

# QuickRAM Family Data Sheet



- • • • • Up to 90,000 Usable PLD Gate QuickRAM ESP Combining Performance, Density and Embedded RAM

## Device Highlights

### High Performance & High Density

- Up to 90,000 usable PLD gates with up to 316 I/Os
- 300 MHz 16-bit counters, 400 MHz datapaths, 160+ MHz FIFOs
- 0.35  $\mu$ m four-layer metal non-volatile CMOS process

### High Speed Embedded SRAM

- Up to 22 dual-port RAM modules, organized in user-configurable 1,152 bit blocks
- 5 ns access times, each port independently accessible
- Fast and efficient for FIFO, RAM, and ROM functions

### 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 3.3 V and 5.0 V devices
- PCI compliant with 3.3 V and 5.0 V busses for -1/-2/-3/-4 speed grades
- Full JTAG boundary scan
- I/O cells with individually controlled registered input path and output enables

### Up to 316 I/O Pins

- Up to 308 bi-directional input/output pins, PCI-compliant for 5.0 V and 3.3 V busses for -1/-2/-3/-4 speed grades
- Eight high-drive input/distributed network pins

### Eight Low-Skew Distributed Networks

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

### High Performance Silicon

- Input + logic cell + output total delays under 6 ns
- Data path speeds over 400 MHz
- Counter speeds over 300 MHz
- FIFO speeds over 160+ MHz

Figure 1: QuickRAM Block Diagram

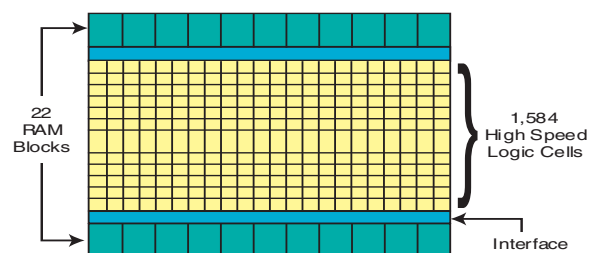


Table 1: QuickRAM Product Family Members

|          |                | QL4009  | QL4016  | QL4036  | QL4058  | QL4090  |
|----------|----------------|---------|---------|---------|---------|---------|
|          | Max Gates      | 47,052  | 63,840  | 97,128  | 61,820  | 44,964  |
|          | Logic Array    | 16 x 16 | 20 x 16 | 28 x 24 | 36 x 28 | 44 x 36 |
|          | Logic Cells    | 160     | 320     | 672     | 1,008   | 1,584   |
|          | Max Flip-Flops | 242     | 438     | 876     | 1,260   | 1,900   |
|          | Max I/O        | 74      | 110     | 196     | 244     | 308     |
|          | RAM Modules    | 8       | 10      | 14      | 18      | 22      |
|          | RAM Bits       | 9,216   | 11,520  | 16,128  | 20,736  | 25,334  |
| Packages | PLCC           | 68/84   | 84      | -       | -       | -       |
|          | TQFP           | 100     | 100/144 | 144     | -       | -       |
|          | PQFP           | -       | -       | 208     | 208/240 | 208/240 |
|          | PBGA           | -       | -       | 256     | 456     | 456     |
|          | CQFP           | -       | 100     | -       | -       | 208     |

Table 2: Max I/O per Device/Package Combination

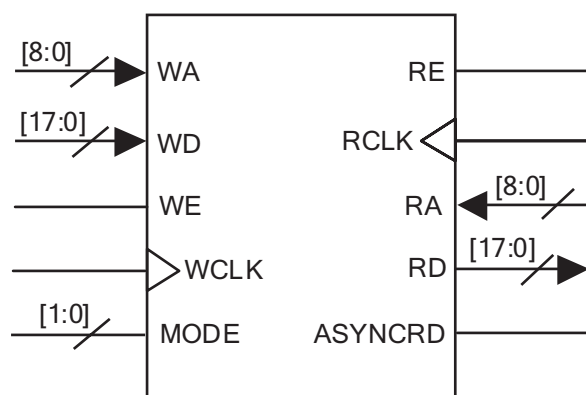
| Device | 68 PLCC | 84 PLCC | 100 TQFP | 144 TQFP | 208 PQFP | 240 PQFP | 256 PBGA | 456 PBGA | 100 CQFP | 208 CQFP |
|--------|---------|---------|----------|----------|----------|----------|----------|----------|----------|----------|
| QL4009 | 46      | 60      | 74       | -        | -        | -        | -        | -        | -        | -        |
| QL4016 | -       | 60      | 74       | 110      | -        | -        | -        | -        | 74       | -        |
| QL4036 | -       | -       | -        | 110      | 166      | -        | 196      | -        | -        | -        |
| QL4058 | -       | -       | -        | -        | 166      | 194      | -        | 244      | -        | -        |
| QL4090 | -       | -       | -        | -        | 166      | 194      | -        | 308      | -        | 166      |

## Architecture Overview

The QuickRAM™ family of Embedded Standard Products (ESP) offer FPGA logic in combination with Dual-Port SRAM modules. The QuickRAM family of ESPs have up to 90,000 usable PLD gates. QuickRAM ESPs are fabricated on a 0.35  $\mu\text{m}$  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.

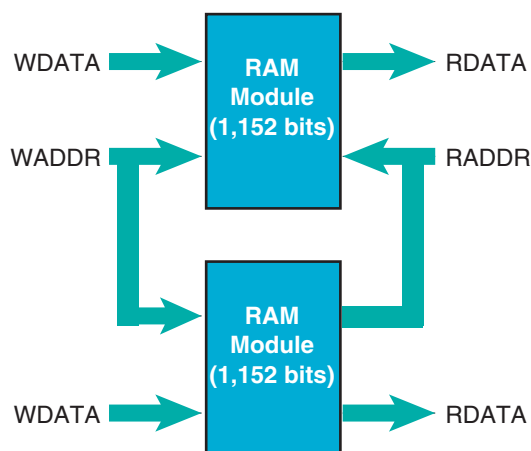
The QuickRAM family contains a range of 160 to 1,584 logic cells and 8 to 22 dual port RAM Modules (see **Figure 1**). Each RAM Module has 1,152 RAM bits, for a total ranging from 9,216 to 25,344 bits (see **Table 1**). RAM Modules are dual port (one read port, one write port) and can be configured into one of four modes: 64 (deep) x18 (wide), 128x9, 256x4, or 512x2 (see **Figure 2**). With a maximum of 308 I/Os, the QuickRAM family of ESPs are available in many device/package combinations (see **Table 2**).

Figure 2: QuickRAM Module



Designers can cascade multiple RAM Modules to increase the depth or width allowed in single modules by connecting corresponding address lines together and dividing the words between modules (see **Figure 3**). This approach allows up to 512-deep configurations as large as 16 bits wide in the smallest QuickRAM device and 44 bits wide in the largest device.

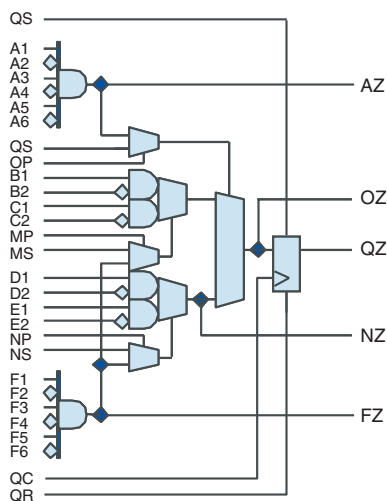
Figure 3: QuickRAM Module Bits



Software support for the complete QuickRAM family is available through two basic packages. The turnkey QuickWorks™ package provides the most complete ESP software solution from design entry to logic synthesis, to place and route, to simulation. The QuickTools™ packages provides a solution for designers who use Cadence, Exemplar, Mentor, Synopsys, Synplicity, Viewlogic, Aldec, or other third-party tools for design entry, synthesis, or simulation.

The QuickLogic variable grain logic cell features up to 16 simultaneous inputs and 5 outputs within a cell that can be fragmented into 5 independent cells. Each cell has a fan-in of 29 including register and control lines (see **Figure 4**).

Figure 4: QuickRAM Logic Cell



## Electrical Specifications

### AC Characteristics at $V_{CC} = 3.3\text{ V}$ , $T_A = 25^\circ\text{ C}$ ( $K = 1.00$ )

To calculate delays, multiply the appropriate K factor from **Table 12** by the numbers provided in **Table 3** through **Table 10**.

Table 3: Logic Cell

| Symbol      | Parameter                        | Propagation Delays (ns) Fanout |     |     |     |     |
|-------------|----------------------------------|--------------------------------|-----|-----|-----|-----|
|             |                                  | 1                              | 2   | 3   | 4   | 5   |
| $t_{PD}$    | Combinatorial Delay <sup>a</sup> | 1.4                            | 1.7 | 1.9 | 2.2 | 3.2 |
| $t_{SU}$    | Setup Time <sup>a</sup>          | 1.7                            | 1.7 | 1.7 | 1.7 | 1.7 |
| $t_H$       | Hold Time                        | 0.0                            | 0.0 | 0.0 | 0.0 | 0.0 |
| $t_{CLK}$   | Clock to Q Delay                 | 0.7                            | 1.0 | 1.2 | 1.5 | 2.5 |
| $t_{CWHI}$  | Clock High Time                  | 1.2                            | 1.2 | 1.2 | 1.2 | 1.2 |
| $t_{CWLO}$  | Clock Low Time                   | 1.2                            | 1.2 | 1.2 | 1.2 | 1.2 |
| $t_{SET}$   | Set Delay                        | 1.0                            | 1.3 | 1.5 | 1.8 | 2.8 |
| $t_{RESET}$ | Reset Delay                      | 0.8                            | 1.1 | 1.3 | 1.6 | 2.6 |
| $t_{SW}$    | Set Width                        | 1.9                            | 1.9 | 1.9 | 1.9 | 1.9 |
| $t_{RW}$    | Reset Width                      | 1.8                            | 1.8 | 1.8 | 1.8 | 1.8 |

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

Table 4: RAM Cell Synchronous Write Timing

| Symbol     | Parameter                       | Propagation Delays (ns) Fanout |     |     |     |     |
|------------|---------------------------------|--------------------------------|-----|-----|-----|-----|
|            |                                 | 1                              | 2   | 3   | 4   | 5   |
| $t_{SWA}$  | WA Setup Time to WCLK           | 1.0                            | 1.0 | 1.0 | 1.0 | 1.0 |
| $t_{HWA}$  | WA Hold Time to WCLK            | 0.0                            | 0.0 | 0.0 | 0.0 | 0.0 |
| $t_{SWD}$  | WD Setup Time to WCLK           | 1.0                            | 1.0 | 1.0 | 1.0 | 1.0 |
| $t_{HWD}$  | WD Hold Time to WCLK            | 0.0                            | 0.0 | 0.0 | 0.0 | 0.0 |
| $t_{SWE}$  | WE Setup Time to WCLK           | 1.0                            | 1.0 | 1.0 | 1.0 | 1.0 |
| $t_{HWE}$  | WE Hold Time to WCLK            | 0.0                            | 0.0 | 0.0 | 0.0 | 0.0 |
| $t_{WCRD}$ | WCLK to RD (WA=RA) <sup>a</sup> | 5.0                            | 5.3 | 5.6 | 5.9 | 7.1 |

a. Stated timing for worst case Propagation Delay over process variation at  $V_{CC} = 3.3\text{ V}$  and  $T_A = 25^\circ\text{ C}$ . Multiply by the appropriate Delay Factor, K, for speed grade, voltage and temperature settings as specified in the Operating Range.

Table 5: RAM Cell Synchronous Read Timing

| Symbol     | Parameter               | Propagation Delays (ns) Fanout |     |     |     |     |
|------------|-------------------------|--------------------------------|-----|-----|-----|-----|
|            |                         | 1                              | 2   | 3   | 4   | 5   |
| $t_{SRA}$  | RA Setup Time to RCLK   | 1.0                            | 1.0 | 1.0 | 1.0 | 1.0 |
| $t_{HRA}$  | RA Hold Time to RCLK    | 0.0                            | 0.0 | 0.0 | 0.0 | 0.0 |
| $t_{SRE}$  | RE Setup Time to RCLK   | 1.0                            | 1.0 | 1.0 | 1.0 | 1.0 |
| $t_{HRE}$  | RE Hold Time to RCLK    | 0.0                            | 0.0 | 0.0 | 0.0 | 0.0 |
| $t_{RCRD}$ | RCLK to RD <sup>a</sup> | 4.0                            | 4.3 | 4.6 | 4.9 | 6.1 |

a. Stated timing for worst case Propagation Delay over process variation at  $V_{CC} = 3.3$  V and  $T_A = 25^{\circ}\text{C}$ . Multiply by the appropriate Delay Factor, K, for speed grade, voltage and temperature settings as specified in the Operating Range.

Table 6: RAM Cell Asynchronous Read Timing

| Symbol | Parameter             | Propagation Delays (ns) Fanout |     |     |     |     |
|--------|-----------------------|--------------------------------|-----|-----|-----|-----|
|        |                       | 1                              | 2   | 3   | 4   | 5   |
| RPDRD  | RA to RD <sup>a</sup> | 3.0                            | 3.3 | 3.6 | 3.9 | 5.1 |

a. Stated timing for worst case Propagation Delay over process variation at  $V_{CC} = 3.3$  V and  $T_A = 25^{\circ}\text{C}$ . Multiply by the appropriate Delay Factor, K, for speed grade, voltage and temperature settings as specified in the Operating Range.

Table 7: Input-Only/Clock Cells

| Symbol     | Parameter                              | Propagation Delays (ns) Fanout <sup>a</sup> |     |     |     |     |     |     |
|------------|----------------------------------------|---------------------------------------------|-----|-----|-----|-----|-----|-----|
|            |                                        | 1                                           | 2   | 3   | 4   | 8   | 12  | 24  |
| $t_{IN}$   | High Drive Input Delay                 | 1.5                                         | 1.6 | 1.8 | 1.9 | 2.4 | 2.9 | 4.4 |
| $t_{INI}$  | High Drive Input, Inverting Delay      | 1.6                                         | 1.7 | 1.9 | 2.0 | 2.5 | 3.0 | 4.5 |
| $t_{ISU}$  | Input Register Set-Up Time             | 3.1                                         | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 |
| $t_{IH}$   | Input Register Hold Time               | 0.0                                         | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| $t_{ICLK}$ | Input Register Clock To Q              | 0.7                                         | 0.8 | 1.0 | 1.1 | 1.6 | 2.1 | 3.6 |
| $t_{IRST}$ | Input Register Reset Delay             | 0.6                                         | 0.7 | 0.9 | 1.0 | 1.5 | 2.0 | 3.5 |
| $t_{IESU}$ | Input Register Clock Enable Setup Time | 2.3                                         | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |
| $t_{IEH}$  | Input Register Clock Enable Hold Time  | 0.0                                         | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

a. Stated timing for worst case Propagation Delay over process variation at  $V_{CC} = 3.3$  V and  $T_A = 25^{\circ}\text{C}$ . Multiply by the appropriate Delay Factor, K, for speed grade, voltage and temperature settings as specified in [Table 12](#).

Table 8: Clock Cells

| Symbol     | Parameter                 | Propagation Delays (ns) Fanout <sup>a</sup> |     |     |     |     |     |     |
|------------|---------------------------|---------------------------------------------|-----|-----|-----|-----|-----|-----|
|            |                           | 1                                           | 2   | 3   | 4   | 8   | 10  | 11  |
| $t_{ACK}$  | Array Clock Delay         | 1.2                                         | 1.2 | 1.3 | 1.3 | 1.5 | 1.6 | 1.7 |
| $t_{GCKP}$ | Global Clock Pin Delay    | 0.7                                         | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| $t_{GCKB}$ | Global Clock Buffer Delay | 0.8                                         | 0.8 | 0.9 | 0.9 | 1.1 | 1.2 | 1.3 |

a. The array distributed networks consist of 40 half columns and the global distributed networks consist of 44 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 8 loads per half column. The global clock has up to 11 loads per half column.

Table 9: I/O Cell Input Delays

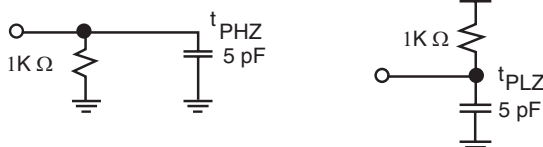
| Symbol      | Parameter                               | Propagation Delays (ns) Fanout <sup>a</sup> |     |     |     |     |     |  |
|-------------|-----------------------------------------|---------------------------------------------|-----|-----|-----|-----|-----|--|
|             |                                         | 1                                           | 2   | 3   | 4   | 8   | 10  |  |
| $t_{I/O}$   | Input Delay (bidirectional pad)         | 1.3                                         | 1.6 | 1.8 | 2.1 | 3.1 | 3.6 |  |
| $t_{ISU}$   | Input Register Set-Up Time              | 3.1                                         | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 |  |
| $t_{IH}$    | Input Register Hold Time                | 0.0                                         | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |  |
| $t_{IOCLK}$ | Input Register Clock to Q               | 0.7                                         | 1.0 | 1.2 | 1.5 | 2.5 | 3.0 |  |
| $t_{IORST}$ | Input Register Reset Delay              | 0.6                                         | 0.9 | 1.1 | 1.4 | 2.4 | 2.9 |  |
| $t_{IESU}$  | Input Register Clock Enable Set-Up Time | 2.3                                         | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |  |
| $t_{IEH}$   | Input Register Clock Enable Hold Time   | 0.0                                         | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |  |

a. Stated timing for worst case Propagation Delay over process variation at  $V_{CC} = 3.3\text{ V}$  and  $T_A = 25^\circ\text{C}$ . Multiply by the appropriate Delay Factor, K, for speed grade, voltage and temperature settings as specified in the Operating Range.

Table 10: I/O Cell Output Delays

| Symbol      | Parameter                                   | Propagation Delays (ns)<br>Output Load Capacitance (pF) |     |     |     |     |
|-------------|---------------------------------------------|---------------------------------------------------------|-----|-----|-----|-----|
|             |                                             | 3                                                       | 50  | 75  | 100 | 150 |
| $t_{OUTLH}$ | Output Delay Low to High                    | 2.1                                                     | 2.5 | 3.1 | 3.6 | 4.7 |
| $t_{OUTHL}$ | Output Delay High to Low                    | 2.2                                                     | 2.6 | 3.2 | 3.7 | 4.8 |
| $t_{PZH}$   | Output Delay Tri-state to High              | 1.2                                                     | 1.7 | 2.2 | 2.8 | 3.9 |
| $t_{PZL}$   | Output Delay Tri-state to Low               | 1.6                                                     | 2.0 | 2.6 | 3.1 | 4.2 |
| $t_{PHZ}$   | Output Delay High to Tri-state <sup>a</sup> | 2.0                                                     | -   | -   | -   | -   |
| $t_{PLZ}$   | Output Delay High to Tri-state <sup>a</sup> | 1.2                                                     | -   | -   | -   | -   |

a. The loads presented in **Figure 5** are used for  $t_{PXZ}$ :

Figure 5: Loads used for  $t_{PXZ}$ 

## 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 to 4.6 V                      | DC Input Current    | ±20 mA            |
| V <sub>CCIO</sub> Voltage | -0.5 to 7.0 V                      | ESD Pad Protection  | ±2000 V           |
| Input Voltage             | -0.5 V to V <sub>CCIO</sub> +0.5 V | Storage Temperature | -65° C to +150° C |
| Latch-up Immunity         | ±200 mA                            | Lead Temperature    | 300° C            |

Table 12: Operating Range

| Symbol            | Parameter                   |                | Military |      | Industrial |      | Commercial |      | Unit |
|-------------------|-----------------------------|----------------|----------|------|------------|------|------------|------|------|
|                   |                             |                | Min.     | Max. | Min.       | Max. | Min.       | Max. |      |
| V <sub>CC</sub>   | Supply Voltage              |                | 3.0      | 3.6  | 3.0        | 3.6  | 3.0        | 3.6  | V    |
| V <sub>CCIO</sub> | I/O Input Tolerance Voltage |                | 3.0      | 5.5  | 3.0        | 5.5  | 3.0        | 5.25 | V    |
| T <sub>A</sub>    | Ambient Temperature         |                | -55      | -    | -40        | 85   | 0          | 70   | °C   |
| T <sub>C</sub>    | Case Temperature            |                | -        | 125  | -          | -    | -          | -    | °C   |
| K                 | Delay Factor                | -0 Speed Grade | 0.42     | 2.03 | 0.43       | 1.90 | 0.46       | 1.85 | n/a  |
|                   |                             | -1 Speed Grade | 0.42     | 1.64 | 0.43       | 1.54 | 0.46       | 1.50 | n/a  |
|                   |                             | -2 Speed Grade | 0.42     | 1.37 | 0.43       | 1.28 | 0.46       | 1.25 | n/a  |
|                   |                             | -3 Speed Grade |          |      | 0.43       | 0.90 | 0.46       | 0.88 | n/a  |
|                   |                             | -4 Speed Grade |          |      | 0.43       | 0.82 | 0.46       | 0.80 | n/a  |

Table 13: DC Characteristics

| Symbol            | Parameter                                 | Conditions                                                  | Min.                | Max.                    | Units |
|-------------------|-------------------------------------------|-------------------------------------------------------------|---------------------|-------------------------|-------|
| V <sub>IH</sub>   | Input HIGH Voltage                        |                                                             | 0.5 V <sub>CC</sub> | V <sub>CCIO</sub> + 0.5 | V     |
| V <sub>IL</sub>   | Input LOW Voltage                         |                                                             | -0.5                | 0.3 V <sub>CC</sub>     | V     |
| V <sub>OH</sub>   | Output HIGH Voltage                       | I <sub>OH</sub> = -12 mA                                    | 2.4                 | V <sub>CC</sub>         | V     |
|                   |                                           | I <sub>OH</sub> = -500 µA                                   | 0.9 V <sub>CC</sub> | V <sub>CC</sub>         | V     |
| V <sub>OL</sub>   | Output LOW Voltage                        | I <sub>OL</sub> = 16 mA <sup>a</sup>                        |                     | 0.45                    | V     |
|                   |                                           | I <sub>OL</sub> = 1.5 mA                                    |                     | 0.1 V <sub>CC</sub>     | V     |
| 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>b</sup>            |                                                             |                     | 10                      | pF    |
| I <sub>OS</sub>   | Output Short Circuit Current <sup>c</sup> | V <sub>O</sub> = GND                                        | -15                 | -180                    | mA    |
|                   |                                           | V <sub>O</sub> = V <sub>CC</sub>                            | 40                  | 210                     | mA    |
| I <sub>CC</sub>   | D.C. Supply Current <sup>d</sup>          | V <sub>I</sub> , V <sub>IO</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                   | 100                     | µA    |

a. 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.

b. Capacitance is sample tested only. Clock pins are 12 pF maximum.

c. Only one output at a time. Duration should not exceed 30 seconds.

d. For -1/-2/-3/-4 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. For AC conditions, contact QuickLogic customer applications group.



## Kv and Kt Graphs

Figure 6: Voltage Factor vs. Supply Voltage

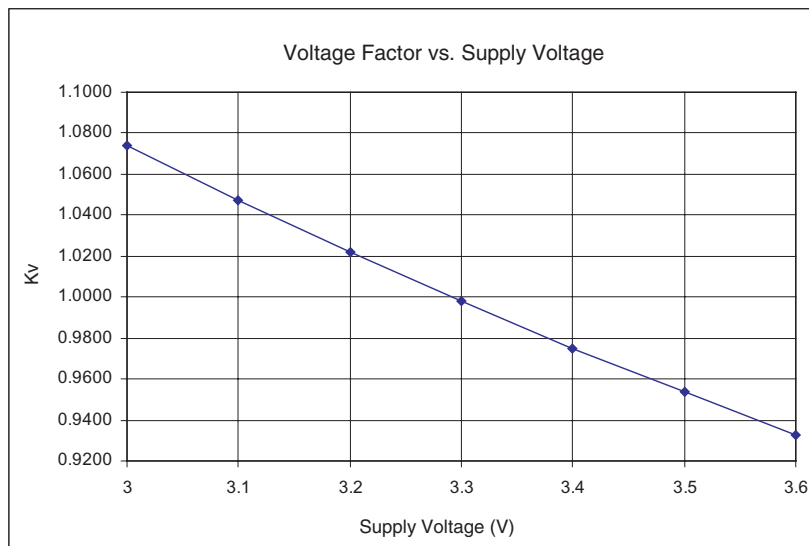
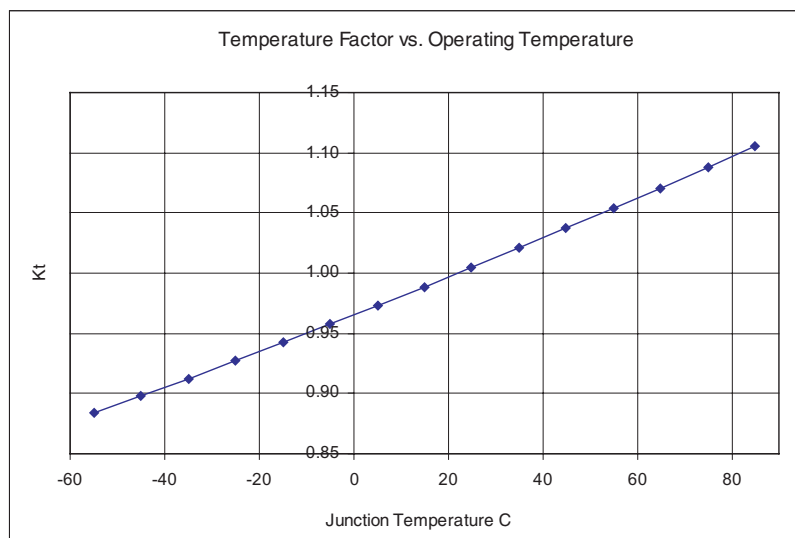
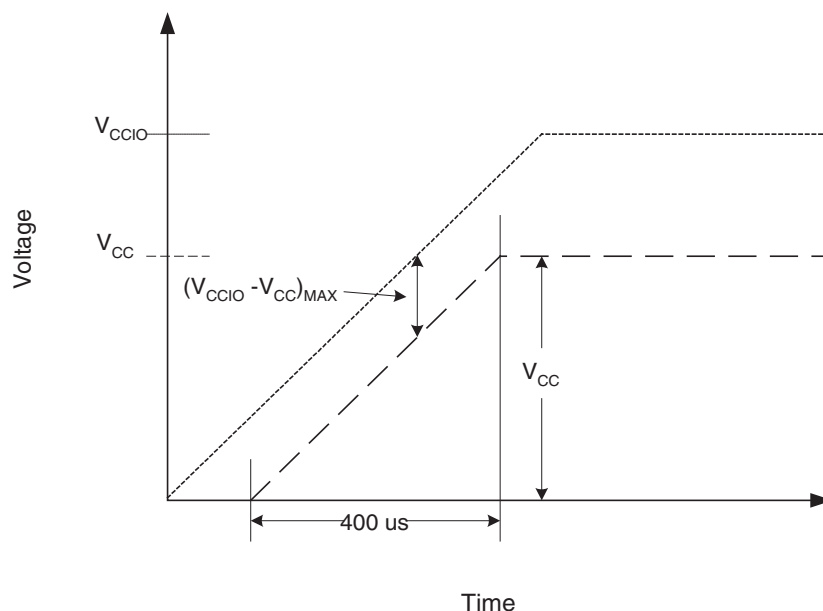


Figure 7: Temperature Factor vs. Operating Temperature



## Power-Up Sequencing

Figure 8: Power-Up Requirements



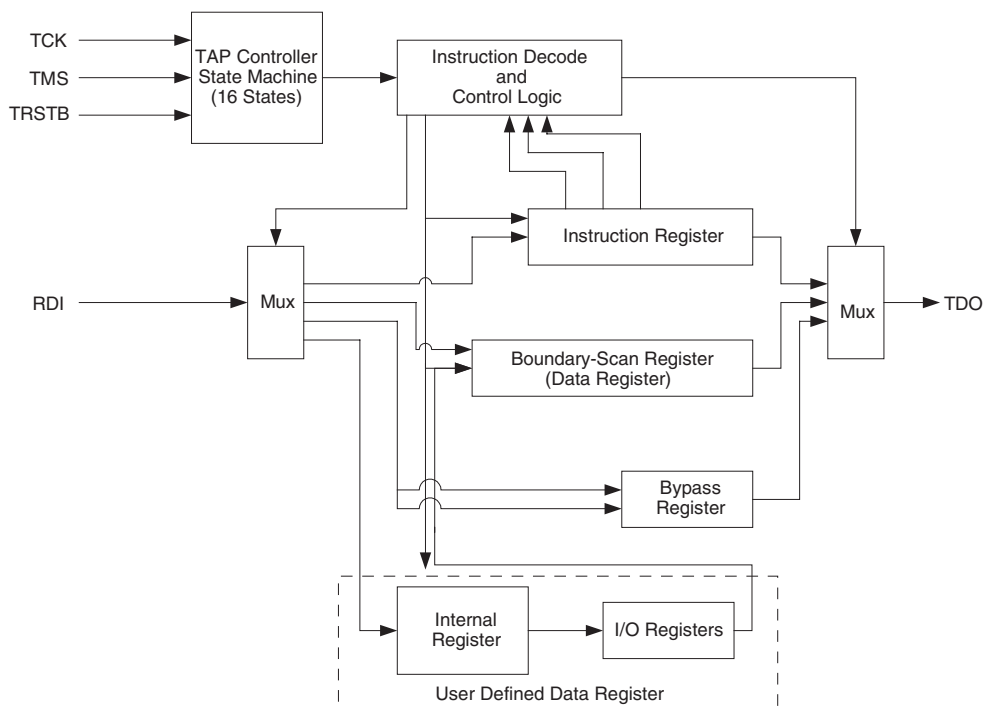
When powering up a device, the  $V_{CC}/V_{CCIO}$  rails must take 400  $\mu$ s or longer to reach the maximum value (refer to **Figure 7**).

**NOTE:** Ramping  $V_{CC}/V_{CCIO}$  to the maximum voltage faster than 400  $\mu$ s can cause the device to behave improperly.

For users with a limited power budget, keep  $(V_{CCIO} - V_{CC})_{MAX} \leq 500$  mV when ramping up the power supply.

## JTAG

Figure 9: JTAG Block Diagram



Microprocessors and Application Specific Integrated Circuits (ASICs) pose many design challenges, not 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); these 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 Printed Circuit Board (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 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.** The Sample/Preload 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 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.

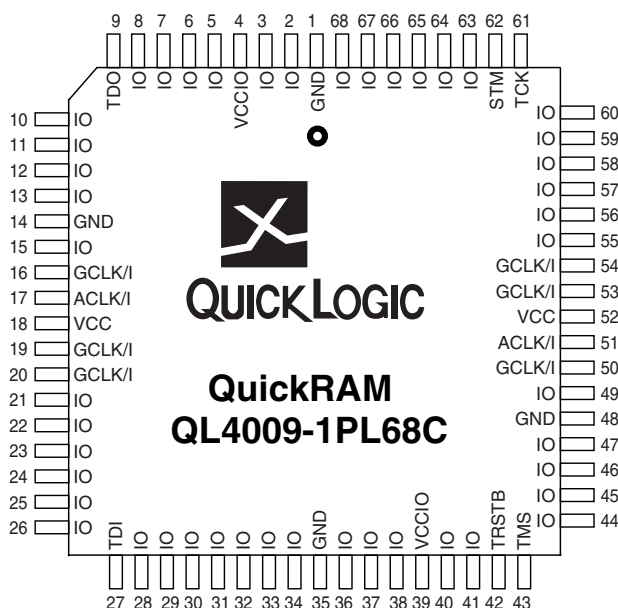
## Pin Descriptions

Table 14: Pin Descriptions

| Pin        | Function                                           | Description                                                                                                               |
|------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| TDI/RSI    | Test Data In for JTAG /RAM init.<br>Serial Data In | Hold HIGH during normal operation. Connects to serial PROM data in for RAM initialization. Connect to $V_{CC}$ if unused. |
| TRSTB/RRO  | Active low Reset for JTAG /RAM init.<br>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 $V_{CC}$ if not used for JTAG.                                              |
| TCK        | Test Clock for JTAG                                | Hold HIGH or LOW during normal operation. Connect to $V_{CC}$ or ground if not used for JTAG.                             |
| TDO/RCO    | Test data out for JTAG /RAM init.<br>clock out     | Connect to serial PROM clock for RAM initialization. Must be left unconnected if not used for JTAG or RAM initialization. |
| STM        | Special Test Mode                                  | Must be grounded during normal operation.                                                                                 |
| I/ACLK     | High-drive input and/or array<br>network driver    | Can be configured as either or both.                                                                                      |
| I/GCLK     | High-drive input and/or global<br>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.                                                                              |
| $V_{CC}$   | Power supply pin                                   | Connect to 3.3 V supply.                                                                                                  |
| $V_{CCIO}$ | Input voltage tolerance pin                        | Connect to 5.0 V supply if 5 V input tolerance is required, otherwise connect to 3.3 V 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.    |

## QL4009 – 68 PLCC Pinout Diagram

Figure 10: QL4009 – 68 Pin PLCC (Top View)



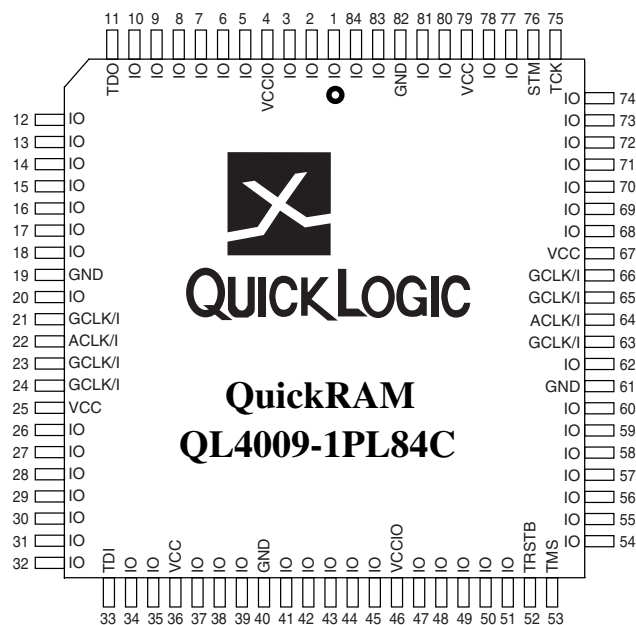
## QL4009 – 68 PLCC Pinout Table

Table 15: QL4009 – 68 PLCC Pinout Table

| 68 PLCC | Function | 68 PLCC | Function | 68 PLCC | Function | 68 PLCC | Function |
|---------|----------|---------|----------|---------|----------|---------|----------|
| 1       | GND      | 18      | VCC      | 35      | GND      | 52      | VCC      |
| 2       | I/O      | 19      | GCLK/I   | 36      | I/O      | 53      | GCLK/I   |
| 3       | I/O      | 20      | GCLK/I   | 37      | I/O      | 54      | GCLK/I   |
| 4       | VCCIO    | 21      | I/O      | 38      | I/O      | 55      | I/O      |
| 5       | I/O      | 22      | I/O      | 39      | VCCIO    | 56      | I/O      |
| 6       | I/O      | 23      | I/O      | 40      | I/O      | 57      | I/O      |
| 7       | I/O      | 24      | I/O      | 41      | I/O      | 58      | I/O      |
| 8       | I/O      | 25      | I/O      | 42      | TRSTB    | 58      | I/O      |
| 9       | TDO      | 26      | I/O      | 43      | TMS      | 60      | I/O      |
| 10      | I/O      | 27      | TDI      | 44      | I/O      | 61      | TCK      |
| 11      | I/O      | 28      | I/O      | 45      | I/O      | 62      | STM      |
| 12      | I/O      | 29      | I/O      | 46      | I/O      | 63      | I/O      |
| 13      | I/O      | 30      | I/O      | 47      | I/O      | 64      | I/O      |
| 14      | GND      | 31      | I/O      | 48      | GND      | 65      | I/O      |
| 15      | I/O      | 32      | I/O      | 49      | I/O      | 66      | I/O      |
| 16      | GCLK/I   | 33      | I/O      | 50      | GCLK/I   | 67      | I/O      |
| 17      | ACLK/I   | 34      | I/O      | 51      | ACLK/I   | 68      | I/O      |

## QL4009 – 84 PLCC Pinout Diagram

Figure 11: QL4009 – 84 Pin PLCC (Top View)



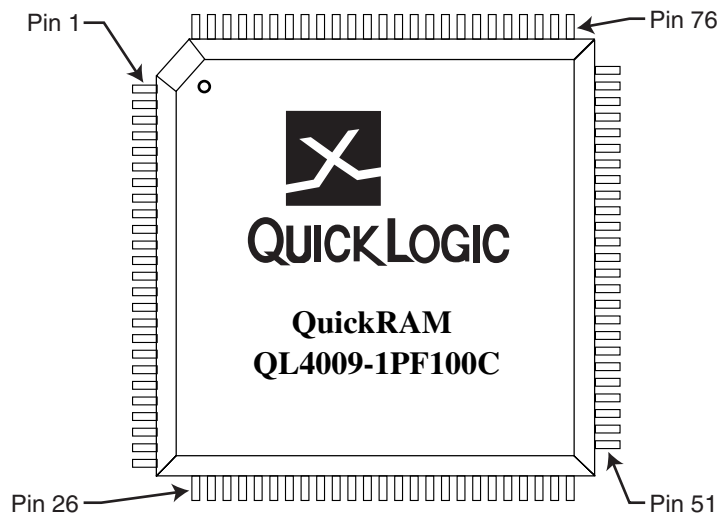
## QL4009 – 84 PLCC Pinout Table

Table 16: QL4009 – 84 PLCC Pinout Table

| 84 PLCC | Function | 84 PLCC | Function | 84 PLCC | Function | 84 PLCC | Function |
|---------|----------|---------|----------|---------|----------|---------|----------|
| 1       | I/O      | 22      | ACLK/I   | 43      | I/O      | 64      | ACLK/I   |
| 2       | I/O      | 23      | GCLK/I   | 44      | I/O      | 65      | GCLK/I   |
| 3       | I/O      | 24      | GCLK/I   | 45      | I/O      | 66      | GCLK/I   |
| 4       | VCCIO    | 25      | VCC      | 46      | VCCIO    | 67      | VCC      |
| 5       | I/O      | 26      | I/O      | 47      | I/O      | 68      | I/O      |
| 6       | I/O      | 27      | I/O      | 48      | I/O      | 69      | I/O      |
| 7       | I/O      | 28      | I/O      | 49      | I/O      | 70      | I/O      |
| 8       | I/O      | 29      | I/O      | 50      | I/O      | 71      | I/O      |
| 9       | I/O      | 30      | I/O      | 51      | I/O      | 72      | I/O      |
| 10      | I/O      | 31      | I/O      | 52      | TRSTB    | 73      | I/O      |
| 11      | TDO      | 32      | I/O      | 53      | TMS      | 74      | I/O      |
| 12      | I/O      | 33      | TDI      | 54      | I/O      | 75      | TCK      |
| 13      | I/O      | 34      | I/O      | 55      | I/O      | 76      | STM      |
| 14      | I/O      | 35      | I/O      | 56      | I/O      | 77      | I/O      |
| 15      | I/O      | 36      | VCC      | 57      | I/O      | 78      | I/O      |
| 16      | I/O      | 37      | I/O      | 58      | I/O      | 79      | VCC      |
| 17      | I/O      | 38      | I/O      | 59      | I/O      | 80      | I/O      |
| 18      | I/O      | 39      | I/O      | 60      | I/O      | 81      | I/O      |
| 19      | GND      | 40      | GND      | 61      | GND      | 82      | GND      |
| 20      | I/O      | 41      | I/O      | 62      | I/O      | 83      | I/O      |
| 21      | GCLK/I   | 42      | I/O      | 63      | GCLK/I   | 84      | I/O      |

## QL4009 – 100 TQFP Pinout Diagram

Figure 12: QL4009 – 100 Pin TQFP (Top View)



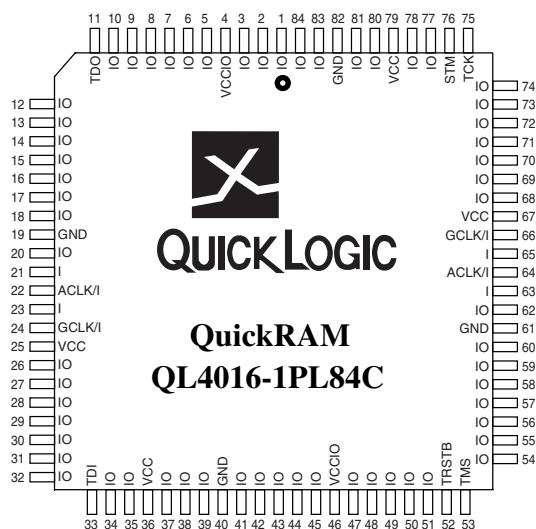
## QL4009 – 100 TQFP Pinout Table

Table 17: QL4009 – 100 TQFP Pinout Table

| 100TQFP | Function | 100TQFP | Function | 100TQFP | Function | 100TQFP | Function |
|---------|----------|---------|----------|---------|----------|---------|----------|
| 1       | I/O      | 26      | TDI      | 51      | I/O      | 76      | TCK      |
| 2       | I/O      | 27      | I/O      | 52      | I/O      | 77      | STM      |
| 3       | I/O      | 28      | I/O      | 53      | I/O      | 78      | I/O      |
| 4       | I/O      | 29      | I/O      | 54      | I/O      | 79      | I/O      |
| 5       | I/O      | 30      | I/O      | 55      | I/O      | 80      | I/O      |
| 6       | I/O      | 31      | I/O      | 56      | I/O      | 81      | I/O      |
| 7       | I/O      | 32      | I/O      | 57      | I/O      | 82      | I/O      |
| 8       | I/O      | 33      | I/O      | 58      | I/O      | 83      | I/O      |
| 9       | GND      | 34      | I/O      | 59      | GND      | 84      | I/O      |
| 10      | I/O      | 35      | GND      | 60      | I/O      | 85      | GND      |
| 11      | I        | 36      | I/O      | 61      | I        | 86      | I/O      |
| 12      | ACLK/I   | 37      | I/O      | 62      | ACLK/I   | 87      | I/O      |
| 13      | VCC      | 38      | GND      | 63      | VCC      | 88      | GND      |
| 14      | I        | 39      | I/O      | 64      | I        | 89      | I/O      |
| 15      | GCLK/I   | 40      | I/O      | 65      | GCLK/I   | 90      | I/O      |
| 16      | VCC      | 41      | I/O      | 66      | VCC      | 91      | I/O      |
| 17      | I/O      | 42      | VCCIO    | 67      | I/O      | 92      | VCCIO    |
| 18      | I/O      | 43      | I/O      | 68      | I/O      | 93      | I/O      |
| 19      | I/O      | 44      | I/O      | 69      | I/O      | 94      | I/O      |
| 20      | I/O      | 45      | I/O      | 70      | I/O      | 95      | I/O      |
| 21      | I/O      | 46      | I/O      | 71      | I/O      | 96      | I/O      |
| 22      | I/O      | 47      | I/O      | 72      | I/O      | 97      | I/O      |
| 23      | I/O      | 48      | I/O      | 73      | I/O      | 98      | I/O      |
| 24      | I/O      | 49      | TRSTB    | 74      | I/O      | 99      | I/O      |
| 25      | I/O      | 50      | TMS      | 75      | I/O      | 100     | TDO      |

## QL4016 – 84 PLCC Pinout Diagram

Figure 13: QL4016 – 84 Pin PLCC (Top View)



## QL4016 – 84 PLCC Pinout Table

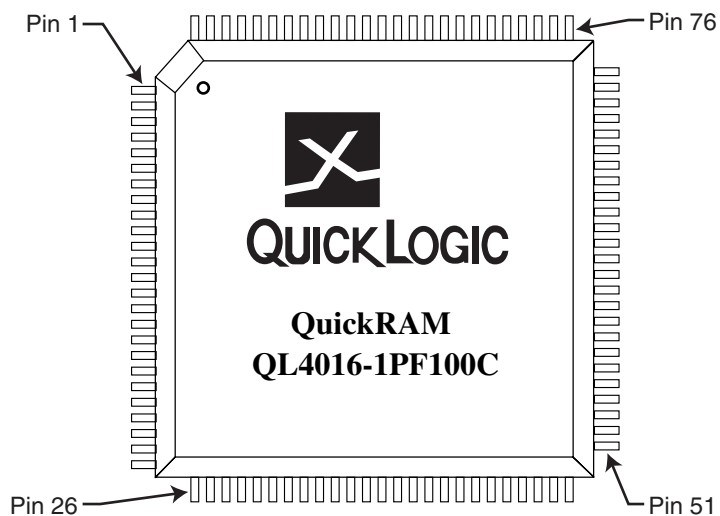
Table 18: QL4016 – 84 PLCC Pinout Table

| 84 PLCC | Function | 84 PLCC | Function | 84 PLCC | Function | 84 PLCC | Function |
|---------|----------|---------|----------|---------|----------|---------|----------|
| 1       | I/O      | 22      | ACLK/I   | 43      | I/O      | 64      | ACLK/I   |
| 2       | I/O      | 23      | I        | 44      | I/O      | 65      | I        |
| 3       | I/O      | 24      | GCLK/I   | 45      | I/O      | 66      | GCLK/I   |
| 4       | VCCIO    | 25      | VCC      | 46      | VCCIO    | 67      | VCC      |
| 5       | I/O      | 26      | I/O      | 47      | I/O      | 68      | I/O      |
| 6       | I/O      | 27      | I/O      | 48      | I/O      | 69      | I/O      |
| 7       | I/O      | 28      | I/O      | 49      | I/O      | 70      | I/O      |
| 8       | I/O      | 29      | I/O      | 50      | I/O      | 71      | I/O      |
| 9       | I/O      | 30      | I/O      | 51      | I/O      | 72      | I/O      |
| 10      | I/O      | 31      | I/O      | 52      | TRSTB    | 73      | I/O      |
| 11      | TDO      | 32      | I/O      | 53      | TMS      | 74      | I/O      |
| 12      | I/O      | 33      | TDI      | 54      | I/O      | 75      | TCK      |
| 13      | I/O      | 34      | I/O      | 55      | I/O      | 76      | STM      |
| 14      | I/O      | 35      | I/O      | 56      | I/O      | 77      | I/O      |
| 15      | I/O      | 36      | VCC      | 57      | I/O      | 78      | I/O      |
| 16      | I/O      | 37      | I/O      | 58      | I/O      | 79      | VCC      |
| 17      | I/O      | 38      | I/O      | 59      | I/O      | 80      | I/O      |
| 18      | I/O      | 39      | I/O      | 60      | I/O      | 81      | I/O      |
| 19      | GND      | 40      | GND      | 61      | GND      | 82      | GND      |
| 20      | I/O      | 41      | I/O      | 62      | I/O      | 83      | I/O      |
| 21      | I        | 42      | I/O      | 63      | I        | 84      | I/O      |



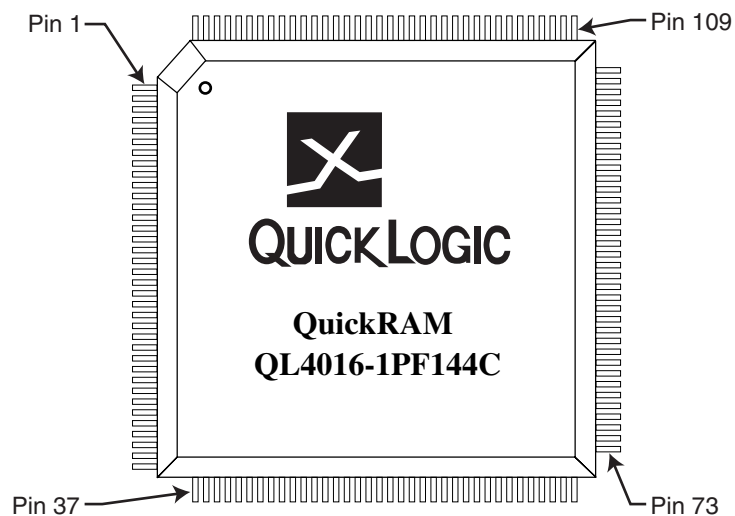
## QL4016 – 100 TQFP/CQFP Pinout Diagram

Figure 14: QL4016 – 100 Pin TQFP/CQFP (Top View)



## QL4016 – 144 TQFP Pinout Diagram

Figure 15: QL4016 – 144 Pin TQFP (Top View)



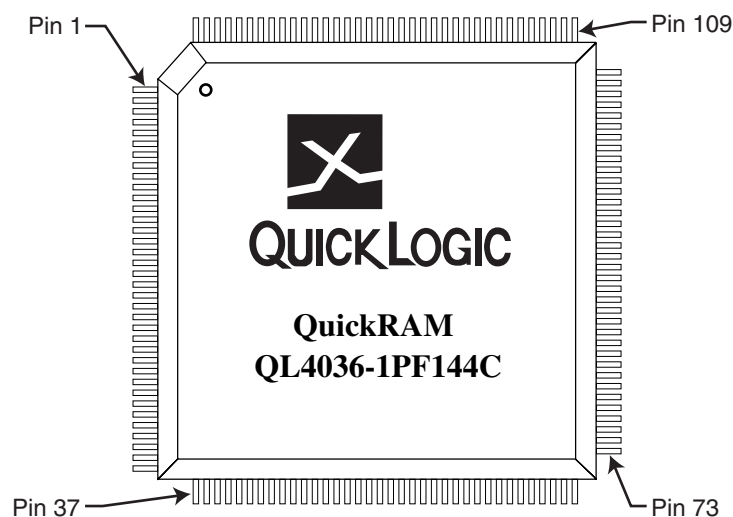
## QL4016 – 144 TQFP and 100 TQFP/CQFP Pinout Table

Table 19: QL4016 – 144 TQFP and 100 TQFP/CQFP Pinout Table

| 144TQFP | 100TQFP | Function | 144TQFP | 100TQFP | Function | 144TQFP | 100TQFP | Function | 144TQFP | 100TQFP | Function |
|---------|---------|----------|---------|---------|----------|---------|---------|----------|---------|---------|----------|
| 1       | 2       | I/O      | 38      | 26      | TDI      | 75      | 53      | I/O      | 111     | 78      | I/O      |
| 2       | 3       | I/O      | 39      | 27      | I/O      | 76      | 54      | I/O      | 112     | 79      | I/O      |
| 3       | NC      | I/O      | 40      | 28      | I/O      | 77      | 55      | I/O      | 113     | 80      | I/O      |
| 4       | 4       | I/O      | 41      | 29      | I/O      | 78      | NC      | I/O      | 114     | NC      | VCC      |
| 5       | NC      | I/O      | 42      | NC      | VCC      | 79      | NC      | VCC      | 115     | 81      | I/O      |
| 6       | 5       | I/O      | 43      | 30      | I/O      | 80      | NC      | I/O      | 116     | 82      | I/O      |
| 7       | NC      | VCC      | 44      | 31      | I/O      | 81      | 56      | I/O      | 117     | 83      | I/O      |
| 8       | 6       | I/O      | 45      | NC      | I/O      | 82      | NC      | I/O      | 118     | NC      | I/O      |
| 9       | NC      | I/O      | 46      | 32      | I/O      | 83      | 57      | I/O      | 119     | 84      | I/O      |
| 10      | 7       | I/O      | 47      | 33      | I/O      | 84      | NC      | I/O      | 120     | NC      | I/O      |
| 11      | NC      | I/O      | 48      | NC      | I/O      | 85      | 58      | I/O      | 121     | NC      | I/O      |
| 12      | NC      | I/O      | 49      | 34      | I/O      | 86      | NC      | I/O      | 122     | 85      | GND      |
| 13      | 8       | I/O      | 50      | 35      | GND      | 87      | 59      | GND      | 123     | NC      | I/O      |
| 14      | NC      | I/O      | 51      | 36      | I/O      | 88      | 60      | I/O      | 124     | 86      | I/O      |
| 15      | 9       | GND      | 52      | NC      | I/O      | 89      | 61      | I        | 125     | 87      | I/O      |
| 16      | 10      | I/O      | 53      | 37      | I/O      | 90      | 62      | ACLK/I   | 126     | 88      | GND      |
| 17      | 11      | I        | 54      | 38      | GND      | 91      | 63      | VCC      | 127     | 89      | I/O      |
| 18      | 12      | ACLK/I   | 55      | 39      | I/O      | 92      | 64      | I        | 128     | 90      | I/O      |
| 19      | 13      | VCC      | 56      | 40      | I/O      | 93      | 65      | GCLK/I   | 129     | 91      | I/O      |
| 20      | 14      | I        | 57      | 41      | I/O      | 94      | 66      | VCC      | 130     | 92      | VCCIO    |
| 21      | 15      | GCLK/I   | 58      | 42      | VCCIO    | 95      | 67      | I/O      | 131     | NC      | I/O      |
| 22      | 16      | VCC      | 59      | NC      | I/O      | 96      | NC      | I/O      | 132     | 93      | I/O      |
| 23      | 17      | I/O      | 60      | 43      | I/O      | NC      | 68      | I/O      | 133     | NC      | I/O      |
| 24      | 18      | I/O      | 61      | 44      | I/O      | 97      | NC      | I/O      | 134     | 94      | I/O      |
| 25      | NC      | I/O      | 62      | 45      | I/O      | 98      | 69      | I/O      | 135     | NC      | I/O      |
| 26      | 19      | I/O      | 63      | NC      | I/O      | 99      | NC      | I/O      | 136     | NC      | I/O      |
| 27      | NC      | I/O      | 64      | NC      | I/O      | 100     | 70      | I/O      | NC      | 95      | I/O      |
| 28      | 20      | I/O      | 65      | 46      | I/O      | 101     | 71      | I/O      | 137     | NC      | I/O      |
| 29      | 21      | I/O      | 66      | NC      | GND      | 102     | NC      | GND      | 138     | NC      | GND      |
| 30      | NC      | GND      | 67      | NC      | I/O      | 103     | NC      | I/O      | 139     | 96      | I/O      |
| 31      | NC      | I/O      | 68      | NC      | I/O      | 104     | 72      | I/O      | 140     | 97      | I/O      |
| 32      | 22      | I/O      | 69      | 47      | I/O      | 105     | NC      | I/O      | 141     | 98      | I/O      |
| 33      | 23      | I/O      | 70      | 48      | I/O      | 106     | 73      | I/O      | 142     | 99      | I/O      |
| 34      | NC      | I/O      | 71      | 49      | TRSTB    | 107     | 74      | I/O      | 143     | 100     | TDO      |
| 35      | NC      | I/O      | 72      | 50      | TMS      | 108     | 75      | I/O      | 144     | 1       | I/O      |
| 36      | 24      | I/O      | 73      | 51      | I/O      | 109     | 76      | TCK      |         |         |          |
| 37      | 25      | I/O      | 74      | 52      | I/O      | 110     | 77      | STM      |         |         |          |

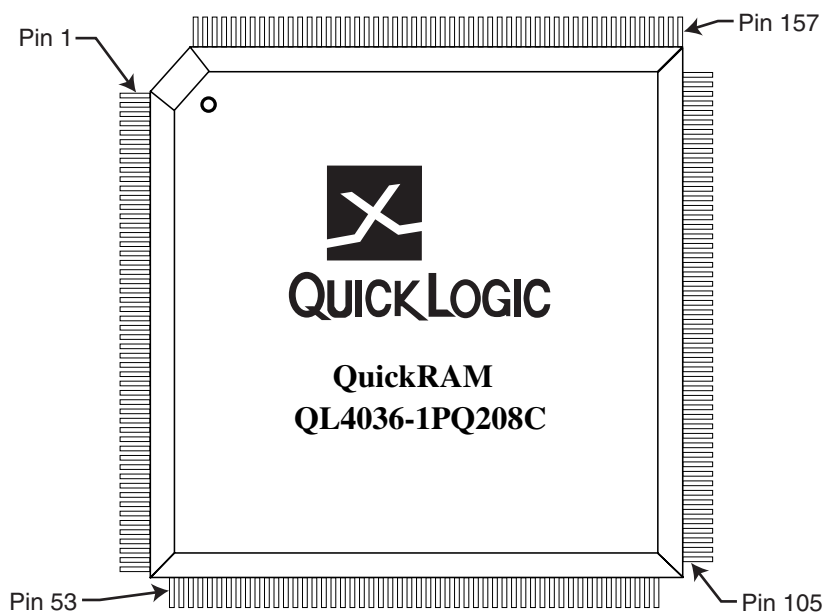
## QL4036 – 144 TQFP Pinout Diagram

Figure 16: QL4036 – 144 Pin TQFP (Top View)



## QL4036 – 208 PQFP Pinout Diagram

Figure 17: QL4036 – 208 Pin PQFP (Top View)



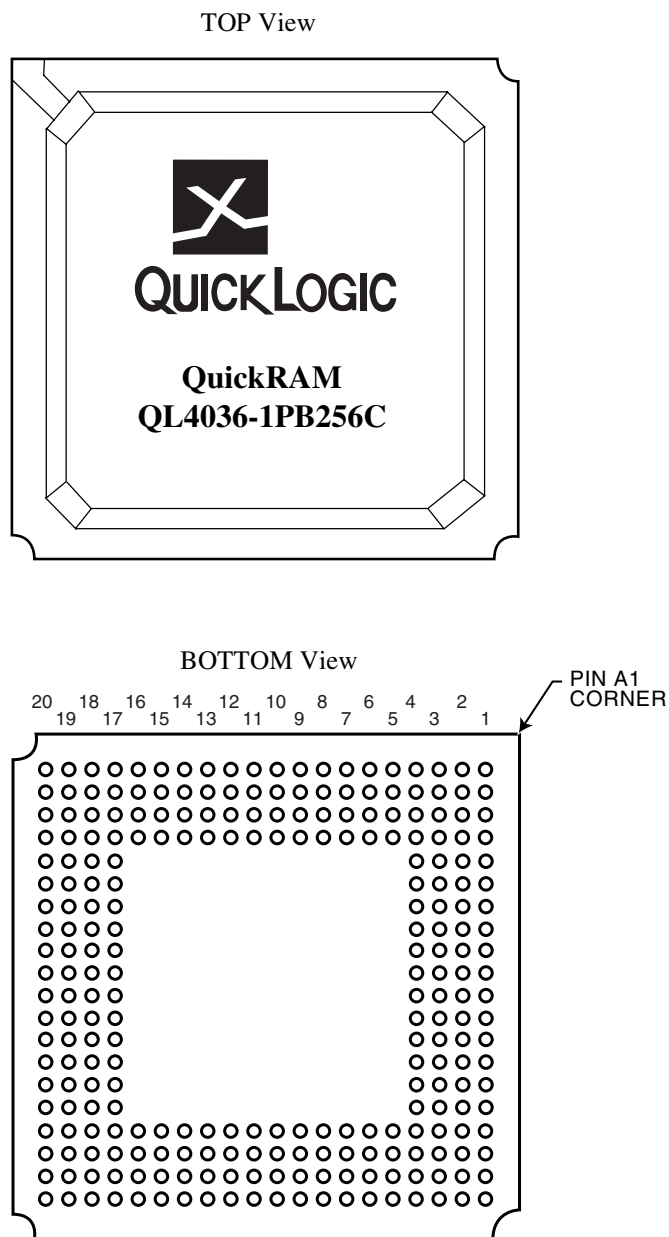
## QL4036 – 144 TQFP and 208 PQFP Pinout Table

Table 20: QL4036 – 144 TQFP and 208 PQFP Pinout Table

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

## QL4036 – 256 PBGA Pinout Diagram

Figure 18: QL4036 – 256 PBGA Pinout Diagram



## QL4036 – 256 PBGA Pinout Table

Table 21: QL4036 – 256 PBGA Pinout Table

| 256 PBGA | Function | 256 PBGA | Function | 256 PBGA | Function | 256 PBGA | Function | 256 PBGA | Function | 256 PBGA | Function |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| A1       | VSS      | C4       | I/O      | E19      | I/O      | L2       | ACLK/I   | T17      | I/O      | V20      | I/O      |
| A2       | I/O      | C5       | I/O      | E20      | I/O      | L3       | GCLK/I   | T18      | I/O      | W1       | I/O      |
| A3       | I/O      | C6       | I/O      | F1       | I/O      | L4       | GCLK/I   | T19      | NC       | W2       | I/O      |
| A4       | I/O      | C7       | I/O      | F2       | I/O      | L17      | VCC      | T20      | I/O      | W3       | TDI      |
| A5       | I/O      | C8       | I/O      | F3       | I/O      | L18      | I/O      | U1       | I/O      | W4       | I/O      |
| A6       | I/O      | C9       | VCCIO    | F4       | VCC      | L19      | I/O      | U2       | I/O      | W5       | I/O      |
| A7       | I/O      | C10      | I/O      | F17      | VCC      | L20      | I/O      | U3       | I/O      | W6       | I/O      |
| A8       | I/O      | C11      | I/O      | F18      | NC       | M1       | I/O      | U4       | VSS      | W7       | I/O      |
| A9       | I/O      | C12      | I/O      | F19      | I/O      | M2       | I/O      | U5       | I/O      | W8       | I/O      |
| A10      | I/O      | C13      | I/O      | F20      | I/O      | M3       | I/O      | U6       | VCC      | W9       | I/O      |
| A11      | I/O      | C14      | I/O      | G1       | I/O      | M4       | NC       | U7       | I/O      | W10      | I/O      |
| A12      | I/O      | C15      | I/O      | G2       | NC       | M17      | NC       | U8       | VSS      | W11      | I/O      |
| A13      | I/O      | C16      | I/O      | G3       | I/O      | M18      | I/O      | U9       | I/O      | W12      | I/O      |
| A14      | I/O      | C17      | I/O      | G4       | I/O      | M19      | I/O      | U10      | VCC      | W13      | I/O      |
| A15      | I/O      | C18      | I/O      | G17      | I/O      | M20      | I/O      | U11      | I/O      | W14      | I/O      |
| A16      | I/O      | C19      | I/O      | G18      | I/O      | N1       | I/O      | U12      | I/O      | W15      | I/O      |
| A17      | I/O      | C20      | I/O      | G19      | NC       | N2       | I/O      | U13      | VSS      | W16      | I/O      |
| A18      | I/O      | D1       | I/O      | G20      | I/O      | N3       | I/O      | U14      | I/O      | W17      | I/O      |
| A19      | TCK      | D2       | I/O      | H1       | I/O      | N4       | VSS      | U15      | VCC      | W18      | I/O      |
| A20      | I/O      | D3       | I/O      | H2       | I/O      | N17      | VSS      | U16      | I/O      | W19      | I/O      |
| B1       | TDO      | D4       | VSS      | H3       | I/O      | N18      | I/O      | U17      | VSS      | W20      | TRSTB    |
| B2       | I/O      | D5       | I/O      | H4       | VSS      | N19      | I/O      | U18      | I/O      | Y1       | I/O      |
| B3       | I/O      | D6       | VCC      | H17      | VSS      | N20      | I/O      | U19      | I/O      | Y2       | NC       |
| B4       | I/O      | D7       | I/O      | H18      | I/O      | P1       | I/O      | U20      | I/O      | Y3       | I/O      |
| B5       | I/O      | D8       | VSS      | H19      | I/O      | P2       | I/O      | V1       | I/O      | Y4       | I/O      |
| B6       | I/O      | D9       | I/O      | H20      | I/O      | P3       | I/O      | V2       | NC       | Y5       | I/O      |
| B7       | I/O      | D10      | I/O      | J1       | I/O      | P4       | I/O      | V3       | I/O      | Y6       | I/O      |
| B8       | I/O      | D11      | VCC      | J2       | I/O      | P17      | I/O      | V4       | I/O      | Y7       | I/O      |
| B9       | I/O      | D12      | I/O      | J3       | NC       | P18      | I/O      | V5       | I/O      | Y8       | I/O      |
| B10      | I/O      | D13      | VSS      | J4       | I/O      | P19      | NC       | V6       | I/O      | Y9       | I/O      |
| B11      | I/O      | D14      | I/O      | J17      | NC       | P20      | I/O      | V7       | I/O      | Y10      | I/O      |
| B12      | I/O      | D15      | VCC      | J18      | I/O      | R1       | NC       | V8       | I/O      | Y11      | I/O      |
| B13      | I/O      | D16      | I/O      | J19      | I/O      | R2       | I/O      | V9       | I/O      | Y12      | I/O      |
| B14      | I/O      | D17      | VSS      | J20      | GCLK/I   | R3       | I/O      | V10      | I/O      | Y13      | I/O      |
| B15      | I/O      | D18      | I/O      | K1       | I/O      | R4       | VCC      | V11      | I/O      | Y14      | I/O      |
| B16      | I/O      | D19      | I/O      | K2       | I/O      | R17      | VCC      | V12      | VCCIO    | Y15      | I/O      |
| B17      | NC       | D20      | I/O      | K3       | I/O      | R18      | I/O      | V13      | I/O      | Y16      | I/O      |
| B18      | STM      | E1       | NC       | K4       | VCC      | R19      | I/O      | V14      | I/O      | Y17      | I/O      |
| B19      | NC       | E2       | I/O      | K17      | GCLK/I   | R20      | I/O      | V15      | I/O      | Y18      | I/O      |
| B20      | I/O      | E3       | I/O      | K18      | ACLK/I   | T1       | NC       | V16      | I/O      | Y19      | I/O      |
| C1       | I/O      | E4       | I/O      | K19      | GCLK/I   | T2       | I/O      | V17      | I/O      | Y20      | NC       |
| C2       | I/O      | E17      | I/O      | K20      | NC       | T3       | I/O      | V18      | I/O      |          |          |
| C3       | I/O      | E18      | I/O      | L1       | GCLK/I   | T4       | NC       | V19      | TMS      |          |          |

## QL4058 – 208 and 240 PQFP Pinout Diagrams

Figure 19: QL4058 – 208 Pin PQFP (Top View)

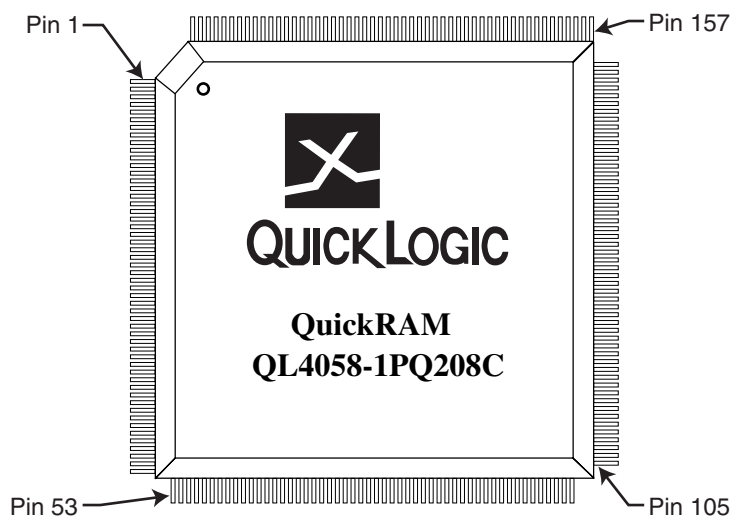
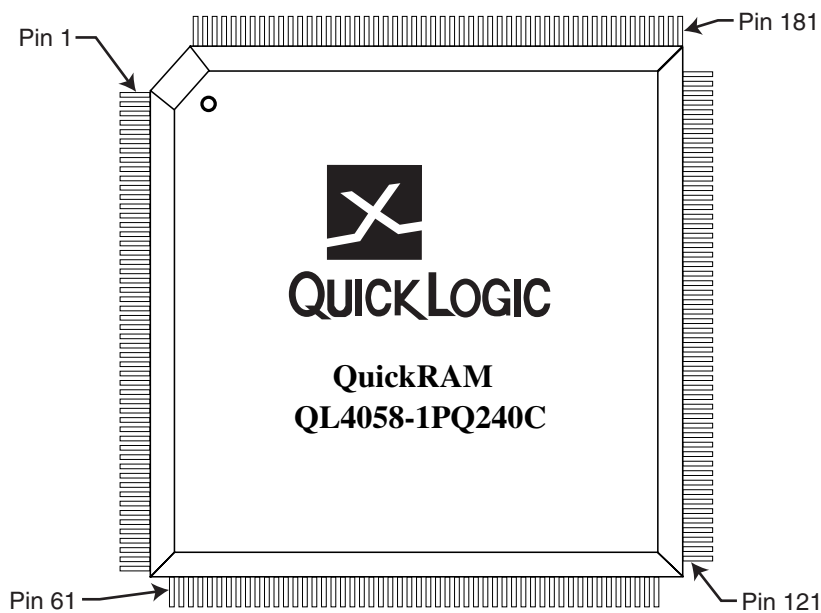


Figure 20: QL4058 – 240 Pin PQFP (Top View)



## QL4058 – 208 and 240 PQFP Pinout Table

Table 22: QL4058 – 208/240 PQFP Pinout Table

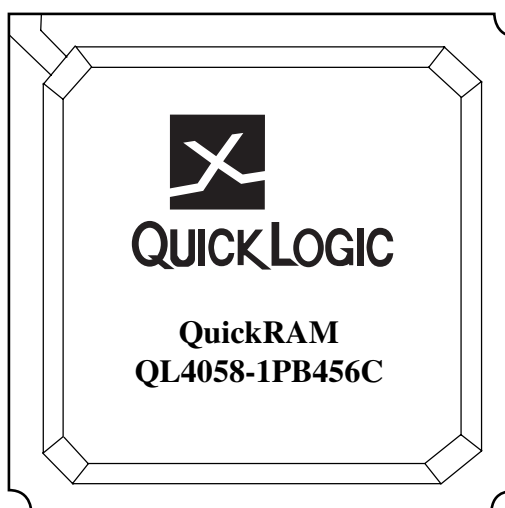
| 240 PQFP | 208 PQFP | Function | 240 PQFP | 208 PQFP | Function | 240 PQFP | 208 PQFP | Function | 240 PQFP | 208 PQFP | Function | 240 PQFP | 208 PQFP | Function |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1        | 208      | I/O      | 51       | 43       | GND      | 98       | 84       | I/O      | 145      | 125      | I/O      | 194      | 168      | I/O      |
| 2        | 1        | I/O      | 52       | 44       | I/O      | 99       | 85       | I/O      | 146      | 126      | I/O      | 195      | 169      | I/O      |
| 3        | 2        | I/O      | 53       | 45       | I/O      | 100      | 86       | I/O      | 147      | 127      | GND      | 196      | NC       | I/O      |
| 4        | 3        | I/O      | 54       | 46       | I/O      | 101      | 87       | I/O      | 148      | 128      | I/O      | 197      | 170      | I/O      |
| 5        | 4        | I/O      | 55       | 47       | I/O      | 102      | 88       | I/O      | 149      | NC       | I/O      | 198      | 171      | I/O      |
| 6        | 5        | I/O      | 56       | 48       | I/O      | 103      | 89       | I/O      | 150      | 129      | GLCK/I   | 199      | 172      | I/O      |
| 7        | NC       | I/O      | 57       | NC       | I/O      | 104      | 90       | I/O      | 151      | 130      | ACLK/I   | 200      | 173      | I/O      |
| 8        | 6        | I/O      | 58       | 49       | I/O      | 105      | 91       | I/O      | 152      | 131      | VCC      | 201      | 174      | I/O      |
| 9        | 7        | I/O      | 59       | 50       | I/O      | 106      | 92       | I/O      | 153      | 132      | GLCK/I   | 202      | 175      | I/O      |
| 10       | 8        | I/O      | 60       | 51       | I/O      | 107      | NC       | I/O      | 154      | 133      | GLCK/I   | 203      | NC       | I/O      |
| 11       | 9        | I/O      | NC       | 52       | I/O      | 108      | 93       | I/O      | 155      | 134      | VCC      | 204      | 176      | I/O      |
| 12       | 10       | VCC      | NC       | 53       | I/O      | 109      | 94       | I/O      | 156      | 135      | I/O      | 205      | 177      | GND      |
| 13       | 11       | I/O      | 61       | 54       | TDI      | 110      | 95       | GND      | 157      | 136      | I/O      | 206      | 178      | I/O      |
| 14       | 12       | GND      | 62       | NC       | I/O      | NC       | 96       | I/O      | 158      | NC       | I/O      | 207      | 179      | I/O      |
| 15       | 13       | I/O      | 63       | NC       | I/O      | 111      | 97       | VCC      | 159      | 137      | I/O      | 208      | NC       | I/O      |
| 16       | 14       | I/O      | 64       | 55       | I/O      | NC       | 98       | I/O      | 160      | NC       | GND      | 209      | 180      | I/O      |
| 17       | NC       | I/O      | 65       | 56       | I/O      | NC       | 99       | I/O      | 161      | 138      | I/O      | 210      | 181      | I/O      |
| 18       | 15       | I/O      | 66       | NC       | I/O      | 112      | 100      | I/O      | 162      | 139      | I/O      | 211      | 182      | GND      |
| 19       | 16       | I/O      | 67       | 57       | I/O      | 113      | NC       | I/O      | 163      | 140      | I/O      | 212      | NC       | VCC      |
| 20       | 17       | I/O      | 68       | 58       | I/O      | 114      | 101      | I/O      | 164      | 141      | I/O      | 213      | 183      | I/O      |
| 21       | 18       | I/O      | 69       | 59       | GND      | 115      | NC       | I/O      | 165      | 142      | I/O      | 214      | 184      | I/O      |
| 22       | 19       | I/O      | 70       | 60       | I/O      | 116      | 102      | I/O      | 166      | NC       | I/O      | 215      | 185      | I/O      |
| 23       | 20       | I/O      | 71       | 61       | VCC      | 117      | NC       | I/O      | 167      | 143      | I/O      | 216      | 186      | I/O      |
| 24       | NC       | I/O      | 72       | 62       | I/O      | 118      | NC       | I/O      | 168      | 144      | I/O      | 217      | 187      | VCCIO    |
| 25       | 21       | I/O      | 73       | 63       | I/O      | 119      | 103      | TRSTB    | 169      | 145      | VCC      | 218      | 188      | I/O      |
| 26       | 22       | I/O      | 74       | 64       | I/O      | 120      | 104      | TMS      | 170      | NC       | I/O      | 219      | NC       | I/O      |
| 27       | 23       | GND      | 75       | NC       | I/O      | 121      | 105      | I/O      | 171      | 146      | I/O      | 220      | 189      | I/O      |
| 28       | 24       | I/O      | 76       | 65       | I/O      | 122      | NC       | I/O      | 172      | 147      | GND      | 221      | 190      | I/O      |
| 29       | 25       | GCLK/I   | 77       | 66       | I/O      | 123      | 106      | I/O      | 173      | 148      | I/O      | 222      | 191      | I/O      |
| 30       | 26       | ACLK/I   | 78       | 67       | I/O      | 124      | 107      | I/O      | 174      | 149      | I/O      | 223      | 192      | I/O      |
| 31       | 27       | VCC      | 79       | NC       | I/O      | 125      | 108      | I/O      | 175      | 150      | I/O      | 224      | 193      | I/O      |
| 32       | 28       | GCLK/I   | 80       | 68       | I/O      | 126      | 109      | I/O      | 176      | 151      | I/O      | 225      | 194      | I/O      |
| 33       | 29       | GCLK/I   | 81       | 69       | I/O      | 127      | NC       | I/O      | 177      | 152      | I/O      | 226      | NC       | I/O      |
| 34       | 30       | VCC      | 82       | 70       | I/O      | 128      | 110      | I/O      | 178      | 153      | I/O      | 227      | 195      | I/O      |
| 35       | 31       | I/O      | 83       | NC       | I/O      | 129      | 111      | I/O      | 179      | 154      | I/O      | 228      | 196      | I/O      |
| 36       | 32       | I/O      | NC       | 71       | I/O      | 130      | 112      | I/O      | 180      | 155      | I/O      | 229      | 197      | I/O      |
| 37       | NC       | GND      | 84       | NC       | I/O      | 131      | 113      | I/O      | NC       | 156      | I/O      | 230      | 198      | I/O      |
| 38       | 33       | I/O      | 85       | 72       | I/O      | 132      | 114      | VCC      | 181      | 157      | TCK      | 231      | NC       | I/O      |
| 39       | NC       | I/O      | 86       | 73       | GND      | 133      | 115      | I/O      | 182      | 158      | STM      | 232      | 199      | GND      |
| 40       | 34       | I/O      | 87       | 74       | I/O      | 134      | 116      | GND      | 183      | NC       | I/O      | 233      | 200      | I/O      |
| 41       | 35       | I/O      | 88       | NC       | VCC      | 135      | 117      | I/O      | 184      | 159      | I/O      | 234      | 201      | VCC      |
| 42       | 36       | I/O      | 89       | 75       | I/O      | 136      | NC       | I/O      | 185      | 160      | I/O      | 235      | 202      | I/O      |
| 43       | NC       | I/O      | 90       | 76       | I/O      | 137      | 118      | I/O      | 186      | 161      | I/O      | 236      | 203      | I/O      |
| 44       | 37       | I/O      | 91       | 77       | I/O      | 138      | 119      | I/O      | 187      | 162      | I/O      | 237      | 204      | I/O      |
| 45       | 38       | I/O      | 92       | 78       | GND      | 139      | 120      | I/O      | 188      | 163      | GND      | 238      | 205      | I/O      |
| 46       | 39       | I/O      | 93       | 79       | I/O      | 140      | 121      | I/O      | 189      | 164      | I/O      | 239      | 206      | I/O      |
| 47       | NC       | I/O      | 94       | 80       | I/O      | 141      | NC       | I/O      | 190      | 165      | VCC      | 240      | 207      | TDO      |
| 48       | 40       | I/O      | 95       | 81       | I/O      | 142      | 122      | I/O      | 191      | 166      | I/O      |          |          |          |
| 49       | 41       | VCC      | 96       | 82       | I/O      | 143      | 123      | I/O      | 192      | NC       | I/O      |          |          |          |
| 50       | 42       | I/O      | 97       | 83       | VCCIO    | 144      | 124      | I/O      | 193      | 167      | I/O      |          |          |          |



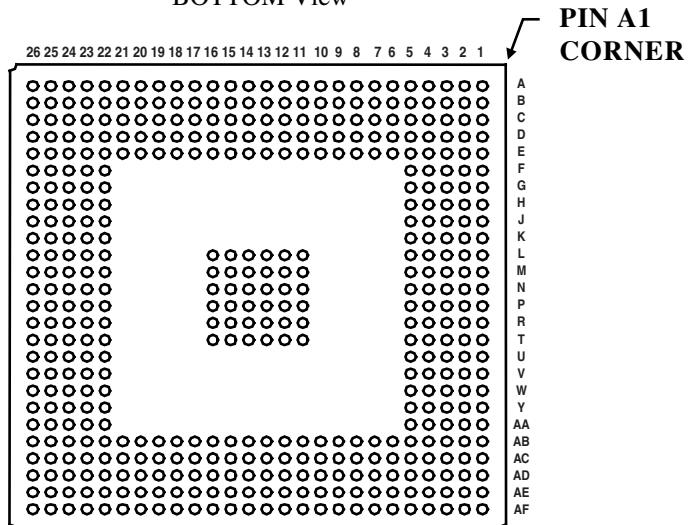
## QL4058 – 456 PBGA Pinout Diagram

Figure 21: QL4058 – 456 PBGA Pinout Diagram

TOP View



BOTTOM View



## QL4058 – 456 PBGA Pinout Table

Table 23: QL4058 – 456 PBGA Pinout Table

| 456 | Function | 456 | Function | 456 | Function | 456 | Function  | 456 | Function  |
|-----|----------|-----|----------|-----|----------|-----|-----------|-----|-----------|
| A1  | I/O      | C1  | I/O      | E1  | I/O      | H23 | NC        | M23 | NC        |
| A2  | I/O      | C2  | I/O      | E2  | I/O      | H24 | I/O       | M24 | I/O       |
| A3  | I/O      | C3  | I/O      | E3  | I/O      | H25 | NC        | M25 | I/O       |
| A4  | I/O      | C4  | TDO      | E4  | I/O      | H26 | I/O       | M26 | I/O       |
| A5  | I/O      | C5  | I/O      | E5  | GND      | J1  | I/O       | N1  | GCLK/I    |
| A6  | I/O      | C6  | I/O      | E6  | VCC      | J2  | I/O       | N2  | I/O       |
| A7  | I/O      | C7  | I/O      | E7  | GND      | J3  | I/O       | N3  | I/O       |
| A8  | I/O      | C8  | I/O      | E8  | NC       | J4  | NC        | N4  | GCLK/I    |
| A9  | NC       | C9  | I/O      | E9  | GND      | J5  | GND       | N5  | VCC       |
| A10 | I/O      | C10 | I/O      | E10 | I/O      | J22 | NC        | N11 | GND/THERM |
| A11 | I/O      | C11 | I/O      | E11 | GND      | J23 | NC        | N12 | GND/THERM |
| A12 | VCCIO    | C12 | I/O      | E12 | GND      | J24 | I/O       | N13 | GND/THERM |
| A13 | I/O      | C13 | I/O      | E13 | VCC      | J25 | I/O       | N14 | GND/THERM |
| A14 | I/O      | C14 | I/O      | E14 | GND      | J26 | I/O       | N15 | GND/THERM |
| A15 | NC       | C15 | I/O      | E15 | GND      | K1  | NC        | N16 | GND/THERM |
| A16 | I/O      | C16 | I/O      | E16 | GND      | K2  | NC        | N22 | GND       |
| A17 | NC       | C17 | NC       | E17 | NC       | K3  | I/O       | N23 | I/O       |
| A18 | I/O      | C18 | NC       | E18 | GND      | K4  | I/O       | N24 | I/O       |
| A19 | I/O      | C19 | I/O      | E19 | NC       | K5  | VCC       | N25 | NC        |
| A20 | I/O      | C20 | I/O      | E20 | GND      | K22 | GND       | N26 | I/O       |
| A21 | NC       | C21 | I/O      | E21 | VCC      | K23 | I/O       | P1  | I/O       |
| A22 | I/O      | C22 | I/O      | E22 | GND      | K24 | I/O       | P2  | I/O       |
| A23 | NC       | C23 | I/O      | E23 | I/O      | K25 | NC        | P3  | NC        |
| A24 | I/O      | C24 | I/O      | E24 | I/O      | K26 | I/O       | P4  | I/O       |
| A25 | I/O      | C25 | TCK      | E25 | I/O      | L1  | I/O       | P5  | NC        |
| A26 | I/O      | C26 | NC       | E26 | I/O      | L2  | I/O       | P11 | GND/THERM |
| B1  | I/O      | D1  | I/O      | F1  | I/O      | L3  | I/O       | P12 | GND/THERM |
| B2  | NC       | D2  | I/O      | F2  | I/O      | L4  | I/O       | P13 | GND/THERM |
| B3  | I/O      | D3  | I/O      | F3  | NC       | L5  | NC        | P14 | GND/THERM |
| B4  | NC       | D4  | GND      | F4  | NC       | L11 | GND/THERM | P15 | GND/THERM |
| B5  | NC       | D5  | NC       | F5  | VCC      | L12 | GND/THERM | P16 | GND/THERM |
| B6  | NC       | D6  | NC       | F22 | VCC      | L13 | GND/THERM | P22 | NC        |
| B7  | NC       | D7  | I/O      | F23 | NC       | L14 | GND/THERM | P23 | GCLK/I    |
| B8  | NC       | D8  | I/O      | F24 | I/O      | L15 | GND/THERM | P24 | GCLK/I    |
| B9  | I/O      | D9  | GND      | F25 | I/O      | L16 | GND/THERM | P25 | NC        |
| B10 | NC       | D10 | I/O      | F26 | I/O      | L22 | NC        | P26 | ACLK/I    |
| B11 | NC       | D11 | I/O      | G1  | I/O      | L23 | I/O       | R1  | NC        |
| B12 | I/O      | D12 | GND      | G2  | I/O      | L24 | I/O       | R2  | I/O       |
| B13 | I/O      | D13 | I/O      | G3  | I/O      | L25 | NC        | R3  | I/O       |
| B14 | NC       | D14 | I/O      | G4  | I/O      | L26 | I/O       | R4  | NC        |
| B15 | I/O      | D15 | GND      | G5  | NC       | M1  | ACLK/I    | R5  | NC        |
| B16 | I/O      | D16 | I/O      | G22 | GND      | M2  | GCLK/I    | R11 | GND/THERM |
| B17 | I/O      | D17 | I/O      | G23 | NC       | M3  | I/O       | R12 | GND/THERM |
| B18 | I/O      | D18 | GND      | G24 | I/O      | M4  | NC        | R13 | GND/THERM |
| B19 | I/O      | D19 | I/O      | G25 | I/O      | M5  | GND       | R14 | GND/THERM |
| B20 | I/O      | D20 | NC       | G26 | I/O      | M11 | GND/THERM | R15 | GND/THERM |
| B21 | I/O      | D21 | NC       | H1  | NC       | M12 | GND/THERM | R16 | GND/THERM |
| B22 | I/O      | D22 | I/O      | H2  | I/O      | M13 | GND/THERM | R22 | VCC       |
| B23 | NC       | D23 | GND      | H3  | NC       | M14 | GND/THERM | R23 | NC        |
| B24 | I/O      | D24 | I/O      | H4  | I/O      | M15 | GND/THERM | R24 | NC        |
| B25 | I/O      | D25 | I/O      | H5  | NC       | M16 | GND/THERM | R25 | I/O       |
| B26 | STM      | D26 | I/O      | H22 | NC       | M22 | NC        | R26 | GCLK/I    |

Table 23: QL4058 – 456 PBGA Pinout Table (Continued)

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

## QL4090 – 208 PQFP/CQFP and 240 PQFP Pinout Diagrams

Figure 22: QL4090 – 208 Pin PQFP/CQFP (Top View)

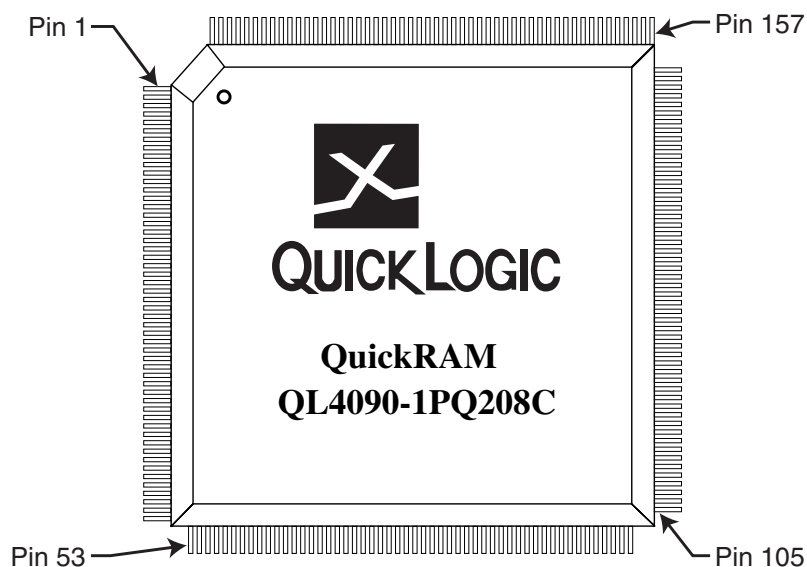
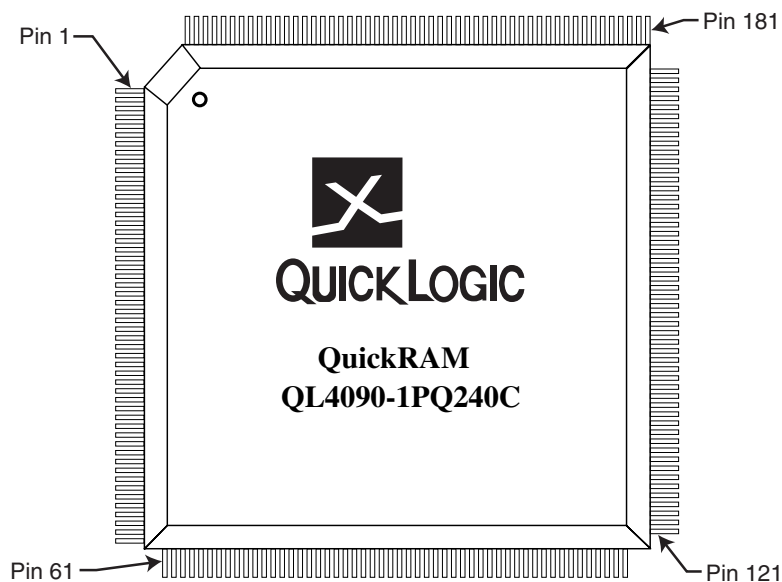


Figure 23: QL4090 – 240 Pin PQFP (Top View)



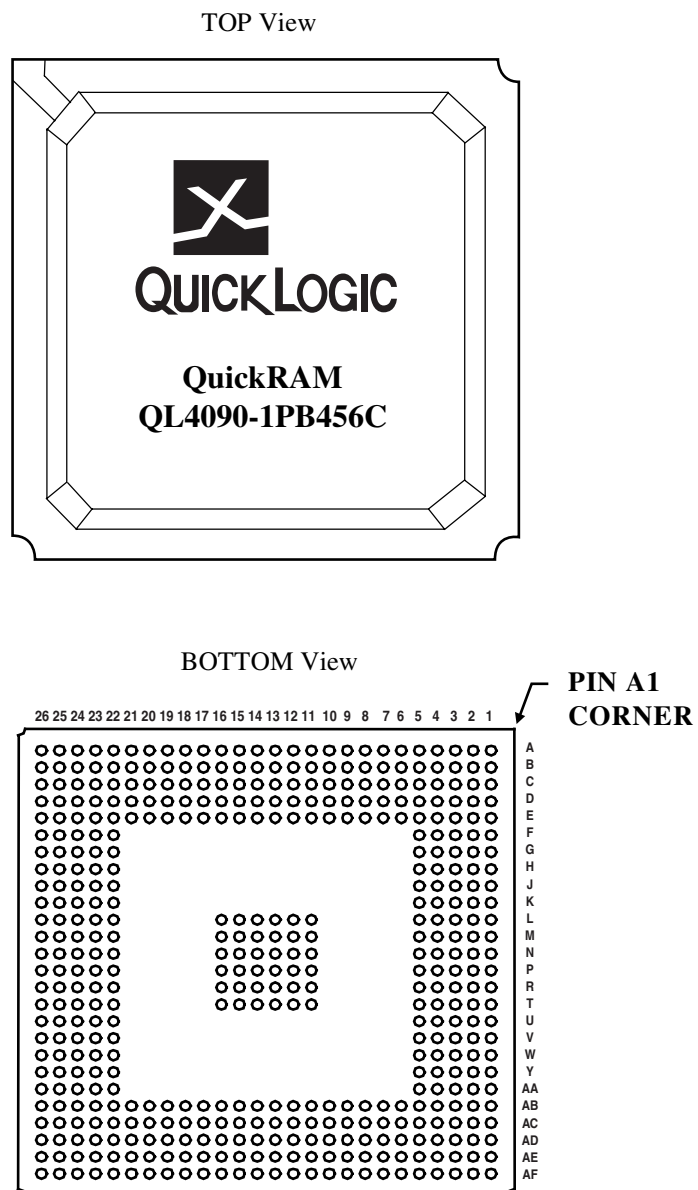
## QL4090 – 208 PQFP/CQFP and 240 PQFP Pinout Table

Table 24: QL4090 – 208 PQFP/CQFP and 240 PQFP Pinout Table

| 240 PQFP | 208 PQFP | Function | 240 PQFP | 208 PQFP | Function | 240 PQFP | 208 PQFP | Function | 240 PQFP | 208 PQFP | Function | 240 PQFP | 208 PQFP | Function |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1        | 208      | I/O      | 51       | 43       | GND      | 98       | 84       | I/O      | 145      | 125      | I/O      | 194      | 168      | I/O      |
| 2        | 1        | I/O      | 52       | 44       | I/O      | 99       | 85       | I/O      | 146      | 126      | I/O      | 195      | 169      | I/O      |
| 3        | 2        | I/O      | 53       | 45       | I/O      | 100      | 86       | I/O      | 147      | 127      | GND      | 196      | NC       | I/O      |
| 4        | 3        | I/O      | 54       | 46       | I/O      | 101      | 87       | I/O      | 148      | 128      | I/O      | 197      | 170      | I/O      |
| 5        | 4        | I/O      | 55       | 47       | I/O      | 102      | 88       | I/O      | 149      | NC       | I/O      | 198      | 171      | I/O      |
| 6        | 5        | I/O      | 56       | 48       | I/O      | 103      | 89       | I/O      | 150      | 129      | GLCK/I   | 199      | 172      | I/O      |
| 7        | NC       | I/O      | 57       | NC       | I/O      | 104      | 90       | I/O      | 151      | 130      | ACLK/I   | 200      | 173      | I/O      |
| 8        | 6        | I/O      | 58       | 49       | I/O      | 105      | 91       | I/O      | 152      | 131      | VCC      | 201      | 174      | I/O      |
| 9        | 7        | I/O      | 59       | 50       | I/O      | 106      | 92       | I/O      | 153      | 132      | GLCK/I   | 202      | 175      | I/O      |
| 10       | 8        | I/O      | 60       | 51       | I/O      | 107      | NC       | I/O      | 154      | 133      | GLCK/I   | 203      | NC       | I/O      |
| 11       | 9        | I/O      | NC       | 52       | I/O      | 108      | 93       | I/O      | 155      | 134      | VCC      | 204      | 176      | I/O      |
| 12       | 10       | VCC      | NC       | 53       | I/O      | 109      | 94       | I/O      | 156      | 135      | I/O      | 205      | 177      | GND      |
| 13       | 11       | I/O      | 61       | 54       | TDI      | 110      | 95       | GND      | 157      | 136      | I/O      | 206      | 178      | I/O      |
| 14       | 12       | GND      | 62       | NC       | I/O      | NC       | 96       | I/O      | 158      | NC       | I/O      | 207      | 179      | I/O      |
| 15       | 13       | I/O      | 63       | NC       | I/O      | 111      | 97       | VCC      | 159      | 137      | I/O      | 208      | NC       | I/O      |
| 16       | 14       | I/O      | 64       | 55       | I/O      | NC       | 98       | I/O      | 160      | NC       | GND      | 209      | 180      | I/O      |
| 17       | NC       | I/O      | 65       | 56       | I/O      | NC       | 99       | I/O      | 161      | 138      | I/O      | 210      | 181      | I/O      |
| 18       | 15       | I/O      | 66       | NC       | I/O      | 112      | 100      | I/O      | 162      | 139      | I/O      | 211      | 182      | GND      |
| 19       | 16       | I/O      | 67       | 57       | I/O      | 113      | NC       | I/O      | 163      | 140      | I/O      | 212      | NC       | VCC      |
| 20       | 17       | I/O      | 68       | 58       | I/O      | 114      | 101      | I/O      | 164      | 141      | I/O      | 213      | 183      | I/O      |
| 21       | 18       | I/O      | 69       | 59       | GND      | 115      | NC       | I/O      | 165      | 142      | I/O      | 214      | 184      | I/O      |
| 22       | 19       | I/O      | 70       | 60       | I/O      | 116      | 102      | I/O      | 166      | NC       | I/O      | 215      | 185      | I/O      |
| 23       | 20       | I/O      | 71       | 61       | VCC      | 117      | NC       | I/O      | 167      | 143      | I/O      | 216      | 186      | I/O      |
| 24       | NC       | I/O      | 72       | 62       | I/O      | 118      | NC       | I/O      | 168      | 144      | I/O      | 217      | 187      | VCCIO    |
| 25       | 21       | I/O      | 73       | 63       | I/O      | 119      | 103      | TRSTB    | 169      | 145      | VCC      | 218      | 188      | I/O      |
| 26       | 22       | I/O      | 74       | 64       | I/O      | 120      | 104      | TMS      | 170      | NC       | I/O      | 219      | NC       | I/O      |
| 27       | 23       | GND      | 75       | NC       | I/O      | 121      | 105      | I/O      | 171      | 146      | I/O      | 220      | 189      | I/O      |
| 28       | 24       | I/O      | 76       | 65       | I/O      | 122      | NC       | I/O      | 172      | 147      | GND      | 221      | 190      | I/O      |
| 29       | 25       | GCLK/I   | 77       | 66       | I/O      | 123      | 106      | I/O      | 173      | 148      | I/O      | 222      | 191      | I/O      |
| 30       | 26       | ACLK/I   | 78       | 67       | I/O      | 124      | 107      | I/O      | 174      | 149      | I/O      | 223      | 192      | I/O      |
| 31       | 27       | VCC      | 79       | NC       | I/O      | 125      | 108      | I/O      | 175      | 150      | I/O      | 224      | 193      | I/O      |
| 32       | 28       | GCLK/I   | 80       | 68       | I/O      | 126      | 109      | I/O      | 176      | 151      | I/O      | 225      | 194      | I/O      |
| 33       | 29       | GCLK/I   | 81       | 69       | I/O      | 127      | NC       | I/O      | 177      | 152      | I/O      | 226      | NC       | I/O      |
| 34       | 30       | VCC      | 82       | 70       | I/O      | 128      | 110      | I/O      | 178      | 153      | I/O      | 227      | 195      | I/O      |
| 35       | 31       | I/O      | 83       | NC       | I/O      | 129      | 111      | I/O      | 179      | 154      | I/O      | 228      | 196      | I/O      |
| 36       | 32       | I/O      | NC       | 71       | I/O      | 130      | 112      | I/O      | 180      | 155      | I/O      | 229      | 197      | I/O      |
| 37       | NC       | GND      | 84       | NC       | I/O      | 131      | 113      | I/O      | NC       | 156      | I/O      | 230      | 198      | I/O      |
| 38       | 33       | I/O      | 85       | 72       | I/O      | 132      | 114      | VCC      | 181      | 157      | TCK      | 231      | NC       | I/O      |
| 39       | NC       | I/O      | 86       | 73       | GND      | 133      | 115      | I/O      | 182      | 158      | STM      | 232      | 199      | GND      |
| 40       | 34       | I/O      | 87       | 74       | I/O      | 134      | 116      | GND      | 183      | NC       | I/O      | 233      | 200      | I/O      |
| 41       | 35       | I/O      | 88       | NC       | VCC      | 135      | 117      | I/O      | 184      | 159      | I/O      | 234      | 201      | VCC      |
| 42       | 36       | I/O      | 89       | 75       | I/O      | 136      | NC       | I/O      | 185      | 160      | I/O      | 235      | 202      | I/O      |
| 43       | NC       | I/O      | 90       | 76       | I/O      | 137      | 118      | I/O      | 186      | 161      | I/O      | 236      | 203      | I/O      |
| 44       | 37       | I/O      | 91       | 77       | I/O      | 138      | 119      | I/O      | 187      | 162      | I/O      | 237      | 204      | I/O      |
| 45       | 38       | I/O      | 92       | 78       | GND      | 139      | 120      | I/O      | 188      | 163      | GND      | 238      | 205      | I/O      |
| 46       | 39       | I/O      | 93       | 79       | I/O      | 140      | 121      | I/O      | 189      | 164      | I/O      | 239      | 206      | I/O      |
| 47       | NC       | I/O      | 94       | 80       | I/O      | 141      | NC       | I/O      | 190      | 165      | VCC      | 240      | 207      | TDO      |
| 48       | 40       | I/O      | 95       | 81       | I/O      | 142      | 122      | I/O      | 191      | 166      | I/O      |          |          |          |
| 49       | 41       | VCC      | 96       | 82       | I/O      | 143      | 123      | I/O      | 192      | NC       | I/O      |          |          |          |
| 50       | 42       | I/O      | 97       | 83       | VCCIO    | 144      | 124      | I/O      | 193      | 167      | I/O      |          |          |          |

## QL4090 – 456 PBGA Pinout Diagram

Figure 24: QL4090 – 456 PBGA Pinout Diagram



## QL4090 – 456 PBGA Pinout Table

Table 25: QL4090 – 456 PBGA Pinout Table

| 456 | Function | 456 | Function | 456 | Function | 456 | Function  | 456 | Function  |
|-----|----------|-----|----------|-----|----------|-----|-----------|-----|-----------|
| A1  | I/O      | C1  | I/O      | E1  | I/O      | H23 | I/O       | M23 | NC        |
| A2  | I/O      | C2  | I/O      | E2  | I/O      | H24 | I/O       | M24 | I/O       |
| A3  | I/O      | C3  | I/O      | E3  | I/O      | H25 | I/O       | M25 | I/O       |
| A4  | I/O      | C4  | TDO      | E4  | I/O      | H26 | I/O       | M26 | I/O       |
| A5  | I/O      | C5  | I/O      | E5  | GND      | J1  | I/O       | N1  | GCLK/I    |
| A6  | I/O      | C6  | I/O      | E6  | VCC      | J2  | I/O       | N2  | I/O       |
| A7  | I/O      | C7  | I/O      | E7  | GND      | J3  | I/O       | N3  | I/O       |
| A8  | I/O      | C8  | I/O      | E8  | NC       | J4  | NC        | N4  | GCLK/I    |
| A9  | I/O      | C9  | I/O      | E9  | GND      | J5  | GND       | N5  | VCC       |
| A10 | I/O      | C10 | I/O      | E10 | I/O      | J22 | NC        | N11 | GND/THERM |
| A11 | I/O      | C11 | I/O      | E11 | GND      | J23 | NC        | N12 | GND/THERM |
| A12 | VCCIO    | C12 | I/O      | E12 | GND      | J24 | I/O       | N13 | GND/THERM |
| A13 | I/O      | C13 | I/O      | E13 | VCC      | J25 | I/O       | N14 | GND/THERM |
| A14 | I/O      | C14 | I/O      | E14 | GND      | J26 | I/O       | N15 | GND/THERM |
| A15 | I/O      | C15 | I/O      | E15 | GND      | K1  | I/O       | N16 | GND/THERM |
| A16 | I/O      | C16 | I/O      | E16 | GND      | K2  | I/O       | N22 | GND       |
| A17 | I/O      | C17 | I/O      | E17 | NC       | K3  | I/O       | N23 | I/O       |
| A18 | I/O      | C18 | I/O      | E18 | GND      | K4  | I/O       | N24 | I/O       |
| A19 | I/O      | C19 | I/O      | E19 | NC       | K5  | VCC       | N25 | I/O       |
| A20 | I/O      | C20 | I/O      | E20 | GND      | K22 | GND       | N26 | I/O       |
| A21 | I/O      | C21 | I/O      | E21 | VCC      | K23 | I/O       | P1  | I/O       |
| A22 | I/O      | C22 | I/O      | E22 | GND      | K24 | I/O       | P2  | I/O       |
| A23 | I/O      | C23 | I/O      | E23 | I/O      | K25 | I/O       | P3  | I/O       |
| A24 | I/O      | C24 | I/O      | E24 | I/O      | K26 | I/O       | P4  | I/O       |
| A25 | I/O      | C25 | TCK      | E25 | I/O      | L1  | I/O       | P5  | NC        |
| A26 | I/O      | C26 | I/O      | E26 | I/O      | L2  | I/O       | P11 | GND/THERM |
| B1  | I/O      | D1  | I/O      | F1  | I/O      | L3  | I/O       | P12 | GND/THERM |
| B2  | I/O      | D2  | I/O      | F2  | I/O      | L4  | I/O       | P13 | GND/THERM |
| B3  | I/O      | D3  | I/O      | F3  | I/O      | L5  | NC        | P14 | GND/THERM |
| B4  | I/O      | D4  | GND      | F4  | NC       | L11 | GND/THERM | P15 | GND/THERM |
| B5  | I/O      | D5  | I/O      | F5  | VCC      | L12 | GND/THERM | P16 | GND/THERM |
| B6  | I/O      | D6  | NC       | F22 | VCC      | L13 | GND/THERM | P22 | NC        |
| B7  | I/O      | D7  | I/O      | F23 | NC       | L14 | GND/THERM | P23 | GCLK/I    |
| B8  | I/O      | D8  | I/O      | F24 | I/O      | L15 | GND/THERM | P24 | GCLK/I    |
| B9  | I/O      | D9  | GND      | F25 | I/O      | L16 | GND/THERM | P25 | I/O       |
| B10 | I/O      | D10 | I/O      | F26 | I/O      | L22 | NC        | p26 | ACLK/I    |
| B11 | I/O      | D11 | I/O      | G1  | I/O      | L23 | I/O       | R1  | I/O       |
| B12 | I/O      | D12 | GND      | G2  | I/O      | L24 | I/O       | R2  | I/O       |
| B13 | I/O      | D13 | I/O      | G3  | I/O      | L25 | I/O       | R3  | I/O       |
| B14 | I/O      | D14 | I/O      | G4  | I/O      | L26 | I/O       | R4  | NC        |
| B15 | I/O      | D15 | GND      | G5  | NC       | M1  | ACLK/I    | R5  | NC        |
| B16 | I/O      | D16 | I/O      | G22 | GND      | M2  | GCLK/I    | R11 | GND/THERM |
| B17 | I/O      | D17 | I/O      | G23 | I/O      | M3  | I/O       | R12 | GND/THERM |
| B18 | I/O      | D18 | GND      | G24 | I/O      | M4  | NC        | R13 | GND/THERM |
| B19 | I/O      | D19 | I/O      | G25 | I/O      | M5  | GND       | R14 | GND/THERM |
| B20 | I/O      | D20 | I/O      | G26 | I/O      | M11 | GND/THERM | R15 | GND/THERM |
| B21 | I/O      | D21 | NC       | H1  | I/O      | M12 | GND/THERM | R16 | GND/THERM |
| B22 | I/O      | D22 | I/O      | H2  | I/O      | M13 | GND/THERM | R22 | VCC       |
| B23 | I/O      | D23 | GND      | H3  | I/O      | M14 | GND/THERM | R23 | NC        |
| B24 | I/O      | D24 | I/O      | H4  | I/O      | M15 | GND/THERM | R24 | I/O       |
| B25 | I/O      | D25 | I/O      | H5  | NC       | M16 | GND/THERM | R25 | I/O       |
| B26 | STM      | D26 | I/O      | H22 | NC       | M22 | NC        | R26 | GCLK/I    |

Table 25: QL4090 – 456 PBGA Pinout Table (Continued)

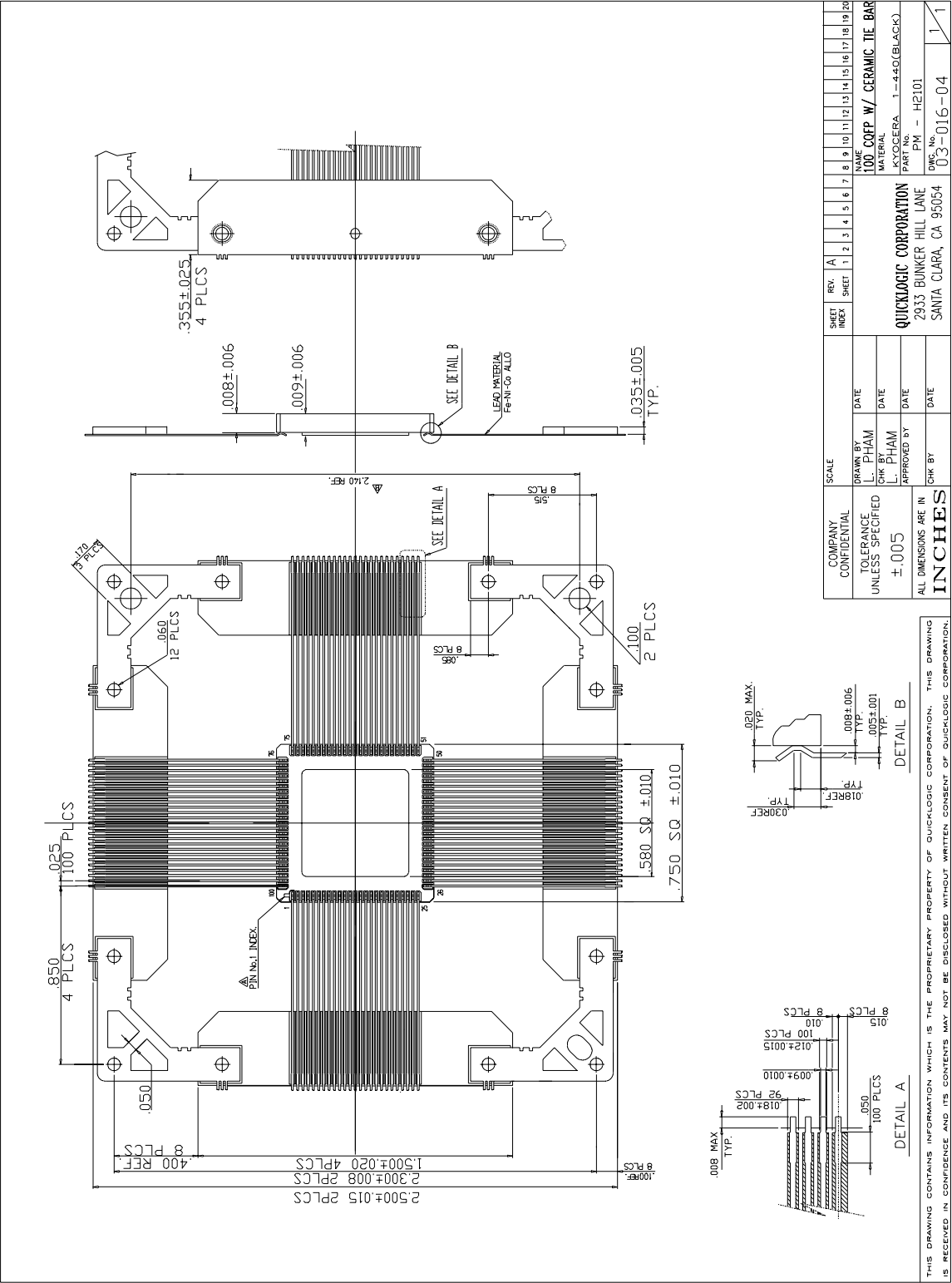
| 456 | Function    | 456  | Function | 456  | Function | 456  | Function | 456  | Function |
|-----|-------------|------|----------|------|----------|------|----------|------|----------|
| T1  | I/O         | W5   | NC       | AB15 | VCC      | AD3  | I/O      | AE17 | I/O      |
| T2  | I/O       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



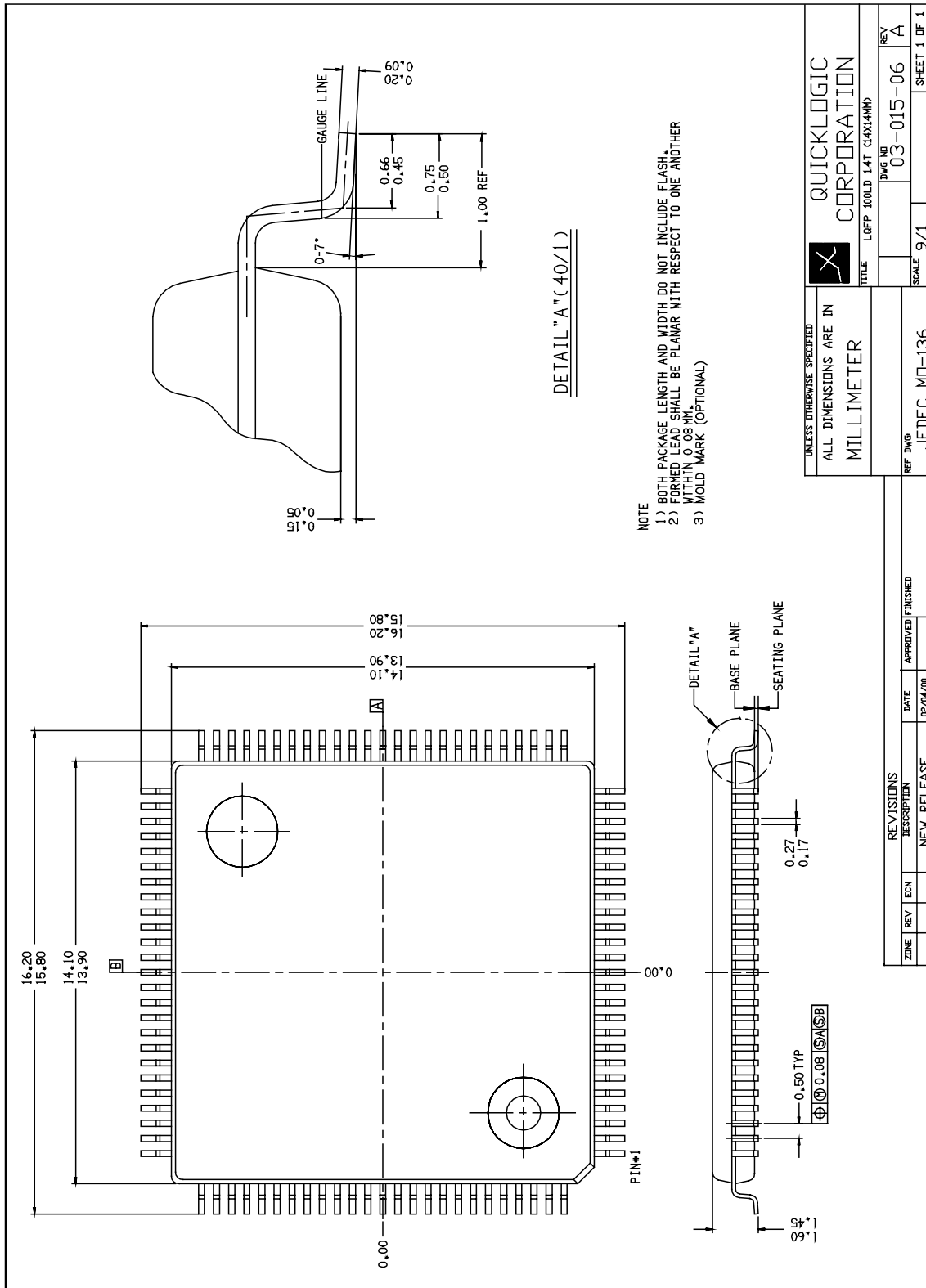




100 CQFP Mechanical Drawing



# 100 TQFP Mechanical Drawing

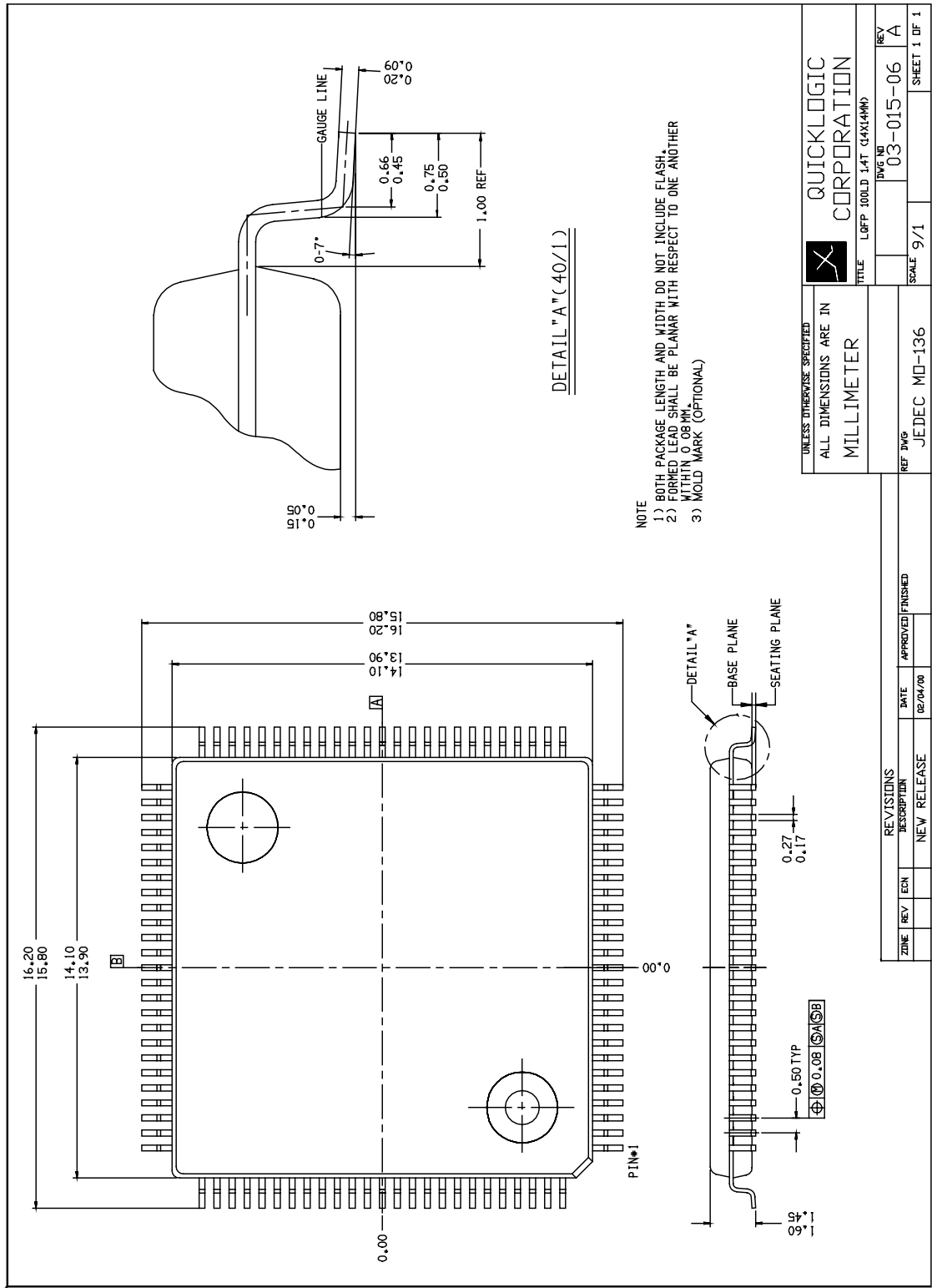


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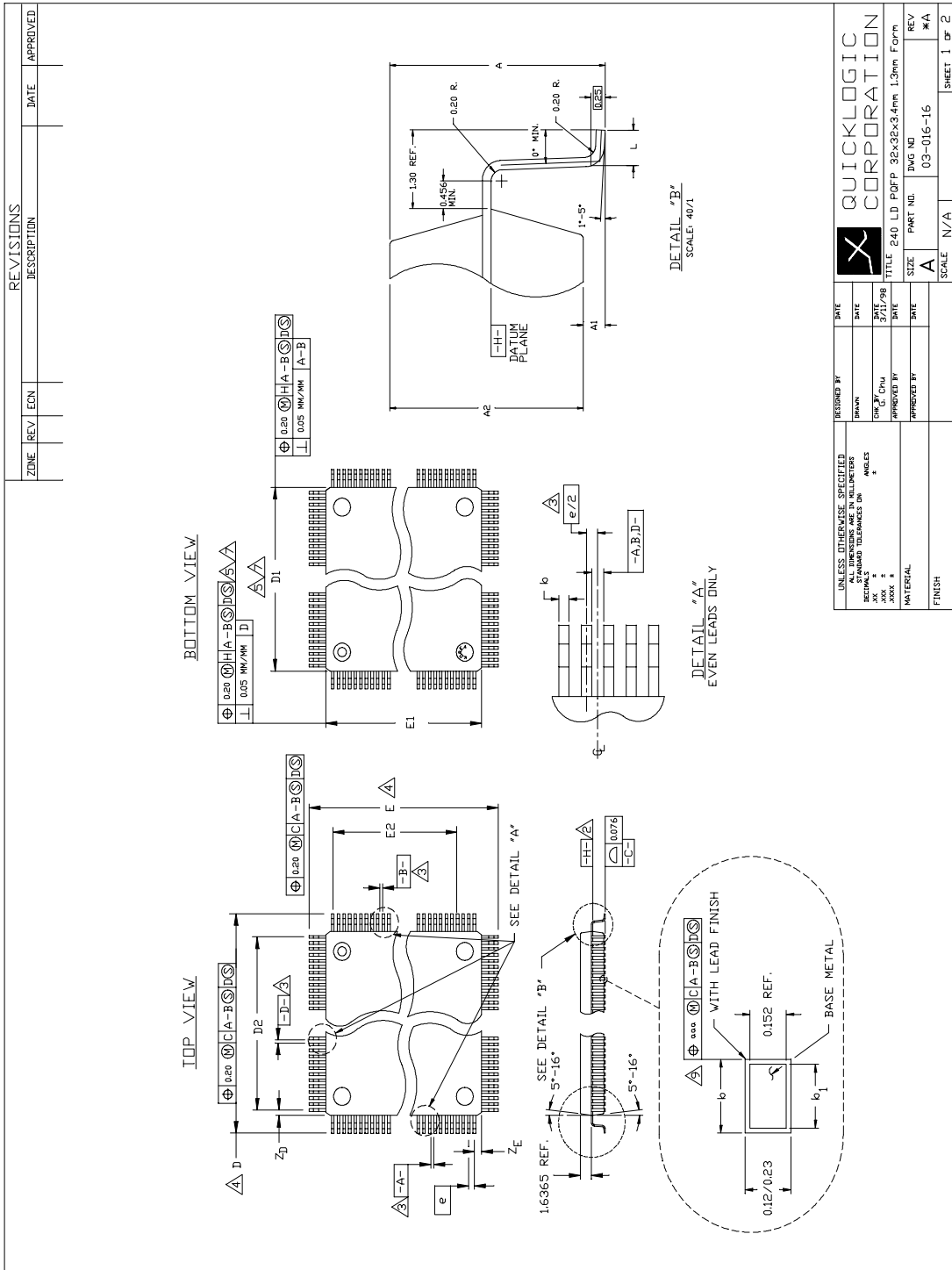




208 PQFP Mechanical Drawing



240 PQFP Mechanical Drawing









## Packaging Information

The QuickRAM product family packaging information is presented in **Table 26**.

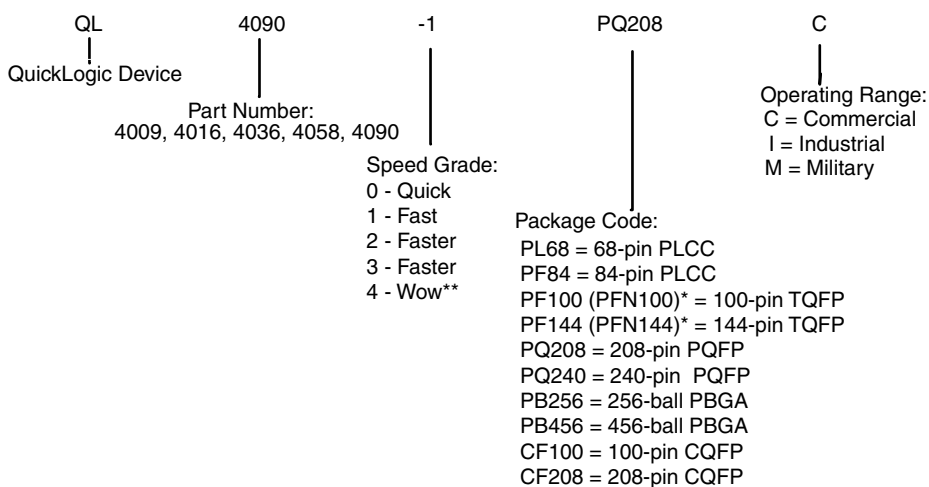
**NOTE:** Military temperature range plastic packages will be added as follow on products to the commercial and industrial products.

Table 26: Packaging Options

| Device Information               | Device   |          |          |           |          |         |          |         |          |         |
|----------------------------------|----------|----------|----------|-----------|----------|---------|----------|---------|----------|---------|
|                                  | QL4009   |          | QL4016   |           | QL4036   |         | QL4058   |         | QL4090   |         |
|                                  | Pin      | Pitch    | Pin      | Pitch     | Pin      | Pitch   | Pin      | Pitch   | Pin      | Pin     |
| Package Definitions <sup>a</sup> | 68 PLCC  | 0.05 in. | 84 PLCC  | 0.05 in.  | 144 TQFP | 0.5 mm  | 208 PQFP | 0.5 mm  | 208 PQFP | 0.5 mm  |
|                                  | 84 PLCC  | 0.05 in. | 100 TQFP | 0.5 mm    | 208 PQFP | 0.5 mm  | 240 PQFP | 0.5 mm  | 240 PQFP | 0.5 mm  |
|                                  | 100 TQFP | 0.5 mm   | 144 TQFP | 0.5 mm    | 256 PBGA | 1.27 mm | 456 PBGA | 1.27 mm | 456 PBGA | 1.27 mm |
|                                  | -        | -        | 100 CQFP | 0.025 in. | -        | -       | -        | -       | 208 CQFP | 0.5 mm  |

- a. PLCC = Plastic Leaded Chip Carrier  
 PQFP = Plastic Quad Flat Pack  
 PBGA = Plastic Ball Grid Array  
 TQFP = Thin Quad Flat Pack  
 CQFP = Ceramic Quad Flat Pack

## Ordering Information



\* Lead-free packaging is available, contact QuickLogic regarding availability (see Contact Information).

\*\* Contact QuickLogic regarding availability (see Contact Information)

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Sales: [www.quicklogic.com/sales](http://www.quicklogic.com/sales)

Support: [www.quicklogic.com/support](http://www.quicklogic.com/support)

Internet: [www.quicklogic.com](http://www.quicklogic.com)

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## Revision History

| Revision    | Date          | Originator and Comments           |
|-------------|---------------|-----------------------------------|
| A through G | Not available | Not available                     |
| H           | March 2002    | Brian Faith and Andreea Rotaru    |
| I           | March 2005    | Mehul Kochar and Kathleen Murchek |

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