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## Understanding [Embedded - CPLDs \(Complex Programmable Logic Devices\)](#)

Embedded - CPLDs, or Complex Programmable Logic Devices, are highly versatile digital logic devices used in electronic systems. These programmable components are designed to perform complex logical operations and can be customized for specific applications. Unlike fixed-function ICs, CPLDs offer the flexibility to reprogram their configuration, making them an ideal choice for various embedded systems. They consist of a set of logic gates and programmable interconnects, allowing designers to implement complex logic circuits without needing custom hardware.

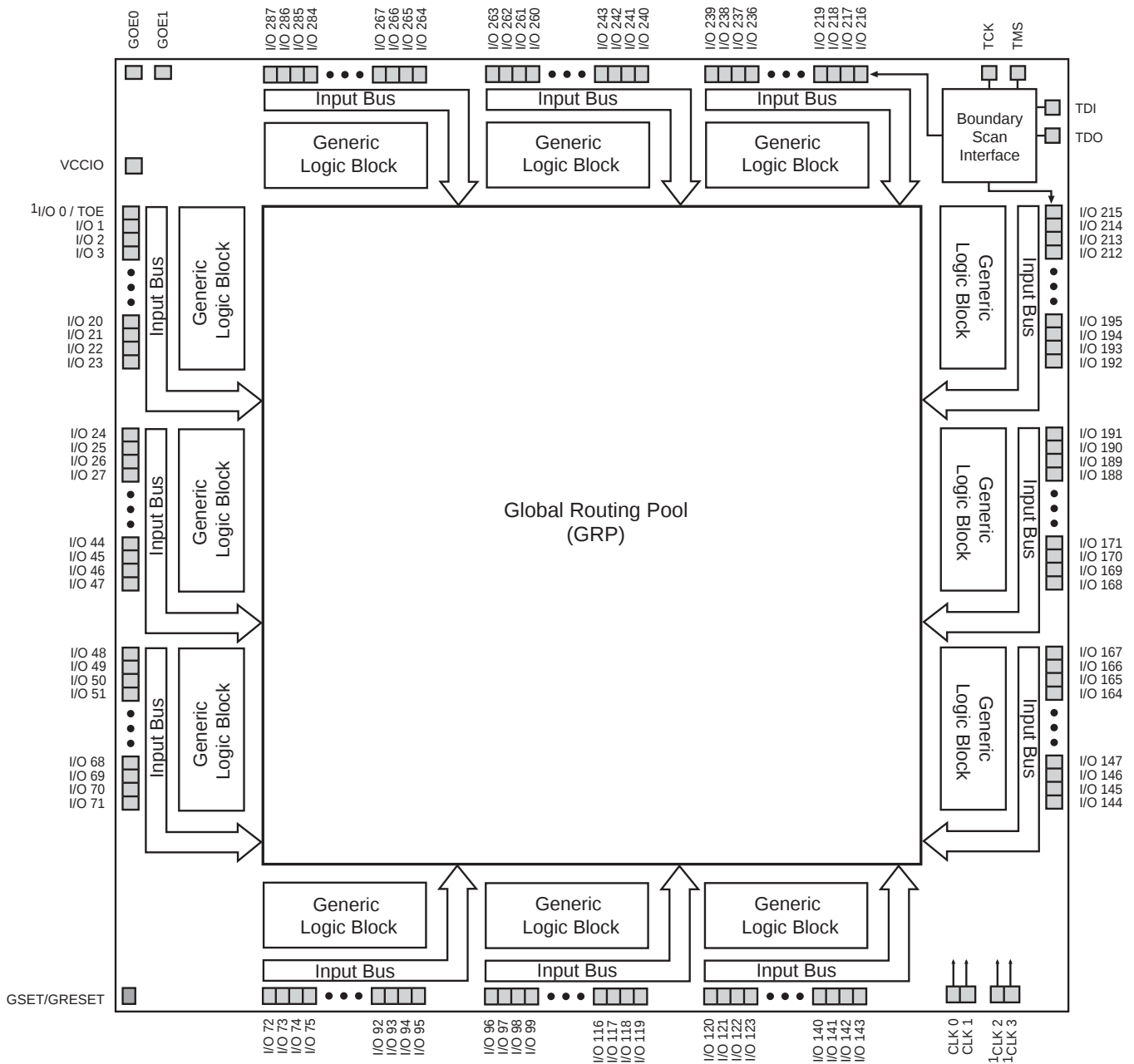
## Applications of Embedded - CPLDs

### Details

|                                 |                                                                                                                                                                                 |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Status                  | Obsolete                                                                                                                                                                        |
| Programmable Type               | In System Programmable                                                                                                                                                          |
| Delay Time tpd(1) Max           | 15 ns                                                                                                                                                                           |
| Voltage Supply - Internal       | 3V ~ 3.6V                                                                                                                                                                       |
| Number of Logic Elements/Blocks | 12                                                                                                                                                                              |
| Number of Macrocells            | 384                                                                                                                                                                             |
| Number of Gates                 | 18000                                                                                                                                                                           |
| Number of I/O                   | 192                                                                                                                                                                             |
| Operating Temperature           | 0°C ~ 70°C (TA)                                                                                                                                                                 |
| Mounting Type                   | Surface Mount                                                                                                                                                                   |
| Package / Case                  | 272-BBGA                                                                                                                                                                        |
| Supplier Device Package         | 272-BGA (27x27)                                                                                                                                                                 |
| Purchase URL                    | <a href="https://www.e-xfl.com/product-detail/lattice-semiconductor/isplsi-5384va-70lb272">https://www.e-xfl.com/product-detail/lattice-semiconductor/isplsi-5384va-70lb272</a> |

## Functional Block Diagram

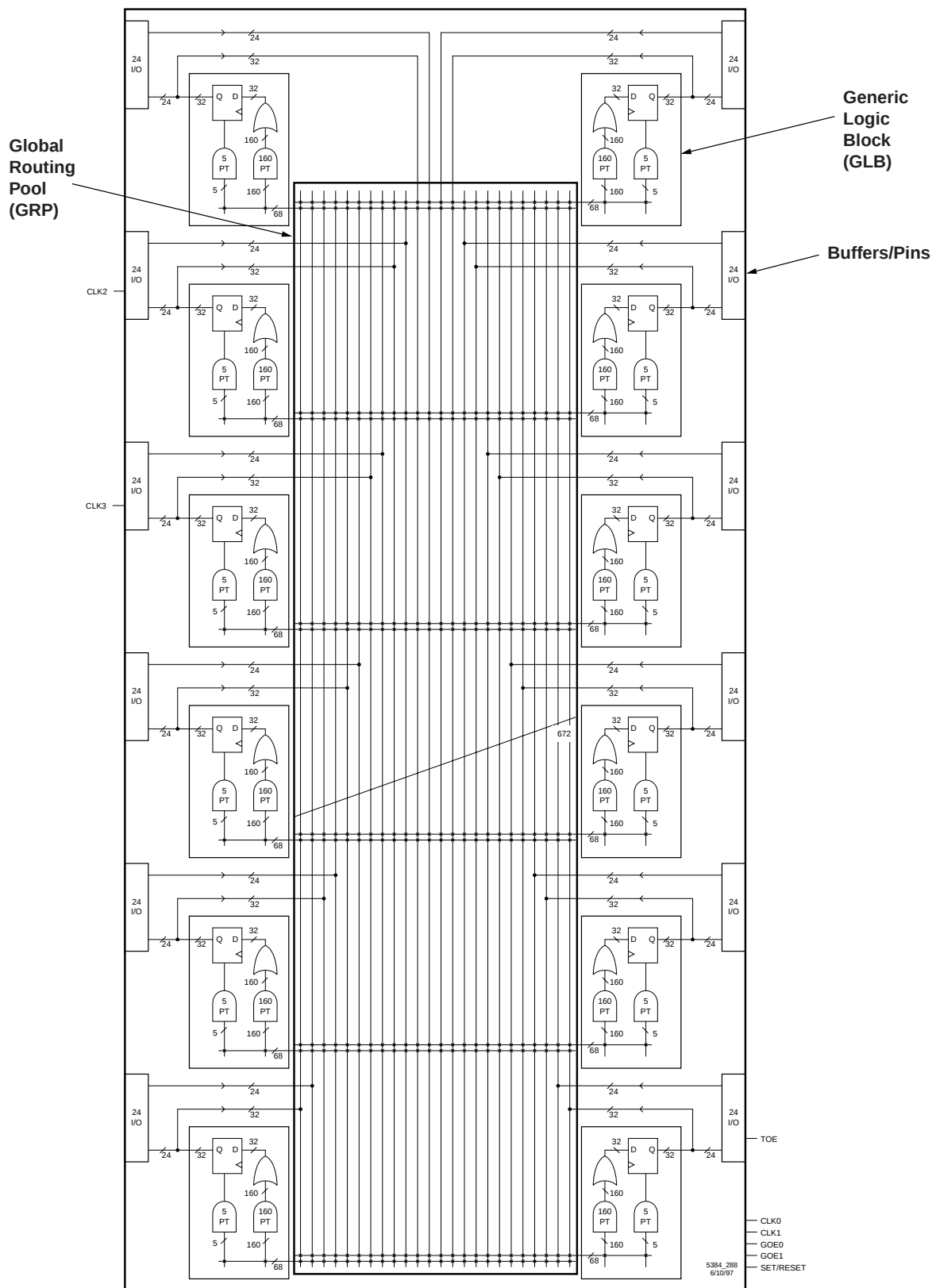
Figure 1. ispLSI 5384VA Functional Block Diagram (388 BGA Option)



1. CLK2, CLK3 and TOE signals are multiplexed with I/O signals. Which I/O is multiplexed is determined by the package type used – see table below.

| Package Type | Multiplexed Signals |                |             |
|--------------|---------------------|----------------|-------------|
| 208 PQFP     | I/O 89 / CLK2       | I/O 98 / CLK3  | I/O 0 / TOE |
| 208 fpBGA    | I/O 89 / CLK2       | I/O 98 / CLK3  | I/O 0 / TOE |
| 272 BGA      | I/O 119 / CLK2      | I/O 131 / CLK3 | I/O 0 / TOE |
| 388 BGA      | I/O 179 / CLK2      | I/O 197 / CLK3 | I/O 0 / TOE |

Figure 2. ispLSI 5384VA Block Diagram (288 I/O Version)



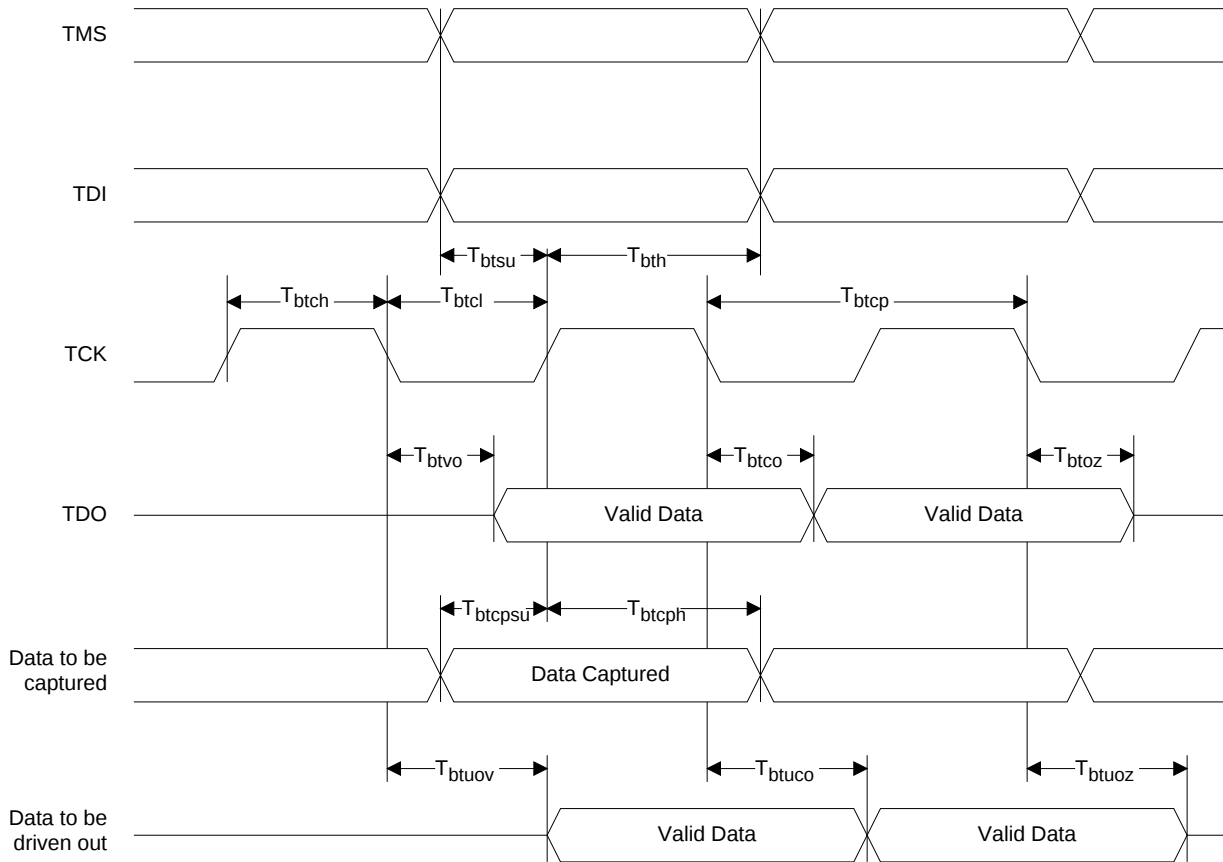
The diagram illustrates the internal logic of a BSCAN cell. It features three BSCAN Registers (D-type flip-flops) and three BSCAN Latches (D-type flip-flops). The registers are controlled by Shift DR, Clock DR, and Update DR signals. The latches are controlled by Update DR and Reset signals. The output of the latches is connected to an I/O Pin. The diagram also shows the connection to the next cell via SCANOUT and the connection to the previous cell via SCANIN. Control signals include EXTEST, TOE, HIGHZ, PROG\_MODE, and Normal Function OE. The logic involves multiplexers and AND/OR gates to manage the data flow and control signals.

```

graph LR
    IP[Input Pin] --> MUX
    SCANIN[SCANIN  
(from previous cell)] --> MUX
    ShiftDR[Shift DR] --> MUX
    MUX --> D
    ClockDR[Clock DR] --> CK
    D --> Q
    CK --> Q
    Q --> SCANOUT[SCANOUT  
(to next cell)]
    subgraph Cell
        MUX
        D
        CK
        Q
    end

```

**Figure 8. Boundary Scan Waveforms and Timing Specifications**



| SYMBOL       | PARAMETER                                                     | MIN  | MAX | UNITS |
|--------------|---------------------------------------------------------------|------|-----|-------|
| $t_{btcp}$   | TCK [BSCAN test] clock pulse width                            | 125  | –   | ns    |
| $t_{btch}$   | TCK [BSCAN test] pulse width high                             | 62.5 | –   | ns    |
| $t_{btcl}$   | TCK [BSCAN test] pulse width low                              | 62.5 | –   | ns    |
| $t_{btsu}$   | TCK [BSCAN test] setup time                                   | 25   | –   | ns    |
| $t_{bth}$    | TCK [BSCAN test] hold time                                    | 25   | –   | ns    |
| $t_{rf}$     | TCK [BSCAN test] rise and fall time                           | 50   | –   | mV/ns |
| $t_{btco}$   | TAP controller falling edge of clock to valid output          | –    | 25  | ns    |
| $t_{btoz}$   | TAP controller falling edge of clock to data output disable   | –    | 25  | ns    |
| $t_{btvo}$   | TAP controller falling edge of clock to data output enable    | –    | 25  | ns    |
| $t_{btcpsh}$ | BSCAN test Capture register setup time                        | 25   | –   | ns    |
| $t_{btcpsh}$ | BSCAN test Capture register hold time                         | 25   | –   | ns    |
| $t_{btuco}$  | BSCAN test Update reg, falling edge of clock to valid output  | –    | 50  | ns    |
| $t_{btuoov}$ | BSCAN test Update reg, falling edge of clock to output enable | –    | 50  | ns    |
| $t_{btuoov}$ | BSCAN test Update reg, falling edge of clock to output enable | –    | 50  | ns    |

## Switching Test Conditions

|                                |                         |
|--------------------------------|-------------------------|
| Input Pulse Levels             | GND to $V_{CCIOmin}$    |
| Input Rise and Fall Time       | $\leq 1.5ns$ 10% to 90% |
| Input Timing Reference Levels  | 1.5V                    |
| Output Timing Reference Levels | 1.5V                    |
| Output Load                    | See figure              |

3-state levels are measured 0.5V from steady-state active level.

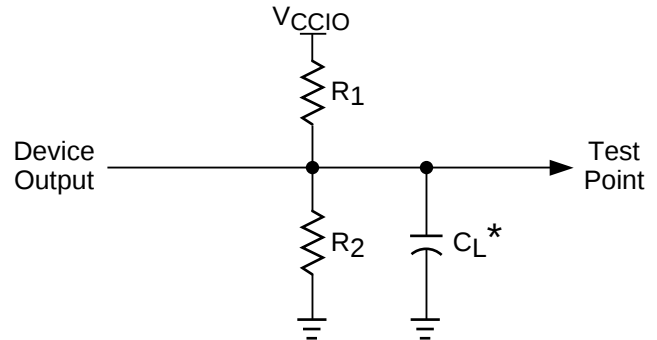
Table 2 - 0003/5384

## Output Load Conditions (See figure 8)

|                |                                   | 3.3V |      | 2.5V |      |      |
|----------------|-----------------------------------|------|------|------|------|------|
| TEST CONDITION |                                   | R1   | R2   | R1   | R2   | CL   |
| A              |                                   | 316Ω | 348Ω | 511Ω | 475Ω | 35pF |
| B              | Active High                       | ∞    | 348Ω | ∞    | 475Ω | 35pF |
|                | Active Low                        | 316Ω | ∞    | 511Ω | ∞    | 35pF |
| C              | Active High to Z at $V_{OH}-0.5V$ | ∞    | 348Ω | ∞    | 475Ω | 5pF  |
|                | Active Low to Z at $V_{OL}+0.5V$  | 316Ω | ∞    | 511Ω | ∞    | 5pF  |
| D              | Slow Slew                         | ∞    | ∞    | ∞    | ∞    | 35pF |

Table 2 - 0004A/5384

Figure 9. Test Load



\* $C_L$  includes Test Fixture and Probe Capacitance.

0213D

## DC Electrical Characteristics for 3.3V Range<sup>1</sup>

### Over Recommended Operating Conditions

| SYMBOL     | PARAMETER             | CONDITION                                           | MIN. | TYP. | MAX. | UNITS |
|------------|-----------------------|-----------------------------------------------------|------|------|------|-------|
| $V_{CCIO}$ | I/O Reference Voltage |                                                     | 3.0  | —    | 3.6  | V     |
| $V_{IL}$   | Input Low Voltage     | $V_{OH} \leq V_{OUT}$ or $V_{OUT} \leq V_{OL(max)}$ | -0.3 | —    | 0.8  | V     |
| $V_{IH}$   | Input High Voltage    | $V_{OH} \leq V_{OUT}$ or $V_{OUT} \leq V_{OL(max)}$ | 2.0  | —    | 5.25 | V     |
| $V_{OL}$   | Output Low Voltage    | $I_{OL} = 8\text{ mA}$                              | —    | —    | 0.4  | V     |
| $V_{OH}$   | Output High Voltage   | $I_{OH} = -4\text{ mA}$                             | 2.4  | —    | —    | V     |

1. I/O voltage configuration must be set to VCC.

Table 2-0007/5384VA

## DC Electrical Characteristics for 2.5V Range<sup>1</sup>

### Over Recommended Operating Conditions

| SYMBOL            | PARAMETER             | CONDITION                                                                                              | MIN. | TYP. | MAX. | UNITS |
|-------------------|-----------------------|--------------------------------------------------------------------------------------------------------|------|------|------|-------|
| V <sub>CCIO</sub> | I/O Reference Voltage |                                                                                                        | 2.3  | –    | 2.7  | V     |
| V <sub>IL</sub>   | Input Low Voltage     | $V_{OH(min)} \leq V_{OUT}$ or $V_{OUT} \leq V_{OL(max)}$                                               | -0.3 | –    | 0.7  | V     |
| V <sub>IH</sub>   | Input High Voltage    | $V_{OH(min)} \leq V_{OUT}$ or $V_{OUT} \leq V_{OL(max)}$                                               | 1.7  | –    | 5.25 | V     |
| V <sub>OL</sub>   | Output Low Voltage    | V <sub>CCIO</sub> =min, V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OL</sub> = 100μA  | –    | –    | 0.2  | V     |
|                   |                       | V <sub>CCIO</sub> =min, V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OL</sub> = 2mA    | –    | –    | 0.7  | V     |
| V <sub>OH</sub>   | Output High Voltage   | V <sub>CCIO</sub> =min, V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OH</sub> = -100μA | 2.1  | –    | –    | V     |
|                   |                       | V <sub>CCIO</sub> =min, V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OH</sub> = -2mA   | 1.7  | –    | –    | V     |

1. I/O voltage configuration must be set to V<sub>CCIO</sub>.

2.5V/5384VA

## DC Electrical Characteristics

### Over Recommended Operating Conditions

| SYMBOL                       | PARAMETER                                | CONDITION                                              | MIN.            | TYP. | MAX.            | UNITS |
|------------------------------|------------------------------------------|--------------------------------------------------------|-----------------|------|-----------------|-------|
| I <sub>IL</sub>              | Input or I/O Low Leakage Current         | $0V \leq V_{IN} \leq V_{IL(Max)}$                      | –               | –    | -10             | μA    |
| I <sub>IH</sub>              | Input or I/O High Leakage Current        | $(V_{CCIO}-0.2)V \leq V_{IN} \leq V_{CCIO}$            | –               | –    | 10              | μA    |
|                              |                                          | $V_{CCIO} \leq V_{IN} \leq 5.25V$                      | –               | –    | 50              | μA    |
| I <sub>PU</sub> <sup>1</sup> | I/O Active Pullup Current                | $0V \leq V_{IN} \leq V_{IL}$                           | –               | –    | -150            | μA    |
| I <sub>BHL</sub>             | Bus Hold Low Sustaining Current          | $V_{IN} = V_{IL(max)}$                                 | 40              | –    | –               | μA    |
| I <sub>BHH</sub>             | Bus Hold High Sustaining Current         | $V_{IN} = V_{IH(min)}$                                 | -40             | –    | –               | μA    |
| I <sub>BHLO</sub>            | Bus Hold Low Overdrive Current           | $0V \leq V_{IN} \leq V_{CCIO}$                         | –               | –    | 550             | μA    |
| I <sub>BHLH</sub>            | Bus Hold High Overdrive Current          | $0V \leq V_{IN} \leq V_{CCIO}$                         | –               | –    | -550            | μA    |
| I <sub>BHT</sub>             | Bus Hold Trip Points                     |                                                        | V <sub>IL</sub> | –    | V <sub>IH</sub> | V     |
| I <sub>VCCIO</sub>           | Current Needed for V <sub>CCIO</sub> Pin | All I/Os Pulled-up, (Total I/Os * I <sub>PUmax</sub> ) | –               | –    | 45              | mA    |

1. Pullup is capable of pulling to a minimum voltage of V<sub>OH</sub> under no-load conditions.

DC Char\_5384VA

## External Switching Characteristics

### Over Recommended Operating Conditions

| PARAM.                   | TEST <sup>3</sup><br>COND. | #  | DESCRIPTION <sup>4,5</sup>                                 | -125 |      | -100 |      | -70  |      | UNITS |
|--------------------------|----------------------------|----|------------------------------------------------------------|------|------|------|------|------|------|-------|
|                          |                            |    |                                                            | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. |       |
| <b>tpd1</b> <sup>6</sup> | A                          | 1  | Data Prop. Delay, 5PT Bypass                               | —    | 7.5  | —    | 10   | —    | 15   | ns    |
| <b>tpd2</b> <sup>6</sup> | A                          | 2  | Data Propagation Delay                                     | —    | 9.5  | —    | 13   | —    | 19   | ns    |
| <b>fmax</b>              | A                          | 3  | Clock Frequency with Internal Feedback <sup>1</sup>        | 125  | —    | 100  | —    | 70   | —    | MHz   |
| <b>fmax (Ext.)</b>       | —                          | 4  | Clock Freq. with Ext. Feedback, 1/(tsu2 + tco1)            | 91   | —    | 69   | —    | 45   | —    | MHz   |
| <b>fmax (Tog.)</b>       | —                          | 5  | Clock Frequency, Max Toggle <sup>2</sup>                   | 167  | —    | 125  | —    | 83   | —    | MHz   |
| <b>tsu1</b>              | —                          | 6  | GLB Reg. Setup Time before Clk, 5PT bypass                 | 6    | —    | 8    | —    | 12   | —    | ns    |
| <b>tco1</b> <sup>6</sup> | A                          | 7  | GLB Reg. Clock to Output Delay                             | —    | 4    | —    | 5.5  | —    | 8    | ns    |
| <b>th1</b>               | —                          | 8  | GLB Reg. Hold Time after Clock, 5PT bypass                 | 0    | —    | 0    | —    | 0    | —    | ns    |
| <b>tsu2</b>              | —                          | 9  | GLB Reg. Setup Time before Clock                           | 7    | —    | 9    | —    | 14   | —    | ns    |
| <b>th2</b>               | —                          | 10 | GLB Reg. Hold Time after Clock                             | 0    | —    | 0    | —    | 0    | —    | ns    |
| <b>tsu3 (CLK0/1)</b>     | —                          | 11 | GLB Reg. Setup Time before Clock, Input Reg. Path (CLK0/1) | 4.5  | —    | 6    | —    | 9    | —    | ns    |
| <b>tsu3 (CLK2/3)</b>     | —                          | 12 | GLB Reg. Setup Time before Clock, Input Reg. Path (CLK2/3) | 3.5  | —    | 5    | —    | 7    | —    | ns    |
| <b>th3 (CLK0/1)</b>      | —                          | 13 | GLB Reg. Hold Time after Clock, Input Reg. Path (CLK0/1)   | 0    | —    | 0    | —    | 0    | —    | ns    |
| <b>th3 (CLK2/3)</b>      | —                          | 14 | GLB Reg. Hold Time after Clock, Input Reg. Path (CLK2/3)   | 0    | —    | 0    | —    | 0    | —    | ns    |
| <b>tr1</b>               | A                          | 15 | Ext. Reset Pin to Output Delay                             | —    | 15   | —    | 20   | —    | 30   | ns    |
| <b>trw1</b>              | —                          | 16 | Ext. Reset Pulse Duration                                  | 7    | —    | 9    | —    | 14   | —    | ns    |
| <b>tp toe/dis</b>        | B/C                        | 17 | Local Product Term Output Enable/Disable                   | —    | 9    | —    | 12   | —    | 18   | ns    |
| <b>tg toe/dis</b>        | B/C                        | 18 | Global Product Term Output Enable/Disable                  | —    | 18   | —    | 24   | —    | 30   | ns    |
| <b>tgoe/dis</b>          | B/C                        | 19 | Global OE Input to Output Enable/Disable                   | —    | 6    | —    | 8    | —    | 12   | ns    |
| <b>twh</b>               | —                          | 20 | Ext. Sync. Clock Pulse Duration, High                      | 3    | —    | 4    | —    | 6    | —    | ns    |
| <b>twl</b>               | —                          | 21 | Ext. Sync. Clock Pulse Duration, Low                       | 3    | —    | 4    | —    | 6    | —    | ns    |

1. Standard 32-bit counter using GRP feedback.
2. fmax (Toggle) may be less than 1/(twh + twl). This is to allow for a clock duty cycle of other than 50%.
3. Reference Switching Test Conditions section.
4. Unless noted otherwise, all timing numbers are taken with worst case PTSA fanout, a GRP load of 1 GLB, and CLK0.
5. Timing parameters measured using normal active output driver.
6. The delay parameters are measured with Vcc as I/O voltage reference. An additional 0.5ns delay is incurred when Vccio is used as I/O voltage reference.

Timing Ext.5384VA/4.0.eps

## Internal Timing Parameters<sup>1</sup>

### Over Recommended Operating Conditions

| PARAM                        | #  | DESCRIPTION                                 | -125 |      | -100 |      | -70 |     | UNIT |
|------------------------------|----|---------------------------------------------|------|------|------|------|-----|-----|------|
|                              |    |                                             | MIN  | MAX  | MIN  | MAX  | MIN | MAX |      |
| I/O Buffer                   |    |                                             |      |      |      |      |     |     |      |
| tidcom                       | 22 | Input Pad and Buffer, Combinatorial Input   | —    | 0.7  | —    | 0.9  | —   | 1.4 | ns   |
| tidreg                       | 23 | Input Pad and Buffer, Registered Input      | —    | 4.7  | —    | 6.6  | —   | 9.7 | ns   |
| todcom                       | 24 | Output Pad and Buffer, Combinatorial Output | —    | 1.3  | —    | 1.7  | —   | 2.6 | ns   |
| todreg                       | 25 | Output Pad and Buffer, Registered Output    | —    | 1.8  | —    | 2.8  | —   | 4.6 | ns   |
| todz                         | 26 | Output Buffer Enable/Disable                | —    | 1.3  | —    | 1.7  | —   | 2.6 | ns   |
| tslf                         | 27 | Slew Rate Adder, Fast Slew                  | —    | 0    | —    | 0    | —   | 0   | ns   |
| tsls                         | 28 | Slew Rate Adder, Slow Slew                  | —    | 7.5  | —    | 10   | —   | 15  | ns   |
| tslfd                        | 29 | Programmable Delay Adder, Fast Slew         | —    | 0.5  | —    | 0.7  | —   | 1   | ns   |
| tslsd                        | 30 | Programmable Delay Adder, Slow Slew         | —    | 8    | —    | 10.7 | —   | 16  | ns   |
| GLB/Macrocell Delay Register |    |                                             |      |      |      |      |     |     |      |
| tmbp                         | 31 | Macrocell Register/Latch Bypass             | —    | 0    | —    | 0    | —   | 0   | ns   |
| tmlat                        | 32 | Macrocell Latch Delay                       | —    | 1    | —    | 1.4  | —   | 2   | ns   |
| tmco                         | 33 | Macrocell Register/Latch Clock to Output    | —    | 1    | —    | 1    | —   | 1   | ns   |
| tmsu                         | 34 | Macrocell Register/Latch Setup Time         | 1    | —    | 1.1  | —    | 1.7 | —   | ns   |
| tmh                          | 35 | Macrocell Register/Latch Hold Time          | 2.5  | —    | 3.9  | —    | 5.3 | —   | ns   |
| tmsuce                       | 36 | Macrocell Register/Latch CLKEN Setup Time   | 1    | —    | 1.4  | —    | 2   | —   | ns   |
| tmhce                        | 37 | Macrocell Register/Latch CLKEN Hold Time    | 1    | —    | 1.4  | —    | 2   | —   | ns   |
| tmrst                        | 38 | Macrocell Register/Latch Set/Reset Time     | —    | 1    | —    | 1.4  | —   | 2   | ns   |
| ttfog                        | 39 | Toggle Flip-Flop Feedback                   | —    | 1    | —    | 1.3  | —   | 2   | ns   |
| AND Array                    |    |                                             |      |      |      |      |     |     |      |
| tandhs                       | 40 | AND Array, High Speed Mode                  | —    | 3    | —    | 4    | —   | 6   | ns   |
| tandlp                       | 41 | AND Array, Low Power Mode                   | —    | 5    | —    | 6.6  | —   | 10  | ns   |
| PTSA                         |    |                                             |      |      |      |      |     |     |      |
| t5ptcom                      | 42 | 5 Product Term Bypass, Combinatorial        | —    | 1    | —    | 1.4  | —   | 2   | ns   |
| t5ptreg                      | 43 | 5 Product Term Bypass, Registered           | —    | 1    | —    | 1.7  | —   | 2.3 | ns   |
| t5ptxcom                     | 44 | 5 Product Term XOR, Combinatorial           | —    | 2.5  | —    | 3.6  | —   | 5   | ns   |
| t5ptxreg                     | 45 | 5 Product Term XOR, Registered              | —    | 1.5  | —    | 2.2  | —   | 3.3 | ns   |
| tptsacom                     | 46 | Product Term Sharing Array, Combinatorial   | —    | 3    | —    | 4.1  | —   | 6   | ns   |
| tptsareg                     | 47 | Product Term Sharing Array, Registered      | —    | 2.0  | —    | 2.7  | —   | 4.3 | ns   |
| PTSA Controls                |    |                                             |      |      |      |      |     |     |      |
| tpck                         | 48 | Product Term Clock Delay                    | —    | 0.5  | —    | 0.7  | —   | 1   | ns   |
| tpcken                       | 49 | Product Term CLKEN Delay                    | —    | 1    | —    | 1.4  | —   | 2   | ns   |
| tscken                       | 50 | Shared Product Term CLKEN Delay             | —    | 1    | —    | 1.4  | —   | 2   | ns   |
| tsck                         | 51 | Shared Product Term Clock Delay             | —    | 0.5  | —    | 0.7  | —   | 1   | ns   |
| tptsacken                    | 52 | Product Term Sharing Array CLKEN Delay      | —    | 2.0  | —    | 2.4  | —   | 4   | ns   |
| tsrst                        | 53 | Shared Product Term Set/Reset Delay         | —    | 2.5  | —    | 3.4  | —   | 5   | ns   |
| tprst                        | 54 | Product Term Set/Reset Delay                | —    | 1.5  | —    | 2    | —   | 3   | ns   |
| tpoe                         | 55 | Product Term Output Enable/Disable          | —    | 2.5  | —    | 3.4  | —   | 5   | ns   |
| tgpo                         | 56 | Global PT Output Enable/Disable             | —    | 11.5 | —    | 15.4 | —   | 17  | ns   |

1. Internal Timing Parameters are not tested and are for reference only.  
Refer to Timing Model in this data sheet for further details.

Timing Rev 4.0

## Internal Timing Parameters<sup>1</sup>

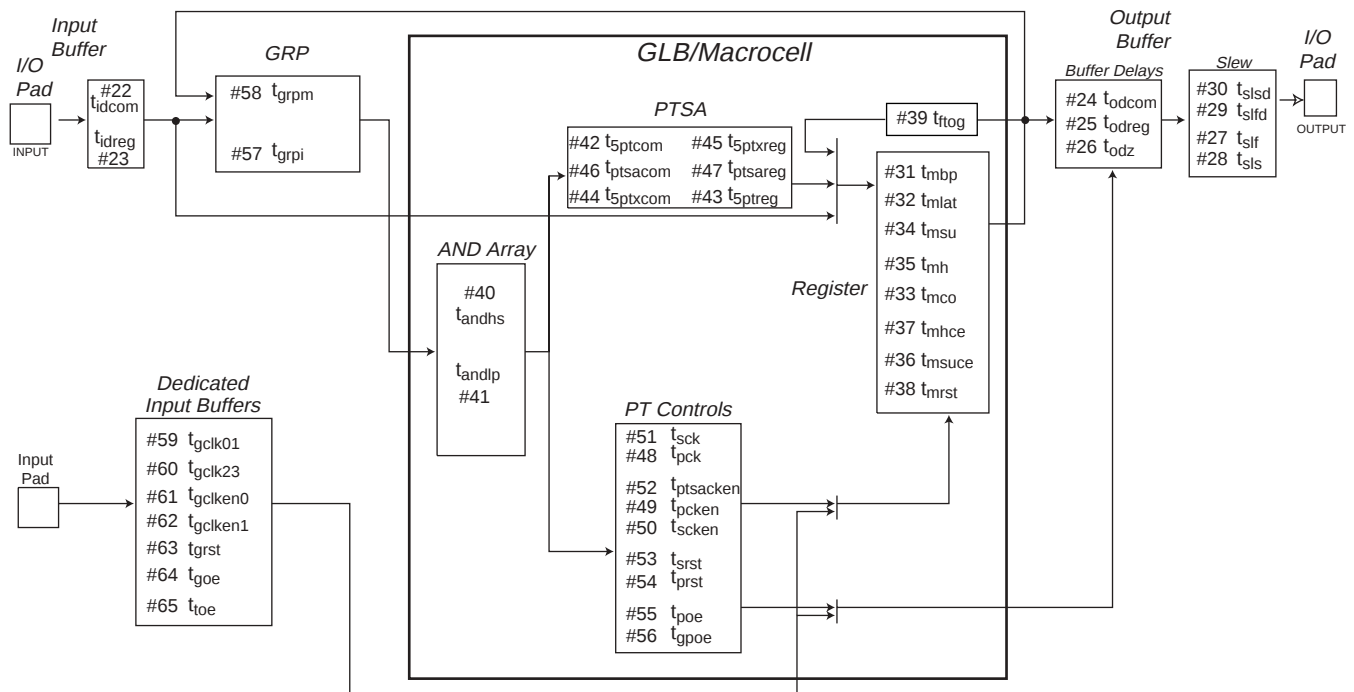
### Over Recommended Operating Conditions

| PARAM                 | #  | DESCRIPTION               | -125 |      | -100 |      | -70 |      | UNIT |
|-----------------------|----|---------------------------|------|------|------|------|-----|------|------|
|                       |    |                           | MIN  | MAX  | MIN  | MAX  | MIN | MAX  |      |
| GRP                   |    |                           |      |      |      |      |     |      |      |
| tgrpi                 | 57 | GRP Delay from I/O Pad    | –    | 1.5  | –    | 2    | –   | 3    | ns   |
| tgrpm                 | 58 | GRP Delay from Macrocell  | –    | 1.0  | –    | 1.2  | –   | 1.2  | ns   |
| Global Control Delays |    |                           |      |      |      |      |     |      |      |
| tgclk01               | 59 | Global Clock 0 or 1 Delay | –    | 1.2  | –    | 1.7  | –   | 2.4  | ns   |
| tgclk23               | 60 | Global Clock 2 or 3 Delay | –    | 2.2  | –    | 2.7  | –   | 4.4  | ns   |
| tgclken0              | 61 | Global CLKEN 0 Delay      | –    | 1.7  | –    | 2.4  | –   | 3.4  | ns   |
| tgclken1              | 62 | Global CLKEN 1 Delay      | –    | 2.7  | –    | 3.4  | –   | 5.4  | ns   |
| tgrst                 | 63 | Global Set/Reset Delay    | –    | 12.2 | –    | 15.8 | –   | 23.4 | ns   |
| tgoe                  | 64 | Global OE Delay           | –    | 4.7  | –    | 6.3  | –   | 9.4  | ns   |
| ttoe                  | 65 | Test OE Delay             | –    | 4.7  | –    | 6.2  | –   | 9.4  | ns   |

1. Internal Timing Parameters are not tested and are for reference only.  
Refer to Timing Model in this data sheet for further details.

Timing Rev 4.0

## ispLSI 5384VA Timing Model



## Signal Descriptions

| Signal Name               | Description                                                                                                                                                                                                                                                                                                                                         |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TMS                       | Input - This pin is the Test Mode Select input, which is used to control the JTAG state machine.                                                                                                                                                                                                                                                    |
| TCK                       | Input - This pin is the Test Clock input pin used to clock through the JTAG state machine.                                                                                                                                                                                                                                                          |
| TDI                       | Input - This pin is the JTAG Test Data In pin used to load data.                                                                                                                                                                                                                                                                                    |
| TDO                       | Output - This pin is the JTAG Test Data Out pin used to shift data out.                                                                                                                                                                                                                                                                             |
| TOE / I/O0                | Input/Output - This pin functions as either the Test Output Enable pin or an I/O pin based upon customer's design. TOE tristates all I/O pins when a logic low is driven.                                                                                                                                                                           |
| GOE0, GOE1                | Input - These two pins are the Global Output Enable input pins.                                                                                                                                                                                                                                                                                     |
| GSET/GRST                 | Dedicated Set/Reset Input - This pin is available to all registers in the device and can independently be configured as preset, reset or no effect on each register. The global polarity (active high or low input) for this pin is also selectable.                                                                                                |
| I/O                       | Input/Output – These are the general purpose I/O used by the logic array.                                                                                                                                                                                                                                                                           |
| GND                       | Ground                                                                                                                                                                                                                                                                                                                                              |
| NC <sup>1</sup>           | No connect.                                                                                                                                                                                                                                                                                                                                         |
| VCC                       | Vcc                                                                                                                                                                                                                                                                                                                                                 |
| CLK0, CLK1                | Dedicated clock inputs for all registers. Both clocks are muxed before being used as the clock input to all registers in the device.                                                                                                                                                                                                                |
| CLK2 / I/O,<br>CLK3 / I/O | Input/Output - These pins function as either dedicated clock inputs for all registers or an I/O pin based upon customer's design. Both clocks are muxed before being used as the clock input to all registers in the device.                                                                                                                        |
| VCCIO                     | Input - This pin is used if an optional 2.5V output is to be used. Every IO can independently select either 3.3V or the optional voltage as its output level. If the optional output voltage is not required, this pin must be connected to the Vcc supply. Programmable pull-up resistors and bus-hold latches only draw current from this supply. |

1. NC pins are not to be connected to any active signals, VCC or GND.

## 208-Pin PQFP Signal Locations

| Signal       | Pin                                                                                         |
|--------------|---------------------------------------------------------------------------------------------|
| GOE0, GOE1   | 78, 79                                                                                      |
| TOE / I/O0   | 32                                                                                          |
| GSET/GRST    | 138                                                                                         |
| TCK          | 29                                                                                          |
| TDI          | 30                                                                                          |
| TDO          | 136                                                                                         |
| TMS          | 28                                                                                          |
| CLK0, CLK1   | 184,185                                                                                     |
| CLK2 / I/O89 | 162                                                                                         |
| CLK3 / I/O98 | 173                                                                                         |
| VCCIO        | 137                                                                                         |
| GND          | 3, 12, 19, 27, 39, 48, 58, 69, 77, 88, 99, 113, 121, 128, 135, 150, 164, 170, 179, 191, 199 |
| VCC          | 7, 14, 22, 31, 41, 61, 80, 90, 110, 123, 139, 152, 156, 177, 186, 201                       |
| NC           | 49, 50, 51, 52, 101, 102, 103, 104, 105, 106, 107, 108, 109, 157, 158, 207, 208             |

1. NCs are not to be connected to any active signals, VCC or GND.

## 208-Pin PQFP I/O Locations

| I/O # | Pin | I/O # | Pin | I/O # | Pin | I/O # | Pin | I/O # | Pin | I/O # | Pin |
|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|
| 0*    | 32  | 24    | 65  | 48    | 96  | 72    | 140 | 96    | 171 | 120   | 203 |
| 1     | 33  | 25    | 66  | 49    | 97  | 73    | 141 | 97    | 172 | 121   | 204 |
| 2     | 34  | 26    | 67  | 50    | 98  | 74    | 142 | 98*   | 173 | 122   | 205 |
| 3     | 35  | 27    | 68  | 51    | 100 | 75    | 143 | 99    | 174 | 123   | 206 |
| 4     | 36  | 28    | 70  | 52    | 111 | 76    | 144 | 100   | 175 | 124   | 1   |
| 5     | 37  | 29    | 71  | 53    | 112 | 77    | 145 | 101   | 176 | 125   | 2   |
| 6     | 38  | 30    | 72  | 54    | 114 | 78    | 146 | 102   | 178 | 126   | 4   |
| 7     | 40  | 31    | 73  | 55    | 115 | 79    | 147 | 103   | 180 | 127   | 5   |
| 8     | 42  | 32    | 74  | 56    | 116 | 80    | 148 | 104   | 181 | 128   | 6   |
| 9     | 43  | 33    | 75  | 57    | 117 | 81    | 149 | 105   | 182 | 129   | 8   |
| 10    | 44  | 34    | 76  | 58    | 118 | 82    | 151 | 106   | 183 | 130   | 9   |
| 11    | 45  | 35    | 81  | 59    | 119 | 83    | 153 | 107   | 187 | 131   | 10  |
| 12    | 46  | 36    | 82  | 60    | 120 | 84    | 154 | 108   | 188 | 132   | 11  |
| 13    | 47  | 37    | 83  | 61    | 122 | 85    | 155 | 109   | 189 | 133   | 13  |
| 14    | 53  | 38    | 84  | 62    | 124 | 86    | 159 | 110   | 190 | 134   | 15  |
| 15    | 54  | 39    | 85  | 63    | 125 | 87    | 160 | 111   | 192 | 135   | 16  |
| 16    | 55  | 40    | 86  | 64    | 126 | 88    | 161 | 112   | 193 | 136   | 17  |
| 17    | 56  | 41    | 87  | 65    | 127 | 89*   | 162 | 113   | 194 | 137   | 18  |
| 18    | 57  | 42    | 89  | 66    | 129 | 90    | 163 | 114   | 195 | 138   | 20  |
| 19    | 59  | 43    | 91  | 67    | 130 | 91    | 165 | 115   | 196 | 139   | 21  |
| 20    | 60  | 44    | 92  | 68    | 131 | 92    | 166 | 116   | 197 | 140   | 23  |
| 21    | 62  | 45    | 93  | 69    | 132 | 93    | 167 | 117   | 198 | 141   | 24  |
| 22    | 63  | 46    | 94  | 70    | 133 | 94    | 168 | 118   | 200 | 142   | 25  |
| 23    | 64  | 47    | 95  | 71    | 134 | 95    | 169 | 119   | 202 | 143   | 26  |

\* I/O 89 is multiplexed with CLK2, I/O 98 is multiplexed with CLK3 and I/O 0 is multiplexed with TOE.

## 208-Ball fpBGA Signal Locations

| Signal          | Ball                                                                                                                           |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------|
| GOE0, GOE1      | P9, P10                                                                                                                        |
| TOE / I/O0      | K1                                                                                                                             |
| GSET/GRST       | H14                                                                                                                            |
| TCK             | K2                                                                                                                             |
| TDI             | K3                                                                                                                             |
| TDO             | G14                                                                                                                            |
| TMS             | J1                                                                                                                             |
| CLK0, CLK1      | A7, B8                                                                                                                         |
| CLK2 / I/O89    | B13                                                                                                                            |
| CLK3 / I/O98    | A11                                                                                                                            |
| VCCIO           | H15                                                                                                                            |
| GND             | D10, D12, D13, D5, D7, D8, E4, F13, G4, G8, G9, H10, H13, H7, J10, J13, J4, J7, K8, K9, L13, L4, M13, N10, N12, N4, N5, N7, N8 |
| VCC             | D11, D4, D6, D9, E13, F4, G10, G13, G7, H4, H8, H9, J8, J9, K10, K13, K4, K7, M4, N11, N13, N6, N9                             |
| NC <sup>1</sup> | E15, C14                                                                                                                       |

1. NCs are not to be connected to any active signals, VCC or GND.

## 208-Ball fpBGA I/O Locations (Sorted by I/O)

| I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball |
|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|
| 0*    | K1   | 24    | T4   | 48    | R12  | 72    | G16  | 96    | C11  | 120   | C3   |
| 1     | L2   | 25    | T5   | 49    | P14  | 73    | F14  | 97    | B11  | 121   | C2   |
| 2     | L1   | 26    | R7   | 50    | P13  | 74    | G15  | 98*   | A11  | 122   | B3   |
| 3     | L3   | 27    | P6   | 51    | R13  | 75    | F16  | 99    | B10  | 123   | B2   |
| 4     | M1   | 28    | T6   | 52    | R15  | 76    | E14  | 100   | A10  | 124   | A1   |
| 5     | M2   | 29    | T7   | 53    | P15  | 77    | F15  | 101   | C10  | 125   | D2   |
| 6     | M3   | 30    | R8   | 54    | R16  | 78    | E16  | 102   | B9   | 126   | B1   |
| 7     | N1   | 31    | P8   | 55    | P16  | 79    | D16  | 103   | C9   | 127   | D3   |
| 8     | N3   | 32    | P7   | 56    | N15  | 80    | C16  | 104   | A9   | 128   | E2   |
| 9     | N2   | 33    | T8   | 57    | N14  | 81    | B16  | 105   | A8   | 129   | C1   |
| 10    | P2   | 34    | T9   | 58    | M14  | 82    | D15  | 106   | C8   | 130   | E3   |
| 11    | P1   | 35    | R9   | 59    | N16  | 83    | D14  | 107   | C7   | 131   | D1   |
| 12    | R1   | 36    | R10  | 60    | M15  | 84    | A16  | 108   | B7   | 132   | F2   |
| 13    | R2   | 37    | T10  | 61    | M16  | 85    | C15  | 109   | A6   | 133   | E1   |
| 14    | R3   | 38    | T11  | 62    | L14  | 86    | B15  | 110   | A5   | 134   | F1   |
| 15    | P3   | 39    | T12  | 63    | L15  | 87    | A15  | 111   | C6   | 135   | G2   |
| 16    | T1   | 40    | T13  | 64    | L16  | 88    | B14  | 112   | B6   | 136   | F3   |
| 17    | P4   | 41    | T14  | 65    | K14  | 89*   | B13  | 113   | A4   | 137   | H2   |
| 18    | R4   | 42    | P11  | 66    | K15  | 90    | C13  | 114   | A3   | 138   | H3   |
| 19    | R5   | 43    | P12  | 67    | K16  | 91    | A14  | 115   | A2   | 139   | G3   |
| 20    | P5   | 44    | R11  | 68    | J14  | 92    | C12  | 116   | C5   | 140   | G1   |
| 21    | T2   | 45    | T15  | 69    | J15  | 93    | B12  | 117   | B5   | 141   | H1   |
| 22    | R6   | 46    | T16  | 70    | J16  | 94    | A13  | 118   | B4   | 142   | J2   |
| 23    | T3   | 47    | R14  | 71    | H16  | 95    | A12  | 119   | C4   | 143   | J3   |

\* I/O 89 is multiplexed with CLK2, I/O 98 is multiplexed with CLK3 and I/O 0 is multiplexed with TOE.

## 272-Ball BGA I/O Locations (Sorted by I/O)

| I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball |
|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|
| 0*    | M2   | 32    | W7   | 64    | U16  | 96    | J17  | 128   | B14  | 160   | A3   |
| 1     | M3   | 33    | Y7   | 65    | V17  | 97    | H20  | 129   | A14  | 161   | D5   |
| 2     | M4   | 34    | V8   | 66    | W18  | 98    | H19  | 130   | C13  | 162   | C4   |
| 3     | N1   | 35    | W8   | 67    | Y19  | 99    | H18  | 131*  | B13  | 163   | B2   |
| 4     | N2   | 36    | Y8   | 68    | V18  | 100   | G20  | 132   | A13  | 164   | A2   |
| 5     | N3   | 37    | U9   | 69    | V19  | 101   | G19  | 133   | D12  | 165   | B1   |
| 6     | P1   | 38    | V9   | 70    | U19  | 102   | F20  | 134   | C12  | 166   | C2   |
| 7     | P2   | 39    | W9   | 71    | U18  | 103   | G18  | 135   | B12  | 167   | D2   |
| 8     | R1   | 40    | Y9   | 72    | V20  | 104   | F19  | 136   | A12  | 168   | E4   |
| 9     | P3   | 41    | W10  | 73    | U20  | 105   | E20  | 137   | B11  | 169   | C1   |
| 10    | R2   | 42    | V10  | 74    | T18  | 106   | G17  | 138   | C11  | 170   | D1   |
| 11    | T1   | 43    | Y10  | 75    | T19  | 107   | F18  | 139   | A11  | 171   | E3   |
| 12    | P4   | 44    | Y11  | 76    | R18  | 108   | E19  | 140   | A10  | 172   | E1   |
| 13    | T2   | 45    | W11  | 77    | P17  | 109   | D20  | 141   | B10  | 173   | F3   |
| 14    | T3   | 46    | W12  | 78    | R19  | 110   | E18  | 142   | A9   | 174   | G4   |
| 15    | V1   | 47    | V12  | 79    | R20  | 111   | C20  | 143   | B9   | 175   | F2   |
| 16    | V2   | 48    | U12  | 80    | P18  | 112   | E17  | 144   | C9   | 176   | F1   |
| 17    | V3   | 49    | Y13  | 81    | P20  | 113   | D18  | 145   | D9   | 177   | G3   |
| 18    | Y1   | 50    | W13  | 82    | N18  | 114   | A20  | 146   | A8   | 178   | G2   |
| 19    | W3   | 51    | V13  | 83    | N19  | 115   | A19  | 147   | B8   | 179   | G1   |
| 20    | V4   | 52    | Y14  | 84    | N20  | 116   | B17  | 148   | C8   | 180   | H3   |
| 21    | U5   | 53    | W14  | 85    | M17  | 117   | C17  | 149   | A7   | 181   | H2   |
| 22    | Y3   | 54    | Y15  | 86    | M18  | 118   | D16  | 150   | B7   | 182   | H1   |
| 23    | Y4   | 55    | V14  | 87    | M19  | 119*  | A18  | 151   | A6   | 183   | J4   |
| 24    | V5   | 56    | W15  | 88    | M20  | 120   | C16  | 152   | C7   | 184   | J3   |
| 25    | W5   | 57    | Y16  | 89    | L19  | 121   | B16  | 153   | B6   | 185   | J2   |
| 26    | Y5   | 58    | U14  | 90    | L18  | 122   | A16  | 154   | A5   | 186   | J1   |
| 27    | V6   | 59    | V15  | 91    | L20  | 123   | C15  | 155   | D7   | 187   | K2   |
| 28    | U7   | 60    | W16  | 92    | K20  | 124   | D14  | 156   | C6   | 188   | K3   |
| 29    | W6   | 61    | Y17  | 93    | K19  | 125   | B15  | 157   | B5   | 189   | K1   |
| 30    | Y6   | 62    | V16  | 94    | K18  | 126   | A15  | 158   | A4   | 190   | L1   |
| 31    | V7   | 63    | Y18  | 95    | K17  | 127   | C14  | 159   | B4   | 191   | L2   |

\* I/O 119 is multiplexed with CLK2, I/O 131 is multiplexed with CLK3 and I/O 0 is multiplexed with TOE.

## 272-Ball BGA I/O Locations (Sorted by Ball)

| I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball |
|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|
| 164   | A02  | 121   | B16  | 108   | E19  | 93    | K19  | 11    | T01  | 72    | V20  |
| 160   | A03  | 116   | B17  | 105   | E20  | 92    | K20  | 13    | T02  | 19    | W03  |
| 158   | A04  | 169   | C01  | 176   | F01  | 190   | L01  | 14    | T03  | 25    | W05  |
| 154   | A05  | 166   | C02  | 175   | F02  | 191   | L02  | 74    | T18  | 29    | W06  |
| 151   | A06  | 162   | C04  | 173   | F03  | 90    | L18  | 75    | T19  | 32    | W07  |
| 149   | A07  | 156   | C06  | 107   | F18  | 89    | L19  | 21    | U05  | 35    | W08  |
| 146   | A08  | 152   | C07  | 104   | F19  | 91    | L20  | 28    | U07  | 39    | W09  |
| 142   | A09  | 148   | C08  | 102   | F20  | 0*    | M02  | 37    | U09  | 41    | W10  |
| 140   | A10  | 144   | C09  | 179   | G01  | 1     | M03  | 48    | U12  | 45    | W11  |
| 139   | A11  | 138   | C11  | 178   | G02  | 2     | M04  | 58    | U14  | 46    | W12  |
| 136   | A12  | 134   | C12  | 177   | G03  | 85    | M17  | 64    | U16  | 50    | W13  |
| 132   | A13  | 130   | C13  | 174   | G04  | 86    | M18  | 71    | U18  | 53    | W14  |
| 129   | A14  | 127   | C14  | 106   | G17  | 87    | M19  | 70    | U19  | 56    | W15  |
| 126   | A15  | 123   | C15  | 103   | G18  | 88    | M20  | 73    | U20  | 60    | W16  |
| 122   | A16  | 120   | C16  | 101   | G19  | 3     | N01  | 15    | V01  | 66    | W18  |
| 119*  | A18  | 117   | C17  | 100   | G20  | 4     | N02  | 16    | V02  | 18    | Y01  |
| 115   | A19  | 111   | C20  | 182   | H01  | 5     | N03  | 17    | V03  | 22    | Y03  |
| 114   | A20  | 170   | D01  | 181   | H02  | 82    | N18  | 20    | V04  | 23    | Y04  |
| 165   | B01  | 167   | D02  | 180   | H03  | 83    | N19  | 24    | V05  | 26    | Y05  |
| 163   | B02  | 161   | D05  | 99    | H18  | 84    | N20  | 27    | V06  | 30    | Y06  |
| 159   | B04  | 155   | D07  | 98    | H19  | 6     | P01  | 31    | V07  | 33    | Y07  |
| 157   | B05  | 145   | D09  | 97    | H20  | 7     | P02  | 34    | V08  | 36    | Y08  |
| 153   | B06  | 133   | D12  | 186   | J01  | 9     | P03  | 38    | V09  | 40    | Y09  |
| 150   | B07  | 124   | D14  | 185   | J02  | 12    | P04  | 42    | V10  | 43    | Y10  |
| 147   | B08  | 118   | D16  | 184   | J03  | 77    | P17  | 47    | V12  | 44    | Y11  |
| 143   | B09  | 113   | D18  | 183   | J04  | 80    | P18  | 51    | V13  | 49    | Y13  |
| 141   | B10  | 109   | D20  | 96    | J17  | 81    | P20  | 55    | V14  | 52    | Y14  |
| 137   | B11  | 172   | E01  | 189   | K01  | 8     | R01  | 59    | V15  | 54    | Y15  |
| 135   | B12  | 171   | E03  | 187   | K02  | 10    | R02  | 62    | V16  | 57    | Y16  |
| 131*  | B13  | 168   | E04  | 188   | K03  | 76    | R18  | 65    | V17  | 61    | Y17  |
| 128   | B14  | 112   | E17  | 95    | K17  | 78    | R19  | 68    | V18  | 63    | Y18  |
| 125   | B15  | 110   | E18  | 94    | K18  | 79    | R20  | 69    | V19  | 67    | Y19  |

\* I/O 119 is multiplexed with CLK2, I/O 131 is multiplexed with CLK3 and I/O 0 is multiplexed with TOE.

## 388-Ball BGA Signal Locations

| Signal          | Ball                                                                                                                                                                                                                                                                                                                                             |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GOE0, GOE1      | AF14, AD13                                                                                                                                                                                                                                                                                                                                       |
| TOE / I/O0      | T1                                                                                                                                                                                                                                                                                                                                               |
| GSET/GRST       | L25                                                                                                                                                                                                                                                                                                                                              |
| TCK             | T2                                                                                                                                                                                                                                                                                                                                               |
| TDI             | R3                                                                                                                                                                                                                                                                                                                                               |
| TDO             | N24                                                                                                                                                                                                                                                                                                                                              |
| TMS             | R1                                                                                                                                                                                                                                                                                                                                               |
| CLK0, CLK1      | A13, C14                                                                                                                                                                                                                                                                                                                                         |
| CLK2 / I/O179   | A23                                                                                                                                                                                                                                                                                                                                              |
| CLK3 / I/O197   | B17                                                                                                                                                                                                                                                                                                                                              |
| VCCIO           | M26                                                                                                                                                                                                                                                                                                                                              |
| GND             | A1, A2, A26, B2, B25, B26, C3, C24, D4, D9, D14, D19, D23, H4, J23, L11, L12, L13, L14, L15, L16, M11, M12, M13, M14, M15, M16, N4, N11, N12, N13, N14, N15, N16, P11, P12, P13, P14, P15, P16, P23, R11, R12, R13, R14, R15, R16, T11, T12, T13, T14, T15, T16, V4, W23, AC4, AC8, AC13, AC18, AC23, AD3, AD24, AE1, AE2, AE25, AF1, AF25, AF26 |
| VCC             | D6, D11, D16, D21, F4, F23, L4, L23, T4, T23, AA4, AA23, AC6, AC11, AC16, AC21                                                                                                                                                                                                                                                                   |
| NC <sup>1</sup> | C9, D2, E24, L1, AC25, AF19                                                                                                                                                                                                                                                                                                                      |

1. NCs are not to be connected to any active signals, VCC or GND.

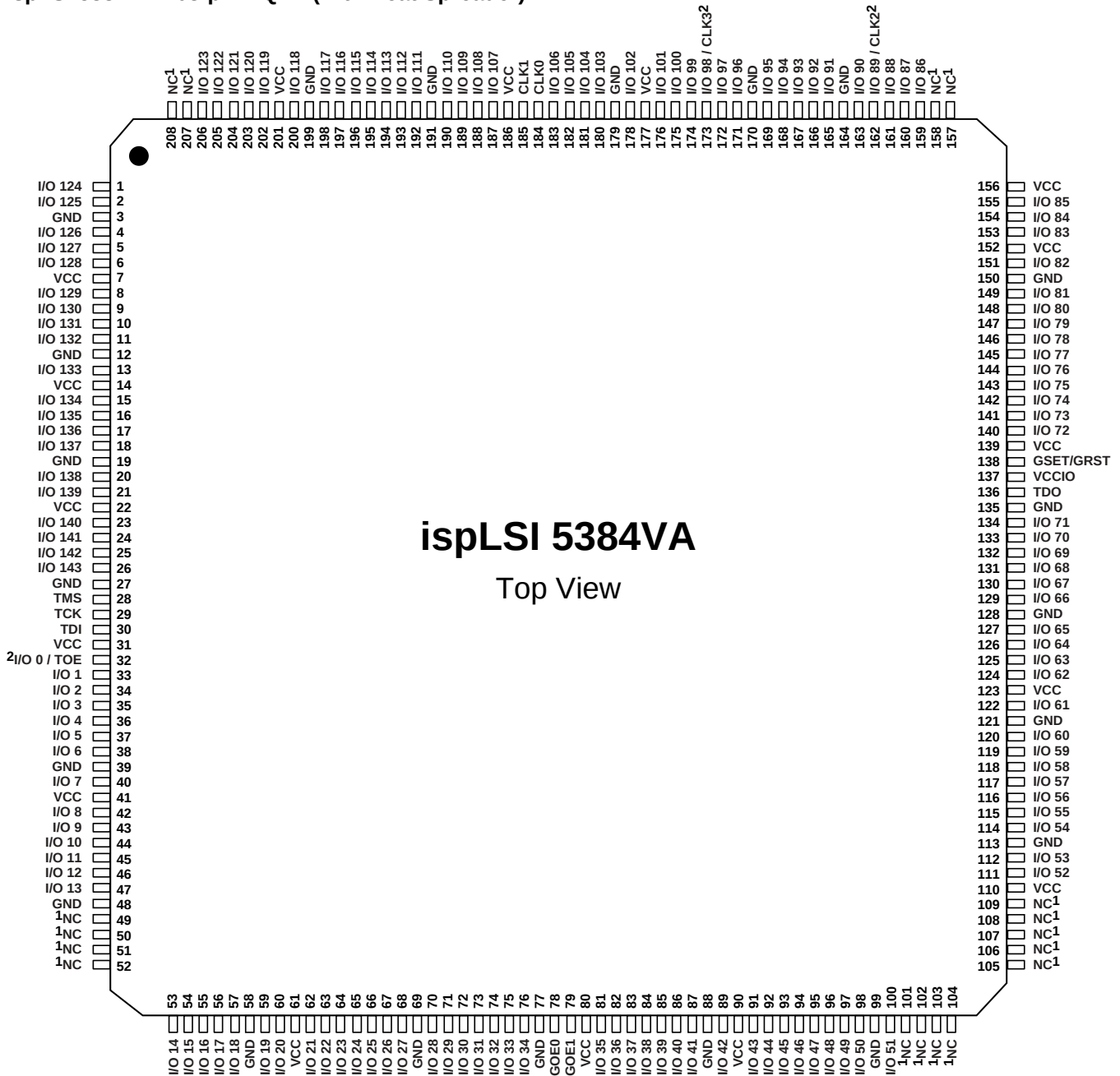
## 388-Ball BGA I/O Locations (Sorted by I/O)

| I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball | I/O # | Ball |
|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|
| 0*    | T1   | 48    | AC9  | 96    | AE23 | 144   | M24  | 192   | D18  | 240   | B4   |
| 1     | R4   | 49    | AF8  | 97    | AC22 | 145   | L26  | 193   | A19  | 241   | D5   |
| 2     | U2   | 50    | AD8  | 98    | AF23 | 146   | M23  | 194   | C19  | 242   | A4   |
| 3     | T3   | 51    | AE9  | 99    | AD22 | 147   | K25  | 195   | B18  | 243   | C5   |
| 4     | U1   | 52    | AF9  | 100   | AE24 | 148   | L24  | 196   | A18  | 244   | B3   |
| 5     | U4   | 53    | AE10 | 101   | AD23 | 149   | K26  | 197*  | B17  | 245   | C4   |
| 6     | V2   | 54    | AD9  | 102   | AF24 | 150   | K23  | 198   | C18  | 246   | A3   |
| 7     | U3   | 55    | AF10 | 103   | AE26 | 151   | J25  | 199   | A17  | 247   | B1   |
| 8     | V1   | 56    | AC10 | 104   | AD25 | 152   | K24  | 200   | D17  | 248   | C2   |
| 9     | W2   | 57    | AE11 | 105   | AD26 | 153   | J26  | 201   | B16  | 249   | C1   |
| 10    | W1   | 58    | AD10 | 106   | AC24 | 154   | H25  | 202   | C17  | 250   | D3   |
| 11    | V3   | 59    | AF11 | 107   | AC26 | 155   | H26  | 203   | A16  | 251   | D1   |
| 12    | Y2   | 60    | AE12 | 108   | AB25 | 156   | J24  | 204   | B15  | 252   | E2   |
| 13    | W4   | 61    | AF12 | 109   | AB23 | 157   | G25  | 205   | A15  | 253   | E4   |
| 14    | Y1   | 62    | AD11 | 110   | AB24 | 158   | H23  | 206   | C16  | 254   | E3   |
| 15    | W3   | 63    | AE13 | 111   | AB26 | 159   | G26  | 207   | B14  | 255   | E1   |
| 16    | AA2  | 64    | AC12 | 112   | AA25 | 160   | H24  | 208   | D15  | 256   | F2   |
| 17    | Y4   | 65    | AF13 | 113   | Y23  | 161   | F25  | 209   | A14  | 257   | G4   |
| 18    | AA1  | 66    | AD12 | 114   | AA24 | 162   | G23  | 210   | C15  | 258   | F3   |
| 19    | Y3   | 67    | AE14 | 115   | AA26 | 163   | F26  | 211   | B13  | 259   | F1   |
| 20    | AB2  | 68    | AC14 | 116   | Y25  | 164   | G24  | 212   | D13  | 260   | G2   |
| 21    | AB1  | 69    | AE15 | 117   | Y26  | 165   | E25  | 213   | B12  | 261   | G1   |
| 22    | AA3  | 70    | AD14 | 118   | Y24  | 166   | E26  | 214   | C13  | 262   | G3   |
| 23    | AC2  | 71    | AF15 | 119   | W25  | 167   | F24  | 215   | A12  | 263   | H2   |
| 24    | AB4  | 72    | AE16 | 120   | V23  | 168   | D25  | 216   | B11  | 264   | J4   |
| 25    | AC1  | 73    | AD15 | 121   | W26  | 169   | E23  | 217   | C12  | 265   | H1   |
| 26    | AB3  | 74    | AF16 | 122   | W24  | 170   | D26  | 218   | A11  | 266   | H3   |
| 27    | AD2  | 75    | AC15 | 123   | V25  | 171   | C25  | 219   | D12  | 267   | J2   |
| 28    | AC3  | 76    | AE17 | 124   | V26  | 172   | D24  | 220   | B10  | 268   | J1   |
| 29    | AD1  | 77    | AD16 | 125   | U25  | 173   | C26  | 221   | C11  | 269   | K2   |
| 30    | AF2  | 78    | AF17 | 126   | V24  | 174   | A25  | 222   | A10  | 270   | J3   |
| 31    | AE3  | 79    | AC17 | 127   | U26  | 175   | B24  | 223   | D10  | 271   | K1   |
| 32    | AF3  | 80    | AE18 | 128   | U23  | 176   | A24  | 224   | B9   | 272   | K4   |
| 33    | AE4  | 81    | AD17 | 129   | T25  | 177   | B23  | 225   | C10  | 273   | L2   |
| 34    | AD4  | 82    | AF18 | 130   | U24  | 178   | C23  | 226   | A9   | 274   | K3   |
| 35    | AF4  | 83    | AE19 | 131   | T26  | 179*  | A23  | 227   | B8   | 275   | M2   |
| 36    | AE5  | 84    | AD18 | 132   | R25  | 180   | B22  | 228   | A8   | 276   | M1   |
| 37    | AC5  | 85    | AE20 | 133   | R26  | 181   | D22  | 229   | B7   | 277   | L3   |
| 38    | AD5  | 86    | AC19 | 134   | T24  | 182   | C22  | 230   | D8   | 278   | N2   |
| 39    | AF5  | 87    | AF20 | 135   | P25  | 183   | A22  | 231   | A7   | 279   | M4   |
| 40    | AE6  | 88    | AD19 | 136   | R23  | 184   | B21  | 232   | C8   | 280   | N1   |
| 41    | AC7  | 89    | AE21 | 137   | P26  | 185   | D20  | 233   | B6   | 281   | M3   |
| 42    | AD6  | 90    | AC20 | 138   | R24  | 186   | C21  | 234   | D7   | 282   | P2   |
| 43    | AF6  | 91    | AF21 | 139   | N25  | 187   | A21  | 235   | A6   | 283   | P4   |
| 44    | AE7  | 92    | AD20 | 140   | N23  | 188   | B20  | 236   | C7   | 284   | P1   |
| 45    | AF7  | 93    | AE22 | 141   | N26  | 189   | A20  | 237   | B5   | 285   | N3   |
| 46    | AD7  | 94    | AF22 | 142   | P24  | 190   | C20  | 238   | A5   | 286   | R2   |
| 47    | AE8  | 95    | AD21 | 143   | M25  | 191   | B19  | 239   | C6   | 287   | P3   |

\* I/O 179 is multiplexed with CLK2, I/O 197 is multiplexed with CLK3 and I/O 0 is multiplexed with TOE.

## Pin Configuration

### ispLSI 5384VA 208-pin PQFP (with Heat Spreader)

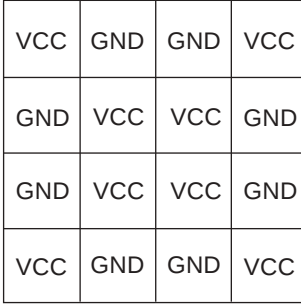
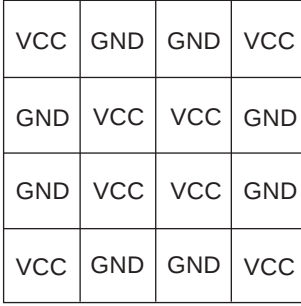


208-PQFP/5384V

1. NC pins are not to be connected to any active signal, Vcc or GND.
2. Pins have dual function capability.

## Signal Configuration

### ispLSI 5384VA 208-ball fpBGA

|   | 16     | 15              | 14              | 13             | 12                                                                                                                                          | 11             | 10      | 9       | 8       | 7       | 6       | 5       | 4       | 3       | 2       | 1            |   |
|---|--------|-----------------|-----------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|---|
| A | I/O 84 | I/O 87          | I/O 91          | I/O 94         | I/O 95                                                                                                                                      | CLK3/<br>I/O98 | I/O 100 | I/O 104 | I/O 105 | CLK 0   | I/O 109 | I/O 110 | I/O 113 | I/O 114 | I/O 115 | I/O 124      | A |
| B | I/O 81 | I/O 86          | I/O 88          | CLK2/<br>I/O89 | I/O 93                                                                                                                                      | I/O 97         | I/O 99  | I/O 102 | CLK 1   | I/O 108 | I/O 112 | I/O 117 | I/O 118 | I/O 122 | I/O 123 | I/O 126      | B |
| C | I/O 80 | I/O 85          | NC <sup>1</sup> | I/O 90         | I/O 92                                                                                                                                      | I/O 96         | I/O 101 | I/O 103 | I/O 106 | I/O 107 | I/O 111 | I/O 116 | I/O 119 | I/O 120 | I/O 121 | I/O 129      | C |
| D | I/O 79 | I/O 82          | I/O 83          | GND            | GND                                                                                                                                         | VCC            | GND     | VCC     | GND     | GND     | VCC     | GND     | VCC     | I/O 127 | I/O 125 | I/O 131      | D |
| E | I/O 78 | NC <sup>1</sup> | I/O 76          | VCC            | <div>  <p><b>ispLSI 5384VA</b><br/>Bottom View</p> </div> |                |         |         |         |         |         |         | GND     | I/O 130 | I/O 128 | I/O 133      | E |
| F | I/O 75 | I/O 77          | I/O 73          | GND            |                                                                                                                                             |                |         |         |         |         |         |         | VCC     | I/O 136 | I/O 132 | I/O 134      | F |
| G | I/O 72 | I/O 74          | TDO             | VCC            |                                                                                                                                             |                |         |         |         |         |         |         | GND     | I/O 139 | I/O 135 | I/O 140      | G |
| H | I/O 71 | VCCIO           | GSET/<br>GRST   | GND            |                                                                                                                                             |                |         |         |         |         |         |         | VCC     | I/O 138 | I/O 137 | I/O 141      | H |
| J | I/O 70 | I/O 69          | I/O 68          | GND            |                                                                                                                                             |                |         |         |         |         |         |         | GND     | I/O 143 | I/O 142 | TMS          | J |
| K | I/O 67 | I/O 66          | I/O 65          | VCC            | <div>  <p><b>ispLSI 5384VA</b><br/>Bottom View</p> </div> |                |         |         |         |         |         |         | VCC     | TDI     | TCK     | TOE/<br>I/O0 | K |
| L | I/O 64 | I/O 63          | I/O 62          | GND            |                                                                                                                                             |                |         |         |         |         |         |         | GND     | I/O 3   | I/O 1   | I/O 2        | L |
| M | I/O 61 | I/O 60          | I/O 58          | GND            |                                                                                                                                             |                |         |         |         |         |         |         | VCC     | I/O 6   | I/O 5   | I/O 4        | M |
| N | I/O 59 | I/O 56          | I/O 57          | VCC            | GND                                                                                                                                         | VCC            | GND     | VCC     | GND     | GND     | VCC     | GND     | GND     | I/O 8   | I/O 9   | I/O 7        | N |
| P | I/O 55 | I/O 53          | I/O 49          | I/O 50         | I/O 43                                                                                                                                      | I/O 42         | GOE1    | GOE0    | I/O 31  | I/O 32  | I/O 27  | I/O 20  | I/O 17  | I/O 15  | I/O 10  | I/O 11       | P |
| R | I/O 54 | I/O 52          | I/O 47          | I/O 51         | I/O 48                                                                                                                                      | I/O 44         | I/O 36  | I/O 35  | I/O 30  | I/O 26  | I/O 22  | I/O 19  | I/O 18  | I/O 14  | I/O 13  | I/O 12       | R |
| T | I/O 46 | I/O 45          | I/O 41          | I/O 40         | I/O 39                                                                                                                                      | I/O 38         | I/O 37  | I/O 34  | I/O 33  | I/O 29  | I/O 28  | I/O 25  | I/O 24  | I/O 23  | I/O 21  | I/O 16       | T |
|   | 16     | 15              | 14              | 13             | 12                                                                                                                                          | 11             | 10      | 9       | 8       | 7       | 6       | 5       | 4       | 3       | 2       | 1            |   |

208 fpBGA/5384VA

1. NCs are not to be connected to any active signals, Vcc or GND.

Note: Ball A1 indicator dot on top side of package.

## Signal Configuration

### ispLSI 5384VA 272-ball BGA

|   | 20              | 19              | 18               | 17              | 16                                                                                                                                                                                                                                                                                                                                      | 15              | 14      | 13               | 12              | 11      | 10      | 9       | 8       | 7       | 6       | 5               | 4               | 3               | 2               | 1               |   |
|---|-----------------|-----------------|------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|------------------|-----------------|---------|---------|---------|---------|---------|---------|-----------------|-----------------|-----------------|-----------------|-----------------|---|
| A | I/O 114         | I/O 115         | CLK2/<br>I/O 119 | NC <sup>1</sup> | I/O 122                                                                                                                                                                                                                                                                                                                                 | I/O 126         | I/O 129 | I/O 132          | I/O 136         | I/O 139 | I/O 140 | I/O 142 | I/O 146 | I/O 149 | I/O 151 | I/O 154         | I/O 158         | I/O 160         | I/O 164         | GND             | A |
| B | NC <sup>1</sup> | NC <sup>1</sup> | NC <sup>1</sup>  | I/O 116         | I/O 121                                                                                                                                                                                                                                                                                                                                 | I/O 125         | I/O 128 | CLK3/<br>I/O 131 | I/O 135         | I/O 137 | I/O 141 | I/O 143 | I/O 147 | I/O 150 | I/O 153 | I/O 157         | I/O 159         | NC <sup>1</sup> | I/O 163         | I/O 165         | B |
| C | I/O 111         | NC <sup>1</sup> | NC <sup>1</sup>  | I/O 117         | I/O 120                                                                                                                                                                                                                                                                                                                                 | I/O 123         | I/O 127 | I/O 130          | I/O 134         | I/O 138 | CLK0    | I/O 144 | I/O 148 | I/O 152 | I/O 156 | NC <sup>1</sup> | I/O 162         | NC <sup>1</sup> | I/O 166         | I/O 169         | C |
| D | I/O 109         | NC <sup>1</sup> | I/O 113          | GND             | I/O 118                                                                                                                                                                                                                                                                                                                                 | VCC             | I/O 124 | GND              | I/O 133         | VCC     | CLK1    | I/O 145 | GND     | I/O 155 | VCC     | I/O 161         | GND             | NC <sup>1</sup> | I/O 167         | I/O 170         | D |
| E | I/O 105         | I/O 108         | I/O 110          | I/O 112         | <div>ispLSI 5384VA</div> <div>Bottom View</div> <div><div><div>GND</div><div>GND</div><div>GND</div><div>GND</div></div><div><div>GND</div><div>GND</div><div>GND</div><div>GND</div></div><div><div>GND</div><div>GND</div><div>GND</div><div>GND</div></div><div><div>GND</div><div>GND</div><div>GND</div><div>GND</div></div></div> |                 |         |                  |                 |         |         |         |         |         |         |                 | I/O 168         | I/O 171         | NC <sup>1</sup> | I/O 172         | E |
| F | I/O 102         | I/O 104         | I/O 107          | VCC             |                                                                                                                                                                                                                                                                                                                                         |                 |         |                  |                 |         |         |         |         |         |         |                 | VCC             | I/O 173         | I/O 175         | I/O 176         | F |
| G | I/O 100         | I/O 101         | I/O 103          | I/O 106         |                                                                                                                                                                                                                                                                                                                                         |                 |         |                  |                 |         |         |         |         |         |         |                 | I/O 174         | I/O 177         | I/O 178         | I/O 179         | G |
| H | I/O 97          | I/O 98          | I/O 99           | GND             |                                                                                                                                                                                                                                                                                                                                         |                 |         |                  |                 |         |         |         |         |         |         |                 | GND             | I/O 180         | I/O 181         | I/O 182         | H |
| J | TDO             | VCCIO           | SET/<br>RST      | I/O 96          |                                                                                                                                                                                                                                                                                                                                         |                 |         |                  |                 |         |         |         |         |         |         |                 | I/O 183         | I/O 184         | I/O 185         | I/O 186         | J |
| K | I/O 92          | I/O 93          | I/O 94           | I/O 95          |                                                                                                                                                                                                                                                                                                                                         |                 |         |                  |                 |         |         |         |         |         |         |                 | VCC             | I/O 188         | I/O 187         | I/O 189         | K |
| L | I/O 91          | I/O 89          | I/O 90           | VCC             |                                                                                                                                                                                                                                                                                                                                         |                 |         |                  |                 |         |         |         |         |         |         |                 | TCK             | TMS             | I/O 191         | I/O 190         | L |
| M | I/O 88          | I/O 87          | I/O 86           | I/O 85          |                                                                                                                                                                                                                                                                                                                                         |                 |         |                  |                 |         |         |         |         |         |         |                 | I/O 2           | I/O 1           | TOE<br>I/O 0    | TDI             | M |
| N | I/O 84          | I/O 83          | I/O 82           | GND             |                                                                                                                                                                                                                                                                                                                                         |                 |         |                  |                 |         |         |         |         |         |         |                 | GND             | I/O 5           | I/O 4           | I/O 3           | N |
| P | I/O 81          | NC <sup>1</sup> | I/O 80           | I/O 77          |                                                                                                                                                                                                                                                                                                                                         |                 |         |                  |                 |         |         |         |         |         |         |                 | I/O 12          | I/O 9           | I/O 7           | I/O 6           | P |
| R | I/O 79          | I/O 78          | I/O 76           | VCC             | VCC                                                                                                                                                                                                                                                                                                                                     | NC <sup>1</sup> | I/O 10  | I/O 8            | R               |         |         |         |         |         |         |                 |                 |                 |                 |                 |   |
| T | NC <sup>1</sup> | I/O 75          | I/O 74           | NC <sup>1</sup> | NC <sup>1</sup>                                                                                                                                                                                                                                                                                                                         | I/O 14          | I/O 13  | I/O 11           | T               |         |         |         |         |         |         |                 |                 |                 |                 |                 |   |
| U | I/O 73          | I/O 70          | I/O 71           | GND             | I/O 64                                                                                                                                                                                                                                                                                                                                  | VCC             | I/O 58  | GND              | I/O 48          | GOE1    | VCC     | I/O 37  | GND     | I/O 28  | VCC     | I/O 21          | GND             | NC <sup>1</sup> | NC <sup>1</sup> | NC <sup>1</sup> | U |
| V | I/O 72          | I/O 69          | I/O 68           | I/O 65          | I/O 62                                                                                                                                                                                                                                                                                                                                  | I/O 59          | I/O 55  | I/O 51           | I/O 47          | GOE0    | I/O 42  | I/O 38  | I/O 34  | I/O 31  | I/O 27  | I/O 24          | I/O 20          | I/O 17          | I/O 16          | I/O 15          | V |
| W | NC <sup>1</sup> | NC <sup>1</sup> | I/O 66           | NC <sup>1</sup> | I/O 60                                                                                                                                                                                                                                                                                                                                  | I/O 56          | I/O 53  | I/O 50           | I/O 46          | I/O 45  | I/O 41  | I/O 39  | I/O 35  | I/O 32  | I/O 29  | I/O 25          | NC <sup>1</sup> | I/O 19          | NC <sup>1</sup> | NC <sup>1</sup> | W |
| Y | NC <sup>1</sup> | I/O 67          | I/O 63           | I/O 61          | I/O 57                                                                                                                                                                                                                                                                                                                                  | I/O 54          | I/O 52  | I/O 49           | NC <sup>1</sup> | I/O 44  | I/O 43  | I/O 40  | I/O 36  | I/O 33  | I/O 30  | I/O 26          | I/O 23          | I/O 22          | NC <sup>1</sup> | I/O 18          | Y |
|   | 20              | 19              | 18               | 17              | 16                                                                                                                                                                                                                                                                                                                                      | 15              | 14      | 13               | 12              | 11      | 10      | 9       | 8       | 7       | 6       | 5               | 4               | 3               | 2               | 1               |   |

1. NCs are not to be connected to any active signals, Vcc or GND.

272 BGA/5384VA

Note: Ball A1 indicator dot on top side of package.

**Pin Configuration**

**ispLSI 5384VA 388-ball BGA**

|    | 26      | 25              | 24              | 23               | 22      | 21      | 20      | 19              | 18      | 17               | 16      | 15      | 14      | 13      | 12      | 11      | 10      | 9               | 8       | 7       | 6       | 5       | 4       | 3       | 2               | 1               |    |
|----|---------|-----------------|-----------------|------------------|---------|---------|---------|-----------------|---------|------------------|---------|---------|---------|---------|---------|---------|---------|-----------------|---------|---------|---------|---------|---------|---------|-----------------|-----------------|----|
| A  | GND     | I/O 174         | I/O 176         | I/O 179/<br>CLK2 | I/O 183 | I/O 187 | I/O 189 | I/O 193         | I/O 196 | I/O 199          | I/O 203 | I/O 205 | I/O 209 | CLK0    | I/O 215 | I/O 218 | I/O 222 | I/O 226         | I/O 228 | I/O 231 | I/O 235 | I/O 238 | I/O 242 | I/O 246 | GND             | GND             | A  |
| B  | GND     | GND             | I/O 175         | I/O 177          | I/O 180 | I/O 184 | I/O 188 | I/O 191         | I/O 195 | I/O 197/<br>CLK3 | I/O 201 | I/O 204 | I/O 207 | I/O 211 | I/O 213 | I/O 216 | I/O 220 | I/O 224         | I/O 227 | I/O 229 | I/O 233 | I/O 237 | I/O 240 | I/O 244 | GND             | I/O 247         | B  |
| C  | I/O 173 | I/O 171         | GND             | I/O 178          | I/O 182 | I/O 186 | I/O 190 | I/O 194         | I/O 198 | I/O 202          | I/O 206 | I/O 210 | CLK1    | I/O 214 | I/O 217 | I/O 221 | I/O 225 | NC <sup>1</sup> | I/O 232 | I/O 236 | I/O 239 | I/O 243 | I/O 245 | GND     | I/O 248         | I/O 249         | C  |
| D  | I/O 170 | I/O 168         | I/O 172         | GND              | I/O 181 | VCC     | I/O 185 | GND             | I/O 192 | I/O 200          | VCC     | I/O 208 | GND     | I/O 212 | I/O 219 | VCC     | I/O 223 | GND             | I/O 230 | I/O 234 | VCC     | I/O 241 | GND     | I/O 250 | NC <sup>1</sup> | I/O 251         | D  |
| E  | I/O 166 | I/O 165         | NC <sup>1</sup> | I/O 169          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 253 | I/O 254 | I/O 252         | I/O 255         | E  |
| F  | I/O 163 | I/O 161         | I/O 167         | VCC              |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | VCC     | I/O 258 | I/O 256         | I/O 259         | F  |
| G  | I/O 159 | I/O 157         | I/O 164         | I/O 162          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 257 | I/O 262 | I/O 260         | I/O 261         | G  |
| H  | I/O 155 | I/O 154         | I/O 160         | I/O 158          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | GND     | I/O 266 | I/O 263         | I/O 265         | H  |
| J  | I/O 153 | I/O 151         | I/O 156         | GND              |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 264 | I/O 270 | I/O 267         | I/O 268         | J  |
| K  | I/O 149 | I/O 147         | I/O 152         | I/O 150          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 272 | I/O 274 | I/O 269         | I/O 271         | K  |
| L  | I/O 145 | SET/<br>RST     | I/O 148         | VCC              |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | VCC     | I/O 277 | I/O 273         | NC <sup>1</sup> | L  |
| M  | VCCIO   | I/O 143         | I/O 144         | I/O 146          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 279 | I/O 281 | I/O 275         | I/O 276         | M  |
| N  | I/O 141 | I/O 139         | TDO             | I/O 140          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | GND     | I/O 285 | I/O 278         | I/O 280         | N  |
| P  | I/O 137 | I/O 135         | I/O 142         | GND              |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 283 | I/O 287 | I/O 282         | I/O 284         | P  |
| R  | I/O 133 | I/O 132         | I/O 138         | I/O 136          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 1   | TDI     | I/O 286         | TMS             | R  |
| T  | I/O 131 | I/O 129         | I/O 134         | VCC              |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | VCC     | I/O 3   | TCK             | I/O 0/<br>TOE   | T  |
| U  | I/O 127 | I/O 125         | I/O 130         | I/O 128          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 5   | I/O 7   | I/O 2           | I/O 4           | U  |
| V  | I/O 124 | I/O 123         | I/O 126         | I/O 120          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | GND     | I/O 11  | I/O 6           | I/O 8           | V  |
| W  | I/O 121 | I/O 119         | I/O 122         | GND              |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 13  | I/O 15  | I/O 9           | I/O 10          | W  |
| Y  | I/O 117 | I/O 116         | I/O 118         | I/O 113          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 17  | I/O 19  | I/O 12          | I/O 14          | Y  |
| AA | I/O 115 | I/O 112         | I/O 114         | VCC              |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | VCC     | I/O 22  | I/O 16          | I/O 18          | AA |
| AB | I/O 111 | I/O 108         | I/O 110         | I/O 109          |         |         |         |                 |         |                  |         |         |         |         |         |         |         |                 |         |         |         |         | I/O 24  | I/O 26  | I/O 20          | I/O 21          | AB |
| AC | I/O 107 | NC <sup>1</sup> | I/O 106         | GND              | I/O 97  | VCC     | I/O 90  | I/O 86          | GND     | I/O 79           | VCC     | I/O 75  | I/O 68  | GND     | I/O 64  | VCC     | I/O 56  | I/O 48          | GND     | I/O 41  | VCC     | I/O 37  | GND     | I/O 28  | I/O 23          | I/O 25          | AC |
| AD | I/O 105 | I/O 104         | GND             | I/O 101          | I/O 99  | I/O 95  | I/O 92  | I/O 88          | I/O 84  | I/O 81           | I/O 77  | I/O 73  | I/O 70  | GOE1    | I/O 66  | I/O 62  | I/O 58  | I/O 54          | I/O 50  | I/O 46  | I/O 42  | I/O 38  | I/O 34  | GND     | I/O 27          | I/O 29          | AD |
| AE | I/O 103 | GND             | I/O 100         | I/O 96           | I/O 93  | I/O 89  | I/O 85  | I/O 83          | I/O 80  | I/O 76           | I/O 72  | I/O 69  | I/O 67  | I/O 63  | I/O 60  | I/O 57  | I/O 53  | I/O 51          | I/O 47  | I/O 44  | I/O 40  | I/O 36  | I/O 33  | I/O 31  | GND             | GND             | AE |
| AF | GND     | GND             | I/O 102         | I/O 98           | I/O 94  | I/O 91  | I/O 87  | NC <sup>1</sup> | I/O 82  | I/O 78           | I/O 74  | I/O 71  | GOE0    | I/O 65  | I/O 61  | I/O 59  | I/O 55  | I/O 52          | I/O 49  | I/O 45  | I/O 43  | I/O 39  | I/O 35  | I/O 32  | I/O 30          | GND             | AF |
|    | 26      | 25              | 24              | 23               | 22      | 21      | 20      | 19              | 18      | 17               | 16      | 15      | 14      | 13      | 12      | 11      | 10      | 9               | 8       | 7       | 6       | 5       | 4       | 3       | 2               | 1               |    |

**ispLSI 5384VA**  
Bottom View

1. NC pins are not to be connected to any active signals, VCC or GND.

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Note: Ball A1 indicator dot on top side of package.