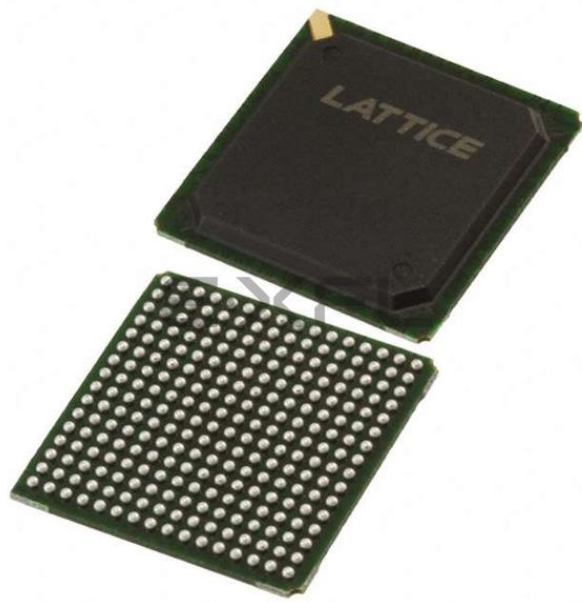




Welcome to [E-XFL.COM](https://www.e-xfl.com)

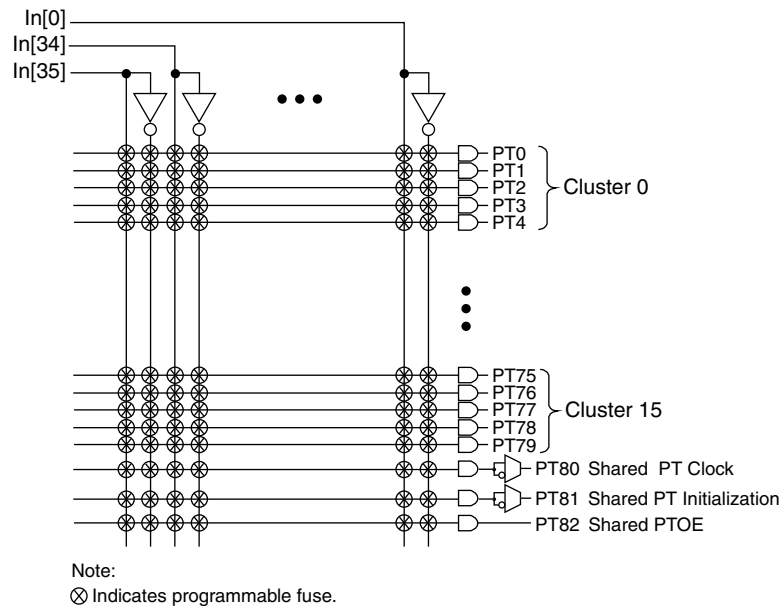
Understanding [Embedded - CPLDs \(Complex Programmable Logic Devices\)](#)

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	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-BGA
Supplier Device Package	256-FPBGA (17x17)
Purchase URL	https://www.e-xfl.com/product-detail/lattice-semiconductor/lc4256b-75fn256ai

Figure 3. AND Array

Enhanced Logic Allocator

Within the logic allocator, product terms are allocated to macrocells in product term clusters. Each product term cluster is associated with a macrocell. The cluster size for the ispMACH 4000 family is 4+1 (total 5) product terms. The software automatically considers the availability and distribution of product term clusters as it fits the functions within a GLB. The logic allocator is designed to provide three speed paths: 5-PT fast bypass path, 20-PT Speed Locking path and an up to 80-PT path. The availability of these three paths lets designers trade timing variability for increased performance.

The enhanced Logic Allocator of the ispMACH 4000 family consists of the following blocks:

- Product Term Allocator
- Cluster Allocator
- Wide Steering Logic

Figure 4 shows a macrocell slice of the Logic Allocator. There are 16 such slices in the GLB.

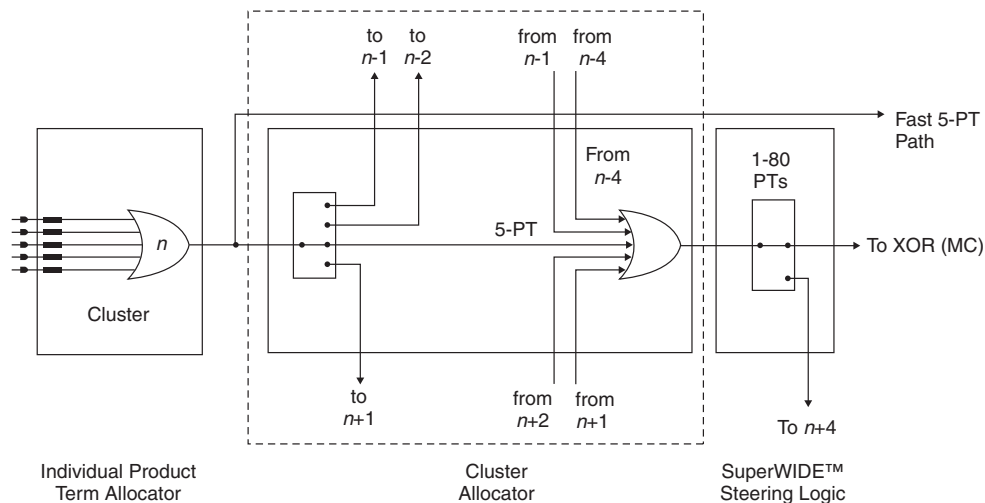
Figure 4. Macrocell Slice

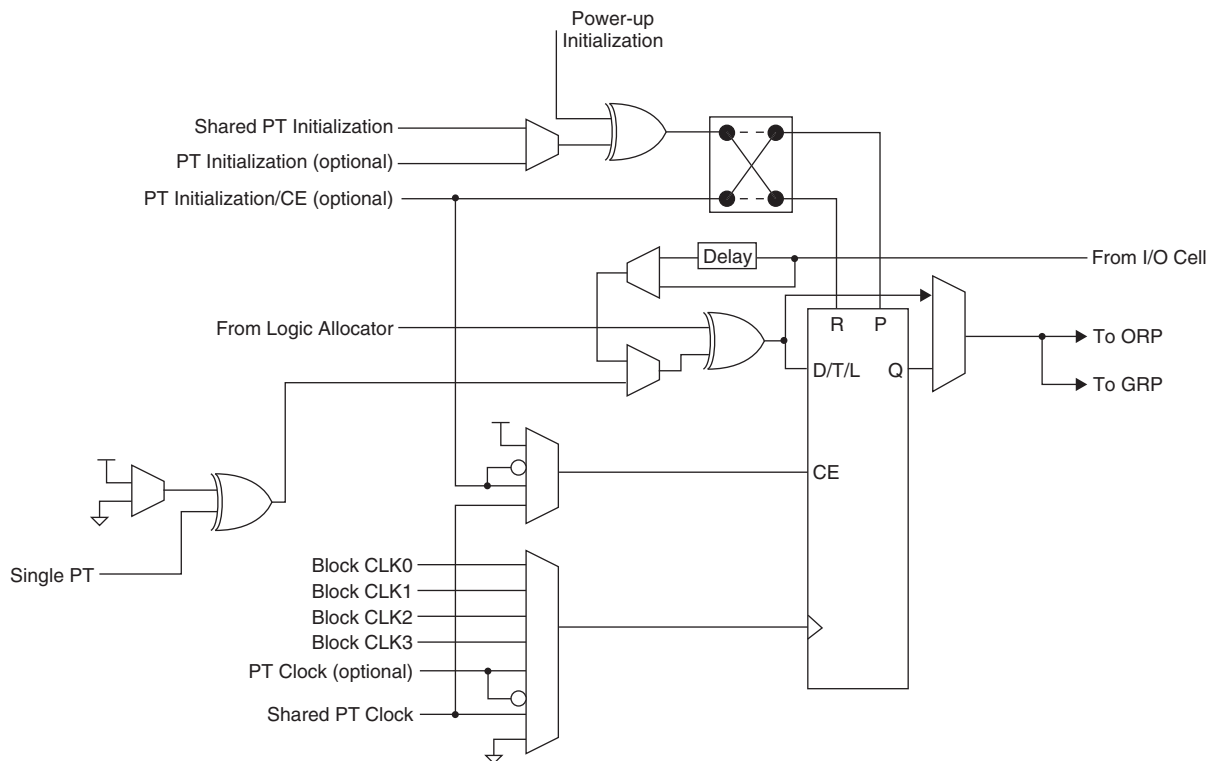
Table 5. Product Term Expansion Capability

Expansion Chains	Macrocells Associated with Expansion Chain (with Wrap Around)	Max PT/Macrocell
Chain-0	M0 M4 M8 M12 M0	75
Chain-1	M1 M5 M9 M13 M1	80
Chain-2	M2 M6 M10 M14 M2	75
Chain-3	M3 M7 M11 M15 M3	70

Every time the super cluster allocator is used, there is an incremental delay of t_{EXP} . When the super cluster allocator is used, all destinations other than the one being steered to, are given the value of ground (i.e., if the super cluster is steered to M (n+4), then M (n) is ground).

Macrocell

The 16 macrocells in the GLB are driven by the 16 outputs from the logic allocator. Each macrocell contains a programmable XOR gate, a programmable register/latch, along with routing for the logic and control functions. Figure 5 shows a graphical representation of the macrocell. The macrocells feed the ORP and GRP. A direct input from the I/O cell allows designers to use the macrocell to construct high-speed input registers. A programmable delay in this path allows designers to choose between the fastest possible set-up time and zero hold time.

Figure 5. Macrocell

Enhanced Clock Multiplexer

The clock input to the flip-flop can select any of the four block clocks along with the shared PT clock, and true and complement forms of the optional individual term clock. An 8:1 multiplexer structure is used to select the clock. The eight sources for the clock multiplexer are as follows:

- Block CLK0
- Block CLK1

Supply Current, ispMACH 4000V/B/C

Over Recommended Operating Conditions

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
ispMACH 4032V/B/C						
ICC ^{1,2,3}	Operating Power Supply Current	Vcc = 3.3V	—	11.8	—	mA
		Vcc = 2.5V	—	11.8	—	mA
		Vcc = 1.8V	—	1.8	—	mA
ICC ⁴	Standby Power Supply Current	Vcc = 3.3V	—	11.3	—	mA
		Vcc = 2.5V	—	11.3	—	mA
		Vcc = 1.8V	—	1.3	—	mA
ispMACH 4064V/B/C						
ICC ^{1,2,3}	Operating Power Supply Current	Vcc = 3.3V	—	12	—	mA
		Vcc = 2.5V	—	12	—	mA
		Vcc = 1.8V	—	2	—	mA
ICC ⁵	Standby Power Supply Current	Vcc = 3.3V	—	11.5	—	mA
		Vcc = 2.5V	—	11.5	—	mA
		Vcc = 1.8V	—	1.5	—	mA
ispMACH 4128V/B/C						
ICC ^{1,2,3}	Operating Power Supply Current	Vcc = 3.3V	—	12	—	mA
		Vcc = 2.5V	—	12	—	mA
		Vcc = 1.8V	—	2	—	mA
ICC ⁴	Standby Power Supply Current	Vcc = 3.3V	—	11.5	—	mA
		Vcc = 2.5V	—	11.5	—	mA
		Vcc = 1.8V	—	1.5	—	mA
ispMACH 4256V/B/C						
I _{CC} ^{1,2,3}	Operating Power Supply Current	Vcc = 3.3V	—	12.5	—	mA
		Vcc = 2.5V	—	12.5	—	mA
		Vcc = 1.8V	—	2.5	—	mA
I _{CC} ⁴	Standby Power Supply Current	Vcc = 3.3V	—	12	—	mA
		Vcc = 2.5V	—	12	—	mA
		Vcc = 1.8V	—	2	—	mA
ispMACH 4384V/B/C						
I _{CC} ^{1,2,3}	Operating Power Supply Current	Vcc = 3.3V	—	13.5	—	mA
		Vcc = 2.5V	—	13.5	—	mA
		Vcc = 1.8V	—	3.5	—	mA
I _{CC} ⁴	Standby Power Supply Current	Vcc = 3.3V	—	12.5	—	mA
		Vcc = 2.5V	—	12.5	—	mA
		Vcc = 1.8V	—	2.5	—	mA
ispMACH 4512V/B/C						
I _{CC} ^{1,2,3}	Operating Power Supply Current	Vcc = 3.3V	—	14	—	mA
		Vcc = 2.5V	—	14	—	mA
		Vcc = 1.8V	—	4	—	mA

Supply Current, ispMACH 4000V/B/C (Cont.)

Over Recommended Operating Conditions

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
I_{CC}^{4}	Standby Power Supply Current	$V_{CC} = 3.3V$	—	13	—	mA
		$V_{CC} = 2.5V$	—	13	—	mA
		$V_{CC} = 1.8V$	—	3	—	mA

1. $T_A = 25^{\circ}C$, frequency = 1.0 MHz.
2. Device configured with 16-bit counters.
3. I_{CC} varies with specific device configuration and operating frequency.
4. $T_A = 25^{\circ}C$

Supply Current, ispMACH 4000Z

Over Recommended Operating Conditions

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
ispMACH 4032ZC						
ICC ^{1, 2, 3, 5}	Operating Power Supply Current	Vcc = 1.8V, T _A = 25°C	—	50	—	μA
		Vcc = 1.9V, T _A = 70°C	—	58	—	μA
		Vcc = 1.9V, T _A = 85°C	—	60	—	μA
		Vcc = 1.9V, T _A = 125°C	—	70	—	μA
ICC ^{4, 5}	Standby Power Supply Current	Vcc = 1.8V, T _A = 25°C	—	10	—	μA
		Vcc = 1.9V, T _A = 70°C	—	13	20	μA
		Vcc = 1.9V, T _A = 85°C	—	15	25	μA
		Vcc = 1.9V, T _A = 125°C	—	22	—	μA
ispMACH 4064ZC						
ICC ^{1, 2, 3, 5}	Operating Power Supply Current	Vcc = 1.8V, T _A = 25°C	—	80	—	μA
		Vcc = 1.9V, T _A = 70°C	—	89	—	μA
		Vcc = 1.9V, T _A = 85°C	—	92	—	μA
		Vcc = 1.9V, T _A = 125°C	—	109	—	μA
ICC ^{4, 5}	Standby Power Supply Current	Vcc = 1.8V, T _A = 25°C	—	11	—	μA
		Vcc = 1.9V, T _A = 70°C	—	15	25	μA
		Vcc = 1.9V, T _A = 85°C	—	18	35	μA
		Vcc = 1.9V, T _A = 125°C	—	37	—	μA
ispMACH 4128ZC						
ICC ^{1, 2, 3, 5}	Operating Power Supply Current	Vcc = 1.8V, T _A = 25°C	—	168	—	μA
		Vcc = 1.9V, T _A = 70°C	—	190	—	μA
		Vcc = 1.9V, T _A = 85°C	—	195	—	μA
		Vcc = 1.9V, T _A = 125°C	—	212	—	μA
ICC ^{4, 5}	Standby Power Supply Current	Vcc = 1.8V, T _A = 25°C	—	12	—	μA
		Vcc = 1.9V, T _A = 70°C	—	16	35	μA
		Vcc = 1.9V, T _A = 85°C	—	19	50	μA
		Vcc = 1.9V, T _A = 125°C	—	42	—	μA

ispMACH 4000V/B/C Internal Timing Parameters (Cont.)**Over Recommended Operating Conditions**

Parameter	Description	-2.5		-2.7		-3		-3.5		Units
t_{PDLi}	Propagation Delay through Transparent Latch to Output/ Feedback MUX	—	0.25	—	0.25	—	0.25	—	0.25	ns
t_{SRi}	Asynchronous Reset or Set to Output/Feedback MUX Delay	0.28	—	0.28	—	0.28	—	0.28	—	ns
t_{SRR}	Asynchronous Reset or Set Recovery Time	1.67	—	1.67	—	1.67	—	1.67	—	ns
Control Delays										
t_{BCLK}	GLB PT Clock Delay	—	1.12	—	1.12	—	1.12	—	1.12	ns
t_{PTCLK}	Macrocell PT Clock Delay	—	0.87	—	0.87	—	0.87	—	0.87	ns
t_{BSR}	Block PT Set/Reset Delay	—	1.83	—	1.83	—	1.83	—	1.83	ns
t_{PTSR}	Macrocell PT Set/Reset Delay	—	1.11	—	1.41	—	1.51	—	1.61	ns
t_{GPTOE}	Global PT OE Delay	—	2.83	—	4.13	—	5.33	—	5.33	ns
t_{PTOE}	Macrocell PT OE Delay	—	1.83	—	2.13	—	2.33	—	2.83	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 4000V/B/C Internal Timing Parameters

Over Recommended Operating Conditions

Parameter	Description	-5		-75		-10		Units
		Min.	Max.	Min.	Max.	Min.	Max.	
In/Out Delays								
t _{IN}	Input Buffer Delay	—	0.95	—	1.50	—	2.00	ns
t _{GOE}	Global OE Pin Delay	—	4.04	—	6.04	—	7.04	ns
t _{GCLK_IN}	Global Clock Input Buffer Delay	—	1.83	—	2.28	—	3.28	ns
t _{BUF}	Delay through Output Buffer	—	1.00	—	1.50	—	1.50	ns
t _{EN}	Output Enable Time	—	0.96	—	0.96	—	0.96	ns
t _{DIS}	Output Disable Time	—	0.96	—	0.96	—	0.96	ns
Routing/GLB Delays								
t _{ROUTE}	Delay through GRP	—	1.51	—	2.26	—	3.26	ns
t _{MCELL}	Macrocell Delay	—	1.05	—	1.45	—	1.95	ns
t _{INREG}	Input Buffer to Macrocell Register Delay	—	0.56	—	0.96	—	1.46	ns
t _{FBK}	Internal Feedback Delay	—	0.00	—	0.00	—	0.00	ns
t _{PDb}	5-PT Bypass Propagation Delay	—	1.54	—	2.24	—	3.24	ns
t _{PDi}	Macrocell Propagation Delay	—	0.94	—	1.24	—	1.74	ns
Register/Latch Delays								
t _S	D-Register Setup Time (Global Clock)	1.32	—	1.57	—	1.57	—	ns
t _{S_PT}	D-Register Setup Time (Product Term Clock)	1.32	—	1.32	—	1.32	—	ns
t _{ST}	T-Register Setup Time (Global Clock)	1.52	—	1.77	—	1.77	—	ns
t _{ST_PT}	T-Register Setup Time (Product Term Clock)	1.32	—	1.32	—	1.32	—	ns
t _H	D-Register Hold Time	1.68	—	2.93	—	3.93	—	ns
t _{HT}	T-Register Hold Time	1.68	—	2.93	—	3.93	—	ns
t _{SIR}	D-Input Register Setup Time (Global Clock)	1.52	—	1.57	—	1.57	—	ns
t _{SIR_PT}	D-Input Register Setup Time (Product Term Clock)	1.45	—	1.45	—	1.45	—	ns
t _{HIR}	D-Input Register Hold Time (Global Clock)	0.68	—	1.18	—	1.18	—	ns
t _{HIR_PT}	D-Input Register Hold Time (Product Term Clock)	0.68	—	1.18	—	1.18	—	ns
t _{COi}	Register Clock to Output/Feedback MUX Time	—	0.52	—	0.67	—	1.17	ns
t _{CES}	Clock Enable Setup Time	2.25	—	2.25	—	2.25	—	ns
t _{CEH}	Clock Enable Hold Time	1.88	—	1.88	—	1.88	—	ns
t _{SL}	Latch Setup Time (Global Clock)	1.32	—	1.57	—	1.57	—	ns
t _{SL_PT}	Latch Setup Time (Product Term Clock)	1.32	—	1.32	—	1.32	—	ns
t _{HL}	Latch Hold Time	1.17	—	1.17	—	1.17	—	ns
t _{GOi}	Latch Gate to Output/Feedback MUX Time	—	0.33	—	0.33	—	0.33	ns
t _{PDLi}	Propagation Delay through Transparent Latch to Output/Feedback MUX	—	0.25	—	0.25	—	0.25	ns
t _{SRI}	Asynchronous Reset or Set to Output/Feedback MUX Delay	0.28	—	0.28	—	0.28	—	ns
t _{SRR}	Asynchronous Reset or Set Recovery Time	1.67	—	1.67	—	1.67	—	ns
Control Delays								
t _{BCLK}	GLB PT Clock Delay	—	1.12	—	1.12	—	0.62	ns
t _{PTCLK}	Macrocell PT Clock Delay	—	0.87	—	0.87	—	0.87	ns
t _{BSR}	GLB PT Set/Reset Delay	—	1.83	—	1.83	—	1.83	ns
t _{PTSR}	Macrocell PT Set/Reset Delay	—	2.51	—	3.41	—	3.41	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.

Boundary Scan Waveforms and Timing Specifications

Symbol	Parameter	Min.	Max.	Units
t_{BTCP}	TCK [BSCAN test] clock cycle	40	—	ns
t_{BTCH}	TCK [BSCAN test] pulse width high	20	—	ns
t_{BTCL}	TCK [BSCAN test] pulse width low	20	—	ns
t_{BTSU}	TCK [BSCAN test] setup time	8	—	ns
t_{BTH}	TCK [BSCAN test] hold time	10	—	ns
t_{BRF}	TCK [BSCAN test] rise and fall time	50	—	mV/ns
t_{BTCO}	TAP controller falling edge of clock to valid output	—	10	ns
t_{BTOZ}	TAP controller falling edge of clock to data output disable	—	10	ns
t_{BTVO}	TAP controller falling edge of clock to data output enable	—	10	ns
t_{BTCPSU}	BSCAN test Capture register setup time	8	—	ns
t_{BTCPH}	BSCAN test Capture register hold time	10	—	ns
t_{BTUCO}	BSCAN test Update reg, falling edge of clock to valid output	—	25	ns
t_{BTUOZ}	BSCAN test Update reg, falling edge of clock to output disable	—	25	ns
t_{BTUOV}	BSCAN test Update reg, falling edge of clock to output enable	—	25	ns

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 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 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
C12	1	O0	O ⁰	O2	O ²	GX0	GX ⁰	OX0	OX ⁰
E10	1	NC	-	O1	O ¹	CX8	CX ⁴	MX0	MX ⁰
A13	1	NC	-	O0	O ⁰	CX10	CX ⁵	MX4	MX ¹
D12	1	NC	-	NC	-	NC	-	LX0	LX ⁰
-	1	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-	GND (Bank 1)	-
-	1	VCCO (Bank 1)	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-	VCCO (Bank 1)	-
B12	1	NC	-	NC	-	NC	-	LX4	LX ¹
A12	1	NC	-	NC	-	EX2	EX ¹	LX8	LX ²
B11	1	NC	-	NC	-	EX0	EX ⁰	LX12	LX ³
A11	1	NC	-	P14	P ⁹	CX12	CX ⁶	MX8	MX ²
D10	1	NC	-	P12	P ⁸	CX14	CX ⁷	MX12	MX ³
C10	1	P14	P ⁷	P10	P ⁷	HX14	HX ⁷	PX14	PX ⁷
B10	1	P12	P ⁶	P9	P ⁶	HX12	HX ⁶	PX12	PX ⁶
A10	1	P10	P ⁵	P8	P ⁵	HX10	HX ⁵	PX10	PX ⁵
A9	1	P8	P ⁴	P6	P ⁴	HX8	HX ⁴	PX8	PX ⁴
F9	1	P6	P ³	P4	P ³	HX6	HX ³	PX6	PX ³
B9	1	P4	P ²	P2	P ²	HX4	HX ²	PX4	PX ²
E9	1	P2/GOE1	P ¹	P1/GOE1	P ¹	HX2/GOE1	HX ¹	PX2/GOE1	PX ¹
C9	1	P0	P ⁰	P0	P ⁰	HX0	HX ⁰	PX0	PX ⁰
-	-	GND	-	GND	-	GND	-	GND	-
D9	1	CLK3/I	-	CLK3/I	-	CLK3/I	-	CLK3/I	-
-	0	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-
B8	0	CLK0/I	-	CLK0/I	-	CLK0/I	-	CLK0/I	-
-	-	VCC	-	VCC	-	VCC	-	VCC	-
D8	0	A0	A ⁰	A0	A ⁰	A0	A ⁰	A0	A ⁰
C8	0	A2/GOE0	A ¹	A1/GOE0	A ¹	A2/GOE0	A ¹	A2/GOE0	A ¹
A8	0	A4	A ²	A2	A ²	A4	A ²	A4	A ²
A7	0	A6	A ³	A4	A ³	A6	A ³	A6	A ³
B7	0	A8	A ⁴	A6	A ⁴	A8	A ⁴	A8	A ⁴
E8	0	A10	A ⁵	A8	A ⁵	A10	A ⁵	A10	A ⁵
D7	0	A12	A ⁶	A9	A ⁶	A12	A ⁶	A12	A ⁶
F8	0	A14	A ⁷	A10	A ⁷	A14	A ⁷	A14	A ⁷
C7	0	NC	-	A12	A ⁸	F14	F ⁷	D0	D ⁰
A6	0	NC	-	A14	A ⁹	F12	F ⁶	D4	D ¹
B6	0	NC	-	NC	-	D14	D ⁷	E0	E ⁰
A5	0	NC	-	NC	-	D12	D ⁶	E4	E ¹
B5	0	NC	-	NC	-	NC	-	E8	E ²
-	0	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-	VCCO (Bank 0)	-
-	0	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-	GND (Bank 0)	-
D5	0	NC	-	NC	-	NC	-	E12	E ³
A4	0	NC	-	B0	B ⁰	F10	F ⁵	D8	D ²

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) Commercial Devices (Cont.)

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4512V	LC4512V-35FT256C	512	3.3	3.5	ftBGA	256	208	C
	LC4512V-5FT256C	512	3.3	5	ftBGA	256	208	C
	LC4512V-75FT256C	512	3.3	7.5	ftBGA	256	208	C
	LC4512V-35F256C ¹	512	3.3	3.5	fpBGA	256	208	C
	LC4512V-5F256C ¹	512	3.3	5	fpBGA	256	208	C
	LC4512V-75F256C ¹	512	3.3	7.5	fpBGA	256	208	C
	LC4512V-35T176C	512	3.3	3.5	TQFP	176	128	C
	LC4512V-5T176C	512	3.3	5	TQFP	176	128	C
	LC4512V-75T176C	512	3.3	7.5	TQFP	176	128	C

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

ispMACH 4000V (3.3V) Industrial Devices

Family	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032V	LC4032V-5T48I	32	3.3	5	TQFP	48	32	I
	LC4032V-75T48I	32	3.3	7.5	TQFP	48	32	I
	LC4032V-10T48I	32	3.3	10	TQFP	48	32	I
	LC4032V-5T44I	32	3.3	5	TQFP	44	30	I
	LC4032V-75T44I	32	3.3	7.5	TQFP	44	30	I
	LC4032V-10T44I	32	3.3	10	TQFP	44	30	I
LC4064V	LC4064V-5T100I	64	3.3	5	TQFP	100	64	I
	LC4064V-75T100I	64	3.3	7.5	TQFP	100	64	I
	LC4064V-10T100I	64	3.3	10	TQFP	100	64	I
	LC4064V-5T48I	64	3.3	5	TQFP	48	32	I
	LC4064V-75T48I	64	3.3	7.5	TQFP	48	32	I
	LC4064V-10T48I	64	3.3	10	TQFP	48	32	I
	LC4064V-5T44I	64	3.3	5	TQFP	44	30	I
	LC4064V-75T44I	64	3.3	7.5	TQFP	44	30	I
	LC4064V-10T44I	64	3.3	10	TQFP	44	30	I
LC4128V	LC4128V-5T144I	128	3.3	5	TQFP	144	96	I
	LC4128V-75T144I	128	3.3	7.5	TQFP	144	96	I
	LC4128V-10T144I	128	3.3	10	TQFP	144	96	I
	LC4128V-5T128I	128	3.3	5	TQFP	128	92	I
	LC4128V-75T128I	128	3.3	7.5	TQFP	128	92	I
	LC4128V-10T128I	128	3.3	10	TQFP	128	92	I
	LC4128V-5T100I	128	3.3	5	TQFP	100	64	I
	LC4128V-75T100I	128	3.3	7.5	TQFP	100	64	I
	LC4128V-10T100I	128	3.3	10	TQFP	100	64	I

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

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4064ZC	LC4064ZC-5MN132I	64	1.8	5	Lead-free csBGA	132	64	I
	LC4064ZC-75MN132I	64	1.8	7.5	Lead-free csBGA	132	64	I
	LC4064ZC-5TN100I	64	1.8	5	Lead-free TQFP	100	64	I
	LC4064ZC-75TN100I	64	1.8	7.5	Lead-free TQFP	100	64	I
	LC4064ZC-5MN56I	64	1.8	5	Lead-free csBGA	56	32	I
	LC4064ZC-75MN56I	64	1.8	7.5	Lead-free csBGA	56	32	I
	LC4064ZC-5TN48I	64	1.8	5	Lead-free TQFP	48	32	I
	LC4064ZC-75TN48I	64	1.8	7.5	Lead-free TQFP	48	32	I
LC4128ZC	LC4128ZC-75MN132I	128	1.8	7.5	Lead-free csBGA	132	96	I
	LC4128ZC-75TN100I	128	1.8	7.5	Lead-free TQFP	100	64	I
LC4256ZC	LC4256ZC-75TN176I	256	1.8	7.5	Lead-free TQFP	176	128	I
	LC4256ZC-75MN132I	256	1.8	7.5	Lead-free csBGA	132	96	I
	LC4256ZC-75TN100I	256	1.8	7.5	Lead-free TQFP	100	64	I

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

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032ZC	LC4032ZC-75TN48E	32	1.8	7.5	Lead-free TQFP	48	32	E
LC4064ZC	LC4064ZC-75TN100E	64	1.8	7.5	Lead-free TQFP	100	64	E
	LC4064ZC-75TN48E	64	1.8	7.5	Lead-free TQFP	48	32	E
LC4128ZC	LC4128ZC-75TN100E	128	1.8	7.5	Lead-free TQFP	100	64	E
LC4256ZC	LC4256ZC-75TN176E	256	1.8	7.5	Lead-free TQFP	176	128	E
	LC4256ZC-75TN100E	256	1.8	7.5	Lead-free TQFP	100	64	E

ispMACH 4000C (1.8V) Lead-Free Commercial Devices

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032C	LC4032C-25TN48C	32	1.8	2.5	Lead-free TQFP	48	32	C
	LC4032C-5TN48C	32	1.8	5	Lead-free TQFP	48	32	C
	LC4032C-75TN48C	32	1.8	7.5	Lead-free TQFP	48	32	C
	LC4032C-25TN44C	32	1.8	2.5	Lead-free TQFP	44	30	C
	LC4032C-5TN44C	32	1.8	5	Lead-free TQFP	44	30	C
	LC4032C-75TN44C	32	1.8	7.5	Lead-free TQFP	44	30	C

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

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4512C	LC4512C-35FTN256C	512	1.8	3.5	Lead-free ftBGA	256	208	C
	LC4512C-5FTN256C	512	1.8	5	Lead-free ftBGA	256	208	C
	LC4512C-75FTN256C	512	1.8	7.5	Lead-free ftBGA	256	208	C
	LC4512C-35FN256C ¹	512	1.8	3.5	Lead-free fpBGA	256	208	C
	LC4512C-5FN256C ¹	512	1.8	5	Lead-free fpBGA	256	208	C
	LC4512C-75FN256C ¹	512	1.8	7.5	Lead-free fpBGA	256	208	C
	LC4512C-35TN176C	512	1.8	3.5	Lead-free TQFP	176	128	C
	LC4512C-5TN176C	512	1.8	5	Lead-free TQFP	176	128	C
	LC4512C-75TN176C	512	1.8	7.5	Lead-free TQFP	176	128	C

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

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

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032C	LC4032C-5TN48I	32	1.8	5	Lead-free TQFP	48	32	I
	LC4032C-75TN48I	32	1.8	7.5	Lead-free TQFP	48	32	I
	LC4032C-10TN48I	32	1.8	10	Lead-free TQFP	48	32	I
	LC4032C-5TN44I	32	1.8	5	Lead-free TQFP	44	30	I
	LC4032C-75TN44I	32	1.8	7.5	Lead-free TQFP	44	30	I
	LC4032C-10TN44I	32	1.8	10	Lead-free TQFP	44	30	I
LC4064C	LC4064C-5TN100I	64	1.8	5	Lead-free TQFP	100	64	I
	LC4064C-75TN100I	64	1.8	7.5	Lead-free TQFP	100	64	I
	LC4064C-10TN100I	64	1.8	10	Lead-free TQFP	100	64	I
	LC4064C-5TN48I	64	1.8	5	Lead-free TQFP	48	32	I
	LC4064C-75TN48I	64	1.8	7.5	Lead-free TQFP	48	32	I
	LC4064C-10TN48I	64	1.8	10	Lead-free TQFP	48	32	I
	LC4064C-5TN44I	64	1.8	5	Lead-free TQFP	44	30	I
	LC4064C-75TN44I	64	1.8	5	Lead-free TQFP	44	30	I
	LC4064C-10TN44I	64	1.8	10	Lead-free TQFP	44	30	I
LC4128C	LC4128C-5TN128I	128	1.8	5	Lead-free TQFP	128	92	I
	LC4128C-75TN128I	128	1.8	7.5	Lead-free TQFP	128	92	I
	LC4128C-10TN128I	128	1.8	10	Lead-free TQFP	128	92	I
	LC4128C-5TN100I	128	1.8	5	Lead-free TQFP	100	64	I
	LC4128C-75TN100I	128	1.8	7.5	Lead-free TQFP	100	64	I
	LC4128C-10TN100I	128	1.8	10	Lead-free TQFP	100	64	I

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

Device	Part Number	Macrocells	Voltage	t _{PD}	Package	Pin/Ball Count	I/O	Grade
LC4032B	LC4032B-25TN48C	32	2.5	2.5	Lead-Free TQFP	48	32	C
	LC4032B-5TN48C	32	2.5	5	Lead-Free TQFP	48	32	C
	LC4032B-75TN48C	32	2.5	7.5	Lead-Free TQFP	48	32	C
	LC4032B-25TN44C	32	2.5	2.5	Lead-Free TQFP	44	30	C
	LC4032B-5TN44C	32	2.5	5	Lead-Free TQFP	44	30	C
	LC4032B-75TN44C	32	2.5	7.5	Lead-Free TQFP	44	30	C
LC4064B	LC4064B-25TN100C	64	2.5	2.5	Lead-Free TQFP	100	64	C
	LC4064B-5TN100C	64	2.5	5	Lead-Free TQFP	100	64	C
	LC4064B-75TN100C	64	2.5	7.5	Lead-Free TQFP	100	64	C
	LC4064B-25TN48C	64	2.5	2.5	Lead-Free TQFP	48	32	C
	LC4064B-5TN48C	64	2.5	5	Lead-Free TQFP	48	32	C
	LC4064B-75TN48C	64	2.5	7.5	Lead-Free TQFP	48	32	C
	LC4064B-25TN44C	64	2.5	2.5	Lead-Free TQFP	44	30	C
	LC4064B-5TN44C	64	2.5	5	Lead-Free TQFP	44	30	C
	LC4064B-75TN44C	64	2.5	7.5	Lead-Free TQFP	44	30	C
LC4128B	LC4128B-27TN128C	128	2.5	2.7	Lead-Free TQFP	128	92	C
	LC4128B-5TN128C	128	2.5	5	Lead-Free TQFP	128	92	C
	LC4128B-75TN128C	128	2.5	7.5	Lead-Free TQFP	128	92	C
	LC4128B-27TN100C	128	2.5	2.7	Lead-Free TQFP	100	92	C
	LC4128B-5TN100C	128	2.5	5	Lead-Free TQFP	100	92	C
	LC4128B-75TN100C	128	2.5	7.5	Lead-Free TQFP	100	92	C
LC4256B	LC4256B-3FTN256AC	256	2.5	3	Lead-Free ftBGA	256	128	C
	LC4256B-5FTN256AC	256	2.5	5	Lead-Free ftBGA	256	128	C
	LC4256B-75FTN256AC	256	2.5	7.5	Lead-Free ftBGA	256	128	C
	LC4256B-3FTN256BC	256	2.5	3	Lead-Free ftBGA	256	160	C
	LC4256B-5FTN256BC	256	2.5	5	Lead-Free ftBGA	256	160	C
	LC4256B-75FTN256BC	256	2.5	7.5	Lead-Free ftBGA	256	160	C
	LC4256B-3FN256AC ¹	256	2.5	3	Lead-Free fpBGA	256	128	C
	LC4256B-5FN256AC ¹	256	2.5	5	Lead-Free fpBGA	256	128	C
	LC4256B-75FN256AC ¹	256	2.5	7.5	Lead-Free fpBGA	256	128	C
	LC4256B-3FN256BC ¹	256	2.5	3	Lead-Free fpBGA	256	160	C
	LC4256B-5FN256BC ¹	256	2.5	5	Lead-Free fpBGA	256	160	C
	LC4256B-75FN256BC ¹	256	2.5	7.5	Lead-Free fpBGA	256	160	C
	LC4256B-3TN176C	256	2.5	3	Lead-Free TQFP	176	128	C
	LC4256B-5TN176C	256	2.5	5	Lead-Free TQFP	176	128	C
	LC4256B-75TN176C	256	2.5	7.5	Lead-Free TQFP	176	128	C
	LC4256B-3TN100C	256	2.5	3	Lead-Free TQFP	100	64	C
	LC4256B-5TN100C	256	2.5	5	Lead-Free TQFP	100	64	C
	LC4256B-75TN100C	256	2.5	7.5	Lead-Free TQFP	100	64	C

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 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