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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	10 ns
Voltage Supply - Internal	2.3V ~ 2.7V
Number of Logic Elements/Blocks	16
Number of Macrocells	256
Number of Gates	-
Number of I/O	128
Operating Temperature	-40°C ~ 105°C (TJ)
Mounting Type	Surface Mount
Package / Case	256-LBGA
Supplier Device Package	256-FTBGA (17x17)
Purchase URL	https://www.e-xfl.com/product-detail/lattice-semiconductor/lc4256b-10ft256ai

Table 7. ORP Combinations for I/O Blocks with 16 I/Os

I/O Cell	Available Macrocells
I/O 0	M0, M1, M2, M3, M4, M5, M6, M7
I/O 1	M1, M2, M3, M4, M5, M6, M7, M8
I/O 2	M2, M3, M4, M5, M6, M7, M8, M9
I/O 3	M3, M4, M5, M6, M7, M8, M9, M10
I/O 4	M4, M5, M6, M7, M8, M9, M10, M11
I/O 5	M5, M6, M7, M8, M9, M10, M11, M12
I/O 6	M6, M7, M8, M9, M10, M11, M12, M13
I/O 7	M7, M8, M9, M10, M11, M12, M13, M14
I/O 8	M8, M9, M10, M11, M12, M13, M14, M15
I/O 9	M9, M10, M11, M12, M13, M14, M15, M0
I/O 10	M10, M11, M12, M13, M14, M15, M0, M1
I/O 11	M11, M12, M13, M14, M15, M0, M1, M2
I/O 12	M12, M13, M14, M15, M0, M1, M2, M3
I/O 13	M13, M14, M15, M0, M1, M2, M3, M4
I/O 14	M14, M15, M0, M1, M2, M3, M4, M5
I/O 15	M15, M0, M1, M2, M3, M4, M5, M6

Table 8. ORP Combinations for I/O Blocks with 4 I/Os

I/O Cell	Available Macrocells
I/O 0	M0, M1, M2, M3, M4, M5, M6, M7
I/O 1	M4, M5, M6, M7, M8, M9, M10, M11
I/O 2	M8, M9, M10, M11, M12, M13, M14, M15
I/O 3	M12, M13, M14, M15, M0, M1, M2, M3

Table 9. ORP Combinations for I/O Blocks with 10 I/Os

I/O Cell	Available Macrocells
I/O 0	M0, M1, M2, M3, M4, M5, M6, M7
I/O 1	M2, M3, M4, M5, M6, M7, M8, M9
I/O 2	M4, M5, M6, M7, M8, M9, M10, M11
I/O 3	M6, M7, M8, M9, M10, M11, M12, M13
I/O 4	M8, M9, M10, M11, M12, M13, M14, M15
I/O 5	M10, M11, M12, M13, M14, M15, M0, M1
I/O 6	M12, M13, M14, M15, M0, M1, M2, M3
I/O 7	M14, M15, M0, M1, M2, M3, M4, M5
I/O 8	M2, M3, M4, M5, M6, M7, M8, M9
I/O 9	M10, M11, M12, M13, M14, M15, M0, M1

Table 10. ORP Combinations for I/O Blocks with 12 I/Os

I/O Cell	Available Macrocells
I/O 0	M0, M1, M2, M3, M4, M5, M6, M7
I/O 1	M1, M2, M3, M4, M5, M6, M7, M8
I/O 2	M2, M3, M4, M5, M6, M7, M8, M9
I/O 3	M4, M5, M6, M7, M8, M9, M10, M11
I/O 4	M5, M6, M7, M8, M9, M10, M11, M12
I/O 5	M6, M7, M8, M9, M10, M11, M12, M13
I/O 6	M8, M9, M10, M11, M12, M13, M14, M15
I/O 7	M9, M10, M11, M12, M13, M14, M15, M0
I/O 8	M10, M11, M12, M13, M14, M15, M0, M1
I/O 9	M12, M13, M14, M15, M0, M1, M2, M3
I/O 10	M13, M14, M15, M0, M1, M2, M3, M4
I/O 11	M14, M15, M0, M1, M2, M3, M4, M5

ORP Bypass and Fast Output Multiplexers

The ORP bypass and fast-path output multiplexer is a 4:1 multiplexer and allows the 5-PT fast path to bypass the ORP and be connected directly to the pin with either the regular output or the inverted output. This multiplexer also allows the register output to bypass the ORP to achieve faster t_{CO} .

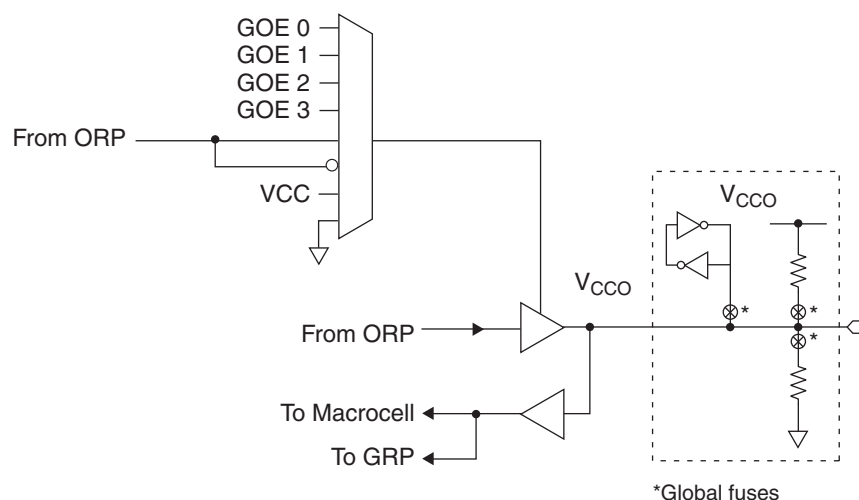
Output Enable Routing Multiplexers

The OE Routing Pool provides the corresponding local output enable (OE) product term to the I/O cell.

I/O Cell

The I/O cell contains the following programmable elements: output buffer, input buffer, OE multiplexer and bus maintenance circuitry. Figure 8 details the I/O cell.

Figure 8. I/O Cell

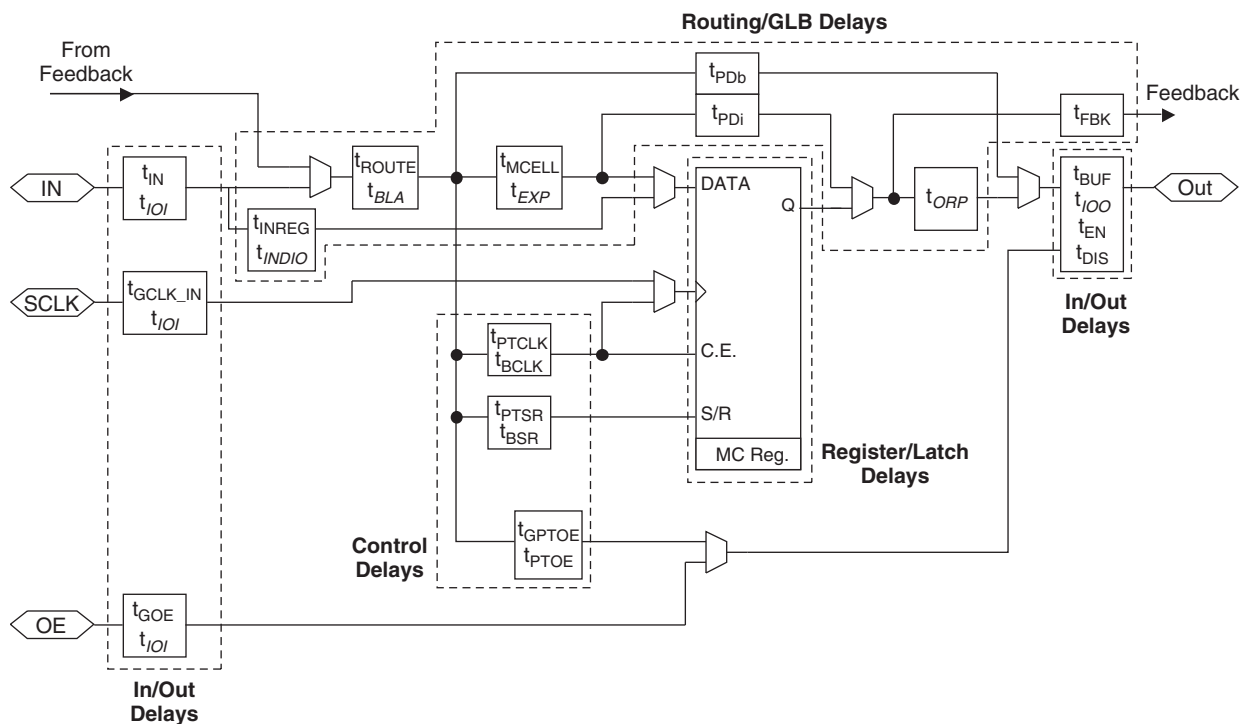


Each output supports a variety of output standards dependent on the V_{CCO} supplied to its I/O bank. Outputs can also be configured for open drain operation. Each input can be programmed to support a variety of standards, independent of the V_{CCO} supplied to its I/O bank. The I/O standards supported are:

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 (Cont.)**Over Recommended Operating Conditions**

Parameter	Description	-5		-75		-10		Units
		Min.	Max.	Min.	Max.	Min.	Max.	
t _{GPTOE}	Global PT OE Delay	—	5.58	—	5.58	—	5.78	ns
t _{PTOE}	Macrocell PT OE Delay	—	3.58	—	4.28	—	4.28	ns

Timing v.3.2

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

ispMACH 4000Z Internal Timing Parameters (Cont.)**Over Recommended Operating Conditions**

Parameter	Description	-45		-5		-75		Units
		Min.	Max.	Min.	Max.	Min.	Max.	
t _{P_{TOE}}	Macrocell PT OE Delay	—	2.50	—	2.70	—	2.00	ns

Note: Internal Timing Parameters are not tested and are for reference only. Refer to the timing model in this data sheet for further details.

Timing v.2.2

Signal Descriptions

Signal Names	Description
TMS	Input – This pin is the IEEE 1149.1 Test Mode Select input, which is used to control the state machine.
TCK	Input – This pin is the IEEE 1149.1 Test Clock input pin, used to clock through the state machine.
TDI	Input – This pin is the IEEE 1149.1 Test Data In pin, used to load data.
TDO	Output – This pin is the IEEE 1149.1 Test Data Out pin used to shift data out.
GOE0/IO, GOE1/IO	These pins are configured to be either Global Output Enable Input or as general I/O pins.
GND	Ground
NC	Not Connected
V _{CC}	The power supply pins for logic core and JTAG port.
CLK0/I, CLK1/I, CLK2/I, CLK3/I	These pins are configured to be either CLK input or as an input.
V _{CC00} , V _{CC01}	The power supply pins for each I/O bank.
yzz	Input/Output ¹ – These are the general purpose I/O used by the logic array. y is GLB reference (alpha) and z is macrocell reference (numeric). z: 0-15.
	ispMACH 4032 y: A-B
	ispMACH 4064 y: A-D
	ispMACH 4128 y: A-H
	ispMACH 4256 y: A-P
	ispMACH 4384 y: A-P, AX-HX
	ispMACH 4512 y: A-P, AX-PX

1. In some packages, certain I/Os are only available for use as inputs. See the signal connections table for details.

ispMACH 4000V/B/C ORP Reference Table

	4032V/B/C		4064V/B/C			4128V/B/C			4256V/B/C				4384V/B/C		4512V/B/C	
Number of I/Os	30 ¹	32	30 ²	32	64	64	92 ³	96	64	96 ⁴	128	160	128	192	128	208
Number of GLBs	2	2	4	4	4	8	8	8	16	16	16	16	16	16	16	16
Number of I/Os / GLB	16	16	8	8	16	8	12	12	4	8	8	10	8	8	8	Mixture of 8 & 4 ⁵
Reference ORP Table	16 I/Os / GLB		8 I/Os / GLB		16 I/Os / GLB	8 I/Os / GLB	12 I/Os / GLB		4 I/Os / GLB	8 I/Os / GLB	8 I/Os / GLB	10 I/Os / GLB	8 I/Os / GLB		8 I/Os / GLB	8 I/Os / GLB 4 I/Os / GLB

1. 32-macrocell device, 44 TQFP: 2 GLBs have 15 out of 16 I/Os bonded out.

2. 64-macrocells device, 44 TQFP: 2 GLBs have 7 out of 8 I/Os bonded out.

3. 128-macrocell device, 128 TQFP: 4 GLBs have 11 out of 12 I/Os

4. 256-macrocell device, 144 TQFP: 16 GLBs have 6 I/Os per

5. 512-macrocell device: 20 GLBs have 8 I/Os per, 12 GLBs have 4 I/Os per

ispMACH 4000Z ORP Reference Table

	4032Z	4064Z		4128Z		4256Z		
Number of I/Os	32	32	64	64	96	64	96 ¹	128
Number of GLBs	2	4	4	8	8	16	16	16
Number of I/Os / GLB	16	8	16	8	12	4	8	8
Reference ORP Table	16 I/Os / GLB	8 I/Os / GLB	16 I/Os / GLB	8 I/Os / GLB	12 I/Os / GLB	4 I/Os / GLB	8 I/Os / GLB	8 I/Os / GLB

1. 256-macrocell device, 132 csBGA: 16 GLBs have 6 I/Os per

ispMACH 4000V/B/C/Z Power Supply and NC Connections¹

Signal	44-pin TQFP ²	48-pin TQFP ²	56-ball csBGA ³	100-pin TQFP ²	128-pin TQFP ²
VCC	11, 33	12, 36	K2, A9	25, 40, 75, 90	32, 51, 96, 115
VCCO0 VCCO (Bank 0)	6	6	F3	13, 33, 95	3, 17, 30, 41, 122
VCCO1 VCCO (Bank 1)	28	30	E8	45, 63, 83	58, 67, 81, 94, 105
GND	12, 34	13, 37	H3, C8	1, 26, 51, 76	1, 33, 65, 97
GND (Bank 0)	5	5	D3	7, 18, 32, 96	10, 24, 40, 113, 123
GND (Bank 1)	27	29	G8	46, 57, 68, 82	49, 59, 74, 88, 104
NC	—	—	4032Z: A8, B10, E1, E3, F8, F10, J1, K3	—	—

1. All grounds must be electrically connected at the board level. However, for the purposes of I/O current loading, grounds are associated with the bank shown.
2. Pin orientation follows the conventional order from pin 1 marking of the top side view and counter-clockwise.
3. Pin orientation A1 starts from the upper left corner of the top side view with alphabetical order ascending vertically and numerical order ascending horizontally.

**ispMACH 4032V/B/C and 4064V/B/C Logic Signal Connections:
44-Pin TQFP**

Pin Number	Bank Number	ispMACH 4032V/B/C		ispMACH 4064V/B/C	
		GLB/MC/Pad	ORP	GLB/MC/Pad	ORP
1	-	TDI	-	TDI	-
2	0	A5	A ⁵	A10	A ⁵
3	0	A6	A ⁶	A12	A ⁶
4	0	A7	A ⁷	A14	A ⁷
5	0	GND (Bank 0)	-	GND (Bank 0)	-
6	0	VCCO (Bank 0)	-	VCCO (Bank 0)	-
7	0	A8	A ⁸	B0	B ⁰
8	0	A9	A ⁹	B2	B ¹
9	0	A10	A ¹⁰	B4	B ²
10	-	TCK	-	TCK	-
11	-	VCC	-	VCC	-
12	-	GND	-	GND	-
13	0	A12	A ¹²	B8	B ⁴
14	0	A13	A ¹³	B10	B ⁵
15	0	A14	A ¹⁴	B12	B ⁶
16	0	A15	A ¹⁵	B14	B ⁷
17	1	CLK2/I	-	CLK2/I	-
18	1	B0	B ⁰	C0	C ⁰
19	1	B1	B ¹	C2	C ¹
20	1	B2	B ²	C4	C ²
21	1	B3	B ³	C6	C ³
22	1	B4	B ⁴	C8	C ⁴
23	-	TMS	-	TMS	-
24	1	B5	B ⁵	C10	C ⁵
25	1	B6	B ⁶	C12	C ⁶
26	1	B7	B ⁷	C14	C ⁷
27	1	GND (Bank 1)	-	GND (Bank 1)	-
28	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-
29	1	B8	B ⁸	D0	D ⁰
30	1	B9	B ⁹	D2	D ¹
31	1	B10	B ¹⁰	D4	D ²
32	-	TDO	-	TDO	-
33	-	VCC	-	VCC	-
34	-	GND	-	GND	-
35	1	B12	B ¹²	D8	D ⁴
36	1	B13	B ¹³	D10	D ⁵
37	1	B14	B ¹⁴	D12	D ⁶
38	1	B15/GOE1	B ¹⁵	D14/GOE1	D ⁷
39	0	CLK0/I	-	CLK0/I	-
40	0	A0/GOE0	A ⁰	A0/GOE0	A ⁰
41	0	A1	A ¹	A2	A ¹

**ispMACH 4032V/B/C/Z and 4064V/B/C/Z Logic Signal Connections:
48-Pin TQFP (Cont.)**

Pin Number	Bank Number	ispMACH 4032V/B/C/Z		ispMACH 4064V/B/C		ispMACH 4064Z	
		GLB/MC/Pad	ORP	GLB/MC/Pad	ORP	GLB/MC/Pad	ORP
33	1	B10	B ¹⁰	D4	D ²	D10	D ⁵
34	1	B11	B ¹¹	D6	D ³	D8	D ⁴
35	-	TDO	-	TDO	-	TDO	-
36	-	VCC	-	VCC	-	VCC	-
37	-	GND	-	GND	-	GND	-
38	1	B12	B ¹²	D8	D ⁴	D6	D ³
39	1	B13	B ¹³	D10	D ⁵	D4	D ²
40	1	B14	B ¹⁴	D12	D ⁶	D2	D ¹
41	1	B15/GOE1	B ¹⁵	D14/GOE1	D ⁷	D0/GOE1	D ⁰
42	1	CLK3/I	-	CLK3/I	-	CLK3/I	-
43	0	CLK0/I	-	CLK0/I	-	CLK0/I	-
44	0	A0/GOE0	A ⁰	A0/GOE0	A ⁰	A0/GOE0	A ⁰
45	0	A1	A ¹	A2	A ¹	A1	A ¹
46	0	A2	A ²	A4	A ²	A2	A ²
47	0	A3	A ³	A6	A ³	A4	A ³
48	0	A4	A ⁴	A8	A ⁴	A6	A ⁴

ispMACH 4032Z and 4064Z Logic Signal Connections: 56-Ball csBGA

Ball Number	Bank Number	ispMACH 4032Z		ispMACH 4064Z	
		GLB/MC/Pad	ORP	GLB/MC/Pad	ORP
B1	-	TDI	-	TDI	-
C3	0	A5	A ⁵	A8	A ⁵
C1	0	A6	A ⁶	A10	A ⁶
D1	0	A7	A ⁷	A11	A ⁷
D3	0	GND (Bank 0)	-	GND (Bank 0)	-
E3	0	NC ¹	-	I ¹	-
E1	0	NC ¹	-	I ¹	-
F3	0	VCCO (Bank 0)	-	VCCO (Bank 0)	-
F1	0	A8	A ⁸	B15	B ⁷
G3	0	A9	A ⁹	B12	B ⁶
G1	0	A10	A ¹⁰	B10	B ⁵
H1	0	A11	A ¹¹	B8	B ⁴
J1	0	NC	-	I	-
K1	-	TCK	-	TCK	-
K2	-	VCC	-	VCC	-
H3	-	GND	-	GND	-
K3	-	NC ¹	-	I ¹	-
K4	0	A12	A ¹²	B6	B ³
H4	0	A13	A ¹³	B4	B ²
H5	0	A14	A ¹⁴	B2	B ¹

**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
42	1	C1	C ¹	E2	E ¹	I6	I ¹
43	1	C2	C ²	E4	E ²	I10	I ²
44	1	C3	C ³	E6	E ³	I12	I ³
45	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-
46	1	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-
47	1	C4	C ⁴	E8	E ⁴	J2	J ⁰
48	1	C5	C ⁵	E10	E ⁵	J6	J ¹
49	1	C6	C ⁶	E12	E ⁶	J10	J ²
50	1	C7	C ⁷	E14	E ⁷	J12	J ³
51	-	GND	-	GND	-	GND	-
52	-	TMS	-	TMS	-	TMS	-
53	1	C8	C ⁸	F0	F ⁰	K12	K ³
54	1	C9	C ⁹	F2	F ¹	K10	K ²
55	1	C10	C ¹⁰	F4	F ²	K6	K ¹
56	1	C11	C ¹¹	F6	F ³	K2	K ⁰
57	1	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-
58	1	C12	C ¹²	F8	F ⁴	L12	L ³
59	1	C13	C ¹³	F10	F ⁵	L10	L ²
60	1	C14	C ¹⁴	F12	F ⁶	L6	L ¹
61	1	C15	C ¹⁵	F13	F ⁷	L4	L ⁰
62*	1	I	-	I	-	I	-
63	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-
64	1	D15	D ¹⁵	G14	G ⁷	M4	M ⁰
65	1	D14	D ¹⁴	G12	G ⁶	M6	M ¹
66	1	D13	D ¹³	G10	G ⁵	M10	M ²
67	1	D12	D ¹²	G8	G ⁴	M12	M ³
68	1	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-
69	1	D11	D ¹¹	G6	G ³	N2	N ⁰
70	1	D10	D ¹⁰	G5	G ²	N6	N ¹
71	1	D9	D ⁹	G4	G ¹	N10	N ²
72	1	D8	D ⁸	G2	G ⁰	N12	N ³
73*	1	I	-	I	-	I	-
74	-	TDO	-	TDO	-	TDO	-
75	-	VCC	-	VCC	-	VCC	-
76	-	GND	-	GND	-	GND	-
77*	1	I	-	I	-	I	-
78	1	D7	D ⁷	H13	H ⁷	O12	O ³
79	1	D6	D ⁶	H12	H ⁶	O10	O ²
80	1	D5	D ⁵	H10	H ⁵	O6	O ¹
81	1	D4	D ⁴	H8	H ⁴	O2	O ⁰
82	1	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-

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

Pin Number	Bank Number	ispMACH 4128V/B/C	
		GLB/MC/Pad	ORP
62	1	E10	E ⁸
63	1	E12	E ⁹
64	1	E14	E ¹¹
65	1	GND	-
66	1	TMS	-
67	1	VCCO (Bank 1)	-
68	1	F0	F ⁰
69	1	F1	F ¹
70	1	F2	F ²
71	1	F4	F ³
72	1	F5	F ⁴
73	1	F6	F ⁵
74	1	GND (Bank 1)	-
75	1	F8	F ⁶
76	1	F9	F ⁷
77	1	F10	F ⁸
78	1	F12	F ⁹
79	1	F13	F ¹⁰
80	1	F14	F ¹¹
81	1	VCCO (Bank 1)	-
82	1	G14	G ¹¹
83	1	G13	G ¹⁰
84	1	G12	G ⁹
85	1	G10	G ⁸
86	1	G9	G ⁷
87	1	G8	G ⁶
88	1	GND (Bank 1)	-
89	1	G6	G ⁵
90	1	G5	G ⁴
91	1	G4	G ³
92	1	G2	G ²
93	1	G0	G ⁰
94	1	VCCO (Bank 1)	-
95	1	TDO	-
96	1	VCC	-
97	1	GND	-
98	1	H14	H ¹¹
99	1	H13	H ¹⁰
100	1	H12	H ⁹
101	1	H10	H ⁸
102	1	H9	H ⁷
103	1	H8	H ⁶
104	1	GND (Bank 1)	-

ispMACH 4128V and 4256V Logic Signal Connections: 144-Pin TQFP (Cont.)

Pin Number	Bank Number	ispMACH 4128V		ispMACH 4256V	
		GLB/MC/Pad	ORP	GLB/MC/Pad	ORP
86	1	F12	F ⁹	L8	L ⁴
87	1	F13	F ¹⁰	L6	L ³
88	1	F14	F ¹¹	L4	L ²
89	1	NC ²	-	I ²	-
90	1	GND (Bank 1) ¹	-	NC ¹	-
91	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-
92	1	NC ²	-	I ²	-
93	1	G14	G ¹¹	M2	M ¹
94	1	G13	G ¹⁰	M4	M ²
95	1	G12	G ⁹	M6	M ³
96	1	G10	G ⁸	M8	M ⁴
97	1	G9	G ⁷	M10	M ⁵
98	1	G8	G ⁶	M12	M ⁶
99	1	GND (Bank 1)	-	GND (Bank 1)	-
100	1	G6	G ⁵	N2	N ¹
101	1	G5	G ⁴	N4	N ²
102	1	G4	G ³	N6	N ³
103	1	G2	G ²	N8	N ⁴
104	1	G1	G ¹	N10	N ⁵
105	1	G0	G ⁰	N12	N ⁶
106	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-
107	-	TDO	-	TDO	-
108	-	VCC	-	VCC	-
109	-	GND	-	GND	-
110	1	NC ²	-	I ²	-
111	1	H14	H ¹¹	O12	O ⁶
112	1	H13	H ¹⁰	O10	O ⁵
113	1	H12	H ⁹	O8	O ⁴
114	1	H10	H ⁸	O6	O ³
115	1	H9	H ⁷	O4	O ²
116	1	H8	H ⁶	O2	O ¹
117	1	NC ²	-	I ²	-
118	1	GND (Bank 1)	-	GND (Bank 1)	-
119	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-
120	1	H6	H ⁵	P12	P ⁶
121	1	H5	H ⁴	P10	P ⁵
122	1	H4	H ³	P8	P ⁴
123	1	H2	H ²	P6	P ³
124	1	H1	H ¹	P4	P ²
125	1	H0/GOE1	H ⁰	P2/GOE1	P ¹
126	1	CLK3/I	-	CLK3/I	-
127	0	GND (Bank 0)	-	GND (Bank 0)	-
128	0	CLK0/I	-	CLK0/I	-

ispMACH 4128V and 4256V Logic Signal Connections: 144-Pin TQFP (Cont.)

Pin Number	Bank Number	ispMACH 4128V		ispMACH 4256V	
		GLB/MC/Pad	ORP	GLB/MC/Pad	ORP
129	-	VCC	-	VCC	-
130	0	A0/GOE0	A^0	A2/GOE0	A^1
131	0	A1	A^1	A4	A^2
132	0	A2	A^2	A6	A^3
133	0	A4	A^3	A8	A^4
134	0	A5	A^4	A10	A^5
135	0	A6	A^5	A12	A^6
136	0	VCCO (Bank 0)	-	VCCO (Bank 0)	-
137	0	GND (Bank 0)	-	GND (Bank 0)	-
138	0	A8	A^6	B2	B^1
139	0	A9	A^7	B4	B^2
140	0	A10	A^8	B6	B^3
141	0	A12	A^9	B8	B^4
142	0	A13	A^10	B10	B^5
143	0	A14	A^11	B12	B^6
144	0	NC ²	-	I ²	-

1. For device migration considerations, these NC pins are GND pins for I/O banks in ispMACH 4128V devices.

2. For device migration considerations, these NC pins are input signal pins in ispMACH 4256V devices.

ispMACH 4256V/B/C/Z, 4384V/B/C, 4512V/B/C, Logic Signal Connections: 176-Pin TQFP

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
1	-	NC	-	NC	-	NC	-
2	-	GND	-	GND	-	GND	-
3	-	TDI	-	TDI	-	TDI	-
4	0	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-
5	0	C14	C^7	C14	C^7	C14	C^7
6	0	C12	C^6	C12	C^6	C12	C^6
7	0	C10	C^5	C10	C^5	C10	C^5
8	0	C8	C^4	C8	C^4	C8	C^4
9	0	C6	C^3	C6	C^3	C6	C^3
10	0	C4	C^2	C4	C^2	C4	C^2
11	0	C2	C^1	C2	C^1	C2	C^1
12	0	C0	C^0	C0	C^0	C0	C^0
13	0	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-
14	0	D14	D^7	E14	E^7	G14	G^7
15	0	D12	D^6	E12	E^6	G12	G^6
16	0	D10	D^5	E10	E^5	G10	G^5
17	0	D8	D^4	E8	E^4	G8	G^4
18	0	D6	D^3	E6	E^3	G6	G^3

**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 ¹⁴	AX14	AX ¹⁴	GX14	GX ¹⁴
103	1	L12	L ¹²	AX12	AX ¹²	GX12	GX ¹²
104	1	L10	L ¹⁰	AX10	AX ¹⁰	GX10	GX ¹⁰
105	1	L8	L ⁸	AX8	AX ⁸	GX8	GX ⁸
106	1	L6	L ⁶	AX6	AX ⁶	GX6	GX ⁶
107	1	L4	L ⁴	AX4	AX ⁴	GX4	GX ⁴
108	1	L2	L ²	AX2	AX ²	GX2	GX ²
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 ²	DX2	DX ²	JX2	JX ²
113	1	M4	M ⁴	DX4	DX ⁴	JX4	JX ⁴
114	1	M6	M ⁶	DX6	DX ⁶	JX6	JX ⁶
115	1	M8	M ⁸	DX8	DX ⁸	JX8	JX ⁸
116	1	M10	M ¹⁰	DX10	DX ¹⁰	JX10	JX ¹⁰
117	1	M12	M ¹²	DX12	DX ¹²	JX12	JX ¹²
118	1	M14	M ¹⁴	DX14	DX ¹⁴	JX14	JX ¹⁴
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 ²	FX2	FX ²	NX2	NX ²
122	1	N4	N ⁴	FX4	FX ⁴	NX4	NX ⁴
123	1	N6	N ⁶	FX6	FX ⁶	NX6	NX ⁶
124	1	N8	N ⁸	FX8	FX ⁸	NX8	NX ⁸
125	1	N10	N ¹⁰	FX10	FX ¹⁰	NX10	NX ¹⁰
126	1	N12	N ¹²	FX12	FX ¹²	NX12	NX ¹²
127	1	N14	N ¹⁴	FX14	FX ¹⁴	NX14	NX ¹⁴
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 ¹⁴	GX14	GX ¹⁴	OX14	OX ¹⁴
136	1	O12	O ¹²	GX12	GX ¹²	OX12	OX ¹²
137	1	O10	O ¹⁰	GX10	GX ¹⁰	OX10	OX ¹⁰
138	1	O8	O ⁸	GX8	GX ⁸	OX8	OX ⁸
139	1	O6	O ⁶	GX6	GX ⁶	OX6	OX ⁶
140	1	O4	O ⁴	GX4	GX ⁴	OX4	OX ⁴
141	1	O2	O ²	GX2	GX ²	OX2	OX ²

**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	t _{PD}	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

Lead-Free Packaging**ispMACH 4000Z (Zero Power, 1.8V) Lead-Free Commercial Devices**

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032ZC	LC4032ZC-35MN56C	32	1.8	3.5	Lead-free csBGA	56	32	C
	LC4032ZC-5MN56C	32	1.8	5	Lead-free csBGA	56	32	C
	LC4032ZC-75MN56C	32	1.8	7.5	Lead-free csBGA	56	32	C
	LC4032ZC-35TN48C	32	1.8	3.5	Lead-free TQFP	48	32	C
	LC4032ZC-5TN48C	32	1.8	5	Lead-free TQFP	48	32	C
	LC4032ZC-75TN48C	32	1.8	7.5	Lead-free TQFP	48	32	C
LC4064ZC	LC4064ZC-37MN132C	64	1.8	3.7	Lead-free csBGA	132	64	C
	LC4064ZC-5MN132C	64	1.8	5	Lead-free csBGA	132	64	C
	LC4064ZC-75MN132C	64	1.8	7.5	Lead-free csBGA	132	64	C
	LC4064ZC-37TN100C	64	1.8	3.7	Lead-free TQFP	100	64	C
	LC4064ZC-5TN100C	64	1.8	5	Lead-free TQFP	100	64	C
	LC4064ZC-75TN100C	64	1.8	7.5	Lead-free TQFP	100	64	C
	LC4064ZC-37MN56C	64	1.8	3.7	Lead-free csBGA	56	32	C
	LC4064ZC-5MN56C	64	1.8	5	Lead-free csBGA	56	32	C
	LC4064ZC-75MN56C	64	1.8	7.5	Lead-free csBGA	56	32	C
	LC4064ZC-37TN48C	64	1.8	3.7	Lead-free TQFP	48	32	C
	LC4064ZC-5TN48C	64	1.8	5	Lead-free TQFP	48	32	C
	LC4064ZC-75TN48C	64	1.8	7.5	Lead-free TQFP	48	32	C
LC4128ZC	LC4128ZC-42MN132C	128	1.8	4.2	Lead-free csBGA	132	96	C
	LC4128ZC-75MN132C	128	1.8	7.5	Lead-free csBGA	132	96	C
	LC4128ZC-42TN100C	128	1.8	4.2	Lead-free TQFP	100	64	C
	LC4128ZC-75TN100C	128	1.8	7.5	Lead-free TQFP	100	64	C
LC4256ZC	LC4256ZC-45TN176C	256	1.8	4.5	Lead-free TQFP	176	128	C
	LC4256ZC-75TN176C	256	1.8	7.5	Lead-free TQFP	176	128	C
	LC4256ZC-45MN132C	256	1.8	4.5	Lead-free csBGA	132	96	C
	LC4256ZC-75MN132C	256	1.8	7.5	Lead-free csBGA	132	96	C
	LC4256ZC-45TN100C	256	1.8	4.5	Lead-free TQFP	100	64	C
	LC4256ZC-75TN100C	256	1.8	7.5	Lead-free TQFP	100	64	C

ispMACH 4000Z (Zero Power, 1.8V) Lead-Free Industrial Devices

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032ZC	LC4032ZC-5MN56I	32	1.8	5	Lead-free csBGA	56	32	I
	LC4032ZC-75MN56I	32	1.8	7.5	Lead-free csBGA	56	32	I
	LC4032ZC-5TN48I	32	1.8	5	Lead-free TQFP	48	32	I
	LC4032ZC-75TN48I	32	1.8	7.5	Lead-free TQFP	48	32	I

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 4000V (3.3V) Lead-Free Commercial Devices

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032V	LC4032V-25TN48C	32	3.3	2.5	Lead-free TQFP	48	32	C
	LC4032V-5TN48C	32	3.3	5	Lead-free TQFP	48	32	C
	LC4032V-75TN48C	32	3.3	7.5	Lead-free TQFP	48	32	C
	LC4032V-25TN44C	32	3.3	2.5	Lead-free TQFP	44	30	C
	LC4032V-5TN44C	32	3.3	5	Lead-free TQFP	44	30	C
	LC4032V-75TN44C	32	3.3	7.5	Lead-free TQFP	44	30	C
LC4064V	LC4064V-25TN100C	64	3.3	2.5	Lead-free TQFP	100	64	C
	LC4064V-5TN100C	64	3.3	5	Lead-free TQFP	100	64	C
	LC4064V-75TN100C	64	3.3	7.5	Lead-free TQFP	100	64	C
	LC4064V-25TN48C	64	3.3	2.5	Lead-free TQFP	48	32	C
	LC4064V-5TN48C	64	3.3	5	Lead-free TQFP	48	32	C
	LC4064V-75TN48C	64	3.3	7.5	Lead-free TQFP	48	32	C
	LC4064V-25TN44C	64	3.3	2.5	Lead-free TQFP	44	30	C
	LC4064V-5TN44C	64	3.3	5	Lead-free TQFP	44	30	C
	LC4064V-75TN44C	64	3.3	7.5	Lead-free TQFP	44	30	C
LC4128V	LC4128V-27TN144C	128	3.3	2.7	Lead-free TQFP	144	96	C
	LC4128V-5TN144C	128	3.3	5	Lead-free TQFP	144	96	C
	LC4128V-75TN144C	128	3.3	7.5	Lead-free TQFP	144	96	C
	LC4128V-27TN128C	128	3.3	2.7	Lead-free TQFP	128	92	C
	LC4128V-5TN128C	128	3.3	5	Lead-free TQFP	128	92	C
	LC4128V-75TN128C	128	3.3	7.5	Lead-free TQFP	128	92	C
	LC4128V-27TN100C	128	3.3	2.7	Lead-free TQFP	100	64	C
	LC4128V-5TN100C	128	3.3	5	Lead-free TQFP	100	64	C
	LC4128V-75TN100C	128	3.3	7.5	Lead-free TQFP	100	64	C

ispMACH 4000V (3.3V) Lead-Free Industrial Devices

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032V	LC4032V-5TN48I	32	3.3	5	Lead-free TQFP	48	32	I
	LC4032V-75TN48I	32	3.3	7.5	Lead-free TQFP	48	32	I
	LC4032V-10TN48I	32	3.3	10	Lead-free TQFP	48	32	I
	LC4032V-5TN44I	32	3.3	5	Lead-free TQFP	44	30	I
	LC4032V-75TN44I	32	3.3	7.5	Lead-free TQFP	44	30	I
	LC4032V-10TN44I	32	3.3	10	Lead-free TQFP	44	30	I
LC4064V	LC4064V-5TN100I	64	3.3	5	Lead-free TQFP	100	64	I
	LC4064V-75TN100I	64	3.3	7.5	Lead-free TQFP	100	64	I
	LC4064V-10TN100I	64	3.3	10	Lead-free TQFP	100	64	I
	LC4064V-5TN48I	64	3.3	5	Lead-free TQFP	48	32	I
	LC4064V-75TN48I	64	3.3	7.5	Lead-free TQFP	48	32	I
	LC4064V-10TN48I	64	3.3	10	Lead-free TQFP	48	32	I
	LC4064V-5TN44I	64	3.3	5	Lead-free TQFP	44	30	I
	LC4064V-75TN44I	64	3.3	7.5	Lead-free TQFP	44	30	I
	LC4064V-10TN44I	64	3.3	10	Lead-free TQFP	44	30	I
LC4128V	LC4128V-5TN144I	128	3.3	5	Lead-free TQFP	144	96	I
	LC4128V-75TN144I	128	3.3	7.5	Lead-free TQFP	144	96	I
	LC4128V-10TN144I	128	3.3	10	Lead-free TQFP	144	96	I
	LC4128V-5TN128I	128	3.3	5	Lead-free TQFP	128	92	I
	LC4128V-75TN128I	128	3.3	7.5	Lead-free TQFP	128	92	I
	LC4128V-10TN128I	128	3.3	10	Lead-free TQFP	128	92	I
	LC4128V-5TN100I	128	3.3	5	Lead-free TQFP	100	64	I
	LC4128V-75TN100I	128	3.3	7.5	Lead-free TQFP	100	64	I
	LC4128V-10TN100I	128	3.3	10	Lead-free TQFP	100	64	I