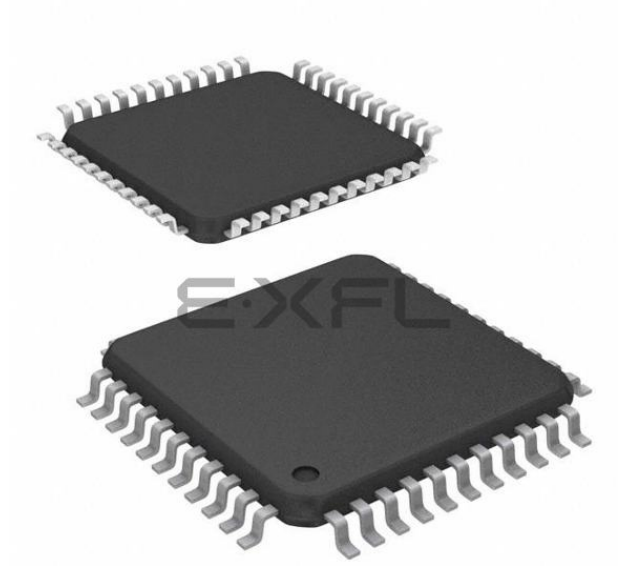

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## Understanding Embedded - CPLDs (Complex Programmable Logic Devices)

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 | 5 ns |
| Voltage Supply - Internal | 2.3V ~ 2.7V |
| Number of Logic Elements/Blocks | 2 |
| Number of Macrocells | 32 |
| Number of Gates | - |
| Number of I/O | 30 |
| Operating Temperature | -40°C ~ 105°C (TJ) |
| Mounting Type | Surface Mount |
| Package / Case | 44-TQFP |
| Supplier Device Package | 44-TQFP (10x10) |
| Purchase URL | https://www.e-xfl.com/product-detail/lattice-semiconductor/lc4032b-5t44i |

## IEEE 1532-Compliant In-System Programming

Programming devices in-system provides a number of significant benefits including: rapid prototyping, lower inventory levels, higher quality and the ability to make in-field modifications. All ispMACH 4000 devices provide In-System Programming (ISP™) capability through the Boundary Scan Test Access Port. This capability has been implemented in a manner that ensures that the port remains complaint to the IEEE 1149.1 standard. By using IEEE 1149.1 as the communication interface through which ISP is achieved, users get the benefit of a standard, well-defined interface. All ispMACH 4000 devices are also compliant with the IEEE 1532 standard.

The ispMACH 4000 devices can be programmed across the commercial temperature and voltage range. The PC-based Lattice software facilitates in-system programming of ispMACH 4000 devices. The software takes the JEDEC file output produced by the design implementation software, along with information about the scan chain, and creates a set of vectors used to drive the scan chain. The software can use these vectors to drive a scan chain via the parallel port of a PC. Alternatively, the software can output files in formats understood by common automated test equipment. This equipment can then be used to program ispMACH 4000 devices during the testing of a circuit board.

## User Electronic Signature

The User Electronic Signature (UES) allows the designer to include identification bits or serial numbers inside the device, stored in $E^2$CMOS memory. The ispMACH 4000 device contains 32 UES bits that can be configured by the user to store unique data such as ID codes, revision numbers or inventory control codes.

## Security Bit

A programmable security bit is provided on the ispMACH 4000 devices as a deterrent to unauthorized copying of the array configuration patterns. Once programmed, this bit defeats readback of the programmed pattern by a device programmer, securing proprietary designs from competitors. Programming and verification are also defeated by the security bit. The bit can only be reset by erasing the entire device.

## Hot Socketing

The ispMACH 4000 devices are well-suited for applications that require hot socketing capability. Hot socketing a device requires that the device, during power-up and down, can tolerate active signals on the I/Os and inputs without being damaged. Additionally, it requires that the effects of I/O pin loading be minimal on active signals. The ispMACH 4000 devices provide this capability for input voltages in the range 0V to 3.0V.

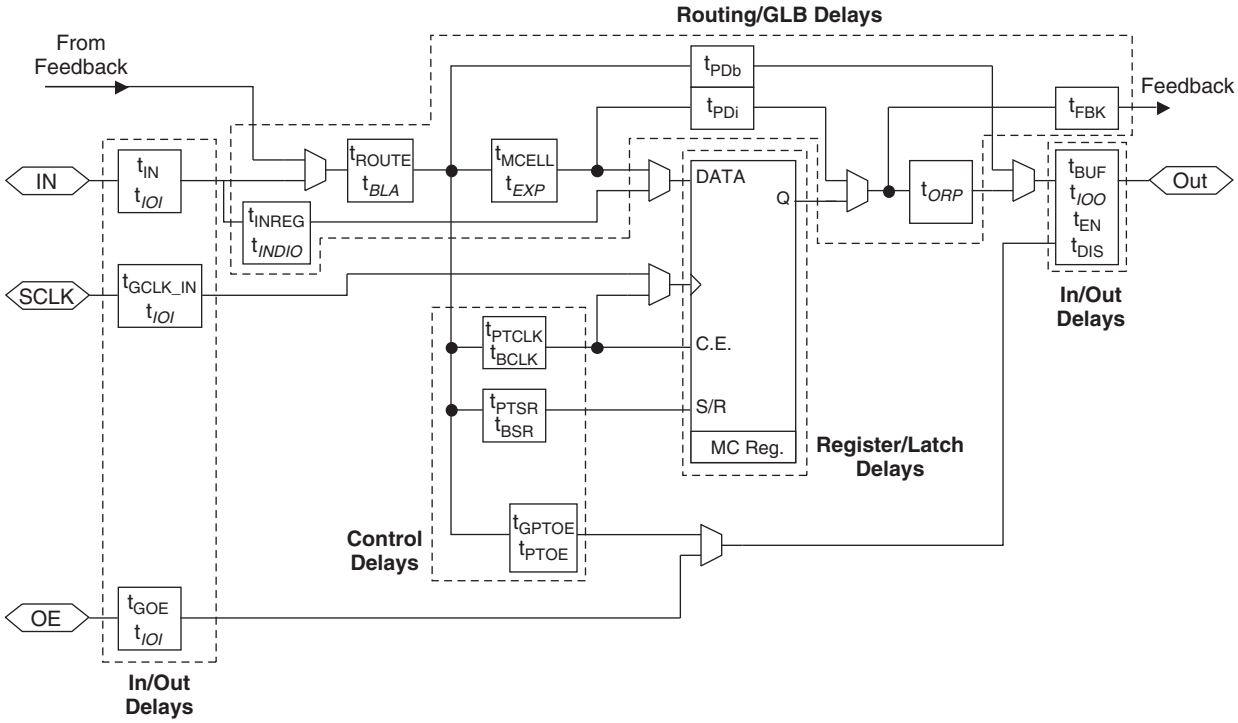
## Density Migration

The ispMACH 4000 family has been designed to ensure that different density devices in the same package have the same pin-out. Furthermore, the architecture ensures a high success rate when performing design migration from lower density parts to higher density parts. In many cases, it is possible to shift a lower utilization design targeted for a high density device to a lower density device. However, the exact details of the final resource utilization will impact the likely success in each case.

## Timing Model

The task of determining the timing through the ispMACH 4000 family, like any CPLD, is relatively simple. The timing model provided in Figure 11 shows the specific delay paths. Once the implementation of a given function is determined either conceptually or from the software report file, the delay path of the function can easily be determined from the timing model. The Lattice design tools report the timing delays based on the same timing model for a particular design. Note that the internal timing parameters are given for reference only, and are not tested. The external timing parameters are tested and guaranteed for every device. For more information on the timing model and usage, refer to TN1004, ispMACH 4000 Timing Model Design and Usage Guidelines.

***Figure 11. ispMACH 4000 Timing Model***



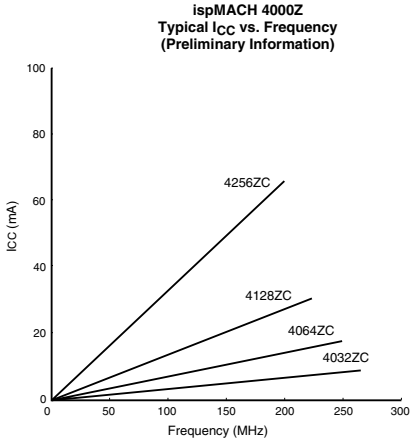

Note: Italicized items are optional delay adders.

# ispMACH 4000V/B/C Internal Timing Parameters

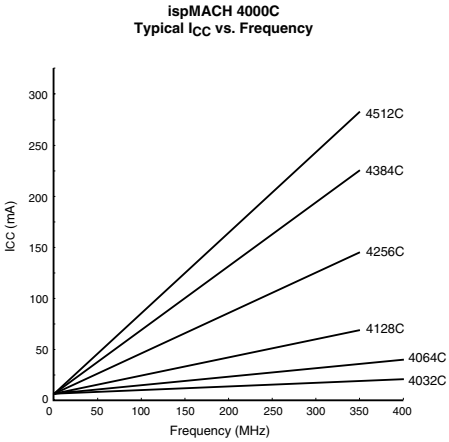
**Over Recommended Operating Conditions**

| Parameter | Description | -2.5 | | -2.7 | | -3 | | -3.5 | | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| **In/Out Delays** | | | | | | | | | | |
| $t_{IN}$ | Input Buffer Delay | — | 0.60 | — | 0.60 | — | 0.70 | — | 0.70 | ns |
| $t_{GOE}$ | Global OE Pin Delay | — | 2.04 | — | 2.54 | — | 3.04 | — | 3.54 | ns |
| $t_{GCLK\_IN}$ | Global Clock Input Buffer Delay | — | 0.78 | — | 1.28 | — | 1.28 | — | 1.28 | ns |
| $t_{BUF}$ | Delay through Output Buffer | — | 0.85 | — | 0.85 | — | 0.85 | — | 0.85 | ns |
| $t_{EN}$ | Output Enable Time | — | 0.96 | — | 0.96 | — | 0.96 | — | 0.96 | ns |
| $t_{DIS}$ | Output Disable Time | — | 0.96 | — | 0.96 | — | 0.96 | — | 0.96 | ns |
| **Routing/GLB Delays** | | | | | | | | | | |
| $t_{ROUTE}$ | Delay through GRP | — | 0.61 | — | 0.81 | — | 1.01 | — | 1.01 | ns |
| $t_{MCELL}$ | Macrocell Delay | — | 0.45 | — | 0.55 | — | 0.55 | — | 0.65 | ns |
| $t_{INREG}$ | Input Buffer to Macrocell Register Delay | — | 0.11 | — | 0.31 | — | 0.31 | — | 0.31 | ns |
| $t_{FBK}$ | Internal Feedback Delay | — | 0.00 | — | 0.00 | — | 0.00 | — | 0.00 | ns |
| $t_{PDb}$ | 5-PT Bypass Propagation Delay | — | 0.44 | — | 0.44 | — | 0.44 | — | 0.94 | ns |
| $t_{PDi}$ | Macrocell Propagation Delay | — | 0.64 | — | 0.64 | — | 0.64 | — | 0.94 | ns |
| **Register/Latch Delays** | | | | | | | | | | |
| $t_S$ | D-Register Setup Time (Global Clock) | 0.92 | — | 1.12 | — | 1.02 | — | 0.92 | — | ns |
| $t_{S\_PT}$ | D-Register Setup Time (Product Term Clock) | 1.42 | — | 1.32 | — | 1.32 | — | 1.32 | — | ns |
| $t_{ST}$ | T-Register Setup Time (Global Clock) | 1.12 | — | 1.32 | — | 1.22 | — | 1.12 | — | ns |
| $t_{ST\_PT}$ | T-Register Setup Time (Product Term Clock) | 1.42 | — | 1.32 | — | 1.32 | — | 1.32 | — | ns |
| $t_H$ | D-Register Hold Time | 0.88 | — | 0.68 | — | 0.98 | — | 1.08 | — | ns |
| $t_{HT}$ | T-Register Hold Time | 0.88 | — | 0.68 | — | 0.98 | — | 1.08 | — | ns |
| $t_{SIR}$ | D-Input Register Setup Time (Global Clock) | 0.82 | — | 1.37 | — | 1.27 | — | 1.27 | — | ns |
| $t_{SIR\_PT}$ | D-Input Register Setup Time (Product Term Clock) | 1.45 | — | 1.45 | — | 1.45 | — | 1.45 | — | ns |
| $t_{HIR}$ | D-Input Register Hold Time (Global Clock) | 0.88 | — | 0.63 | — | 0.73 | — | 0.73 | — | ns |
| $t_{HIR\_PT}$ | D-Input Register Hold Time (Product Term Clock) | 0.88 | — | 0.63 | — | 0.73 | — | 0.73 | — | ns |
| $t_{COi}$ | Register Clock to Output/Feedback MUX Time | — | 0.52 | — | 0.52 | — | 0.52 | — | 0.52 | ns |
| $t_{CES}$ | Clock Enable Setup Time | 2.25 | — | 2.25 | — | 2.25 | — | 2.25 | — | ns |
| $t_{CEH}$ | Clock Enable Hold Time | 1.88 | — | 1.88 | — | 1.88 | — | 1.88 | — | ns |
| $t_{SL}$ | Latch Setup Time (Global Clock) | 0.92 | — | 1.12 | — | 1.02 | — | 0.92 | — | ns |
| $t_{SL\_PT}$ | Latch Setup Time (Product Term Clock) | 1.42 | — | 1.32 | — | 1.32 | — | 1.32 | — | ns |
| $t_{HL}$ | Latch Hold Time | 1.17 | — | 1.17 | — | 1.17 | — | 1.17 | — | ns |
| $t_{GOi}$ | Latch Gate to Output/Feedback MUX Time | — | 0.33 | — | 0.33 | — | 0.33 | — | 0.33 | ns |

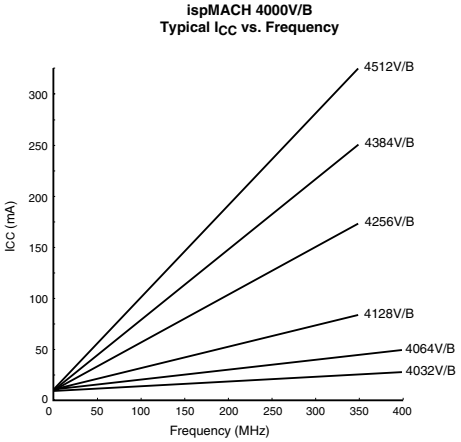
# Power Consumption




Note: The devices are configured with maximum number of 16-bit counters, typical current at 1.8V, 25°C.




Note: The devices are configured with maximum number of 16-bit counters, typical current at 1.8V, 25°C.




Note: The devices are configured with maximum number of 16-bit counters, typical current at 3.3V, 2.5V, 25°C.

# Power Estimation Coefficients[1]

| Device | A | B |
|---|---|---|
| ispMACH 4032V/B | 11.3 | 0.010 |
| ispMACH 4032C | 1.3 | 0.010 |
| ispMACH 4064V/B | 11.5 | 0.010 |
| ispMACH 4064C | 1.5 | 0.010 |
| ispMACH 4128V/B | 11.5 | 0.011 |
| ispMACH 4128C | 1.5 | 0.011 |
| ispMACH 4256V/B | 12 | 0.011 |
| ispMACH 4256C | 2 | 0.011 |
| ispMACH 4384V/B | 12.5 | 0.013 |
| ispMACH 4384C | 2.5 | 0.013 |
| ispMACH 4512V/B | 13 | 0.013 |
| ispMACH 4512C | 3 | 0.013 |
| ispMACH 4032ZC | 0.010 | 0.010 |
| ispMACH 4064ZC | 0.011 | 0.010 |
| ispMACH 4128ZC | 0.012 | 0.010 |
| ispMACH 4256ZC | 0.013 | 0.010 |

1. For further information about the use of these coefficients, refer to TN1005, Power Estimation in ispMACH 4000V/B/C/Z Devices.

## ispMACH 4064V/B/C/Z, 4128V/B/C/Z, 4256V/B/C/Z Logic Signal Connections: 100-Pin TQFP (Cont.)

| Pin Number | Bank Number | ispMACH 4064V/B/C/Z | | ispMACH 4128V/B/C/Z | | ispMACH 4256V/B/C/Z | |
|---|---|---|---|---|---|---|---|
| | | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP |
| 83 | 1 | VCCO (Bank 1) | - | VCCO (Bank 1) | - | VCCO (Bank 1) | - |
| 84 | 1 | D3 | D^3 | H6 | H^3 | P12 | P^3 |
| 85 | 1 | D2 | D^2 | H4 | H^2 | P10 | P^2 |
| 86 | 1 | D1 | D^1 | H2 | H^1 | P6 | P^1 |
| 87 | 1 | D0/GOE1 | D^0 | H0/GOE1 | H^0 | P2/OE1 | P^0 |
| 88 | 1 | CLK3/I | - | CLK3/I | - | CLK3/I | - |
| 89 | 0 | CLK0/I | - | CLK0/I | - | CLK0/I | - |
| 90 | - | VCC | - | VCC | - | VCC | - |
| 91 | 0 | A0/GOE0 | A^0 | A0/GOE0 | A^0 | A2/GOE0 | A^0 |
| 92 | 0 | A1 | A^1 | A2 | A^1 | A6 | A^1 |
| 93 | 0 | A2 | A^2 | A4 | A^2 | A10 | A^2 |
| 94 | 0 | A3 | A^3 | A6 | A^3 | A12 | A^3 |
| 95 | 0 | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |
| 96 | 0 | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |
| 97 | 0 | A4 | A^4 | A8 | A^4 | B2 | B^0 |
| 98 | 0 | A5 | A^5 | A10 | A^5 | B6 | B^1 |
| 99 | 0 | A6 | A^6 | A12 | A^6 | B10 | B^2 |
| 100 | 0 | A7 | A^7 | A14 | A^7 | B12 | B^3 |

*This pin is input only.

## ispMACH 4128V/B/C Logic Signal Connections: 128-Pin TQFP

| Pin Number | Bank Number | ispMACH 4128V/B/C | |
|---|---|---|---|
| | | GLB/MC/Pad | ORP |
| 1 | 0 | GND | - |
| 2 | 0 | TDI | - |
| 3 | 0 | VCCO (Bank 0) | - |
| 4 | 0 | B0 | B^0 |
| 5 | 0 | B1 | B^1 |
| 6 | 0 | B2 | B^2 |
| 7 | 0 | B4 | B^3 |
| 8 | 0 | B5 | B^4 |
| 9 | 0 | B6 | B^5 |
| 10 | 0 | GND (Bank 0) | - |
| 11 | 0 | B8 | B^6 |
| 12 | 0 | B9 | B^7 |
| 13 | 0 | B10 | B^8 |
| 14 | 0 | B12 | B^9 |
| 15 | 0 | B13 | B^10 |
| 16 | 0 | B14 | B^11 |
| 17 | 0 | VCCO (Bank 0) | - |
| 18 | 0 | C14 | C^11 |

## ispMACH 4128V/B/C Logic Signal Connections: 128-Pin TQFP (Cont.)

| Pin Number | Bank Number | ispMACH 4128V/B/C | |
|---|---|---|---|
| | | GLB/MC/Pad | ORP |
| 19 | 0 | C13 | C^10 |
| 20 | 0 | C12 | C^9 |
| 21 | 0 | C10 | C^8 |
| 22 | 0 | C9 | C^7 |
| 23 | 0 | C8 | C^6 |
| 24 | 0 | GND (Bank 0) | - |
| 25 | 0 | C6 | C^5 |
| 26 | 0 | C5 | C^4 |
| 27 | 0 | C4 | C^3 |
| 28 | 0 | C2 | C^2 |
| 29 | 0 | C0 | C^0 |
| 30 | 0 | VCCO (Bank 0) | - |
| 31 | 0 | TCK | - |
| 32 | 0 | VCC | - |
| 33 | 0 | GND | - |
| 34 | 0 | D14 | D^11 |
| 35 | 0 | D13 | D^10 |
| 36 | 0 | D12 | D^9 |
| 37 | 0 | D10 | D^8 |
| 38 | 0 | D9 | D^7 |
| 39 | 0 | D8 | D^6 |
| 40 | 0 | GND (Bank 0) | - |
| 41 | 0 | VCCO (Bank 0) | - |
| 42 | 0 | D6 | D^5 |
| 43 | 0 | D5 | D^4 |
| 44 | 0 | D4 | D^3 |
| 45 | 0 | D2 | D^2 |
| 46 | 0 | D1 | D^1 |
| 47 | 0 | D0 | D^0 |
| 48 | 0 | CLK1/I | - |
| 49 | 1 | GND (Bank 1) | - |
| 50 | 1 | CLK2/I | - |
| 51 | 1 | VCC | - |
| 52 | 1 | E0 | E^0 |
| 53 | 1 | E1 | E^1 |
| 54 | 1 | E2 | E^2 |
| 55 | 1 | E4 | E^3 |
| 56 | 1 | E5 | E^4 |
| 57 | 1 | E6 | E^5 |
| 58 | 1 | VCCO (Bank 1) | - |
| 59 | 1 | GND (Bank 1) | - |
| 60 | 1 | E8 | E^6 |
| 61 | 1 | E9 | E^7 |

## ispMACH 4128V/B/C Logic Signal Connections: 128-Pin TQFP (Cont.)

| Pin Number | Bank Number | ispMACH 4128V/B/C | |
|---|---|---|---|
| | | GLB/MC/Pad | ORP |
| 105 | 1 | VCCO (Bank 1) | - |
| 106 | 1 | H6 | H^5 |
| 107 | 1 | H5 | H^4 |
| 108 | 1 | H4 | H^3 |
| 109 | 1 | H2 | H^2 |
| 110 | 1 | H1 | H^1 |
| 111 | 1 | H0/GOE1 | H^0 |
| 112 | 1 | CLK3/I | - |
| 113 | 0 | GND (Bank 0) | - |
| 114 | 0 | CLK0/I | - |
| 115 | 0 | VCC | - |
| 116 | 0 | A0/GOE0 | A^0 |
| 117 | 0 | A1 | A^1 |
| 118 | 0 | A2 | A^2 |
| 119 | 0 | A4 | A^3 |
| 120 | 0 | A5 | A^4 |
| 121 | 0 | A6 | A^5 |
| 122 | 0 | VCCO (Bank 0) | - |
| 123 | 0 | GND (Bank 0) | - |
| 124 | 0 | A8 | A^6 |
| 125 | 0 | A9 | A^7 |
| 126 | 0 | A10 | A^8 |
| 127 | 0 | A12 | A^9 |
| 128 | 0 | A14 | A^11 |

## ispMACH 4064Z, 4128Z and 4256Z Logic Signal Connections: 132-Ball csBGA

| Ball Number | Bank Number | ispMACH 4064Z | | ispMACH 4128Z | | ispMACH 4256Z | |
|---|---|---|---|---|---|---|---|
| | | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP |
| B1 | - | GND | - | GND | - | GND | - |
| B2 | - | TDI | - | TDI | - | TDI | - |
| C1 | 0 | NC | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |
| C3 | 0 | NC | - | B0 | B^0 | C12 | C^6 |
| C2 | 0 | A8 | A^8 | B1 | B^1 | C10 | C^5 |
| D1 | 0 | A9 | A^9 | B2 | B^2 | C8 | C^4 |
| D3 | 0 | A10 | A^10 | B4 | B^3 | C6 | C^3 |
| D2 | 0 | A11 | A^11 | B5 | B^4 | C4 | C^2 |
| E1 | 0 | NC | | B6 | B^5 | C2 | C^1 |
| E2 | 0 | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |

# ispMACH 4064Z, 4128Z and 4256Z Logic Signal Connections: 132-Ball csBGA (Cont.)

| | | ispMACH 4064Z | | ispMACH 4128Z | | ispMACH 4256Z | |
|---|---|---|---|---|---|---|---|
| Ball Number | Bank Number | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP |
| D13 | 1 | D10 | D^10 | G4 | G^3 | N6 | N^3 |
| D14 | 1 | D9 | D^9 | G2 | G^2 | N8 | N^4 |
| D12 | 1 | D8 | D^8 | G1 | G^1 | N10 | N^5 |
| C14 | 1 | I | - | G0 | G^0 | N12 | N^6 |
| C13 | 1 | NC | - | VCCO (Bank 1) | - | VCCO (Bank 1) | - |
| B14 | - | TDO | - | TDO | - | TDO | - |
| A14 | - | VCC | - | VCC | - | VCC | - |
| A13 | - | GND | - | GND | - | GND | - |
| B13 | 1 | NC | - | H14 | H^11 | O12 | O^6 |
| A12 | 1 | I | - | H13 | H^10 | O10 | O^5 |
| C12 | 1 | D7 | D^7 | H12 | H^9 | O8 | O^4 |
| B12 | 1 | D6 | D^6 | H10 | H^8 | O6 | O^3 |
| A11 | 1 | D5 | D^5 | H9 | H^7 | O4 | O^2 |
| C11 | 1 | D4 | D^4 | H8 | H^6 | O2 | O^1 |
| B11 | 1 | GND (Bank 1) | - | GND (Bank 1) | - | GND (Bank 1) | - |
| A10 | 1 | VCCO (Bank 1) | - | VCCO (Bank 1) | - | VCCO (Bank 1) | - |
| B10 | 1 | NC | - | H6 | H^5 | P12 | P^6 |
| C10 | 1 | NC | - | H5 | H^4 | P10 | P^5 |
| B9 | 1 | D3 | D^3 | H4 | H^3 | P8 | P^4 |
| A9 | 1 | D2 | D^2 | H2 | H^2 | P6 | P^3 |
| C9 | 1 | D1 | D^1 | H1 | H^1 | P4 | P^2 |
| A8 | 1 | D0/GOE1 | D^0 | H0/GOE1 | H^0 | P2/GOE1 | P^1 |
| B8 | 1 | CLK3/I | - | CLK3/I | - | CLK3/I | - |
| C8 | 0 | CLK0/I | - | CLK0/I | - | CLK0/I | - |
| B7 | - | VCC | - | VCC | - | VCC | - |
| A7 | 0 | NC[1] | - | NC[1] | - | I[1] | - |
| C7 | 0 | A0/GOE0 | A^0 | A0/GOE0 | A^0 | A2/GOE0 | A^1 |
| A6 | 0 | A1 | A^1 | A1 | A^1 | A4 | A^2 |
| B6 | 0 | A2 | A^2 | A2 | A^2 | A6 | A^3 |
| C6 | 0 | A3 | A^3 | A4 | A^3 | A8 | A^4 |
| B5 | 0 | NC | - | A5 | A^4 | A10 | A^5 |
| A5 | 0 | NC | - | A6 | A^5 | A12 | A^6 |
| C5 | 0 | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |
| B4 | 0 | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |
| A4 | 0 | NC | - | A8 | A^6 | B2 | B^1 |
| C4 | 0 | A4 | A^4 | A9 | A^7 | B4 | B^2 |
| A3 | 0 | A5 | A^5 | A10 | A^8 | B6 | B^3 |
| B3 | 0 | A6 | A^6 | A12 | A^9 | B8 | B^4 |
| A2 | 0 | A7 | A^7 | A13 | A^10 | B10 | B^5 |
| A1 | 0 | NC | - | A14 | A^11 | B12 | B^6 |

1. For device migration considerations, these NC pins are input signal pins in ispMACH 4256Z device.

## ispMACH 4256V/B/C/Z, 4384V/B/C, 4512V/B/C, Logic Signal Connections: 176-Pin TQFP (Cont.)

| Pin Number | Bank Number | ispMACH 4256V/B/C/Z | | ispMACH 4384V/B/C | | ispMACH 4512V/B/C | |
|---|---|---|---|---|---|---|---|
| | | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP |
| 19 | 0 | D4 | D^2 | E4 | E^2 | G4 | G^2 |
| 20 | 0 | D2 | D^1 | E2 | E^1 | G2 | G^1 |
| 21 | 0 | D0 | D^0 | E0 | E^0 | G0 | G^0 |
| 22 | 0 | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |
| 23 | 0 | E0 | E^0 | H0 | H^0 | J0 | J^0 |
| 24 | 0 | E2 | E^1 | H2 | H^1 | J2 | J^1 |
| 25 | 0 | E4 | E^2 | H4 | H^2 | J4 | J^2 |
| 26 | 0 | E6 | E^3 | H6 | H^3 | J6 | J^3 |
| 27 | 0 | E8 | E^4 | H8 | H^4 | J8 | J^4 |
| 28 | 0 | E10 | E^5 | H10 | H^5 | J10 | J^5 |
| 29 | 0 | E12 | E^6 | H12 | H^6 | J12 | J^6 |
| 30 | 0 | E14 | E^7 | H14 | H^7 | J14 | J^7 |
| 31 | 0 | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |
| 32 | 0 | F0 | F^0 | J0 | J^0 | N0 | N^0 |
| 33 | 0 | F2 | F^1 | J2 | J^1 | N2 | N^1 |
| 34 | 0 | F4 | F^2 | J4 | J^2 | N4 | N^2 |
| 35 | 0 | F6 | F^3 | J6 | J^3 | N6 | N^3 |
| 36 | 0 | F8 | F^4 | J8 | J^4 | N8 | N^4 |
| 37 | 0 | F10 | F^5 | J10 | J^5 | N10 | N^5 |
| 38 | 0 | F12 | F^6 | J12 | J^6 | N12 | N^6 |
| 39 | 0 | F14 | F^7 | J14 | J^7 | N14 | N^7 |
| 40 | 0 | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |
| 41 | - | TCK | - | TCK | - | TCK | - |
| 42 | - | VCC | - | VCC | - | VCC | - |
| 43 | - | NC | - | NC | - | NC | - |
| 44 | - | NC | - | NC | - | NC | - |
| 45 | - | NC | - | NC | - | NC | - |
| 46 | - | GND | - | GND (Bank 0) | - | GND | - |
| 47 | 0 | G14 | G^7 | K14 | K^7 | O14 | O^7 |
| 48 | 0 | G12 | G^6 | K12 | K^6 | O12 | O^6 |
| 49 | 0 | G10 | G^5 | K10 | K^5 | O10 | O^5 |
| 50 | 0 | G8 | G^4 | K8 | K^4 | O8 | O^4 |
| 51 | 0 | G6 | G^3 | K6 | K^3 | O6 | O^3 |
| 52 | 0 | G4 | G^2 | K4 | K^2 | O4 | O^2 |
| 53 | 0 | G2 | G^1 | K2 | K^1 | O2 | O^1 |
| 54 | 0 | G0 | G^0 | K0 | K^0 | O0 | O^0 |
| 55 | 0 | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |
| 56 | 0 | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |
| 57 | 0 | H14 | H^7 | L14 | L^7 | P14 | P^7 |
| 58 | 0 | H12 | H^6 | L12 | L^6 | P12 | P^6 |
| 59 | 0 | H10 | H^5 | L10 | L^5 | P10 | P^5 |

## ispMACH 4256V/B/C/Z, 4384V/B/C, 4512V/B/C, Logic Signal Connections: 176-Pin TQFP (Cont.)

| Pin Number | Bank Number | ispMACH 4256V/B/C/Z | | ispMACH 4384V/B/C | | ispMACH 4512V/B/C | |
|---|---|---|---|---|---|---|---|
| | | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP |
| 101 | 1 | GND (Bank 1) | - | GND (Bank 1) | - | GND (Bank 1) | - |
| 102 | 1 | L14 | L^7 | AX14 | AX^7 | GX14 | GX^7 |
| 103 | 1 | L12 | L^6 | AX12 | AX^6 | GX12 | GX^6 |
| 104 | 1 | L10 | L^5 | AX10 | AX^5 | GX10 | GX^5 |
| 105 | 1 | L8 | L^4 | AX8 | AX^4 | GX8 | GX^4 |
| 106 | 1 | L6 | L^3 | AX6 | AX^3 | GX6 | GX^3 |
| 107 | 1 | L4 | L^2 | AX4 | AX^2 | GX4 | GX^2 |
| 108 | 1 | L2 | L^1 | AX2 | AX^1 | GX2 | GX^1 |
| 109 | 1 | L0 | L^0 | AX0 | AX^0 | GX0 | GX^0 |
| 110 | 1 | VCCO (Bank 1) | - | VCCO (Bank 1) | - | VCCO (Bank 1) | - |
| 111 | 1 | M0 | M^0 | DX0 | DX^0 | JX0 | JX^0 |
| 112 | 1 | M2 | M^1 | DX2 | DX^1 | JX2 | JX^1 |
| 113 | 1 | M4 | M^2 | DX4 | DX^2 | JX4 | JX^2 |
| 114 | 1 | M6 | M^3 | DX6 | DX^3 | JX6 | JX^3 |
| 115 | 1 | M8 | M^4 | DX8 | DX^4 | JX8 | JX^4 |
| 116 | 1 | M10 | M^5 | DX10 | DX^5 | JX10 | JX^5 |
| 117 | 1 | M12 | M^6 | DX12 | DX^6 | JX12 | JX^6 |
| 118 | 1 | M14 | M^7 | DX14 | DX^7 | JX14 | JX^7 |
| 119 | 1 | GND (Bank 1) | - | GND (Bank 1) | - | GND (Bank 1) | - |
| 120 | 1 | N0 | N^0 | FX0 | FX^0 | NX0 | NX^0 |
| 121 | 1 | N2 | N^1 | FX2 | FX^1 | NX2 | NX^1 |
| 122 | 1 | N4 | N^2 | FX4 | FX^2 | NX4 | NX^2 |
| 123 | 1 | N6 | N^3 | FX6 | FX^3 | NX6 | NX^3 |
| 124 | 1 | N8 | N^4 | FX8 | FX^4 | NX8 | NX^4 |
| 125 | 1 | N10 | N^5 | FX10 | FX^5 | NX10 | NX^5 |
| 126 | 1 | N12 | N^6 | FX12 | FX^6 | NX12 | NX^6 |
| 127 | 1 | N14 | N^7 | FX14 | FX^7 | NX14 | NX^7 |
| 128 | 1 | VCCO (Bank 1) | - | VCCO (Bank 1) | - | VCCO (Bank 1) | - |
| 129 | - | TDO | - | TDO | - | TDO | - |
| 130 | - | VCC | - | VCC | - | VCC | - |
| 131 | - | NC | - | NC | - | NC | - |
| 132 | - | NC | - | NC | - | NC | - |
| 133 | - | NC | - | NC | - | NC | - |
| 134 | - | GND | - | GND | - | GND | - |
| 135 | 1 | O14 | O^7 | GX14 | GX^7 | OX14 | OX^7 |
| 136 | 1 | O12 | O^6 | GX12 | GX^6 | OX12 | OX^6 |
| 137 | 1 | O10 | O^5 | GX10 | GX^5 | OX10 | OX^5 |
| 138 | 1 | O8 | O^4 | GX8 | GX^4 | OX8 | OX^4 |
| 139 | 1 | O6 | O^3 | GX6 | GX^3 | OX6 | OX^3 |
| 140 | 1 | O4 | O^2 | GX4 | GX^2 | OX4 | OX^2 |
| 141 | 1 | O2 | O^1 | GX2 | GX^1 | OX2 | OX^1 |

## ispMACH 4256V/B/C/Z, 4384V/B/C, 4512V/B/C, Logic Signal Connections: 176-Pin TQFP (Cont.)

| Pin Number | Bank Number | ispMACH 4256V/B/C/Z | | ispMACH 4384V/B/C | | ispMACH 4512V/B/C | |
|---|---|---|---|---|---|---|---|
| | | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP |
| 142 | 1 | O0 | O^0 | GX0 | GX^0 | OX0 | OX^0 |
| 143 | 1 | GND (Bank 1) | - | GND (Bank 1) | - | GND (Bank 1) | - |
| 144 | 1 | VCCO (Bank 1) | - | VCCO (Bank 1) | - | VCCO (Bank 1) | - |
| 145 | 1 | P14 | P^7 | HX14 | HX^7 | PX14 | PX^7 |
| 146 | 1 | P12 | P^6 | HX12 | HX^6 | PX12 | PX^6 |
| 147 | 1 | P10 | P^5 | HX10 | HX^5 | PX10 | PX^5 |
| 148 | 1 | P8 | P^4 | HX8 | HX^4 | PX8 | PX^4 |
| 149 | 1 | P6 | P^3 | HX6 | HX^3 | PX6 | PX^3 |
| 150 | 1 | P4 | P^2 | HX4 | HX^2 | PX4 | PX^2 |
| 151 | 1 | P2/GOE1 | P^1 | HX2/GOE1 | HX^1 | PX2/GOE1 | PX^1 |
| 152 | 1 | P0 | P^0 | HX0 | HX^0 | PX0 | PX^0 |
| 153 | - | GND | - | GND | - | GND | - |
| 154 | 1 | CLK3/I | - | CLK3/I | - | CLK3/I | - |
| 155 | 0 | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |
| 156 | 0 | CLK0/I | - | CLK0/I | - | CLK0/I | - |
| 157 | - | VCC | - | VCC | - | VCC | - |
| 158 | 0 | A0 | A^0 | A0 | A^0 | A0 | A^0 |
| 159 | 0 | A2/GOE0 | A^1 | A2/GOE0 | A^1 | A2//GOE0 | A^1 |
| 160 | 0 | A4 | A^2 | A4 | A^2 | A4 | A^2 |
| 161 | 0 | A6 | A^3 | A6 | A^3 | A6 | A^3 |
| 162 | 0 | A8 | A^4 | A8 | A^4 | A8 | A^4 |
| 163 | 0 | A10 | A^5 | A10 | A^5 | A10 | A^5 |
| 164 | 0 | A12 | A^6 | A12 | A^6 | A12 | A^6 |
| 165 | 0 | A14 | A^7 | A14 | A^7 | A14 | A^7 |
| 166 | 0 | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |
| 167 | 0 | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |
| 168 | 0 | B0 | B^0 | B0 | B^0 | B0 | B^0 |
| 169 | 0 | B2 | B^1 | B2 | B^1 | B2 | B^1 |
| 170 | 0 | B4 | B^2 | B4 | B^2 | B4 | B^2 |
| 171 | 0 | B6 | B^3 | B6 | B^3 | B6 | B^3 |
| 172 | 0 | B8 | B^4 | B8 | B^4 | B8 | B^4 |
| 173 | 0 | B10 | B^5 | B10 | B^5 | B10 | B^5 |
| 174 | 0 | B12 | B^6 | B12 | B^6 | B12 | B^6 |
| 175 | 0 | B14 | B^7 | B14 | B^7 | B14 | B^7 |
| 176 | - | VCC | - | VCC | - | VCC | - |

## ispMACH 4256V/B/C, 4384V/B/C, 4512V/B/C Logic Signal Connections: 256-Ball ftBGA/fpBGA (Cont.)

| Ball Number | I/O Bank | ispMACH 4256V/B/C 128-I/O | | ispMACH 4256V/B/C 160-I/O | | ispMACH 4384V/B/C | | ispMACH 4512V/B/C | |
|---|---|---|---|---|---|---|---|---|---|
| | | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP | GLB/MC/Pad | ORP |
| J6 | 0 | E14 | E^7 | E10 | E^7 | H14 | H^7 | J14 | J^7 |
| K3 | 0 | NC | - | E12 | E^8 | G0 | G^0 | I0 | I^0 |
| K4 | 0 | NC | - | E14 | E^9 | G2 | G^1 | I4 | I^1 |
| L1 | 0 | NC | - | NC | - | I14 | I^7 | K0 | K^0 |
| L2 | 0 | NC | - | NC | - | I12 | I^6 | K2 | K^1 |
| M1 | 0 | NC | - | NC | - | NC | - | K4 | K^2 |
| - | 0 | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |
| - | 0 | - | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |
| M2 | 0 | NC | - | NC | - | NC | - | K6 | K^3 |
| N1 | 0 | NC | - | NC | - | I10 | I^5 | K8 | K^4 |
| M3 | 0 | NC | - | NC | - | I8 | I^4 | K10 | K^5 |
| M4 | 0 | NC | - | F0 | F^0 | G4 | G^2 | I8 | I^2 |
| N2 | 0 | NC | - | F1 | F^1 | G6 | G^3 | I12 | I^3 |
| K5 | 0 | F0 | F^0 | F2 | F^2 | J0 | J^0 | N0 | N^0 |
| P1 | 0 | F2 | F^1 | F4 | F^3 | J2 | J^1 | N2 | N^1 |
| K6 | 0 | F4 | F^2 | F6 | F^4 | J4 | J^2 | N4 | N^2 |
| N3 | 0 | F6 | F^3 | F8 | F^5 | J6 | J^3 | N6 | N^3 |
| L5 | 0 | F8 | F^4 | F9 | F^6 | J8 | J^4 | N8 | N^4 |
| P2 | 0 | F10 | F^5 | F10 | F^7 | J10 | J^5 | N10 | N^5 |
| L6 | 0 | F12 | F^6 | F12 | F^8 | J12 | J^6 | N12 | N^6 |
| R1 | 0 | F14 | F^7 | F14 | F^9 | J14 | J^7 | N14 | N^7 |
| - | 0 | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |
| P3 | - | TCK | - | TCK | - | TCK | - | TCK | - |
| - | - | VCC | - | VCC | - | VCC | - | VCC | - |
| - | - | GND | - | GND | - | GND | - | GND | - |
| - | 0 | - | - | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |
| T2 | 0 | NC | - | G14 | G^9 | I6 | I^3 | K12 | K^6 |
| M5 | 0 | NC | - | G12 | G^8 | I4 | I^2 | K14 | K^7 |
| N4 | 0 | G14 | G^7 | G10 | G^7 | K14 | K^7 | O14 | O^7 |
| T3 | 0 | G12 | G^6 | G9 | G^6 | K12 | K^6 | O12 | O^6 |
| R3 | 0 | G10 | G^5 | G8 | G^5 | K10 | K^5 | O10 | O^5 |
| M6 | 0 | G8 | G^4 | G6 | G^4 | K8 | K^4 | O8 | O^4 |
| P4 | 0 | G6 | G^3 | G4 | G^3 | K6 | K^3 | O6 | O^3 |
| L7 | 0 | G4 | G^2 | G2 | G^2 | K4 | K^2 | O4 | O^2 |
| N5 | 0 | G2 | G^1 | G1 | G^1 | K2 | K^1 | O2 | O^1 |
| M7 | 0 | G0 | G^0 | G0 | G^0 | K0 | K^0 | O0 | O^0 |
| P5 | 0 | NC | - | NC | - | G8 | G^4 | M0 | M^0 |
| R4 | 0 | NC | - | NC | - | G10 | G^5 | M4 | M^1 |
| T4 | 0 | NC | - | NC | - | NC | - | L0 | L^0 |
| - | 0 | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - | GND (Bank 0) | - |
| - | 0 | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - | VCCO (Bank 0) | - |

# Ordering Information

Note: ispMACH 4000 devices are all dual marked except the slowest commercial speed grade ispMACH 4000Z devices. For example, the commercial speed grade LC4128C-5T100C is also marked with the industrial grade -75I. The commercial grade is always one speed grade faster than the associated dual mark industrial grade. The slowest commercial speed grade ispMACH 4000Z devices are marked as commercial grade only.

## Conventional Packaging

**ispMACH 4000ZC (Zero Power, 1.8V) Commercial Devices**

| Device | Part Number | Macrocells | Voltage | $t_{PD}$ | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4032ZC | LC4032ZC-35M56C | 32 | 1.8 | 3.5 | csBGA | 56 | 32 | C |
| | LC4032ZC-5M56C | 32 | 1.8 | 5 | csBGA | 56 | 32 | C |
| | LC4032ZC-75M56C | 32 | 1.8 | 7.5 | csBGA | 56 | 32 | C |
| | LC4032ZC-35T48C | 32 | 1.8 | 3.5 | TQFP | 48 | 32 | C |
| | LC4032ZC-5T48C | 32 | 1.8 | 5 | TQFP | 48 | 32 | C |
| | LC4032ZC-75T48C | 32 | 1.8 | 7.5 | TQFP | 48 | 32 | C |
| LC4064ZC | LC4064ZC-37M132C | 64 | 1.8 | 3.7 | csBGA | 132 | 64 | C |
| | LC4064ZC-5M132C | 64 | 1.8 | 5 | csBGA | 132 | 64 | C |
| | LC4064ZC-75M132C | 64 | 1.8 | 7.5 | csBGA | 132 | 64 | C |
| | LC4064ZC-37T100C | 64 | 1.8 | 3.7 | TQFP | 100 | 64 | C |
| | LC4064ZC-5T100C | 64 | 1.8 | 5 | TQFP | 100 | 64 | C |
| | LC4064ZC-75T100C | 64 | 1.8 | 7.5 | TQFP | 100 | 64 | C |
| | LC4064ZC-37M56C | 64 | 1.8 | 3.7 | csBGA | 56 | 32 | C |
| | LC4064ZC-5M56C | 64 | 1.8 | 5 | csBGA | 56 | 32 | C |
| | LC4064ZC-75M56C | 64 | 1.8 | 7.5 | csBGA | 56 | 32 | C |
| | LC4064ZC-37T48C | 64 | 1.8 | 3.7 | TQFP | 48 | 32 | C |
| | LC4064ZC-5T48C | 64 | 1.8 | 5 | TQFP | 48 | 32 | C |
| | LC4064ZC-75T48C | 64 | 1.8 | 7.5 | TQFP | 48 | 32 | C |
| LC4128ZC | LC4128ZC-42M132C | 128 | 1.8 | 4.2 | csBGA | 132 | 96 | C |
| | LC4128ZC-75M132C | 128 | 1.8 | 7.5 | csBGA | 132 | 96 | C |
| | LC4128ZC-42T100C | 128 | 1.8 | 4.2 | TQFP | 100 | 64 | C |
| | LC4128ZC-75T100C | 128 | 1.8 | 7.5 | TQFP | 100 | 64 | C |
| LC4256ZC | LC4256ZC-45T176C | 256 | 1.8 | 4.5 | TQFP | 176 | 128 | C |
| | LC4256ZC-75T176C | 256 | 1.8 | 7.5 | TQFP | 176 | 128 | C |
| | LC4256ZC-45M132C | 256 | 1.8 | 4.5 | csBGA | 132 | 96 | C |
| | LC4256ZC-75M132C | 256 | 1.8 | 7.5 | csBGA | 132 | 96 | C |
| | LC4256ZC-45T100C | 256 | 1.8 | 4.5 | TQFP | 100 | 64 | C |
| | LC4256ZC-75T100C | 256 | 1.8 | 7.5 | TQFP | 100 | 64 | C |

**ispMACH 4000ZC (1.8V, Zero Power) Industrial Devices**

| Device | Part Number | Macrocells | Voltage | tPD | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4032ZC | LC4032ZC-5M56I | 32 | 1.8 | 5 | csBGA | 56 | 32 | I |
| | LC4032ZC-75M56I | 32 | 1.8 | 7.5 | csBGA | 56 | 32 | I |
| | LC4032ZC-5T48I | 32 | 1.8 | 5 | TQFP | 48 | 32 | I |
| | LC4032ZC-75T48I | 32 | 1.8 | 7.5 | TQFP | 48 | 32 | I |

**ispMACH 4000ZC (1.8V, Zero Power) Industrial Devices (Cont.)**

| Device | Part Number | Macrocells | Voltage | tPD | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4064ZC | LC4064ZC-5M132I | 64 | 1.8 | 5 | csBGA | 132 | 64 | I |
| | LC4064ZC-75M132I | 64 | 1.8 | 7.5 | csBGA | 132 | 64 | I |
| | LC4064ZC-5T100I | 64 | 1.8 | 5 | TQFP | 100 | 64 | I |
| | LC4064ZC-75T100I | 64 | 1.8 | 7.5 | TQFP | 100 | 64 | I |
| | LC4064ZC-5M56I | 64 | 1.8 | 5 | csBGA | 56 | 34 | I |
| | LC4064ZC-75M56I | 64 | 1.8 | 7.5 | csBGA | 56 | 34 | I |
| | LC4064ZC-5T48I | 64 | 1.8 | 5 | TQFP | 48 | 32 | I |
| | LC4064ZC-75T48I | 64 | 1.8 | 7.5 | TQFP | 48 | 32 | I |
| LC4128ZC | LC4128ZC-75M132I | 128 | 1.8 | 7.5 | csBGA | 132 | 96 | I |
| | LC4128ZC-75T100I | 128 | 1.8 | 7.5 | TQFP | 100 | 64 | I |
| LC4256ZC | LC4256ZC-75T176I | 256 | 1.8 | 7.5 | TQFP | 176 | 128 | I |
| | LC4256ZC-75M132I | 256 | 1.8 | 7.5 | csBGA | 132 | 96 | I |
| | LC4256ZC-75T100I | 256 | 1.8 | 7.5 | TQFP | 100 | 64 | I |

**ispMACH 4000ZC (1.8V, Zero Power) Extended Temperature Devices**

| Family | Part Number | Macrocells | Voltage | $t_{PD}$ | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4032ZC | LC4032ZC-75T48E | 32 | 1.8 | 7.5 | TQFP | 48 | 32 | E |
| LC4064ZC | LC4064ZC-75T100E | 64 | 1.8 | 7.5 | TQFP | 100 | 64 | E |
| | LC4064ZC-75T48E | 64 | 1.8 | 7.5 | TQFP | 48 | 32 | E |
| LC4128ZC | LC4128ZC-75T100E | 128 | 1.8 | 7.5 | TQFP | 100 | 64 | E |
| LC4256ZC | LC4256ZC-75T176E | 256 | 1.8 | 7.5 | TQFP | 176 | 128 | E |
| | LC4256ZC-75T100E | 256 | 1.8 | 7.5 | TQFP | 100 | 64 | E |

**ispMACH 4000C (1.8V) Commercial Devices**

| Device | Part Number | Macrocells | Voltage | $t_{PD}$ | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4032C | LC4032C-25T48C | 32 | 1.8 | 2.5 | TQFP | 48 | 32 | C |
| | LC4032C-5T48C | 32 | 1.8 | 5 | TQFP | 48 | 32 | C |
| | LC4032C-75T48C | 32 | 1.8 | 7.5 | TQFP | 48 | 32 | C |
| | LC4032C-25T44C | 32 | 1.8 | 2.5 | TQFP | 44 | 30 | C |
| | LC4032C-5T44C | 32 | 1.8 | 5 | TQFP | 44 | 30 | C |
| | LC4032C-75T44C | 32 | 1.8 | 7.5 | TQFP | 44 | 30 | C |
| LC4064C | LC4064C-25T100C | 64 | 1.8 | 2.5 | TQFP | 100 | 64 | C |
| | LC4064C-5T100C | 64 | 1.8 | 5 | TQFP | 100 | 64 | C |
| | LC4064C-75T100C | 64 | 1.8 | 7.5 | TQFP | 100 | 64 | C |
| | LC4064C-25T48C | 64 | 1.8 | 2.5 | TQFP | 48 | 32 | C |
| | LC4064C-5T48C | 64 | 1.8 | 5 | TQFP | 48 | 32 | C |
| | LC4064C-75T48C | 64 | 1.8 | 7.5 | TQFP | 48 | 32 | C |
| | LC4064C-25T44C | 64 | 1.8 | 2.5 | TQFP | 44 | 30 | C |
| | LC4064C-5T44C | 64 | 1.8 | 5 | TQFP | 44 | 30 | C |
| | LC4064C-75T44C | 64 | 1.8 | 7.5 | TQFP | 44 | 30 | C |

**ispMACH 4000V (3.3V) Industrial Devices (Cont.)**

| Family | Part Number | Macrocells | Voltage | $t_{PD}$ | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4256V | LC4256V-5FT256AI | 256 | 3.3 | 5 | ftBGA | 256 | 128 | I |
| | LC4256V-75FT256AI | 256 | 3.3 | 7.5 | ftBGA | 256 | 128 | I |
| | LC4256V-10FT256AI | 256 | 3.3 | 10 | ftBGA | 256 | 128 | I |
| | LC4256V-5FT256BI | 256 | 3.3 | 5 | ftBGA | 256 | 160 | I |
| | LC4256V-75FT256BI | 256 | 3.3 | 7.5 | ftBGA | 256 | 160 | I |
| | LC4256V-10FT256BI | 256 | 3.3 | 10 | ftBGA | 256 | 160 | I |
| | LC4256V-5F256AI[1] | 256 | 3.3 | 5 | fpBGA | 256 | 128 | I |
| | LC4256V-75F256AI[1] | 256 | 3.3 | 7.5 | fpBGA | 256 | 128 | I |
| | LC4256V-10F256AI[1] | 256 | 3.3 | 10 | fpBGA | 256 | 128 | I |
| | LC4256V-5F256BI[1] | 256 | 3.3 | 5 | fpBGA | 256 | 160 | I |
| | LC4256V-75F256BI[1] | 256 | 3.3 | 7.5 | fpBGA | 256 | 160 | I |
| | LC4256V-10F256BI[1] | 256 | 3.3 | 10 | fpBGA | 256 | 160 | I |
| | LC4256V-5T176I | 256 | 3.3 | 5 | TQFP | 176 | 128 | I |
| | LC4256V-75T176I | 256 | 3.3 | 7.5 | TQFP | 176 | 128 | I |
| | LC4256V-10T176I | 256 | 3.3 | 10 | TQFP | 176 | 128 | I |
| | LC4256V-5T144I | 256 | 3.3 | 5 | TQFP | 144 | 96 | I |
| | LC4256V-75T144I | 256 | 3.3 | 7.5 | TQFP | 144 | 96 | I |
| | LC4256V-10T144I | 256 | 3.3 | 10 | TQFP | 144 | 96 | I |
| | LC4256V-5T100I | 256 | 3.3 | 5 | TQFP | 100 | 64 | I |
| | LC4256V-75T100I | 256 | 3.3 | 7.5 | TQFP | 100 | 64 | I |
| | LC4256V-10T100I | 256 | 3.3 | 10 | TQFP | 100 | 64 | I |
| LC4384V | LC4384V-5FT256I | 384 | 3.3 | 5 | ftBGA | 256 | 192 | I |
| | LC4384V-75FT256I | 384 | 3.3 | 7.5 | ftBGA | 256 | 192 | I |
| | LC4384V-10FT256I | 384 | 3.3 | 10 | ftBGA | 256 | 192 | I |
| | LC4384V-5F256I[1] | 384 | 3.3 | 5 | fpBGA | 256 | 192 | I |
| | LC4384V-75F256I[1] | 384 | 3.3 | 7.5 | fpBGA | 256 | 192 | I |
| | LC4384V-10F256I[1] | 384 | 3.3 | 10 | fpBGA | 256 | 192 | I |
| | LC4384V-5T176I | 384 | 3.3 | 5 | TQFP | 176 | 128 | I |
| | LC4384V-75T176I | 384 | 3.3 | 7.5 | TQFP | 176 | 128 | I |
| | LC4384V-10T176I | 384 | 3.3 | 10 | TQFP | 176 | 128 | I |
| LC4512V | LC4512V-5FT256I | 512 | 3.3 | 5 | ftBGA | 256 | 208 | I |
| | LC4512V-75FT256I | 512 | 3.3 | 7.5 | ftBGA | 256 | 208 | I |
| | LC4512V-10FT256I | 512 | 3.3 | 10 | ftBGA | 256 | 208 | I |
| | LC4512V-5F256I[1] | 512 | 3.3 | 5 | fpBGA | 256 | 208 | I |
| | LC4512V-75F256I[1] | 512 | 3.3 | 7.5 | fpBGA | 256 | 208 | I |
| | LC4512V-10F256I[1] | 512 | 3.3 | 10 | fpBGA | 256 | 208 | I |
| | LC4512V-5T176I | 512 | 3.3 | 5 | TQFP | 176 | 128 | I |
| | LC4512V-75T176I | 512 | 3.3 | 7.5 | TQFP | 176 | 128 | I |
| | LC4512V-10T176I | 512 | 3.3 | 10 | TQFP | 176 | 128 | I |

1. Use ftBGA package. fpBGA package devices have been discontinued via PCN#14A-07.

**ispMACH 4000C (1.8V) Lead-Free Industrial Devices (Cont.)**

| Device | Part Number | Macrocells | Voltage | $t_{PD}$ | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4256C | LC4256C-5FTN256AI | 256 | 1.8 | 5 | Lead-free ftBGA | 256 | 128 | I |
| | LC4256C-75FTN256AI | 256 | 1.8 | 7.5 | Lead-free ftBGA | 256 | 128 | I |
| | LC4256C-10FTN256AI | 256 | 1.8 | 10 | Lead-free ftBGA | 256 | 128 | I |
| | LC4256C-5FTN256BI | 256 | 1.8 | 5 | Lead-free ftBGA | 256 | 160 | I |
| | LC4256C-75FTN256BI | 256 | 1.8 | 7.5 | Lead-free ftBGA | 256 | 160 | I |
| | LC4256C-10FTN256BI | 256 | 1.8 | 10 | Lead-free ftBGA | 256 | 160 | I |
| | LC4256C-5FN256AI[1] | 256 | 1.8 | 5 | Lead-free fpBGA | 256 | 128 | I |
| | LC4256C-75FN256AI[1] | 256 | 1.8 | 7.5 | Lead-free fpBGA | 256 | 128 | I |
| | LC4256C-10FN256AI[1] | 256 | 1.8 | 10 | Lead-free fpBGA | 256 | 128 | I |
| | LC4256C-5FN256BI[1] | 256 | 1.8 | 5 | Lead-free fpBGA | 256 | 160 | I |
| | LC4256C-75FN256BI[1] | 256 | 1.8 | 7.5 | Lead-free fpBGA | 256 | 160 | I |
| | LC4256C-10FN256BI[1] | 256 | 1.8 | 10 | Lead-free fpBGA | 256 | 160 | I |
| | LC4256C-5TN176I | 256 | 1.8 | 5 | Lead-free TQFP | 176 | 128 | I |
| | LC4256C-75TN176I | 256 | 1.8 | 7.5 | Lead-free TQFP | 176 | 128 | I |
| | LC4256C-10TN176I | 256 | 1.8 | 10 | Lead-free TQFP | 176 | 128 | I |
| | LC4256C-5TN100I | 256 | 1.8 | 5 | Lead-free TQFP | 100 | 64 | I |
| | LC4256C-75TN100I | 256 | 1.8 | 7.5 | Lead-free TQFP | 100 | 64 | I |
| | LC4256C-10TN100I | 256 | 1.8 | 10 | Lead-free TQFP | 100 | 64 | I |
| LC4384C | LC4384C-5FTN256I | 384 | 1.8 | 5 | Lead-free ftBGA | 256 | 192 | I |
| | LC4384C-75FTN256I | 384 | 1.8 | 7.5 | Lead-free ftBGA | 256 | 192 | I |
| | LC4384C-10FTN256I | 384 | 1.8 | 10 | Lead-free ftBGA | 256 | 192 | I |
| | LC4384C-5FN256I[1] | 384 | 1.8 | 5 | Lead-free fpBGA | 256 | 192 | I |
| | LC4384C-75FN256I[1] | 384 | 1.8 | 7.5 | Lead-free fpBGA | 256 | 192 | I |
| | LC4384C-10FN256I[1] | 384 | 1.8 | 10 | Lead-free fpBGA | 256 | 192 | I |
| | LC4384C-5TN176I | 384 | 1.8 | 5 | Lead-free TQFP | 176 | 128 | I |
| | LC4384C-75TN176I | 384 | 1.8 | 7.5 | Lead-free TQFP | 176 | 128 | I |
| | LC4384C-10TN176I | 384 | 1.8 | 10 | Lead-free TQFP | 176 | 128 | I |
| LC4512C | LC4512C-5FTN256I | 512 | 1.8 | 5 | Lead-free ftBGA | 256 | 208 | I |
| | LC4512C-75FTN256I | 512 | 1.8 | 7.5 | Lead-free ftBGA | 256 | 208 | I |
| | LC4512C-10FTN256I | 512 | 1.8 | 10 | Lead-free ftBGA | 256 | 208 | I |
| | LC4512C-5FN256I[1] | 512 | 1.8 | 5 | Lead-free fpBGA | 256 | 208 | I |
| | LC4512C-75FN256I[1] | 512 | 1.8 | 7.5 | Lead-free fpBGA | 256 | 208 | I |
| | LC4512C-10FN256I[1] | 512 | 1.8 | 10 | Lead-free fpBGA | 256 | 208 | I |
| | LC4512C-5TN176I | 512 | 1.8 | 5 | Lead-free TQFP | 176 | 128 | I |
| | LC4512C-75TN176I | 512 | 1.8 | 7.5 | Lead-free TQFP | 176 | 128 | I |
| | LC4512C-10TN176I | 512 | 1.8 | 10 | Lead-free TQFP | 176 | 128 | I |

1. Use ftBGA package. fpBGA package devices have been discontinued via PCN#14A-07.

**ispMACH 4000B (2.5V) Lead-Free Commercial Devices (Cont.)**

| Device | Part Number | Macrocells | Voltage | $t_{PD}$ | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4384B | LC4384B-35FTN256C | 384 | 2.5 | 3.5 | Lead-Free ftBGA | 256 | 192 | C |
| | LC4384B-5FTN256C | 384 | 2.5 | 5 | Lead-Free ftBGA | 256 | 192 | C |
| | LC4384B-75FTN256C | 384 | 2.5 | 7.5 | Lead-Free ftBGA | 256 | 192 | C |
| | LC4384B-35FN256C[1] | 384 | 2.5 | 3.5 | Lead-Free fpBGA | 256 | 192 | C |
| | LC4384B-5FN256C[1] | 384 | 2.5 | 5 | Lead-Free fpBGA | 256 | 192 | C |
| | LC4384B-75FN256C[1] | 384 | 2.5 | 7.5 | Lead-Free fpBGA | 256 | 192 | C |
| | LC4384B-35TN176C | 384 | 2.5 | 3.5 | Lead-Free TQFP | 176 | 128 | C |
| | LC4384B-5TN176C | 384 | 2.5 | 5 | Lead-Free TQFP | 176 | 128 | C |
| | LC4384B-75TN176C | 384 | 2.5 | 7.5 | Lead-Free TQFP | 176 | 128 | C |
| LC4512B | LC4512B-35FTN256C | 512 | 2.5 | 3.5 | Lead-Free ftBGA | 256 | 208 | C |
| | LC4512B-5FTN256C | 512 | 2.5 | 5 | Lead-Free ftBGA | 256 | 208 | C |
| | LC4512B-75FTN256C | 512 | 2.5 | 7.5 | Lead-Free ftBGA | 256 | 208 | C |
| | LC4512B-35FN256C[1] | 512 | 2.5 | 3.5 | Lead-Free fpBGA | 256 | 208 | C |
| | LC4512B-5FN256C[1] | 512 | 2.5 | 5 | Lead-Free fpBGA | 256 | 208 | C |
| | LC4512B-75FN256C[1] | 512 | 2.5 | 7.5 | Lead-Free fpBGA | 256 | 208 | C |
| | LC4512B-35TN176C | 512 | 2.5 | 3.5 | Lead-Free TQFP | 176 | 128 | C |
| | LC4512B-5TN176C | 512 | 2.5 | 5 | Lead-Free TQFP | 176 | 128 | C |
| | LC4512B-75TN176C | 512 | 2.5 | 7.5 | Lead-Free TQFP | 176 | 128 | C |

1. Use ftBGA package. fpBGA package devices have been discontinued via PCN#14A-07.

**ispMACH 4000B (2.5V) Lead-Free Industrial Devices**

| Device | Part Number | Macrocells | Voltage | $t_{PD}$ | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4032B | LC4032B-5TN48I | 32 | 2.5 | 5 | Lead-Free TQFP | 48 | 32 | I |
| | LC4032B-75TN48I | 32 | 2.5 | 7.5 | Lead-Free TQFP | 48 | 32 | I |
| | LC4032B-10TN48I | 32 | 2.5 | 10 | Lead-Free TQFP | 48 | 32 | I |
| | LC4032B-5TN44I | 32 | 2.5 | 5 | Lead-Free TQFP | 44 | 30 | I |
| | LC4032B-75TN44I | 32 | 2.5 | 7.5 | Lead-Free TQFP | 44 | 30 | I |
| | LC4032B-10TN44I | 32 | 2.5 | 10 | Lead-Free TQFP | 44 | 30 | I |
| LC4064B | LC4064B-5TN100I | 64 | 2.5 | 5 | Lead-Free TQFP | 100 | 64 | I |
| | LC4064B-75TN100I | 64 | 2.5 | 7.5 | Lead-Free TQFP | 100 | 64 | I |
| | LC4064B-10TN100I | 64 | 2.5 | 10 | Lead-Free TQFP | 100 | 64 | I |
| | LC4064B-5TN48I | 64 | 2.5 | 5 | Lead-Free TQFP | 48 | 32 | I |
| | LC4064B-75TN48I | 64 | 2.5 | 7.5 | Lead-Free TQFP | 48 | 32 | I |
| | LC4064B-10TN48I | 64 | 2.5 | 10 | Lead-Free TQFP | 48 | 32 | I |
| | LC4064B-5TN44I | 64 | 2.5 | 5 | Lead-Free TQFP | 44 | 30 | I |
| | LC4064B-75TN44I | 64 | 2.5 | 7.5 | Lead-Free TQFP | 44 | 30 | I |
| | LC4064B-10TN44I | 64 | 2.5 | 10 | Lead-Free TQFP | 44 | 30 | I |

**ispMACH 4000B (2.5V) Lead-Free Industrial Devices (Cont.)**

| Device | Part Number | Macrocells | Voltage | $t_{PD}$ | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4128B | LC4128B-5TN128I | 128 | 2.5 | 5 | Lead-Free TQFP | 128 | 92 | I |
| | LC4128B-75TN128I | 128 | 2.5 | 7.5 | Lead-Free TQFP | 128 | 92 | I |
| | LC4128B-10TN128I | 128 | 2.5 | 10 | Lead-Free TQFP | 128 | 92 | I |
| | LC4128B-5TN100I | 128 | 2.5 | 5 | Lead-Free TQFP | 100 | 64 | I |
| | LC4128B-75TN100I | 128 | 2.5 | 7.5 | Lead-Free TQFP | 100 | 64 | I |
| | LC4128B-10TN100I | 128 | 2.5 | 10 | Lead-Free TQFP | 100 | 64 | I |
| LC4256B | LC4256B-5FTN256AI | 256 | 2.5 | 5 | Lead-Free ftBGA | 256 | 128 | I |
| | LC4256B-75FTN256AI | 256 | 2.5 | 7.5 | Lead-Free ftBGA | 256 | 128 | I |
| | LC4256B-10FTN256AI | 256 | 2.5 | 10 | Lead-Free ftBGA | 256 | 128 | I |
| | LC4256B-5FTN256BI | 256 | 2.5 | 5 | Lead-Free ftBGA | 256 | 160 | I |
| | LC4256B-75FTN256BI | 256 | 2.5 | 7.5 | Lead-Free ftBGA | 256 | 160 | I |
| | LC4256B-10FTN256BI | 256 | 2.5 | 10 | Lead-Free ftBGA | 256 | 160 | I |
| | LC4256B-5FN256AI[1] | 256 | 2.5 | 5 | Lead-Free fpBGA | 256 | 128 | I |
| | LC4256B-75FN256AI[1] | 256 | 2.5 | 7.5 | Lead-Free fpBGA | 256 | 128 | I |
| | LC4256B-10FN256AI[1] | 256 | 2.5 | 10 | Lead-Free fpBGA | 256 | 128 | I |
| | LC4256B-5FN256BI[1] | 256 | 2.5 | 5 | Lead-Free fpBGA | 256 | 160 | I |
| | LC4256B-75FN256BI[1] | 256 | 2.5 | 7.5 | Lead-Free fpBGA | 256 | 160 | I |
| | LC4256B-10FN256BI[1] | 256 | 2.5 | 10 | Lead-Free fpBGA | 256 | 160 | I |
| | LC4256B-5TN176I | 256 | 2.5 | 5 | Lead-Free TQFP | 176 | 128 | I |
| | LC4256B-75TN176I | 256 | 2.5 | 7.5 | Lead-Free TQFP | 176 | 128 | I |
| | LC4256B-10TN176I | 256 | 2.5 | 10 | Lead-Free TQFP | 176 | 128 | I |
| | LC4256B-5TN100I | 256 | 2.5 | 5 | Lead-Free TQFP | 100 | 64 | I |
| | LC4256B-75TN100I | 256 | 2.5 | 7.5 | Lead-Free TQFP | 100 | 64 | I |
| | LC4256B-10TN100I | 256 | 2.5 | 10 | Lead-Free TQFP | 100 | 64 | I |
| LC4384B | LC4384B-5FTN256I | 384 | 2.5 | 5 | Lead-Free ftBGA | 256 | 192 | I |
| | LC4384B-75FTN256I | 384 | 2.5 | 7.5 | Lead-Free ftBGA | 256 | 192 | I |
| | LC4384B-10FTN256I | 384 | 2.5 | 10 | Lead-Free ftBGA | 256 | 192 | I |
| | LC4384B-5FN256I[1] | 384 | 2.5 | 5 | Lead-Free fpBGA | 256 | 192 | I |
| | LC4384B-75FN256I[1] | 384 | 2.5 | 7.5 | Lead-Free fpBGA | 256 | 192 | I |
| | LC4384B-10FN256I[1] | 384 | 2.5 | 10 | Lead-Free fpBGA | 256 | 192 | I |
| | LC4384B-5TN176I | 384 | 2.5 | 5 | Lead-Free TQFP | 176 | 128 | I |
| | LC4384B-75TN176I | 384 | 2.5 | 7.5 | Lead-Free TQFP | 176 | 128 | I |
| | LC4384B-10TN176I | 384 | 2.5 | 10 | Lead-Free TQFP | 176 | 128 | I |
| LC4512B | LC4512B-5FTN256I | 512 | 2.5 | 5 | Lead-Free ftBGA | 256 | 208 | I |
| | LC4512B-75FTN256I | 512 | 2.5 | 7.5 | Lead-Free ftBGA | 256 | 208 | I |
| | LC4512B-10FTN256I | 512 | 2.5 | 10 | Lead-Free ftBGA | 256 | 208 | I |
| | LC4512B-5FN256I[1] | 512 | 2.5 | 5 | Lead-Free fpBGA | 256 | 208 | I |
| | LC4512B-75FN256I[1] | 512 | 2.5 | 7.5 | Lead-Free fpBGA | 256 | 208 | I |
| | LC4512B-10FN256I[1] | 512 | 2.5 | 10 | Lead-Free fpBGA | 256 | 208 | I |
| | LC4512B-5TN176I | 512 | 2.5 | 5 | Lead-Free TQFP | 176 | 128 | I |
| | LC4512B-75TN176I | 512 | 2.5 | 7.5 | Lead-Free TQFP | 176 | 128 | I |
| | LC4512B-10TN176I | 512 | 2.5 | 10 | Lead-Free TQFP | 176 | 128 | I |

1. Use ftBGA package. fpBGA package devices have been discontinued via PCN#14A-07.

**ispMACH 4000V (3.3V) Lead-Free Industrial Devices (Cont.)**

| Device | Part Number | Macrocells | Voltage | $t_{PD}$ | Package | Pin/Ball Count | I/O | Grade |
|---|---|---|---|---|---|---|---|---|
| LC4256V | LC4256V-5FTN256AI | 256 | 3.3 | 5 | Lead-free ftBGA | 256 | 128 | I |
| | LC4256V-75FTN256AI | 256 | 3.3 | 7.5 | Lead-free ftBGA | 256 | 128 | I |
| | LC4256V-10FTN256AI | 256 | 3.3 | 10 | Lead-free ftBGA | 256 | 128 | I |
| | LC4256V-5FTN256BI | 256 | 3.3 | 5 | Lead-free ftBGA | 256 | 160 | I |
| | LC4256V-75FTN256BI | 256 | 3.3 | 7.5 | Lead-free ftBGA | 256 | 160 | I |
| | LC4256V-10FTN256BI | 256 | 3.3 | 10 | Lead-free ftBGA | 256 | 160 | I |
| | LC4256V-5FN256AI[1] | 256 | 3.3 | 5 | Lead-free fpBGA | 256 | 128 | I |
| | LC4256V-75FN256AI[1] | 256 | 3.3 | 7.5 | Lead-free fpBGA | 256 | 128 | I |
| | LC4256V-10FN256AI[1] | 256 | 3.3 | 10 | Lead-free fpBGA | 256 | 128 | I |
| | LC4256V-5FN256BI[1] | 256 | 3.3 | 5 | Lead-free fpBGA | 256 | 160 | I |
| | LC4256V-75FN256BI[1] | 256 | 3.3 | 7.5 | Lead-free fpBGA | 256 | 160 | I |
| | LC4256V-10FN256BI[1] | 256 | 3.3 | 10 | Lead-free fpBGA | 256 | 160 | I |
| | LC4256V-5TN176I | 256 | 3.3 | 5 | Lead-free TQFP | 176 | 128 | I |
| | LC4256V-75TN176I | 256 | 3.3 | 7.5 | Lead-free TQFP | 176 | 128 | I |
| | LC4256V-10TN176I | 256 | 3.3 | 10 | Lead-free TQFP | 176 | 128 | I |
| | LC4256V-5TN144I | 256 | 3.3 | 5 | Lead-free TQFP | 144 | 96 | I |
| | LC4256V-75TN144I | 256 | 3.3 | 7.5 | Lead-free TQFP | 144 | 96 | I |
| | LC4256V-10TN144I | 256 | 3.3 | 10 | Lead-free TQFP | 144 | 96 | I |
| | LC4256V-5TN100I | 256 | 3.3 | 5 | Lead-free TQFP | 100 | 64 | I |
| | LC4256V-75TN100I | 256 | 3.3 | 7.5 | Lead-free TQFP | 100 | 64 | I |
| | LC4256V-10TN100I | 256 | 3.3 | 10 | Lead-free TQFP | 100 | 64 | I |
| LC4384V | LC4384V-5FTN256I | 384 | 3.3 | 5 | Lead-free ftBGA | 256 | 192 | I |
| | LC4384V-75FTN256I | 384 | 3.3 | 7.5 | Lead-free ftBGA | 256 | 192 | I |
| | LC4384V-10FTN256I | 384 | 3.3 | 10 | Lead-free ftBGA | 256 | 192 | I |
| | LC4384V-5FN256I[1] | 384 | 3.3 | 5 | Lead-free fpBGA | 256 | 192 | I |
| | LC4384V-75FN256I[1] | 384 | 3.3 | 7.5 | Lead-free fpBGA | 256 | 192 | I |
| | LC4384V-10FN256I[1] | 384 | 3.3 | 10 | Lead-free fpBGA | 256 | 192 | I |
| | LC4384V-5TN176I | 384 | 3.3 | 5 | Lead-free TQFP | 176 | 128 | I |
| | LC4384V-75TN176I | 384 | 3.3 | 7.5 | Lead-free TQFP | 176 | 128 | I |
| | LC4384V-10TN176I | 384 | 3.3 | 10 | Lead-free TQFP | 176 | 128 | I |
| LC4512V | LC4512V-5FTN256I | 512 | 3.3 | 5 | Lead-free ftBGA | 256 | 208 | I |
| | LC4512V-75FTN256I | 512 | 3.3 | 7.5 | Lead-free ftBGA | 256 | 208 | I |
| | LC4512V-10FTN256I | 512 | 3.3 | 10 | Lead-free ftBGA | 256 | 208 | I |
| | LC4512V-5FN256I[1] | 512 | 3.3 | 5 | Lead-free fpBGA | 256 | 208 | I |
| | LC4512V-75FN256I[1] | 512 | 3.3 | 7.5 | Lead-free fpBGA | 256 | 208 | I |
| | LC4512V-10FN256I[1] | 512 | 3.3 | 10 | Lead-free fpBGA | 256 | 208 | I |
| | LC4512V-5TN176I | 512 | 3.3 | 5 | Lead-free TQFP | 176 | 128 | I |
| | LC4512V-75TN176I | 512 | 3.3 | 7.5 | Lead-free TQFP | 176 | 128 | I |
| | LC4512V-10TN176I | 512 | 3.3 | 10 | Lead-free TQFP | 176 | 128 | I |

1. Use ftBGA package. fpBGA package devices have been discontinued via PCN#14A-07.

## Revision History (Cont.)

| Date | Version | Change Summary |
|---|---|---|
| January 2004 | 20z | ispMACH 4000Z data sheet status changed from preliminary to final. Documents production release of the ispMACH 4256Z device. |
| | | Added new feature - ispMACH 4000Z supports operation down to 1.6V. |
| | | Added lead-free packaging ordering part numbers for the ispMACH 4000Z/C/V devices. |
| April 2004 | 21z | Updated $I_{PU}$ (I/O Weak Pull-up Resistor Current) max. specification for the ispMACH 4000V/B/C; -150µA to -200µA. |
| November 2004 | 22z | Added User Electronic Signature section. |
| | | Added ispMACH 4000B (2.5V) Lead-Free Ordering Part Numbers. |
| December 2004 | 22z.1 | Updated Further Information section. |
| February 2006 | 22z.2 | Clarification to ispMACH 4000Z Input Leakage ($I_{IH}$) specification. |
| March 2007 | 22.3 | Updated ispMACH 4000 Introduction section. |
| | | Updated Signal Descriptions table. |
| June 2007 | 22.4 | Updated Features bullets to include reference to “LA” automotive data sheet under the “Broad Device Offering” bullet. |
| | | Added footnote 1 to Part Number Description to reference the “LA” automotive data sheet. |
| | | Changed device temperature references from ‘Automotive’ to “Extended Temperature” for non-AEC-Q100 qualified devices. |
| November 2007 | 23.0 | Added 256-ftBGA package Ordering Part Number information per PCN#14A-07. |
| May 2009 | 23.1 | Correction to $t_{CW}$, $t_{GW}$, $t_{WIR}$ and $f_{MAX}$ parameters in ispMACH 4000Z External Switching Characteristics table. |
| | | Correction to $t_{CW}$, $t_{GW}$, $t_{WIR}$ and $f_{MAX}$ parameters in ispMACH 4000V/B/C External Switching Characteristics table. |