stated timing for worst case Propagation Delay over process variation at VCC=3.3V and TA=25°C. Multiply by the appropriate Delay Factor, K, for speed grade, voltage and temperature settings as specified in the Operating Range.

[6] These limits are derived from a representative selection of the slowest paths through the pASIC 3 logic cell *including typical net delays*. Worst case delay values for specific paths should be determined from timing analysis of your particular design.

## Clock Cells

| Symbol | Parameter | Propagation Delays (ns) Loads per Half Column [7] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 8 | 10 | 12 | 14 | 16 |
| tACK | Array Clock Delay | 1.2 | 1.2 | 1.3 | 1.3 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 |
| tGCKP | Global Clock Pin Delay | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| tGCKB | Global Clock Buffer Delay | 0.8 | 0.8 | 0.9 | 0.9 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 |

## I/O Cells

| Symbol | Parameter | Propagation Delays (ns) Fanout [5] | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 8 | 10 |
| tI/O | Input Delay (bidirectional pad) | 1.3 | 1.6 | 1.8 | 2.1 | 3.1 | 3.6 |
| tISU | Input Register Set-Up Time | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 |
| tIH | Input Register Hold Time | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| tIOCLK | Input Register Clock To Q | 0.7 | 1.0 | 1.2 | 1.5 | 2.5 | 3.0 |
| tIORST | Input Register Reset Delay | 0.6 | 0.9 | 1.1 | 1.4 | 2.4 | 2.9 |
| tIESU | Input Register clock Enable Set-Up Time | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |
| tIEH | Input Register Clock Enable Hold Time | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| Symbol | Parameter | Propagation Delays (ns) Output Load Capacitance (pF) | | | | |
|---|---|---|---|---|---|---|
| | | 30 | 50 | 75 | 100 | 150 |
| tOUTLH | Output Delay Low to High | 2.1 | 2.5 | 3.1 | 3.6 | 4.7 |
| tOUTHL | Output Delay High to Low | 2.2 | 2.6 | 3.2 | 3.7 | 4.8 |
| tPZH | Output Delay Tri-state to High | 1.2 | 1.7 | 2.2 | 2.8 | 3.9 |
| tPZL | Output Delay Tri-state to Low | 1.6 | 2.0 | 2.6 | 3.1 | 4.2 |
| tPHZ | Output Delay High to Tri-State [8] | 2.0 | | | | |
| tPLZ | Output Delay Low to Tri-State [8] | 1.2 | | | | |

Notes:

[7] The array distributed networks consist of 72 half columns and the global distributed networks consist of 76 half columns, each driven by an independent buffer. The number of half columns used does not affect clock buffer delay. The array clock has up to 14 loads per half column. The global clock has up to 16 loads per half column.

[8] The following loads are used for tPXZ: