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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	7.5 ns
Voltage Supply - Internal	1.65V ~ 1.95V
Number of Logic Elements/Blocks	16
Number of Macrocells	256
Number of Gates	-
Number of I/O	160
Operating Temperature	0°C ~ 90°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/lc4256c-75ftn256bc

Figure 2. Generic Logic Block

AND Array

The programmable AND Array consists of 36 inputs and 83 output product terms. The 36 inputs from the GRP are used to form 72 lines in the AND Array (true and complement of the inputs). Each line in the array can be connected to any of the 83 output product terms via a wired-AND. Each of the 80 logic product terms feed the logic allocator with the remaining three control product terms feeding the Shared PT Clock, Shared PT Initialization and Shared PT OE. The Shared PT Clock and Shared PT Initialization signals can optionally be inverted before being fed to the macrocells.

Every set of five product terms from the 80 logic product terms forms a product term cluster starting with PT0. There is one product term cluster for every macrocell in the GLB. Figure 3 is a graphical representation of the AND Array.

ispMACH 4000V/B/C External Switching Characteristics (Cont.)**Over Recommended Operating Conditions**

Parameter	Description ^{1, 2, 3}	-5		-75		-10		Units
		Min.	Max.	Min.	Max.	Min.	Max.	
t_{PD}	5-PT bypass combinatorial propagation delay	—	5.0	—	7.5	—	10.0	ns
t_{PD_MC}	20-PT combinatorial propagation delay through macrocell	—	5.5	—	8.0	—	10.5	ns
t_S	GLB register setup time before clock	3.0	—	4.5	—	5.5	—	ns
t_{ST}	GLB register setup time before clock with T-type register	3.2	—	4.7	—	5.5	—	ns
t_{SIR}	GLB register setup time before clock, input register path	1.2	—	1.7	—	1.7	—	ns
t_{SIRZ}	GLB register setup time before clock with zero hold	2.2	—	2.7	—	2.7	—	ns
t_H	GLB register hold time after clock	0.0	—	0.0	—	0.0	—	ns
t_{HT}	GLB register hold time after clock with T-type register	0.0	—	0.0	—	0.0	—	ns
t_{HIR}	GLB register hold time after clock, input register path	1.0	—	1.0	—	1.0	—	ns
t_{HIRZ}	GLB register hold time after clock, input register path with zero hold	0.0	—	0.0	—	0.0	—	ns
t_{CO}	GLB register clock-to-output delay	—	3.4	—	4.5	—	6.0	ns
t_R	External reset pin to output delay	—	6.3	—	9.0	—	10.5	ns
t_{RW}	External reset pulse duration	2.0	—	4.0	—	4.0	—	ns
$t_{PTOE/DIS}$	Input to output local product term output enable/disable	—	7.0	—	9.0	—	10.5	ns
$t_{GPTOE/DIS}$	Input to output global product term output enable/disable	—	9.0	—	10.3	—	12.0	ns
$t_{GOE/DIS}$	Global OE input to output enable/disable	—	5.0	—	7.0	—	8.0	ns
t_{CW}	Global clock width, high or low	2.2	—	2.8	—	4.0	—	ns
t_{GW}	Global gate width low (for low transparent) or high (for high transparent)	2.2	—	2.8	—	4.0	—	ns
t_{WIR}	Input register clock width, high or low	2.2	—	2.8	—	4.0	—	ns
f_{MAX}^4	Clock frequency with internal feedback	—	227	—	168	—	125	MHz
$f_{MAX} (Ext.)$	Clock frequency with external feedback, $[1/(t_S + t_{CO})]$	—	156	—	111	—	86	MHz

1. Timing numbers are based on default LVCMOS 1.8 I/O buffers. Use timing adjusters provided to calculate other standards.

Timing v.3.2

2. Measured using standard switching circuit, assuming GRP loading of 1 and 1 output switching.

3. Pulse widths and clock widths less than minimum will cause unknown behavior.

4. Standard 16-bit counter using GRP feedback.

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

ispMACH 4000V/B/C Timing Adders¹ (Cont.)

Adder Type	Base Parameter	Description	-5		-75		-10		Units
			Min.	Max.	Min.	Max.	Min.	Max.	
Optional Delay Adders									
t _{INDIO}	t _{INREG}	Input register delay	—	1.00	—	1.00	—	1.00	ns
t _{EXP}	t _{MCELL}	Product term expander delay	—	0.33	—	0.33	—	0.33	ns
t _{ORP}	—	Output routing pool delay	—	0.05	—	0.05	—	0.05	ns
t _{BLA}	t _{ROUTE}	Additional block loading adder	—	0.05	—	0.05	—	0.05	ns
t _{IOI} Input Adjusters									
LVTTTL_in	t _{IN} , t _{GCLK_IN} , t _{GOE}	Using LVTTTL standard	—	0.60	—	0.60	—	0.60	ns
LVC MOS33_in	t _{IN} , t _{GCLK_IN} , t _{GOE}	Using LVC MOS 3.3 standard	—	0.60	—	0.60	—	0.60	ns
LVC MOS25_in	t _{IN} , t _{GCLK_IN} , t _{GOE}	Using LVC MOS 2.5 standard	—	0.60	—	0.60	—	0.60	ns
LVC MOS18_in	t _{IN} , t _{GCLK_IN} , t _{GOE}	Using LVC MOS 1.8 standard	—	0.00	—	0.00	—	0.00	ns
PCI_in	t _{IN} , t _{GCLK_IN} , t _{GOE}	Using PCI compatible input	—	0.60	—	0.60	—	0.60	ns
t _{IOO} Output Adjusters									
LVTTTL_out	t _{BUF} , t _{EN} , t _{DIS}	Output configured as TTL buffer	—	0.20	—	0.20	—	0.20	ns
LVC MOS33_out	t _{BUF} , t _{EN} , t _{DIS}	Output configured as 3.3V buffer	—	0.20	—	0.20	—	0.20	ns
LVC MOS25_out	t _{BUF} , t _{EN} , t _{DIS}	Output configured as 2.5V buffer	—	0.10	—	0.10	—	0.10	ns
LVC MOS18_out	t _{BUF} , t _{EN} , t _{DIS}	Output configured as 1.8V buffer	—	0.00	—	0.00	—	0.00	ns
PCI_out	t _{BUF} , t _{EN} , t _{DIS}	Output configured as PCI compatible buffer	—	0.20	—	0.20	—	0.20	ns
Slow Slew	t _{BUF} , t _{EN}	Output configured for slow slew rate	—	1.00	—	1.00	—	1.00	ns

Note: Open drain timing is the same as corresponding LVC MOS timing.

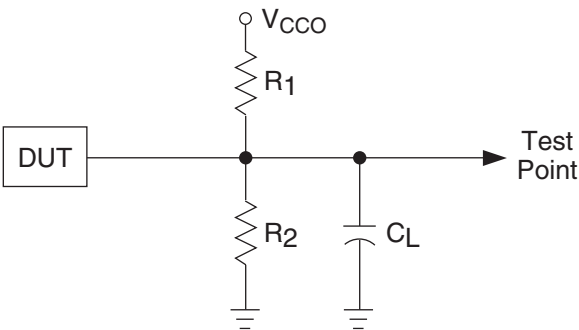
Timing v.3.2

1. Refer to TN1004, [ispMACH 4000 Timing Model Design and Usage Guidelines](#) for information regarding use of these adders.

Switching Test Conditions

Figure 12 shows the output test load that is used for AC testing. The specific values for resistance, capacitance, voltage, and other test conditions are shown in Table 11.

Figure 12. Output Test Load, LVTTTL and LVCMOS Standards



0213A/ispm4k

Table 11. Test Fixture Required Components

Test Condition	R_1	R_2	C_L^1	Timing Ref.	V_{CCO}
LVCMOS I/O, (L -> H, H -> L)	106 Ω	106 Ω	35pF	LVCMOS 3.3 = 1.5V	LVCMOS 3.3 = 3.0V
				LVCMOS 2.5 = $V_{CCO}/2$	LVCMOS 2.5 = 2.3V
				LVCMOS 1.8 = $V_{CCO}/2$	LVCMOS 1.8 = 1.65V
LVCMOS I/O (Z -> H)	∞	106 Ω	35pF	1.5V	3.0V
LVCMOS I/O (Z -> L)	106 Ω	∞	35pF	1.5V	3.0V
LVCMOS I/O (H -> Z)	∞	106 Ω	5pF	$V_{OH} - 0.3$	3.0V
LVCMOS I/O (L -> Z)	106 Ω	∞	5pF	$V_{OL} + 0.3$	3.0V

1. C_L includes test fixtures and probe capacitance.

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

Ball Number	Bank Number	ispMACH 4064Z		ispMACH 4128Z		ispMACH 4256Z	
		GLB/MC/Pad	ORP	GLB/MC/Pad	ORP	GLB/MC/Pad	ORP
E3	0	NC	-	B8	B ⁶	D12	D ⁶
F2	0	A12	A ¹²	B9	B ⁷	D10	D ⁵
F1	0	A13	A ¹³	B10	B ⁸	D8	D ⁴
F3	0	A14	A ¹⁴	B12	B ⁹	D6	D ³
G1	0	A15	A ¹⁵	B13	B ¹⁰	D4	D ²
G2	0	I	-	B14	B ¹¹	D2	D ¹
G3	0	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-
H2	0	NC	-	C14	C ¹¹	E2	E ¹
H1	0	B15	B ¹⁵	C13	C ¹⁰	E4	E ²
H3	0	B14	B ¹⁴	C12	C ⁹	E6	E ³
J1	0	B13	B ¹³	C10	C ⁸	E8	E ⁴
J2	0	B12	B ¹²	C9	C ⁷	E10	E ⁵
J3	0	NC	-	C8	C ⁶	E12	E ⁶
K2	0	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-
K1	0	NC	-	C6	C ⁵	F2	F ¹
K3	0	B11	B ¹¹	C5	C ⁴	F4	F ²
L2	0	B10	B ¹⁰	C4	C ³	F6	F ³
L1	0	B9	B ⁹	C2	C ²	F8	F ⁴
L3	0	B8	B ⁸	C1	C ¹	F10	F ⁵
M1	0	I	-	C0	C ⁰	F12	F ⁶
M2	0	NC	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-
N1	-	TCK	-	TCK	-	TCK	-
P1	-	VCC	-	VCC	-	VCC	-
P2	-	GND	-	GND	-	GND	-
N2	0	I	-	D14	D ¹¹	G12	G ⁶
P3	0	B7	B ⁷	D13	D ¹⁰	G10	G ⁵
M3	0	B6	B ⁶	D12	D ⁹	G8	G ⁴
N3	0	B5	B ⁵	D10	D ⁸	G6	G ³
P4	0	B4	B ⁴	D9	D ⁷	G4	G ²
M4	0	NC	-	D8	D ⁶	G2	G ¹
N4	0	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-
P5	0	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-
N5	0	NC	-	D6	D ⁵	H12	H ⁶
M5	0	B3	B ³	D5	D ⁴	H10	H ⁵
N6	0	B2	B ²	D4	D ³	H8	H ⁴
P6	0	B1	B ¹	D2	D ²	H6	H ³
M6	0	B0	B ⁰	D1	D ¹	H4	H ²
P7	0	NC	-	D0	D ⁰	H2	H ¹
N7	0	CLK1/I	-	CLK1/I	-	CLK1/I	-
M7	1	CLK2/I	-	CLK2/I	-	CLK2/I	-
N8	-	VCC	-	VCC	-	VCC	-

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

Ball Number	Bank Number	ispMACH 4064Z		ispMACH 4128Z		ispMACH 4256Z	
		GLB/MC/Pad	ORP	GLB/MC/Pad	ORP	GLB/MC/Pad	ORP
P8	1	NC ¹	-	NC ¹	-	I ¹	-
M8	1	NC	-	E0	E ⁰	I2	I ¹
P9	1	C0	C ⁰	E1	E ¹	I4	I ²
N9	1	C1	C ¹	E2	E ²	I6	I ³
M9	1	C2	C ²	E4	E ³	I8	I ⁴
N10	1	C3	C ³	E5	E ⁴	I10	I ⁵
P10	1	NC	-	E6	E ⁵	I12	I ⁶
M10	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-
N11	1	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-
P11	1	NC	-	E8	E ⁶	J2	J ¹
M11	1	C4	C ⁴	E9	E ⁷	J4	J ²
P12	1	C5	C ⁵	E10	E ⁸	J6	J ³
N12	1	C6	C ⁶	E12	E ⁹	J8	J ⁴
P13	1	C7	C ⁷	E13	E ¹⁰	J10	J ⁵
P14	1	NC	-	E14	E ¹¹	J12	J ⁶
N14	-	GND	-	GND	-	GND	-
N13	-	TMS	-	TMS	-	TMS	-
M14	1	NC	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-
M12	1	NC	-	F0	F ⁰	K12	K ⁶
M13	1	C8	C ⁸	F1	F ¹	K10	K ⁵
L14	1	C9	C ⁹	F2	F ²	K8	K ⁴
L12	1	C10	C ¹⁰	F4	F ³	K6	K ³
L13	1	C11	C ¹¹	F5	F ⁴	K4	K ²
K14	1	NC	-	F6	F ⁵	K2	K ¹
K13	1	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-
K12	1	NC	-	F8	F ⁶	L12	L ⁶
J13	1	C12	C ¹²	F9	F ⁷	L10	L ⁵
J14	1	C13	C ¹³	F10	F ⁸	L8	L ⁴
J12	1	C14	C ¹⁴	F12	F ⁹	L6	L ³
H14	1	C15	C ¹⁵	F13	F ¹⁰	L4	L ²
H13	1	I	-	F14	F ¹¹	L2	L ¹
H12	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-
G13	1	NC	-	G14	G ¹¹	M2	M ¹
G14	1	NC	-	G13	G ¹⁰	M4	M ²
G12	1	D15	D ¹⁵	G12	G ⁹	M6	M ³
F14	1	D14	D ¹⁴	G10	G ⁸	M8	M ⁴
F13	1	D13	D ¹³	G9	G ⁷	M10	M ⁵
F12	1	D12	D ¹²	G8	G ⁶	M12	M ⁶
E13	1	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-
E14	1	NC	-	G6	G ⁵	N2	N ¹
E12	1	D11	D ¹¹	G5	G ⁴	N4	N ²

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
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

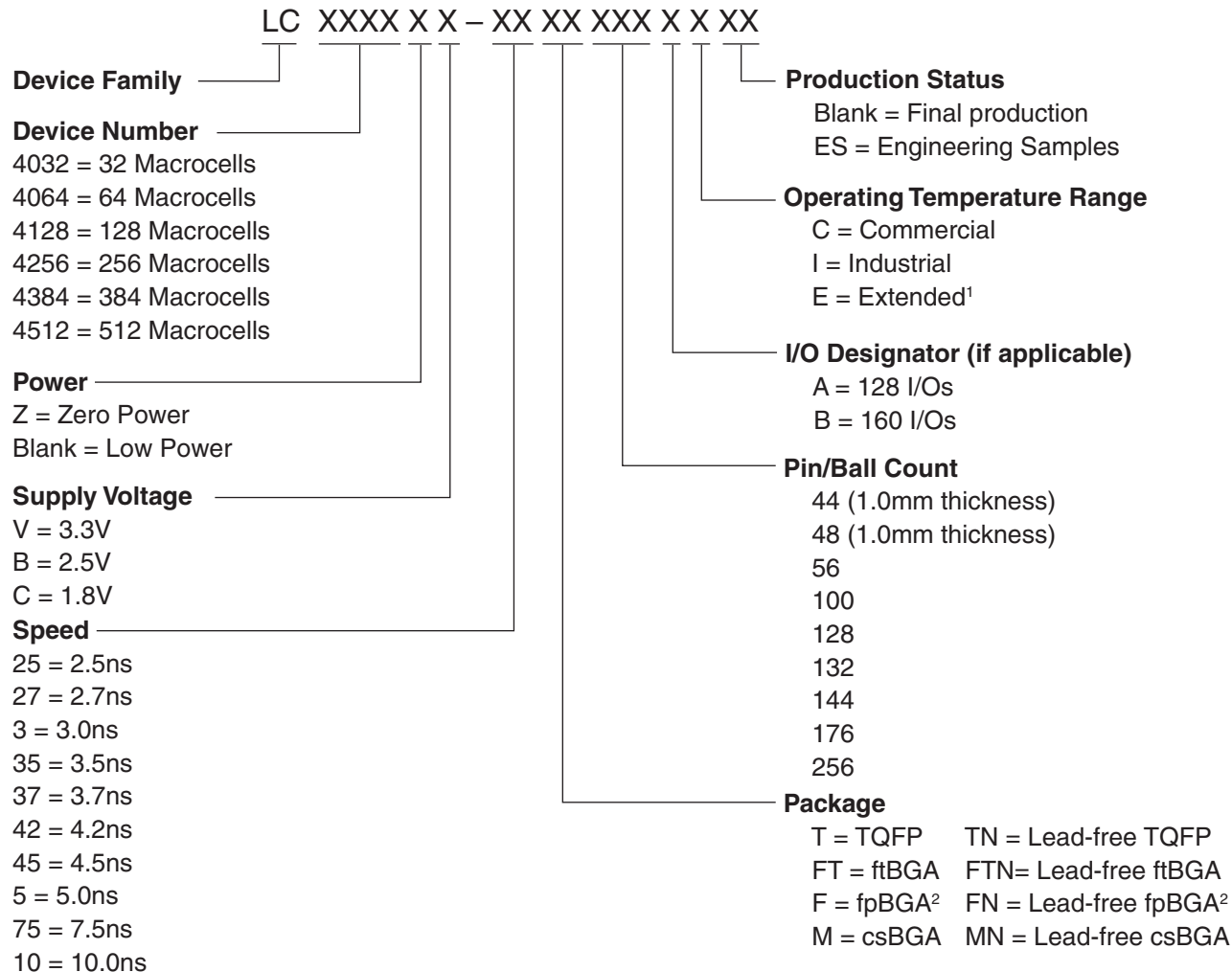
**ispMACH 4256V/B/C, 4384V/B/C, 4512V/B/C Logic Signal Connections:
256-Ball ftBGA/fpBGA**

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
-	-	-	-	-	-	VCC	-	VCC	-
-	-	GND	-	GND	-	GND	-	GND	-
C3	-	TDI	-	TDI	-	TDI	-	TDI	-
-	0	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-
B1	0	C14	C ⁷	C14	C ⁹	C14	C ⁷	C14	C ⁷
F5	0	C12	C ⁶	C12	C ⁸	C12	C ⁶	C12	C ⁶
D3	0	C10	C ⁵	C10	C ⁷	C10	C ⁵	C10	C ⁵
C1	0	C8	C ⁴	C9	C ⁶	C8	C ⁴	C8	C ⁴
C2	0	C6	C ³	C8	C ⁵	C6	C ³	C6	C ³
E3	0	C4	C ²	C6	C ⁴	C4	C ²	C4	C ²
D2	0	C2	C ¹	C4	C ³	C2	C ¹	C2	C ¹
F6	0	C0	C ⁰	C2	C ²	C0	C ⁰	C0	C ⁰
D1	0	NC	-	C1	C ¹	F6	F ³	H0	H ⁰
E2	0	NC	-	C0	C ⁰	F4	F ²	H4	H ¹
E4	0	NC	-	NC	-	D6	D ³	F4	F ²
G5	0	NC	-	NC	-	D4	D ²	F6	F ³
E1	0	NC	-	NC	-	NC	-	F8	F ⁴
-	0	-	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-
-	0	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-
F2	0	NC	-	NC	-	NC	-	F10	F ⁵
F1	0	NC	-	NC	-	D2	D ¹	F12	F ⁶
G1	0	NC	-	NC	-	D0	D ⁰	F14	F ⁷
G6	0	NC	-	D14	D ⁹	F2	F ¹	H8	H ²
G4	0	NC	-	D12	D ⁸	F0	F ⁰	H12	H ³
H6	0	D14	D ⁷	D10	D ⁷	E14	E ⁷	G14	G ⁷
G3	0	D12	D ⁶	D9	D ⁶	E12	E ⁶	G12	G ⁶
H5	0	D10	D ⁵	D8	D ⁵	E10	E ⁵	G10	G ⁵
G2	0	D8	D ⁴	D6	D ⁴	E8	E ⁴	G8	G ⁴
H1	0	D6	D ³	D4	D ³	E6	E ³	G6	G ³
H2	0	D4	D ²	D2	D ²	E4	E ²	G4	G ²
H3	0	D2	D ¹	D1	D ¹	E2	E ¹	G2	G ¹
H4	0	D0	D ⁰	D0	D ⁰	E0	E ⁰	G0	G ⁰
-	0	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-
-	0	-	-	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-
J4	0	E0	E ⁰	E0	E ⁰	H0	H ⁰	J0	J ⁰
J3	0	E2	E ¹	E1	E ¹	H2	H ¹	J2	J ¹
J2	0	E4	E ²	E2	E ²	H4	H ²	J4	J ²
J1	0	E6	E ³	E4	E ³	H6	H ³	J6	J ³
K1	0	E8	E ⁴	E6	E ⁴	H8	H ⁴	J8	J ⁴
J5	0	E10	E ⁵	E8	E ⁵	H10	H ⁵	J10	J ⁵
K2	0	E12	E ⁶	E9	E ⁶	H12	H ⁶	J12	J ⁶

**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
H15	1	M2	M ¹	M1	M ¹	DX2	DX ¹	JX2	JX ¹
H14	1	M4	M ²	M2	M ²	DX4	DX ²	JX4	JX ²
H13	1	M6	M ³	M4	M ³	DX6	DX ³	JX6	JX ³
G16	1	M8	M ⁴	M6	M ⁴	DX8	DX ⁴	JX8	JX ⁴
H12	1	M10	M ⁵	M8	M ⁵	DX10	DX ⁵	JX10	JX ⁵
G15	1	M12	M ⁶	M9	M ⁶	DX12	DX ⁶	JX12	JX ⁶
H11	1	M14	M ⁷	M10	M ⁷	DX14	DX ⁷	JX14	JX ⁷
F16	1	NC	-	M12	M ⁸	CX0	CX ⁰	IX0	IX ⁰
G13	1	NC	-	M14	M ⁹	CX2	CX ¹	IX4	IX ¹
G14	1	NC	-	NC	-	EX14	EX ⁷	KX0	KX ⁰
F15	1	NC	-	NC	-	EX12	EX ⁶	KX2	KX ¹
E16	1	NC	-	NC	-	NC	-	KX4	KX ²
-	1	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-
-	1	-	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-
E15	1	NC	-	NC	-	NC	-	KX6	KX ³
G12	1	NC	-	NC	-	EX10	EX ⁵	KX8	KX ⁴
E13	1	NC	-	NC	-	EX8	EX ⁴	KX10	KX ⁵
D16	1	NC	-	N0	N ⁰	CX4	CX ²	IX8	IX ²
E14	1	NC	-	N1	N ¹	CX6	CX ³	IX12	IX ³
G11	1	N0	N ⁰	N2	N ²	FX0	FX ⁰	NX0	NX ⁰
D15	1	N2	N ¹	N4	N ³	FX2	FX ¹	NX2	NX ¹
F11	1	N4	N ²	N6	N ⁴	FX4	FX ²	NX4	NX ²
C16	1	N6	N ³	N8	N ⁵	FX6	FX ³	NX6	NX ³
F12	1	N8	N ⁴	N9	N ⁶	FX8	FX ⁴	NX8	NX ⁴
D14	1	N10	N ⁵	N10	N ⁷	FX10	FX ⁵	NX10	NX ⁵
C15	1	N12	N ⁶	N12	N ⁸	FX12	FX ⁶	NX12	NX ⁶
B16	1	N14	N ⁷	N14	N ⁹	FX14	FX ⁷	NX14	NX ⁷
-	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-
C14	-	TDO	-	TDO	-	TDO	-	TDO	-
-	-	VCC	-	VCC	-	VCC	-	VCC	-
-	-	GND	-	GND	-	GND	-	GND	-
-	1	-	-	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-
A15	1	NC	-	NC	-	EX6	EX ³	KX12	KX ⁶
B14	1	NC	-	NC	-	EX4	EX ²	KX14	KX ⁷
E12	1	O14	O ⁷	O14	O ⁹	GX14	GX ⁷	OX14	OX ⁷
A14	1	O12	O ⁶	O12	O ⁸	GX12	GX ⁶	OX12	OX ⁶
C13	1	O10	O ⁵	O10	O ⁷	GX10	GX ⁵	OX10	OX ⁵
D13	1	O8	O ⁴	O9	O ⁶	GX8	GX ⁴	OX8	OX ⁴
E11	1	O6	O ³	O8	O ⁵	GX6	GX ³	OX6	OX ³
B13	1	O4	O ²	O6	O ⁴	GX4	GX ²	OX4	OX ²
F10	1	O2	O ¹	O4	O ³	GX2	GX ¹	OX2	OX ¹

Part Number Description



1. For automotive AEC-Q100 compliant devices, refer to the LA-ispMACH 4000V/Z Automotive Family Data Sheet (DS1017).

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

ispMACH 4000 Family Speed Grade Offering

	-25	-27	-3	-35	-37	-42	-45	-5		-75			-10
	Com	Com	Com	Com	Com	Com	Com	Com	Ind	Com	Ind	Ext	Ind
ispMACH 4032V/B/C												1	
ispMACH 4064V/B/C												1	
ispMACH 4128V/B/C												1	
ispMACH 4256V/B/C													
ispMACH 4384V/B/C													
ispMACH 4512V/B/C													
ispMACH 4032ZC												1	
ispMACH 4064ZC												1	
ispMACH 4128ZC												1	
ispMACH 4256ZC													

1. 3.3V only.

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

ispMACH 4000C (1.8V) Commercial Devices (Cont.)

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4128C	LC4128C-27T128C	128	1.8	2.7	TQFP	128	92	C
	LC4128C-5T128C	128	1.8	5	TQFP	128	92	C
	LC4128C-75T128C	128	1.8	7.5	TQFP	128	92	C
	LC4128C-27T100C	128	1.8	2.7	TQFP	100	64	C
	LC4128C-5T100C	128	1.8	5	TQFP	100	64	C
	LC4128C-75T100C	128	1.8	7.5	TQFP	100	64	C
LC4256C	LC4256C-3FT256AC	256	1.8	3	ftBGA	256	128	C
	LC4256C-5FT256AC	256	1.8	5	ftBGA	256	128	C
	LC4256C-75FT256AC	256	1.8	7.5	ftBGA	256	128	C
	LC4256C-3FT256BC	256	1.8	3	ftBGA	256	160	C
	LC4256C-5FT256BC	256	1.8	5	ftBGA	256	160	C
	LC4256C-75FT256BC	256	1.8	7.5	ftBGA	256	160	C
	LC4256C-3F256AC ¹	256	1.8	3	fpBGA	256	128	C
	LC4256C-5F256AC ¹	256	1.8	5	fpBGA	256	128	C
	LC4256C-75F256AC ¹	256	1.8	7.5	fpBGA	256	128	C
	LC4256C-3F256BC ¹	256	1.8	3	fpBGA	256	160	C
	LC4256C-5F256BC ¹	256	1.8	5	fpBGA	256	160	C
	LC4256C-75F256BC ¹	256	1.8	7.5	fpBGA	256	160	C
	LC4256C-3T176C	256	1.8	3	TQFP	176	128	C
	LC4256C-5T176C	256	1.8	5	TQFP	176	128	C
	LC4256C-75T176C	256	1.8	7.5	TQFP	176	128	C
	LC4256C-3T100C	256	1.8	3	TQFP	100	64	C
	LC4256C-5T100C	256	1.8	5	TQFP	100	64	C
	LC4256C-75T100C	256	1.8	7.5	TQFP	100	64	C
LC4384C	LC4384C-35FT256C	384	1.8	3.5	ftBGA	256	192	C
	LC4384C-5FT256C	384	1.8	5	ftBGA	256	192	C
	LC4384C-75FT256C	384	1.8	7.5	ftBGA	256	192	C
	LC4384C-35F256C ¹	384	1.8	3.5	fpBGA	256	192	C
	LC4384C-5F256C ¹	384	1.8	5	fpBGA	256	192	C
	LC4384C-75F256C ¹	384	1.8	7.5	fpBGA	256	192	C
	LC4384C-35T176C	384	1.8	3.5	TQFP	176	128	C
	LC4384C-5T176C	384	1.8	5	TQFP	176	128	C
	LC4384C-75T176C	384	1.8	7.5	TQFP	176	128	C
LC4512C	LC4512C-35FT256C	512	1.8	3.5	ftBGA	256	208	C
	LC4512C-5FT256C	512	1.8	5	ftBGA	256	208	C
	LC4512C-75FT256C	512	1.8	7.5	ftBGA	256	208	C
	LC4512C-35F256C ¹	512	1.8	3.5	fpBGA	256	208	C
	LC4512C-5F256C ¹	512	1.8	5	fpBGA	256	208	C
	LC4512C-75F256C ¹	512	1.8	7.5	fpBGA	256	208	C
	LC4512C-35T176C	512	1.8	3.5	TQFP	176	128	C
	LC4512C-5T176C	512	1.8	5	TQFP	176	128	C
	LC4512C-75T176C	512	1.8	7.5	TQFP	176	128	C

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

ispMACH 4000C (1.8V) Industrial Devices

Family	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032C	LC4032C-5T48I	32	1.8	5	TQFP	48	32	I
	LC4032C-75T48I	32	1.8	7.5	TQFP	48	32	I
	LC4032C-10T48I	32	1.8	10	TQFP	48	32	I
	LC4032C-5T44I	32	1.8	5	TQFP	44	30	I
	LC4032C-75T44I	32	1.8	7.5	TQFP	44	30	I
	LC4032C-10T44I	32	1.8	10	TQFP	44	30	I
LC4064C	LC4064C-5T100I	64	1.8	5	TQFP	100	64	I
	LC4064C-75T100I	64	1.8	7.5	TQFP	100	64	I
	LC4064C-10T100I	64	1.8	10	TQFP	100	64	I
	LC4064C-5T48I	64	1.8	5	TQFP	48	32	I
	LC4064C-75T48I	64	1.8	7.5	TQFP	48	32	I
	LC4064C-10T48I	64	1.8	10	TQFP	48	32	I
	LC4064C-5T44I	64	1.8	5	TQFP	44	30	I
	LC4064C-75T44I	64	1.8	7.5	TQFP	44	30	I
	LC4064C-10T44I	64	1.8	10	TQFP	44	30	I
LC4128C	LC4128C-5T128I	128	1.8	5	TQFP	128	92	I
	LC4128C-75T128I	128	1.8	7.5	TQFP	128	92	I
	LC4128C-10T128I	128	1.8	10	TQFP	128	92	I
	LC4128C-5T100I	128	1.8	5	TQFP	100	64	I
	LC4128C-75T100I	128	1.8	7.5	TQFP	100	64	I
	LC4128C-10T100I	128	1.8	10	TQFP	100	64	I
LC4256C	LC4256C-5FT256AI	256	1.8	5	ftBGA	256	128	I
	LC4256C-75FT256AI	256	1.8	7.5	ftBGA	256	128	I
	LC4256C-10FT256AI	256	1.8	10	ftBGA	256	128	I
	LC4256C-5FT256BI	256	1.8	5	ftBGA	256	160	I
	LC4256C-75FT256BI	256	1.8	7.5	ftBGA	256	160	I
	LC4256C-10FT256BI	256	1.8	10	ftBGA	256	160	I
	LC4256C-5F256AI ¹	256	1.8	5	fpBGA	256	128	I
	LC4256C-75F256AI ¹	256	1.8	7.5	fpBGA	256	128	I
	LC4256C-10F256AI ¹	256	1.8	10	fpBGA	256	128	I
	LC4256C-5F256BI ¹	256	1.8	5	fpBGA	256	160	I
	LC4256C-75F256BI ¹	256	1.8	7.5	fpBGA	256	160	I
	LC4256C-10F256BI ¹	256	1.8	10	fpBGA	256	160	I
	LC4256C-5T176I	256	1.8	5	TQFP	176	128	I
	LC4256C-75T176I	256	1.8	7.5	TQFP	176	128	I
	LC4256C-10T176I	256	1.8	10	TQFP	176	128	I
	LC4256C-5T100I	256	1.8	5	TQFP	100	64	I
	LC4256C-75T100I	256	1.8	7.5	TQFP	100	64	I
	LC4256C-10T100I	256	1.8	10	TQFP	100	64	I

ispMACH 4000B (2.5V) Industrial Devices

Family	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032B	LC4032B-5T48I	32	2.5	5	TQFP	48	32	I
	LC4032B-75T48I	32	2.5	7.5	TQFP	48	32	I
	LC4032B-10T48I	32	2.5	10	TQFP	48	32	I
	LC4032B-5T44I	32	2.5	5	TQFP	44	30	I
	LC4032B-75T44I	32	2.5	7.5	TQFP	44	30	I
	LC4032B-10T44I	32	2.5	10	TQFP	44	30	I
LC4064B	LC4064B-5T100I	64	2.5	5	TQFP	100	64	I
	LC4064B-75T100I	64	2.5	7.5	TQFP	100	64	I
	LC4064B-10T100I	64	2.5	10	TQFP	100	64	I
	LC4064B-5T48I	64	2.5	5	TQFP	48	32	I
	LC4064B-75T48I	64	2.5	7.5	TQFP	48	32	I
	LC4064B-10T48I	64	2.5	10	TQFP	48	32	I
	LC4064B-5T44I	64	2.5	5	TQFP	44	30	I
	LC4064B-75T44I	64	2.5	7.5	TQFP	44	30	I
	LC4064B-10T44I	64	2.5	10	TQFP	44	30	I
LC4128B	LC4128B-5T128I	128	2.5	5	TQFP	128	92	I
	LC4128B-75T128I	128	2.5	7.5	TQFP	128	92	I
	LC4128B-10T128I	128	2.5	10	TQFP	128	92	I
	LC4128B-5T100I	128	2.5	5	TQFP	100	64	I
	LC4128B-75T100I	128	2.5	7.5	TQFP	100	64	I
	LC4128B-10T100I	128	2.5	10	TQFP	100	64	I
LC4256B	LC4256B-5FT256AI	256	2.5	5	ftBGA	256	128	I
	LC4256B-75FT256AI	256	2.5	7.5	ftBGA	256	128	I
	LC4256B-10FT256AI	256	2.5	10	ftBGA	256	128	I
	LC4256B-5FT256BI	256	2.5	5	ftBGA	256	160	I
	LC4256B-75FT256BI	256	2.5	7.5	ftBGA	256	160	I
	LC4256B-10FT256BI	256	2.5	10	ftBGA	256	160	I
	LC4256B-5F256AI ¹	256	2.5	5	fpBGA	256	128	I
	LC4256B-75F256AI ¹	256	2.5	7.5	fpBGA	256	128	I
	LC4256B-10F256AI ¹	256	2.5	10	fpBGA	256	128	I
	LC4256B-5F256BI ¹	256	2.5	5	fpBGA	256	160	I
	LC4256B-75F256BI ¹	256	2.5	7.5	fpBGA	256	160	I
	LC4256B-10F256BI ¹	256	2.5	10	fpBGA	256	160	I
	LC4256B-5T176I	256	2.5	5	TQFP	176	128	I
	LC4256B-75T176I	256	2.5	7.5	TQFP	176	128	I
	LC4256B-10T176I	256	2.5	10	TQFP	176	128	I
	LC4256B-5T100I	256	2.5	5	TQFP	100	64	I
	LC4256B-75T100I	256	2.5	7.5	TQFP	100	64	I
	LC4256B-10T100I	256	2.5	10	TQFP	100	64	I

ispMACH 4000B (2.5V) Industrial Devices (Cont.)

Family	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4384B	LC4384B-5FT256I	384	2.5	5	ftBGA	256	192	I
	LC4384B-75FT256I	384	2.5	7.5	ftBGA	256	192	I
	LC4384B-10FT256I	384	2.5	10	ftBGA	256	192	I
	LC4384B-5F256I ¹	384	2.5	5	fpBGA	256	192	I
	LC4384B-75F256I ¹	384	2.5	7.5	fpBGA	256	192	I
	LC4384B-10F256I ¹	384	2.5	10	fpBGA	256	192	I
	LC4384B-5T176I	384	2.5	5	TQFP	176	128	I
	LC4384B-75T176I	384	2.5	7.5	TQFP	176	128	I
	LC4384B-10T176I	384	2.5	10	TQFP	176	128	I
LC4512B	LC4512B-5FT256I	512	2.5	5	ftBGA	256	208	I
	LC4512B-75FT256I	512	2.5	7.5	ftBGA	256	208	I
	LC4512B-10FT256I	512	2.5	10	ftBGA	256	208	I
	LC4512B-5F256I ¹	512	2.5	5	fpBGA	256	208	I
	LC4512B-75F256I ¹	512	2.5	7.5	fpBGA	256	208	I
	LC4512B-10F256I ¹	512	2.5	10	fpBGA	256	208	I
	LC4512B-5T176I	512	2.5	5	TQFP	176	128	I
	LC4512B-75T176I	512	2.5	7.5	TQFP	176	128	I
	LC4512B-10T176I	512	2.5	10	TQFP	176	128	I

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

ispMACH 4000V (3.3V) Commercial Devices

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032V	LC4032V-25T48C	32	3.3	2.5	TQFP	48	32	C
	LC4032V-5T48C	32	3.3	5	TQFP	48	32	C
	LC4032V-75T48C	32	3.3	7.5	TQFP	48	32	C
	LC4032V-25T44C	32	3.3	2.5	TQFP	44	30	C
	LC4032V-5T44C	32	3.3	5	TQFP	44	30	C
	LC4032V-75T44C	32	3.3	7.5	TQFP	44	30	C
LC4064V	LC4064V-25T100C	64	3.3	2.5	TQFP	100	64	C
	LC4064V-5T100C	64	3.3	5	TQFP	100	64	C
	LC4064V-75T100C	64	3.3	7.5	TQFP	100	64	C
	LC4064V-25T48C	64	3.3	2.5	TQFP	48	32	C
	LC4064V-5T48C	64	3.3	5	TQFP	48	32	C
	LC4064V-75T48C	64	3.3	7.5	TQFP	48	32	C
	LC4064V-25T44C	64	3.3	2.5	TQFP	44	30	C
	LC4064V-5T44C	64	3.3	5	TQFP	44	30	C
	LC4064V-75T44C	64	3.3	7.5	TQFP	44	30	C

ispMACH 4000V (3.3V) Extended Temperature Devices

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032V	LC4032V-75T48E	32	3.3	7.5	TQFP	48	32	E
	LC4032V-75T44E	32	3.3	7.5	TQFP	44	30	E
LC4064V	LC4064V-75T100E	64	3.3	7.5	TQFP	100	64	E
	LC4064V-75T48E	64	3.3	7.5	TQFP	48	32	E
	LC4064V-75T44E	64	3.3	7.5	TQFP	44	30	E
LC4128V	LC4128V-75T144E	128	3.3	7.5	TQFP	144	96	E
	LC4128V-75T128E	128	3.3	7.5	TQFP	128	92	E
	LC4128V-75T100E	128	3.3	7.5	TQFP	100	64	E
LC4256V	LC4256V-75T176E	256	3.3	7.5	TQFP	176	128	E
	LC4256V-75T144E	256	3.3	7.5	TQFP	144	96	E
	LC4256V-75T100E	256	3.3	7.5	TQFP	100	64	E

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