Lattice Semiconductor Corporation - ISPLSI 2032A-180LTN44 Datasheet

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Understanding Embedded - CPLDs (Complex Programmable Logic Devices)

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

Applications of Embedded - CPLDs

Details	
Product Status	Obsolete
Programmable Type	In System Programmable
Delay Time tpd(1) Max	5 ns
Voltage Supply - Internal	4.75V ~ 5.25V
Number of Logic Elements/Blocks	8
Number of Macrocells	32
Number of Gates	1000
Number of I/O	32
Operating Temperature	0°C ~ 70°C (TA)
Mounting Type	Surface Mount
Package / Case	44-TQFP
Supplier Device Package	44-TQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/lattice-semiconductor/isplsi-2032a-180ltn44

Lead-Free Package Options Available!

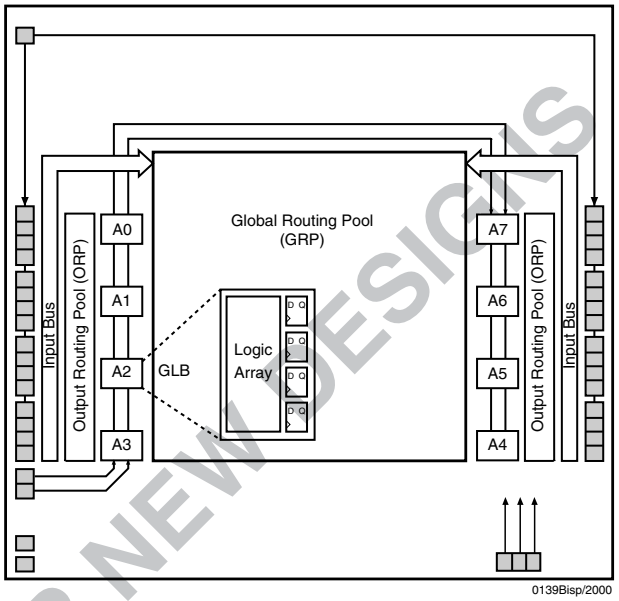
ispLSI® 2032/A

In-System Programmable High Density PLD

Features

- **ENHANCEMENTS**
  - — ispLSI 2032A is Fully Form and Function Compatible to the ispLSI 2032, with Identical Timing Specifcations and Packaging
  - — ispLSI 2032A is Built on an Advanced 0.35 Micron E²CMOS® Technology
- **HIGH DENSITY PROGRAMMABLE LOGIC**
  - — 1000 PLD Gates
  - — 32 I/O Pins, Two Dedicated Inputs
  - — 32 Registers
  - — High Speed Global Interconnect
  - — Wide Input Gating for Fast Counters, State Machines, Address Decoders, etc.
  - — Small Logic Block Size for Random Logic
- **HIGH PERFORMANCE E²CMOS® TECHNOLOGY**
  - — f_{max} = 180 MHz Maximum Operating Frequency
  - — t_{pd} = 5.0 ns Propagation Delay
  - — TTL Compatible Inputs and Outputs
  - — Electrically Erasable and Reprogrammable
  - — Non-Volatile
  - — 100% Tested at Time of Manufacture
  - — Unused Product Term Shutdown Saves Power
- **IN-SYSTEM PROGRAMMABLE**
  - — In-System Programmable (ISP™) 5V Only
  - — Increased Manufacturing Yields, Reduced Time-to-Market and Improved Product Quality
  - — Reprogram Soldered Devices for Faster Prototyping
- **OFFERS THE EASE OF USE AND FAST SYSTEM SPEED OF PLDs WITH THE DENSITY AND FLEXIBILITY OF FIELD PROGRAMMABLE GATE ARRAYS**
  - — Complete Programmable Device Can Combine Glue Logic and Structured Designs
  - — Enhanced Pin Locking Capability
  - — Three Dedicated Clock Input Pins
  - — Synchronous and Asynchronous Clocks
  - — Programmable Output Slew Rate Control to Minimize Switching Noise
  - — Flexible Pin Placement
  - — Optimized Global Routing Pool Provides Global Interconnectivity
  - — Lead-Free Package Options

Functional Block Diagram



Description

The ispLSI 2032 and 2032A are High Density Programmable Logic Devices. The devices contain 32 Registers, 32 Universal I/O pins, two Dedicated Input Pins, three Dedicated Clock Input Pins, one dedicated Global OE input pin and a Global Routing Pool (GRP). The GRP provides complete interconnectivity between all of these elements. The ispLSI 2032 and 2032A feature 5V in-system programmability and in-system diagnostic capabilities. The ispLSI 2032 and 2032A offer non-volatile reprogrammability of the logic, as well as the interconnect to provide truly reconfigurable systems.

The basic unit of logic on these devices is the Generic Logic Block (GLB). The GLBs are labeled A0, A1 .. A7 (Figure 1). There are a total of eight GLBs in the ispLSI 2032 and 2032A devices. Each GLB is made up of four macrocells. Each GLB has 18 inputs, a programmable AND/OR/Exclusive OR array, and four outputs which can be configured to be either combinatorial or registered. Inputs to the GLB come from the GRP and dedicated inputs. All of the GLB outputs are brought back into the GRP so that they can be connected to the inputs of any GLB on the device.

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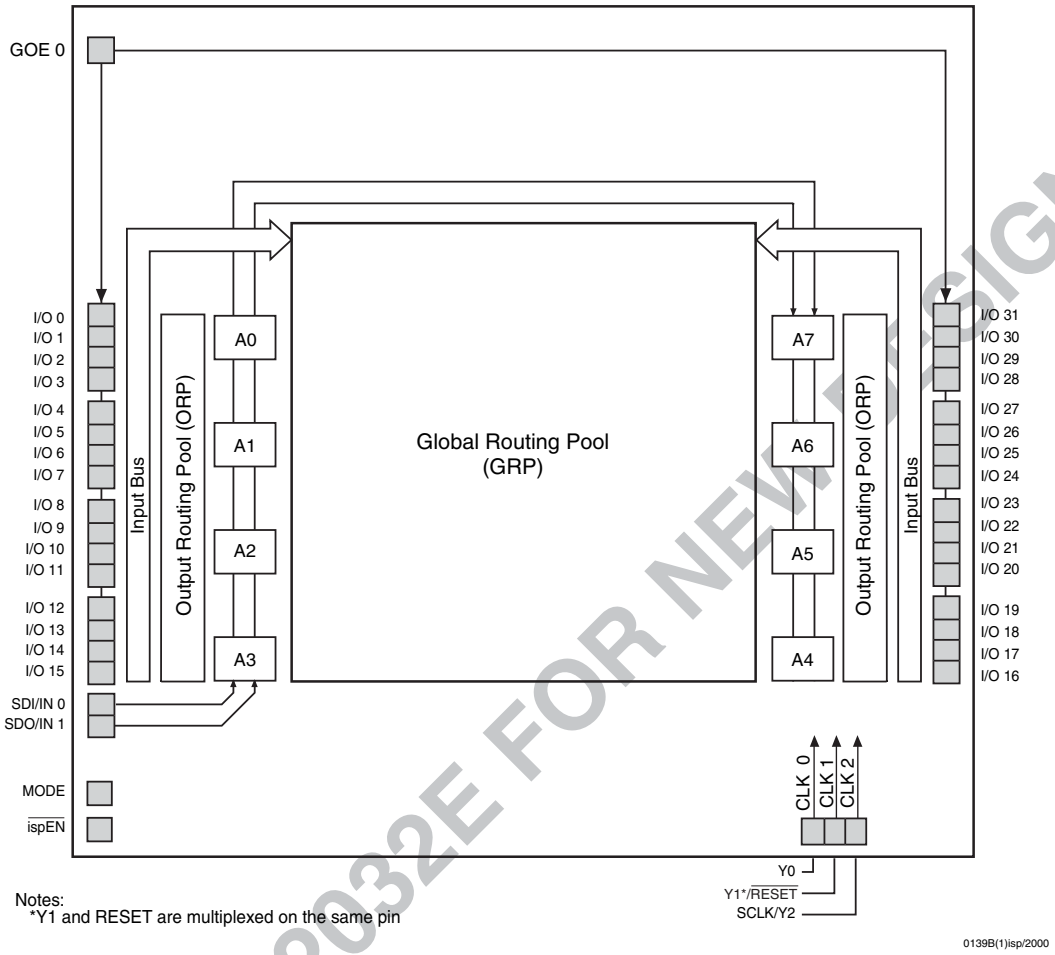
August 2006

Functional Block Diagram

Figure 1. ispLSI 2032/A Functional Block Diagram



The devices also have 32 I/O cells, each of which is directly connected to an I/O pin. Each I/O cell can be individually programmed to be a combinatorial input, output or bi-directional I/O pin with 3-state control. The signal levels are TTL compatible voltages and the output drivers can source 4 mA or sink 8 mA. Each output can be programmed independently for fast or slow output slew rate to minimize overall output switching noise.

Eight GLBs, 32 I/O cells, two dedicated inputs and two ORPs are connected together to make a Megablock (Figure 1). The outputs of the eight GLBs are connected to a set of 32 universal I/O cells by the ORP. Each ispLSI 2032 and 2032A device contains one Megablock.

The GRP has as its inputs, the outputs from all of the GLBs and all of the inputs from the bi-directional I/O cells. All of these signals are made available to the inputs of the GLBs. Delays through the GRP have been equalized to minimize timing skew.

Clocks in the ispLSI 2032 and 2032A devices are selected using the dedicated clock pins. Three dedicated clock pins (Y0, Y1, Y2) or an asynchronous clock can be selected on a GLB basis. The asynchronous or Product Term clock can be generated in any GLB for its own clock.

Absolute Maximum Ratings [1]

Supply Voltage V_{cc} ..... -0.5 to +7.0V

Input Voltage Applied ..... -2.5 to V_{CC} +1.0V

Off-State Output Voltage Applied ..... -2.5 to V_{CC} +1.0V

Storage Temperature ..... -65 to 150°C

Case Temp. with Power Applied ..... -55 to 125°C

Max. Junction Temp. (T_J) with Power Applied ... 150°C

1. Stresses above those listed under the "Absolute Maximum Ratings" may cause permanent damage to the device. Functional operation of the device at these or at any other conditions above those indicated in the operational sections of this specification is not implied (while programming, follow the programming specifications).

DC Recommended Operating Condition

SYMBOL	PARAMETER		MIN.	MAX.	UNITS
V_{CC}	Supply Voltage	Commercial T_A = 0°C to + 70°C	4.75	5.25	V
		Industrial T_A = -40°C to + 85°C	4.5	5.5	V
V_{IL}	Input Low Voltage		0	0.8	V
V_{IH}	Input High Voltage		2.0	V_{CC}+1	V

Table 2 - 0005/2032

Capacitance (T_A=25°C, f=1.0 MHz)

SYMBOL	PARAMETER	TYPICAL	UNITS	TEST CONDITIONS
C_1	Dedicated Input Capacitance	6	pf	V_{CC} = 5.0V, V_{IN} = 2.0V
C_2	I/O Capacitance	7	pf	V_{CC} = 5.0V, $V_{I/O}$ = 2.0V
C_3	Clock Capacitance	10	pf	V_{CC} = 5.0V, V_Y = 2.0V

Table 2-0006/2032

Data Retention Specifications

PARAMETER	MINIMUM	MAXIMUM	UNITS
Data Retention	20	–	Years
Erase/Reprogram Cycles	10000	–	Cycles

Table 2-0008A-isp

Switching Test Conditions

Input Pulse Levels	GND to 3.0V	
Input Rise and Fall Time 10% to 90%	-135, -150, -180	≤ 1.5 ns
	-80, -110	≤ 3 ns
Input Timing Reference Levels	1.5V	
Output Timing Reference Levels	1.5V	
Output Load	See Figure 2	

Table 2-0003/2032

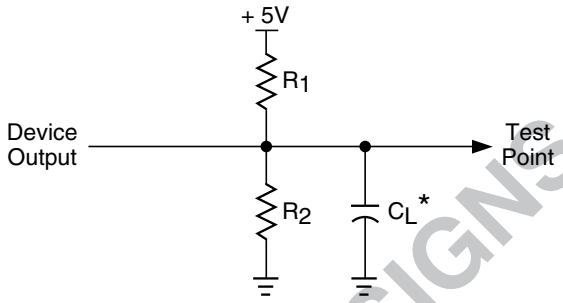
3-state levels are measured 0.5V from steady-state active level.

Output Load Conditions (see Figure 2)

TEST CONDITION		R1	R2	CL
A		470Ω	390Ω	35pF
B	Active High	∞	390Ω	35pF
	Active Low	470Ω	390Ω	35pF
C	Active High to Z at V_{OH}-0.5V	∞	390Ω	5pF
	Active Low to Z at V_{OL}+0.5V	470Ω	390Ω	5pF

Table 2 - 0004A

Figure 2. Test Load



*C_L includes Test Fixture and Probe Capacitance.

0213A

DC Electrical Characteristics

Over Recommended Operating Conditions

SYMBOL	PARAMETER	CONDITION			MIN.	TYP.[3]	MAX.	UNITS
V_{OL}	Output Low Voltage	I_{OL} = 8 mA			–	–	0.4	V
V_{OH}	Output High Voltage	I_{OH} = -4 mA			2.4	–	–	V
I_{IL}	Input or I/O Low Leakage Current	0V ≤ V_{IN} ≤ V_{IL} (Max.)			–	–	-10	µA
I_{IH}	Input or I/O High Leakage Current	3.5V ≤ V_{IN} ≤ V_{CC}			–	–	10	µA
I_{IL-isp}	$\overline{ispEN}$ Input Low Leakage Current	0V ≤ V_{IN} ≤ V_{IL}			–	–	-150	µA
I_{IL-PU}	I/O Active Pull-Up Current	0V ≤ V_{IN} ≤ V_{IL}			–	–	-150	µA
I_{OS}[1]	Output Short Circuit Current	V_{CC} = 5V, V_{OUT} = 0.5V			–	–	-200	mA
I_{CC}[2, 4]	Operating Power Supply Current	V_{IL} = 0.0V, V_{IH} = 3.0V f_{TOGGLE} = 1 MHz	Comm.	-180, -150	–	60	–	mA
				Others	–	40	–	mA
			Industrial		–	40	–	mA

Table 2-0007/2032

1. One output at a time for a maximum duration of one second. V_{OUT} = 0.5V was selected to avoid test problems by tester ground degradation. Characterized but not 100% tested.
2. Measured using two 16-bit counters.
3. Typical values are at V_{CC} = 5V and T_A = 25°C.
4. Maximum I_{CC} varies widely with specific device configuration and operating frequency. Refer to the Power Consumption section of this data sheet and Thermal Management section of the Lattice Semiconductor Data Book or CD-ROM to estimate maximum I_{CC}.

External Timing Parameters

Over Recommended Operating Conditions

PARAMETER	TEST COND.[4]	#[2]	DESCRIPTION[1]	-180		-150		-135		UNITS
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{pd1}	A	1	Data Prop. Delay, 4PT Bypass, ORP Bypass	–	5.0	–	5.5	–	7.5	ns
t_{pd2}	A	2	Data Prop. Delay	–	7.5	–	8.0	–	10.0	ns
f_{max}	A	3	Clk Frequency with Internal Feedback[3]	180	–	154	–	137	–	MHz
f_{max} (Ext.)	–	4	Clk Frequency with Ext. Feedback $\left(\frac{1}{t_{su2} + t_{co1}}\right)$	125	–	111	–	100	–	MHz
f_{max} (Tog.)	–	5	Clk Frequency, Max. Toggle	200	–	167	–	167	–	MHz
t_{su1}	–	6	GLB Reg Setup Time before Clk, 4 PT Bypass	3.0	–	3.0	–	4.0	–	ns
t_{co1}	A	7	GLB Reg. Clk to Output Delay, ORP Bypass	–	4.0	–	4.5	–	4.5	ns
t_{h1}	–	8	GLB Reg. Hold Time after Clk, 4 PT Bypass	0.0	–	0.0	–	0.0	–	ns
t_{su2}	–	9	GLB Reg. Setup Time before Clk	4.0	–	4.5	–	5.5	–	ns
t_{co2}	–	10	GLB Reg. Clk to Output Delay	–	4.5	–	5.0	–	5.5	ns
t_{h2}	–	11	GLB Reg. Hold Time after Clk	0.0	–	0.0	–	0.0	–	ns
t_{r1}	A	12	Ext. Reset Pin to Output Delay	–	7.0	–	8.0	–	10.0	ns
t_{rw1}	–	13	Ext. Reset Pulse Duration	4.0	–	4.5	–	5.0	–	ns
t_{ptoeen}	B	14	Input to Output Enable	–	10.0	–	11.0	–	12.0	ns
$t_{ptoedis}$	C	15	Input to Output Disable	–	10.0	–	11.0	–	12.0	ns
t_{goeen}	B	16	Global OE Output Enable	–	5.0	–	5.0	–	6.0	ns
t_{goedis}	C	17	Global OE Output Disable	–	5.0	–	5.0	–	6.0	ns
t_{wh}	–	18	Ext. Synchronous Clk Pulse Duration, High	2.5	–	3.0	–	3.0	–	ns
t_{wl}	–	19	Ext. Synchronous Clk Pulse Duration, Low	2.5	–	3.0	–	3.0	–	ns

Table 2-0030B-180/2032

1. Unless noted otherwise, all parameters use the GRP, 20 PTXOR path, ORP and Y0 clock.
2. Refer to Timing Model in this data sheet for further details.
3. Standard 16-bit counter using GRP feedback.
4. Reference Switching Test Conditions section.

External Timing Parameters

Over Recommended Operating Conditions

PARAMETER	TEST COND.[4]	#[2]	DESCRIPTION[1]	-110		-80		UNITS
				MIN.	MAX.	MIN.	MAX.	
t_{pd1}	A	1	Data Propagation Delay, 4PT Bypass, ORP Bypass	–	10.0	–	15.0	ns
t_{pd2}	A	2	Data Propagation Delay	–	13.0	–	18.5	ns
f_{max}	A	3	Clock Frequency with Internal Feedback[3]	111	–	84.0	–	MHz
f_{max} (Ext.)	–	4	Clock Frequency with External Feedback $\left(\frac{1}{tsu2 + tco1}\right)$	77.0	–	57.0	–	MHz
f_{max} (Tog.)	–	5	Clock Frequency, Max. Toggle	125	–	83.0	–	MHz
t_{su1}	–	6	GLB Reg. Setup Time before Clock, 4 PT Bypass	5.5	–	7.5	–	ns
t_{co1}	A	7	GLB Reg. Clock to Output Delay, ORP Bypass	–	5.5	–	8.0	ns
t_{h1}	–	8	GLB Reg. Hold Time after Clock, 4 PT Bypass	0.0	–	0.0	–	ns
t_{su2}	–	9	GLB Reg. Setup Time before Clock	7.5	–	9.5	–	ns
t_{co2}	–	10	GLB Reg. Clock to Output Delay	–	6.5	–	9.5	ns
t_{h2}	–	11	GLB Reg. Hold Time after Clock	0.0	–	0.0	–	ns
t_{r1}	A	12	Ext. Reset Pin to Output Delay	–	13.5	–	19.5	ns
t_{rw1}	–	13	Ext. Reset Pulse Duration	6.5	–	10.0	–	ns
t_{ptoeen}	B	14	Input to Output Enable	–	14.5	–	24.0	ns
$t_{ptoedis}$	C	15	Input to Output Disable	–	14.5	–	24.0	ns
t_{goeen}	B	16	Global OE Output Enable	–	7.0	–	12.0	ns
t_{goedis}	C	17	Global OE Output Disable	–	7.0	–	12.0	ns
t_{wh}	–	18	External Synchronous Clock Pulse Duration, High	4.0	–	6.0	–	ns
t_{wl}	–	19	External Synchronous Clock Pulse Duration, Low	4.0	–	6.0	–	ns

Table 2-0030B-110/2032

1. Unless noted otherwise, all parameters use the GRP, 20 PTXOR path, ORP and Y0 clock.
2. Refer to Timing Model in this data sheet for further details.
3. Standard 16-bit counter using GRP feedback.
4. Reference Switching Test Conditions section.

Internal Timing Parameters[1]

Over Recommended Operating Conditions

PARAMETER	#[2]	DESCRIPTION	-180		-150		-135		UNITS
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Inputs									
t_{io}	20	Input Buffer Delay	–	0.6	–	0.6	–	1.1	ns
t_{din}	21	Dedicated Input Delay	–	1.1	–	1.3	–	2.4	ns
GRP									
t_{grp}	22	GRP Delay	–	0.7	–	0.7	–	1.3	ns
GLB									
t_{4ptbpc}	23	4 Product Term Bypass Path Delay (Combinatorial)	–	2.3	–	2.6	–	3.6	ns
t_{4ptbpr}	24	4 Product Term Bypass Path Delay (Registered)	–	3.1	–	3.1	–	3.6	ns
t_{1ptxor}	25	1 Product Term/XOR Path Delay	–	3.6	–	4.3	–	5.0	ns
$t_{20ptxor}$	26	20 Product Term/XOR Path Delay	–	4.1	–	4.6	–	5.1	ns
t_{xoradj}	27	XOR Adjacent Path Delay[3]	–	4.8	–	5.0	–	5.6	ns
t_{gbp}	28	GLB Register Bypass Delay	–	0.2	–	0.0	–	0.0	ns
t_{gsu}	29	GLB Register Setup Time before Clock	0.5	–	0.7	–	0.3	–	ns
t_{gh}	30	GLB Register Hold Time after Clock	1.8	–	1.8	–	3.0	–	ns
t_{gco}	31	GLB Register Clock to Output Delay	–	0.7	–	0.8	–	0.7	ns
t_{gro}	32	GLB Register Reset to Output Delay	–	1.0	–	1.2	–	1.1	ns
t_{ptre}	33	GLB Product Term Reset to Register Delay	–	2.8	–	2.9	–	4.4	ns
t_{ptoe}	34	GLB Product Term Output Enable to I/O Cell Delay	–	5.9	–	6.9	–	6.4	ns
t_{ptck}	35	GLB Product Term Clock Delay	2.5	3.8	2.5	4.1	2.9	5.2	ns
ORP									
t_{orp}	36	ORP Delay	–	0.7	–	0.8	–	1.3	ns
t_{orpbp}	37	ORP Bypass Delay	–	0.2	–	0.3	–	0.3	ns
Outputs									
t_{ob}	38	Output Buffer Delay	–	1.2	–	1.3	–	1.2	ns
t_{sl}	39	Output Slew Limited Delay Adder	–	10.0	–	10.0	–	10.0	ns
t_{oen}	40	I/O Cell OE to Output Enabled	–	2.8	–	2.8	–	3.2	ns
t_{odis}	41	I/O Cell OE to Output Disabled	–	2.8	–	2.8	–	3.2	ns
t_{goe}	42	Global Output Enable	–	2.2	–	2.2	–	2.8	ns
Clocks									
t_{gy0}	43	Clock Delay, Y0 to Global GLB Clock Line (Ref. clock)	1.9	1.9	2.1	2.1	2.3	2.3	ns
$t_{gy1/2}$	44	Clock Delay, Y1 or Y2 to Global GLB Clock Line	1.9	1.9	2.1	2.1	2.3	2.3	ns
Global Reset									
t_{gr}	45	Global Reset to GLB	–	4.1	–	4.7	–	6.4	ns

Table 2-0036C-180/2032

1. Internal Timing Parameters are not tested and are for reference only.
2. Refer to Timing Model in this data sheet for further details.
3. The XOR adjacent path can only be used by hard macros.

Internal Timing Parameters[1]

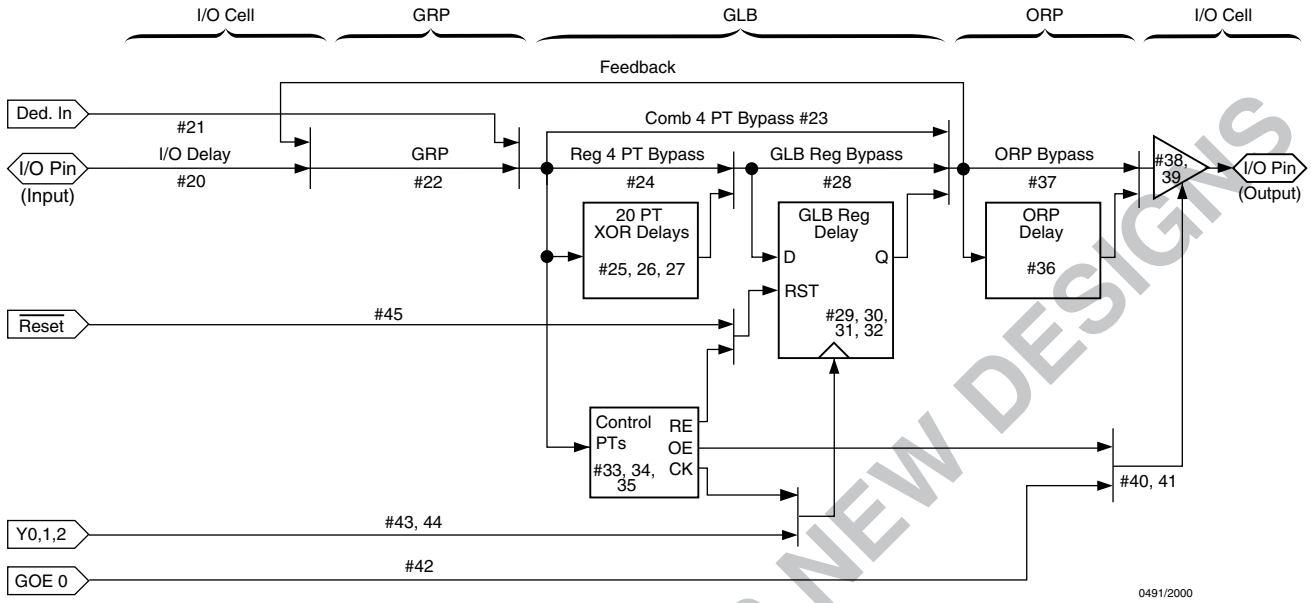
Over Recommended Operating Conditions

PARAMETER	#[2]	DESCRIPTION	-110		-80		UNITS
			MIN.	MAX.	MIN.	MAX.	
Inputs							
t_{io}	20	Input Buffer Delay	–	1.7	–	2.2	ns
t_{din}	21	Dedicated Input Delay	–	3.4	–	4.8	ns
GRP							
t_{grp}	22	GRP Delay	–	1.7	–	2.6	ns
GLB							
t_{4ptbpc}	23	4 Product Term Bypass Path Delay (Combinatorial)	–	4.9	–	7.2	ns
t_{4ptbpr}	24	4 Product Term Bypass Path Delay (Registered)	–	4.8	–	7.2	ns
t_{1ptxor}	25	1 Product Term/XOR Path Delay	–	6.2	–	8.8	ns
$t_{20ptxor}$	26	20 Product Term/XOR Path Delay	–	6.8	–	9.2	ns
t_{xoradj}	27	XOR Adjacent Path Delay[3]	–	7.5	–	10.2	ns
t_{gbp}	28	GLB Register Bypass Delay	–	0.1	–	0.0	ns
t_{gsu}	29	GLB Register Setup Time befor Clock	0.5	–	0.1	–	ns
t_{gh}	30	GLB Register Hold Time after Clock	4.0	–	6.0	–	ns
t_{gco}	31	GLB Register Clock to Output Delay	–	0.6	–	0.4	ns
t_{gro}	32	GLB Register Reset to Output Delay	–	1.8	–	2.2	ns
t_{ptre}	33	GLB Product Term Reset to Register Delay	–	5.9	–	8.8	ns
t_{ptoe}	34	GLB Product Term Output Enable to I/O Cell Delay	–	7.1	–	12.8	ns
t_{ptck}	35	GLB Product Term Clock Delay	4.0	7.0	5.5	9.5	ns
ORP							
t_{orp}	36	ORP Delay	–	1.5	–	2.1	ns
t_{orpbp}	37	ORP Bypass Delay	–	0.5	–	0.6	ns
Outputs							
t_{ob}	38	Output Buffer Delay	–	1.2	–	2.4	ns
t_{sl}	39	Output Slew Limited Delay Adder	–	10.0	–	10.0	ns
t_{oen}	40	I/O Cell OE to Output Enabled	–	4.0	–	6.4	ns
t_{odis}	41	I/O Cell OE to Output Disabled	–	4.0	–	6.4	ns
t_{goe}	42	Global Output Enable	–	3.0	–	5.6	ns
Clocks							
t_{gy0}	43	Clock Delay, Y0 to Global GLB Clock Line (Ref. clock)	3.2	3.2	4.6	4.6	ns
$t_{gy1/2}$	44	Clock Delay, Y1 or Y2 to Global GLB Clock Line	3.2	3.2	4.6	4.6	ns
Global Reset							
t_{gr}	45	Global Reset to GLB	–	9.0	–	12.8	ns

Table 2-0036C-110/2032

1. Internal Timing Parameters are not tested and are for reference only.
2. Refer to Timing Model in this data sheet for further details.
3. The XOR adjacent path can only be used by hard macros.

ispLSI 2032/A Timing Model



Derivations of tsu, th and tco from the Product Term Clock[1]

tsu = Logic + Reg su - Clock (min)
= (**t**io + **t**grp + **t**20ptxor) + (**t**gsu) - (**t**io + **t**grp + **t**ptck(min))
= (#20+ #22+ #26) + (#29) - (#20+ #22+ #35)
2.1 ns = (0.6 + 0.7 + 4.1) + (0.5) - (0.6 + 0.7 + 2.5)

th = Clock (max) + Reg h - Logic
= (**t**io + **t**grp + **t**ptck(max)) + (**t**gh) - (**t**io + **t**grp + **t**20ptxor)
= (#20+ #22+ #35) + (#30) - (#20+ #22+ #26)
1.5 ns = (0.6 + 0.7 + 3.8) + (1.8) - (0.6 + 0.7 + 4.1)

tco = Clock (max) + Reg co + Output
= (**t**io + **t**grp + **t**ptck(max)) + (**t**gco) + (**t**orp + **t**ob)
= (#20+ #22+ #35) + (#31) + (#36 + #38)
7.7 ns = (0.6 + 0.7 + 3.8) + (0.7) + (0.7 + 1.2)

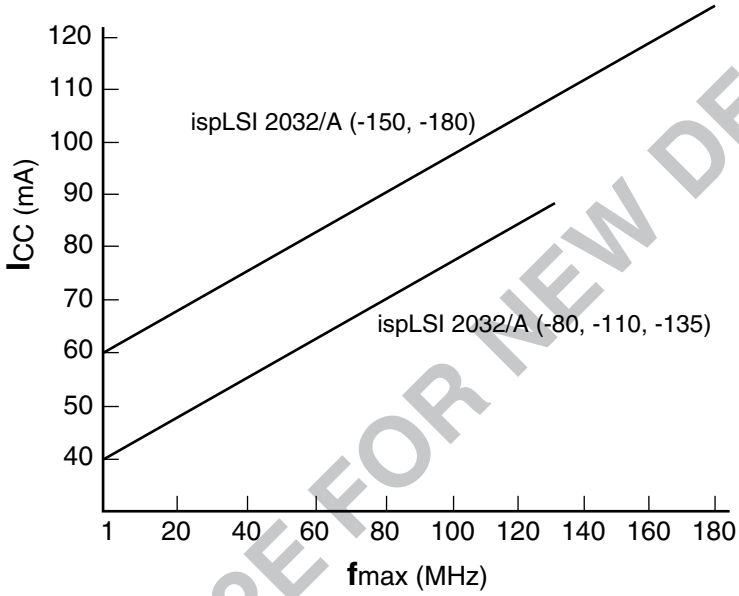
Note: Calculations are based upon timing specifications for the ispLSI 2032/A-180L

Table 2- 0042-16/2032

Power Consumption

Power consumption in the ispLSI 2032 and 2032A devices depends on two primary factors: the speed at which the device is operating and the number of Product Terms used. Figure 4 shows the relationship between power and operating speed.

Figure 4. Typical Device Power Consumption vs fmax



Notes: Configuration of Two 16-bit Counters
Typical Current at 5V, 25° C

I_{CC} can be estimated for the ispLSI 2032/A using the following equation:

For 2032/A -150, -180: I_{CC}(mA) = 30 + (# of PTs * 0.46) + (# of nets * Max freq * 0.012)
For 2032/A -135, -110, -80: I_{CC}(mA) = 21 + (# of PTs * 0.30) + (# of nets * Max freq * 0.012)

Where:
- # of PTs = Number of Product Terms used in design
- # of nets = Number of Signals used in device
- Max freq = Highest Clock Frequency to the device (in MHz)

The I_{CC} estimate is based on typical conditions (V_{CC} = 5.0V, room temperature) and an assumption of two GLB loads on average exists. These values are for estimates only. Since the value of I_{CC} is sensitive to operating conditions and the program in the device, the actual I_{CC} should be verified.

0127A/2032A

Pin Description

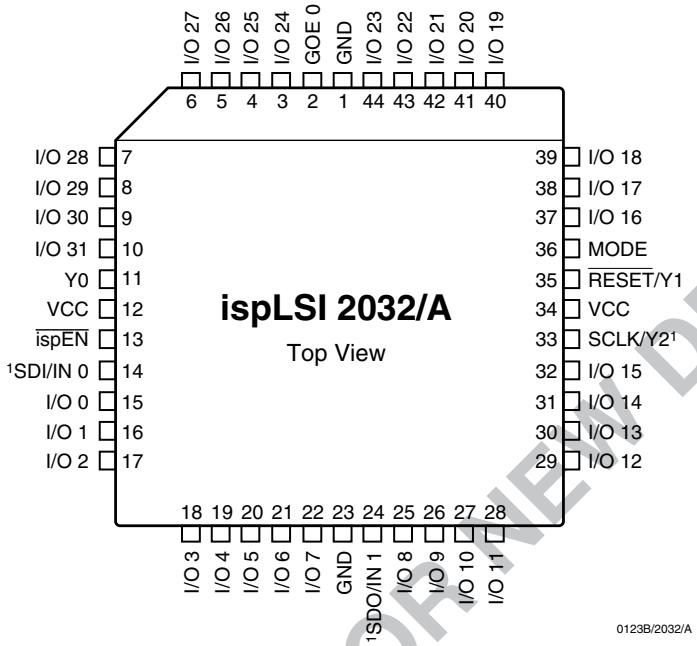
NAME	44-PIN PLCC PIN NUMBERS	44-PIN TQFP PIN NUMBERS	48-PIN TQFP PIN NUMBERS	DESCRIPTION
I/O 0 - I/O 3 I/O 4 - I/O 7 I/O 8 - I/O 11 I/O 12 - I/O 15 I/O 16 - I/O 19 I/O 20 - I/O 23 I/O 24 - I/O 27 I/O 28 - I/O 31	15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31, 32, 37, 38, 39, 40, 41, 42, 43, 44, 3, 4, 5, 6, 7, 8, 9, 10	9, 10, 11, 12, 13, 14, 15, 16, 19, 20, 21, 22, 23, 24, 25, 26, 31 32, 33, 34, 35, 36, 37, 38, 41, 42, 43, 44, 1, 2, 3, 4	9, 10, 11, 13, 14, 15, 16, 17, 20, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, 37, 38, 39, 40, 41, 44, 45, 46, 47, 1, 2, 3, 4	Input/Output Pins — These are the general purpose I/O pins used by the logic array.
GOE 0	2	40	43	Global Output Enable input pin.
Y0	11	5	5	Dedicated Clock input. This clock input is connected to one of the clock inputs of all the GLBs on the device.
$\overline{\text{RESET}}$/Y1	35	29	31	This pin performs two functions: - Dedicated clock input. This clock input is brought into the Clock Distribution Network, and can optionally be routed to any GLB and/or I/O cell on the device. - Active Low (0) Reset pin which resets all of the GLB and I/O registers in the device.
$\overline{\text{ispEN}}$	13	7	7	Input — Dedicated in-system programming enable input pin. This pin is brought low to enable the programming mode. The MODE, SDI, SDO and SCLK controls become active.
SDI/IN 0[2]	14	8	8	Input — This pin performs two functions. When $\overline{\text{ispEN}}$ is logic low, it functions as an input pin to load programming data into the device. SDI/IN0 also is used as one of the two control pins for the isp state machine. When $\overline{\text{ispEN}}$ is high, it functions as a dedicated input pin.
MODE	36	30	32	Input — When in ISP Mode, controls operation of ISP state machine.
SDO/IN 1[2]	24	18	19	Output/Input — This pin performs two functions. When $\overline{\text{ispEN}}$ is logic low, it functions as an output pin to read serial shift register data. When $\overline{\text{ispEN}}$ is high, it functions as a dedicated input pin.
SCLK/Y2[2]	33	27	29	Input — This pin performs two functions. When $\overline{\text{ispEN}}$ is logic low, it functions as a clock pin for the Serial Shift Register. When $\overline{\text{ispEN}}$ is high, it functions as a dedicated clock input. This clock input is brought into the Clock Distribution Network and can be routed to any GLB and/or I/O cell on the device.
GND	1, 23	17, 39	18, 42	Ground (GND)
VCC	12, 34	6, 28	6, 30	V_{CC}
NC[1]			12, 24, 36, 48	No Connect.

Table 2-0002A-08isp/2032

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

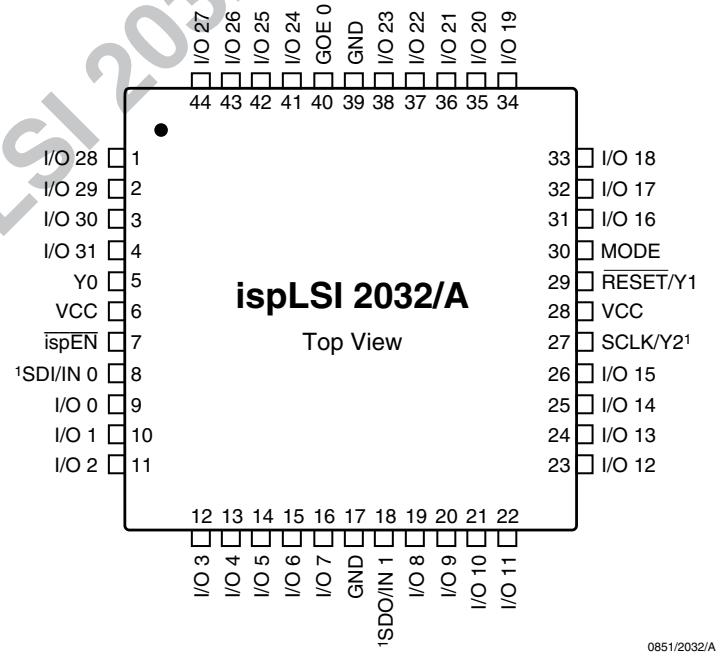
Pin Configuration

ispLSI 2032/A 44-Pin PLCC Pinout Diagram



1. Pins have dual function capability.

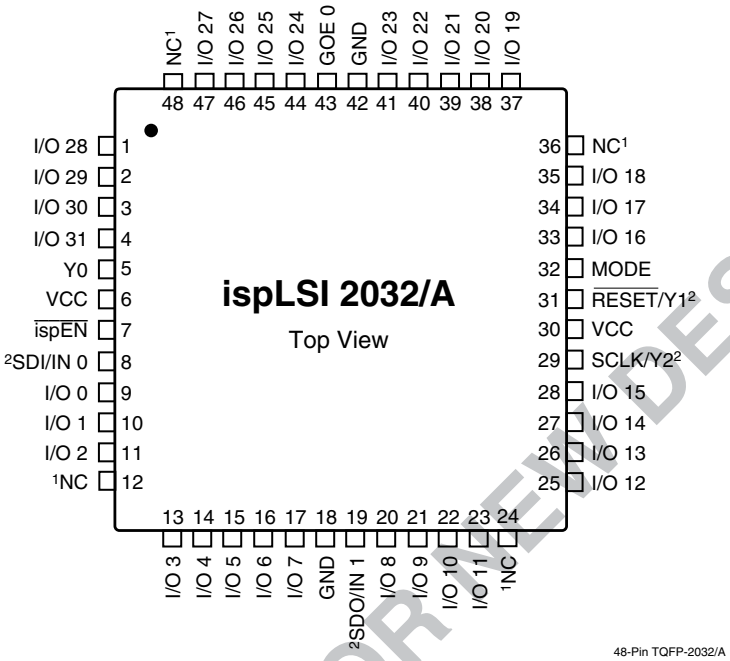
ispLSI 2032/A 44-Pin TQFP Pinout Diagram



1. Pins have dual function capability.

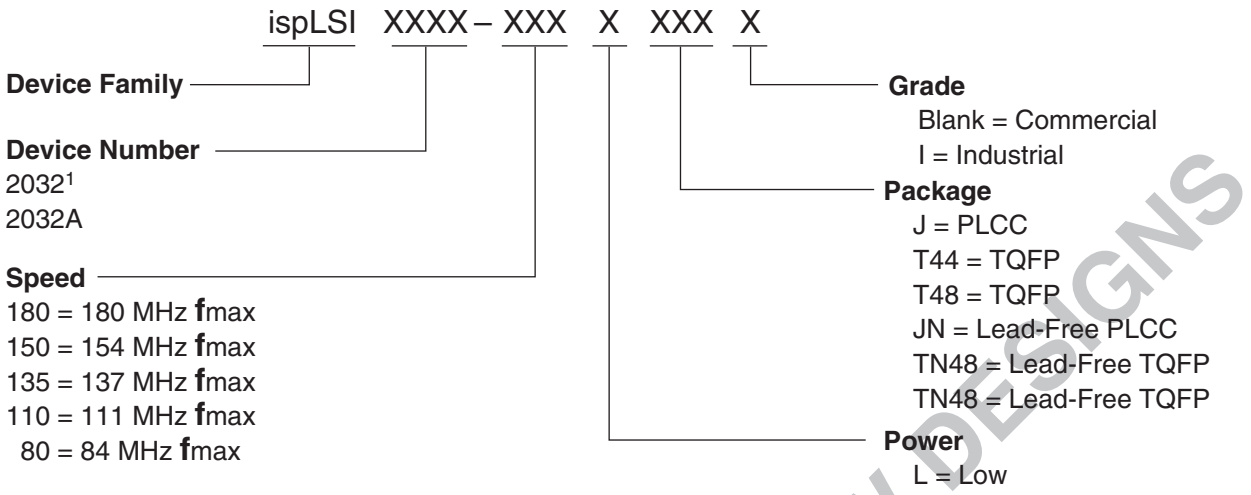
Pin Configuration

ispLSI 2032/A 48-Pin TQFP Pinout Diagram



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

Part Number Description



1. Discontinued per PCN #02-06. Contact Rochester Electronics for available inventory.

ispLSI 2032/A Ordering Information

Conventional Packaging

COMMERCIAL

FAMILY	fmax (MHz)	tpd (ns)	ORDERING NUMBER	PACKAGE
ispLSI	180	5.0	ispLSI 2032A-180LJ44	44-Pin PLCC
	180	5.0	ispLSI 2032A-180LT44	44-Pin TQFP
	180	5.0	ispLSI 2032A-180LT48	48-Pin TQFP
	154	5.5	ispLSI 2032A-150LJ44	44-Pin PLCC
	154	5.5	ispLSI 2032A-150LT44	44-Pin TQFP
	154	5.5	ispLSI 2032A-150LT48	48-Pin TQFP
	137	7.5	ispLSI 2032A-135LJ44	44-Pin PLCC
	137	7.5	ispLSI 2032A-135LT44	44-Pin TQFP
	137	7.5	ispLSI 2032A-135LT48	48-Pin TQFP
	111	10	ispLSI 2032A-110LJ44	44-Pin PLCC
	111	10	ispLSI 2032A-110LT44	44-Pin TQFP
	111	10	ispLSI 2032A-110LT48	48-Pin TQFP
	84	15	ispLSI 2032A-80LJ44	44-Pin PLCC
	84	15	ispLSI 2032A-80LT44	44-Pin TQFP
	84	15	ispLSI 2032A-80LT48	48-Pin TQFP

Table 2-0041A/2032A

INDUSTRIAL

FAMILY	fmax (MHz)	tpd (ns)	ORDERING NUMBER	PACKAGE
ispLSI	84	15	ispLSI 2032A-80LJ44I	44-Pin PLCC
	84	15	ispLSI 2032A-80LT44I	44-Pin TQFP
	84	15	ispLSI 2032A-80LT48I	48-Pin TQFP

Table 2-0041B/2032A

ispLSI 2032/A Ordering Information (Cont.)

Conventional Packaging

COMMERCIAL

FAMILY	fmax (MHz)	tpd (ns)	ORDERING NUMBER	PACKAGE
ispLSI	180	5.0	ispLSI 2032A-180LJ44[1]	44-Pin PLCC
	180	5.0	ispLSI 2032A-180LT44[1]	44-Pin TQFP
	180	5.0	ispLSI 2032A-180LT48[1]	48-Pin TQFP
	154	5.5	ispLSI 2032A-150LJ44[1]	44-Pin PLCC
	154	5.5	ispLSI 2032A-150LT44[1]	44-Pin TQFP
	154	5.5	ispLSI 2032A-150LT48[1]	48-Pin TQFP
	137	7.5	ispLSI 2032A-135LJ44[1]	44-Pin PLCC
	137	7.5	ispLSI 2032A-135LT44[1]	44-Pin TQFP
	137	7.5	ispLSI 2032A-135LT48[1]	48-Pin TQFP
	111	10	ispLSI 2032A-110LJ44[1]	44-Pin PLCC
	111	10	ispLSI 2032A-110LT44[1]	44-Pin TQFP
	111	10	ispLSI 2032A-110LT48[1]	48-Pin TQFP
	84	15	ispLSI 2032A-80LJ44[1]	44-Pin PLCC
	84	15	ispLSI 2032A-80LT44[1]	44-Pin TQFP
	84	15	ispLSI 2032A-80LT48[1]	48-Pin TQFP

1. Discontinued per PCN #02-06. Contact Rochester Electronics for available inventory.

INDUSTRIAL

FAMILY	fmax (MHz)	tpd (ns)	ORDERING NUMBER	PACKAGE
ispLSI	84	15	ispLSI 2032-80LJI[1]	44-Pin PLCC
	84	15	ispLSI 2032-80LT44I[1]	44-Pin TQFP
	84	15	ispLSI 2032-80LT48I[1]	48-Pin TQFP

1. Discontinued per PCN #02-06. Contact Rochester Electronics for available inventory.

Lead-Free Packaging

COMMERCIAL

FAMILY	fmax (MHz)	tpd (ns)	ORDERING NUMBER	PACKAGE
ispLSI	180	5.0	ispLSI 2032A-180LJN44	Lead-Free 44-Pin PLCC
	180	5.0	ispLSI 2032A-180LTN44	Lead-Free 44-Pin TQFP
	180	5.0	ispLSI 2032A-180LTN48	Lead-Free 48-Pin TQFP
	154	5.5	ispLSI 2032A-150LJN44	Lead-Free 44-Pin PLCC
	154	5.5	ispLSI 2032A-150LTN44	Lead-Free 44-Pin TQFP
	154	5.5	ispLSI 2032A-150LTN48	Lead-Free 48-Pin TQFP
	137	7.5	ispLSI 2032A-135LJN44	Lead-Free 44-Pin PLCC
	137	7.5	ispLSI 2032A-135LTN44	Lead-Free 44-Pin TQFP
	137	7.5	ispLSI 2032A-135LTN48	Lead-Free 48-Pin TQFP
	111	10	ispLSI 2032A-110LJN44	Lead-Free 44-Pin PLCC
	111	10	ispLSI 2032A-110LTN44	Lead-Free 44-Pin TQFP
	111	10	ispLSI 2032A-110LTN48	Lead-Free 48-Pin TQFP
	84	15	ispLSI 2032A-80LJN44	Lead-Free 44-Pin PLCC
	84	15	ispLSI 2032A-80LTN44	Lead-Free 44-Pin TQFP
	84	15	ispLSI 2032A-80LTN48	Lead-Free 48-Pin TQFP

ispLSI 2032/A Ordering Information (Cont.)

Lead-Free Packaging

INDUSTRIAL

FAMILY	fmax (MHz)	tpd (ns)	ORDERING NUMBER	PACKAGE
ispLSI	84	15	ispLSI 2032A-80LJN44I	Lead-Free 44-Pin PLCC
	84	15	ispLSI 2032A-80LTN44I	Lead-Free 44-Pin TQFP
	84	15	ispLSI 2032A-80LTN48I	Lead-Free 48-Pin TQFP

Revision History

Date	Version	Change Summary
—	10	Previous Lattice release.
August 2006	11	Updated for lead-free package options.