

# IS63LV1024

# IS63LV1024L



## 128K x 8 HIGH-SPEED CMOS STATIC RAM

### 3.3V REVOLUTIONARY PINOUT

MAY 2012

#### FEATURES

- High-speed access times:  
8, 10, 12 ns
- High-performance, low-power CMOS process
- Multiple center power and ground pins for greater noise immunity
- Easy memory expansion with  $\overline{CE}$  and  $\overline{OE}$  options
- $\overline{CE}$  power-down
- Fully static operation: no clock or refresh required
- TTL compatible inputs and outputs
- Single 3.3V power supply
- Packages available:
  - 32-pin 300-mil SOJ
  - 32-pin 400-mil SOJ
  - 32-pin TSOP (Type II)
  - 32-pin STSOP (Type I)
  - 36-pin BGA (8mmx10mm)
- Lead-free Available

#### DESCRIPTION

The ISSI IS63LV1024/IS63LV1024L is a very high-speed, low power, 131,072-word by 8-bit CMOS static RAM in revolutionary pinout. The IS63LV1024/IS63LV1024L is fabricated using ISSI's high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields higher performance and low power consumption devices.

When  $\overline{CE}$  is HIGH (deselected), the device assumes a standby mode at which the power dissipation can be reduced down to 250  $\mu$ W (typical) with CMOS input levels.

The IS63LV1024/IS63LV1024L operates from a single 3.3V power supply and all inputs are TTL-compatible.

#### FUNCTIONAL BLOCK DIAGRAM



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- a.) the risk of injury or damage has been minimized;
- b.) the user assume all such risks; and
- c.) potential liability of Integrated Silicon Solution, Inc is adequately protected under the circumstances

**PIN CONFIGURATION**  
32-Pin SOJ



**PIN CONFIGURATION**  
32-Pin TSOP (Type II) (T)  
32-Pin STSOP (Type I) (H)



**PIN DESCRIPTIONS**

A0-A16	Address Inputs
$\overline{CE}$	Chip Enable Input
$\overline{OE}$	Output Enable Input
$\overline{WE}$	Write Enable Input
I/O0-I/O7	Data Inputs/Outputs
VDD	Power
GND	Ground

**PIN CONFIGURATION**  
36-mini BGA (B) (8 mm x 10 mm)



## TRUTH TABLE

Mode	$\overline{WE}$	$\overline{CE}$	$\overline{OE}$	I/O Operation	V <sub>DD</sub> Current
Not Selected (Power-down)	X	H	X	High-Z	ISB1, ISB2
Output Disabled	H	L	H	High-Z	I <sub>CC1</sub> , I <sub>CC2</sub>
Read	H	L	L	D <sub>OUT</sub>	I <sub>CC1</sub> , I <sub>CC2</sub>
Write	L	L	X	D <sub>IN</sub>	I <sub>CC1</sub> , I <sub>CC2</sub>

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Parameter	Value	Unit
V <sub>TERM</sub>	Terminal Voltage with Respect to GND	-0.5 to V <sub>DD</sub> + 0.5	V
T <sub>STG</sub>	Storage Temperature	-65 to +150	°C
P <sub>T</sub>	Power Dissipation	1.0	W

### Notes:

1. Stress greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## OPERATING RANGE

Range	Ambient Temperature	V <sub>DD</sub>
Commercial	0°C to +70°C	3.3V ± 0.3V
Industrial	-40°C to +85°C	3.3V ± 0.15V

## DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
V <sub>OH</sub>	Output HIGH Voltage	V <sub>DD</sub> = Min., I <sub>OH</sub> = -4.0 mA	2.4	—	V
V <sub>OL</sub>	Output LOW Voltage	V <sub>DD</sub> = Min., I <sub>OL</sub> = 8.0 mA	—	0.4	V
V <sub>IH</sub>	Input HIGH Voltage		2.2	V <sub>DD</sub> + 0.3	V
V <sub>IL</sub>	Input LOW Voltage <sup>(1)</sup>		-0.3	0.8	V
I <sub>LI</sub>	Input Leakage	GND ≤ V <sub>IN</sub> ≤ V <sub>DD</sub>	Com. Ind.	-1 5	1 5 μA
I <sub>LO</sub>	Output Leakage	GND ≤ V <sub>OUT</sub> ≤ V <sub>DD</sub> , Outputs Disabled	Com. Ind.	-1 -5	1 5 μA

### Note:

1. V<sub>IL</sub> (min.) = -0.3V DC; V<sub>IL</sub> (min.) = -2.0V AC (pulse width under V<sub>SS</sub> < 5ns). Not 100% tested.  
V<sub>IH</sub> (max.) = V<sub>DD</sub> + 0.3V DC; V<sub>IH</sub> (max.) = V<sub>DD</sub> + 2.0V AC (pulse width over V<sub>DD</sub> < 5ns). Not 100% tested.

**IS63LV1024 POWER SUPPLY CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

Symbol	Parameter	Test Conditions		-8 ns		-10 ns		-12 ns		Unit
				Min.	Max.	Min.	Max.	Min.	Max.	
I <sub>CC1</sub>	V <sub>DD</sub> Operating Supply Current	V <sub>DD</sub> = Max., $\overline{CE} = V_{IL}$ I <sub>OUT</sub> = 0 mA, f = Max.	Com.	—	160	—	150	—	130	mA
			Ind.	—	170	—	160	—	140	
			typ. <sup>(2)</sup>	—	105	—	95	—	75	
			Ind. (@15 ns)					—	90	
I <sub>SB</sub>	TTL Standby Current (TTL Inputs)	V <sub>DD</sub> = Max., V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> $\overline{CE} \geq V_{IH}$ , f = Max	Com.	—	55	—	45	—	40	mA
			Ind.	—	55	—	45	—	40	
I <sub>SB1</sub>	TTL Standby Current (TTL Inputs)	V <sub>DD</sub> = Max., V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> $\overline{CE} \geq V_{IH}$ , f = 0	Com.	—	25	—	25	—	25	mA
			Ind.	—	30	—	30	—	30	
I <sub>SB2</sub>	CMOS Standby Current (CMOS Inputs)	V <sub>DD</sub> = Max., $\overline{CE} \geq V_{DD} - 0.2V$ , V <sub>IN</sub> ≥ V <sub>DD</sub> - 0.2V, or V <sub>IN</sub> ≤ 0.2V, f = 0	Com.	—	5	—	5	—	5	mA
			Ind.	—	10	—	10	—	10	
			typ. <sup>(2)</sup>	—	0.5	—	0.5	—	0.5	

**Notes:**

- At f = f<sub>MAX</sub>, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.
- Typical values are measured at V<sub>DD</sub> = 3.3V, T<sub>A</sub> = 25°C. Not 100% tested.

**IS63LV1024L POWER SUPPLY CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

Symbol	Parameter	Test Conditions		-8 ns		-10 ns		-12 ns		Unit
				Min.	Max.	Min.	Max.	Min.	Max.	
I <sub>CC1</sub>	V <sub>DD</sub> Operating Supply Current	V <sub>DD</sub> = Max., $\overline{CE} = V_{IL}$ I <sub>OUT</sub> = 0 mA, f = Max.	Com.	—	100	—	95	—	90	mA
			Ind.	—	110	—	105	—	100	
			typ. <sup>(2)</sup>	—	75	—	70	—	65	
I <sub>SB</sub>	TTL Standby Current (TTL Inputs)	V <sub>DD</sub> = Max., V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> $\overline{CE} \geq V_{IH}$ , f = Max	Com.	—	35	—	30	—	25	mA
			Ind.	—	40	—	35	—	30	
I <sub>SB1</sub>	TTL Standby Current (TTL Inputs)	V <sub>DD</sub> = Max., V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> $\overline{CE} \geq V_{IH}$ , f = 0	Com.	—	15	—	15	—	15	mA
			Ind.	—	20	—	20	—	20	
I <sub>SB2</sub>	CMOS Standby Current (CMOS Inputs)	V <sub>DD</sub> = Max., $\overline{CE} \geq V_{DD} - 0.2V$ , V <sub>IN</sub> ≥ V <sub>DD</sub> - 0.2V, or V <sub>IN</sub> ≤ 0.2V, f = 0	Com.	—	1	—	1	—	1	mA
			Ind.	—	1.5	—	1.5	—	1.5	
			typ. <sup>(2)</sup>	—	0.05	—	0.05	—	0.05	

**Notes:**

- At f = f<sub>MAX</sub>, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.
- Typical values are measured at V<sub>DD</sub> = 3.3V, T<sub>A</sub> = 25°C. Not 100% tested.

**CAPACITANCE<sup>(1,2)</sup>**

Symbol	Parameter	Conditions	Max.	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = 0V	6	pF
C <sub>I/O</sub>	Input/Output Capacitance	V <sub>OUT</sub> = 0V	8	pF

**Notes:**

- Tested initially and after any design or process changes that may affect these parameters.
- Test conditions: T<sub>A</sub> = 25°C, f = 1 MHz, V<sub>DD</sub> = 3.3V.

**READ CYCLE SWITCHING CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

Symbol	Parameter	-8 ns		-10 ns		-12 ns		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>RC</sub>	Read Cycle Time	8	—	10	—	12	—	ns
t <sub>AA</sub>	Address Access Time	—	8	—	10	—	12	ns
t <sub>OH</sub>	Output Hold Time	2	—	2	—	2	—	ns
t <sub>ACE</sub>	$\overline{CE}$ Access Time	—	8	—	10	—	12	ns
t <sub>DOE</sub>	$\overline{OE}$ Access Time	—	4	—	5	—	6	ns
t <sub>LZOE<sup>(2)</sup></sub>	$\overline{OE}$ to Low-Z Output	0	—	0	—	0	—	ns
t <sub>HZOE<sup>(2)</sup></sub>	$\overline{OE}$ to High-Z Output	0	4	0	5	0	6	ns
t <sub>LZCE<sup>(2)</sup></sub>	$\overline{CE}$ to Low-Z Output	3	—	3	—	3	—	ns
t <sub>HZCE<sup>(2)</sup></sub>	$\overline{CE}$ to High-Z Output	0	4	0	5	0	6	ns
t <sub>PU</sub>	$\overline{CE}$ to Power Up Time	0	—	0	—	0	—	ns
t <sub>PD</sub>	$\overline{CE}$ to Power Down Time	—	8	—	10	—	12	ns

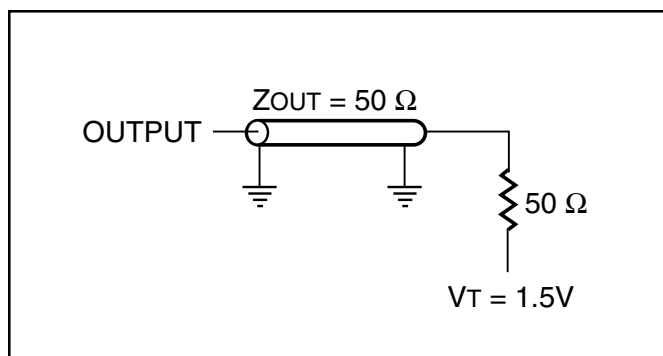
**Notes:**

1. Test conditions assume signal transition times of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V loading specified in Figure 1.
2. Tested with the loading specified in Figure 2. Transition is measured  $\pm 500$  mV from steady-state voltage. Not 100% tested.

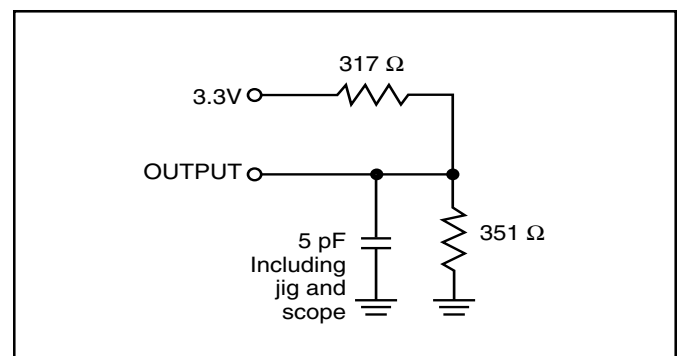
**AC TEST CONDITIONS**

Parameter	Unit
Input Pulse Level	0V to 3.0V
Input Rise and Fall Times	3 ns
Input and Output Timing and Reference Levels	1.5V
Output Load	See Figures 1 and 2

**AC TEST LOADS**



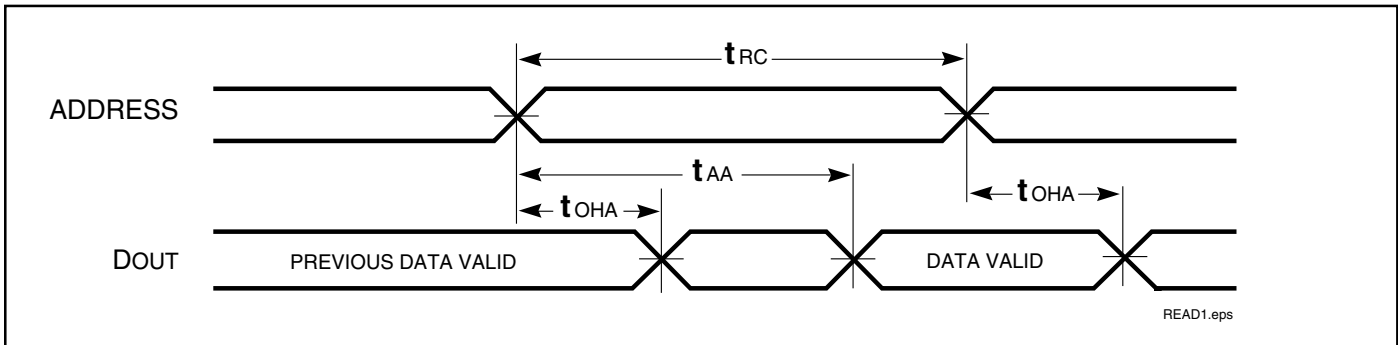
**Figure 1**



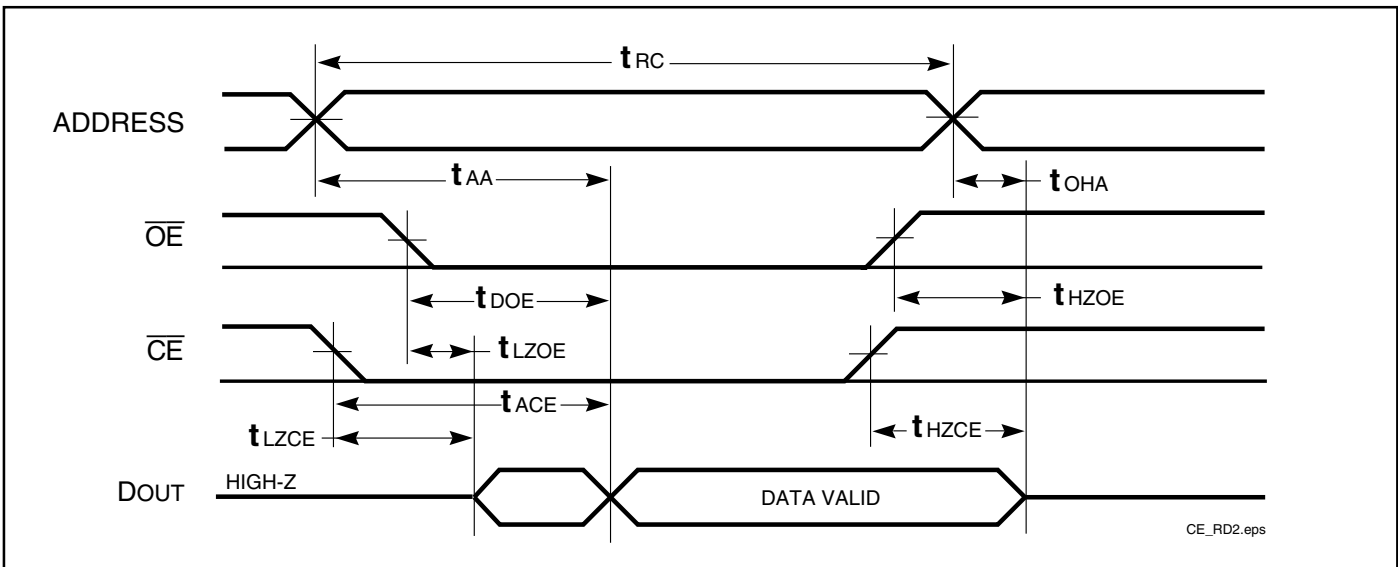
**Figure 2**

AC WAVEFORMS

READ CYCLE NO. 1<sup>(1,2)</sup>



READ CYCLE NO. 2<sup>(1,3)</sup>



Notes:

1.  $\overline{WE}$  is HIGH for a Read Cycle.
2. The device is continuously selected.  $\overline{OE}$ ,  $\overline{CE} = V_{IL}$ .
3. Address is valid prior to or coincident with  $\overline{CE}$  LOW transitions.

**WRITE CYCLE SWITCHING CHARACTERISTICS<sup>(1,3)</sup>** (Over Operating Range)

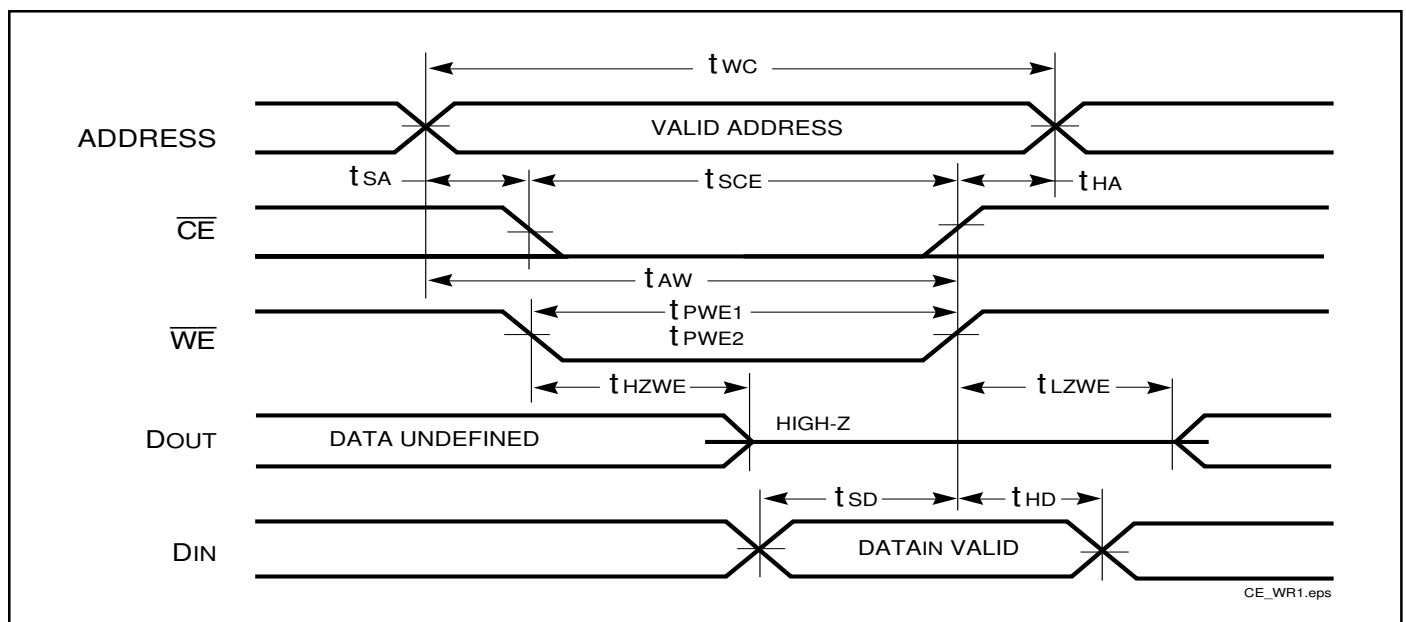
Symbol	Parameter	-8 ns		-10 ns		-12 ns		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>WC</sub>	Write Cycle Time	8	—	10	—	12	—	ns
t <sub>SCE</sub>	$\overline{CE}$ to Write End	7	—	7	—	8	—	ns
t <sub>AW</sub>	Address Setup Time to Write End	8	—	8	—	8	—	ns
t <sub>HA</sub>	Address Hold from Write End	0	—	0	—	0	—	ns
t <sub>SA</sub>	Address Setup Time	0	—	0	—	0	—	ns
t <sub>PWE1</sub> <sup>(1)</sup>	$\overline{WE}$ Pulse Width ( $\overline{OE}$ High)	7	—	7	—	8	—	ns
t <sub>PWE2</sub> <sup>(2)</sup>	$\overline{WE}$ Pulse Width ( $\overline{OE}$ Low)	8	—	10	—	12	—	ns
t <sub>SD</sub>	Data Setup to Write End	5	—	5	—	6	—	ns
t <sub>HD</sub>	Data Hold from Write End	0	—	0	—	0	—	ns
t <sub>HZWE</sub> <sup>(2)</sup>	$\overline{WE}$ LOW to High-Z Output	—	4	—	5	—	6	ns
t <sub>LZWE</sub> <sup>(2)</sup>	$\overline{WE}$ HIGH to Low-Z Output	3	—	3	—	3	—	ns

**Notes:**

1. Test conditions assume signal transition times of 3ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V and output loading specified in Figure 1.
2. Tested with the load in Figure 2. Transition is measured  $\pm 500$  mV from steady-state voltage. Not 100% tested.
3. The internal write time is defined by the overlap of  $\overline{CE}$  LOW and  $\overline{WE}$  LOW. All signals must be in valid states to initiate a Write, but any one can go inactive to terminate the Write. The Data Input Setup and Hold timing are referenced to the rising or falling edge of the signal that terminates the Write.

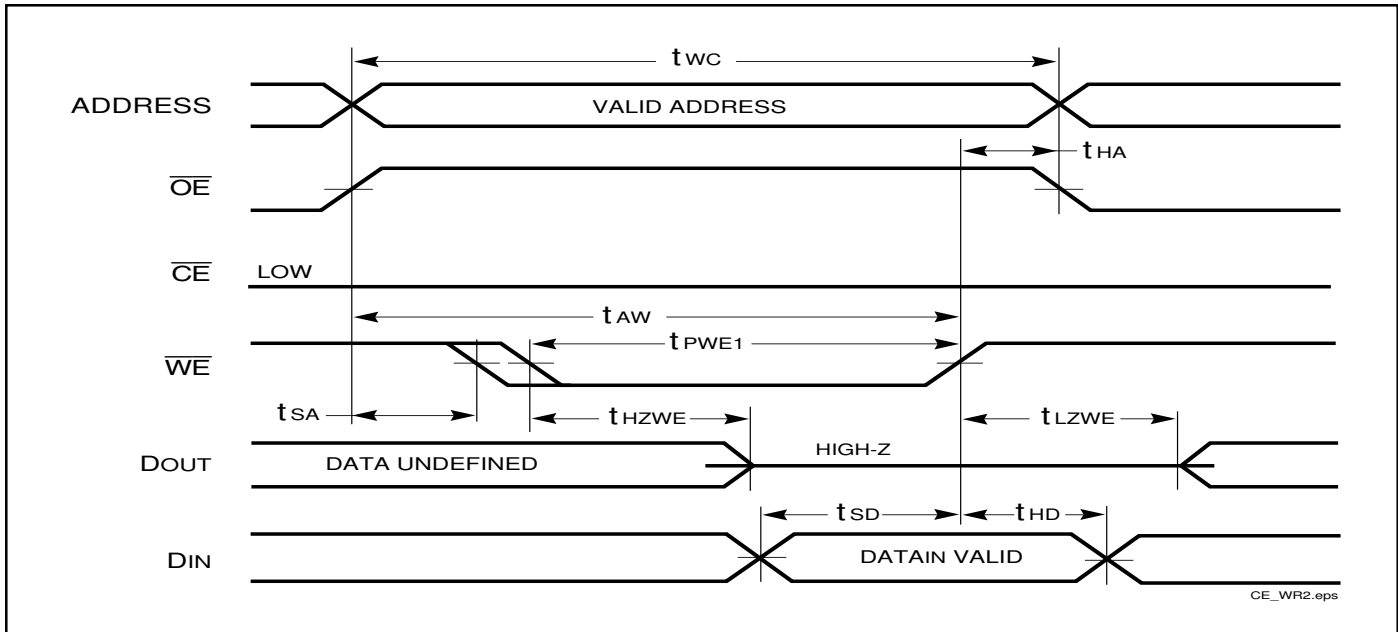
**AC WAVEFORMS**

**WRITE CYCLE NO. 1<sup>(1,2)</sup>** ( $\overline{CE}$  Controlled,  $\overline{OE}$  = HIGH or LOW)

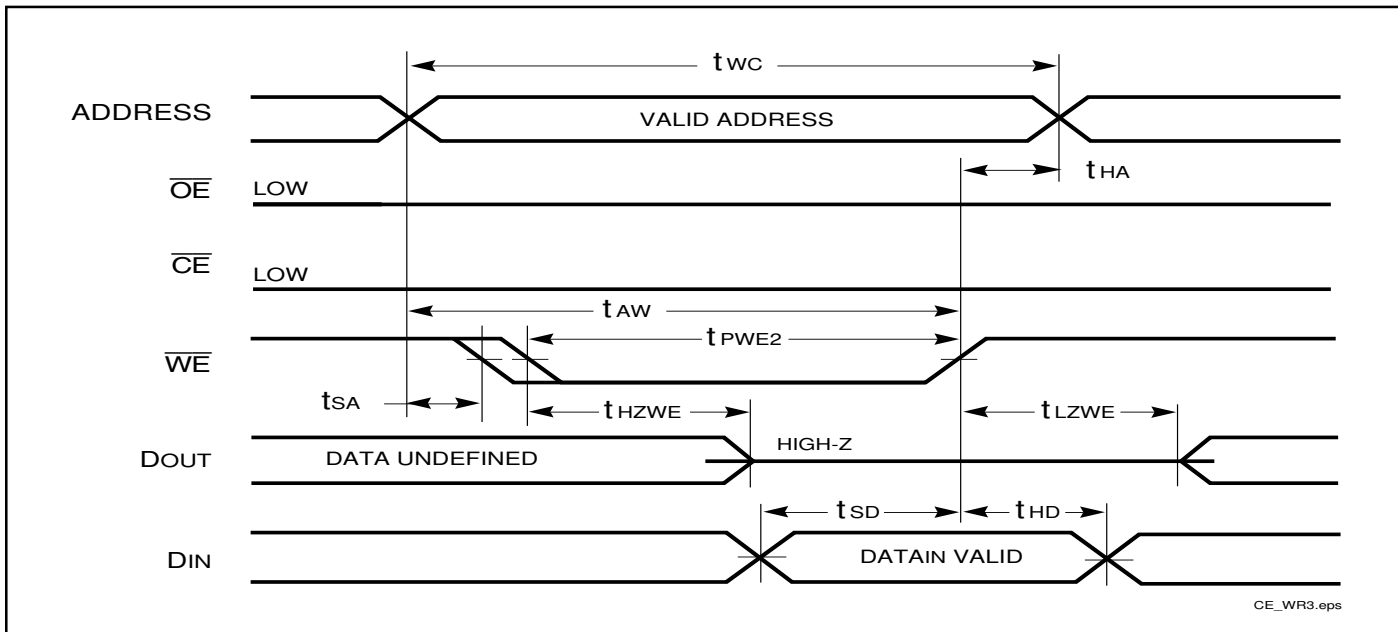


**AC WAVEFORMS**

**WRITE CYCLE NO. 2<sup>(1)</sup>** ( $\overline{WE}$  Controlled,  $\overline{OE}$  = HIGH during Write Cycle)



**WRITE CYCLE NO. 3** ( $\overline{WE}$  Controlled:  $\overline{OE}$  is LOW During Write Cycle)



**Notes:**

1. The internal write time is defined by the overlap of  $\overline{CE}$  LOW and  $\overline{WE}$  LOW. All signals must be in valid states to initiate a Write, but any one can go inactive to terminate the Write. The Data Input Setup and Hold timing are referenced to the rising or falling edge of the signal that terminates the Write.
2. I/O will assume the High-Z state if  $\overline{OE} > V_{IH}$ .

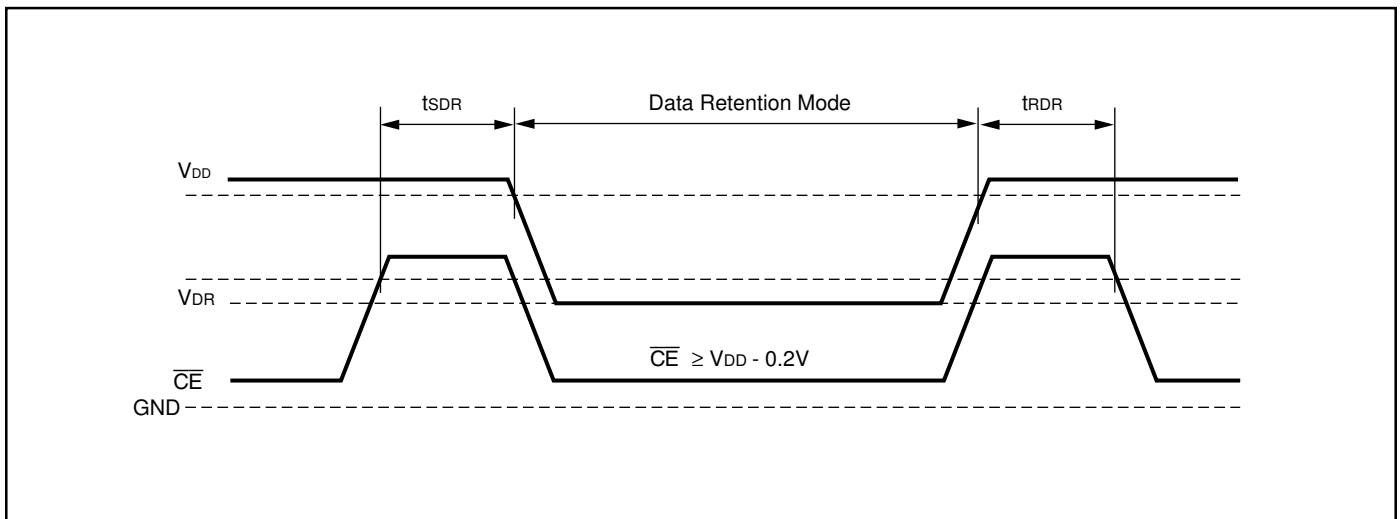


## DATA RETENTION SWITCHING CHARACTERISTICS

Symbol	Parameter	Test Condition	Options	Min.	Typ. <sup>(1)</sup>	Max.	Unit
V <sub>DR</sub>	V <sub>DD</sub> for Data Retention	See Data Retention Waveform		2.0	—	3.6	V
I <sub>DR</sub>	Data Retention Current	V <sub>DD</sub> = 2.0V, $\overline{CE} \geq V_{DD} - 0.2V$	IS63LV1024 IS63LV1024L	—	0.5 0.05	10 1.5	mA
t <sub>SDR</sub>	Data Retention Setup Time	See Data Retention Waveform		0	—	—	ns
t <sub>RDR</sub>	Recovery Time	See Data Retention Waveform		t <sub>RC</sub>	—	—	ns

**Note 1:** Typical values are measured at V<sub>DD</sub> = 3.0V, T<sub>A</sub> = 25°C and not 100% tested.

### DATA RETENTION WAVEFORM ( $\overline{CE}$ Controlled)



## IS63LV1024 ORDERING INFORMATION

### Commercial Range: 0 °C to +70 °C

Speed (ns)	Order Part No.	Package
8	IS63LV1024-8K	400-mil Plastic SOJ
	IS63LV1024-8KL	400-mil Plastic SOJ, Lead-free
10	IS63LV1024-10T	TSOP (Type II)
	IS63LV1024-10J	300-mil Plastic SOJ
	IS63LV1024-10K	400-mil Plastic SOJ
12	IS63LV1024-12T	TSOP (Type II)
	IS63LV1024-12J	300-mil Plastic SOJ
	IS63LV1024-12JL	300-mil Plastic SOJ, Lead-free
	IS63LV1024-12KL	400-mil Plastic SOJ, Lead-free

### Industrial Range: -40 °C to +85 °C

Speed (ns)	Order Part No.	Package
8	IS63LV1024-8KI	400-mil Plastic SOJ
10	IS63LV1024-10KI	400-mil Plastic SOJ
12	IS63LV1024-12TI	TSOP (Type II)

**IS63LV1024L ORDERING INFORMATION**

**Commercial Range: 0° C to +70° C**

Speed (ns)	Order Part No.	Package
8	IS63LV1024L-8T	TSOP (Type II)
	IS63LV1024L-8TL	TSOP (Type II), Lead-free
	IS63LV1024L-8B	mBGA (8mmx10mm)
10	IS63LV1024L-10T	TSOP (Type II)
	IS63LV1024L-10TL	TSOP (Type II), Lead-free
	IS63LV1024L-10HL	sTSOP (Type I) (8mm x13.4mm), Lead-free
12	IS63LV1024L-12T	TSOP (Type II)
	IS63LV1024L-12TL	TSOP (Type II), Lead-free
	IS63LV1024L-12H	sTSOP (Type I) (8mm x13.4mm)
	IS63LV1024L-12JL	300-mil Plastic SOJ, Lead-free
	IS63LV1024L-12B	mBGA (8mmx10mm)

**Industrial Range: -40° C to +85° C**

Speed (ns)	Order Part No.	Package
8	IS63LV1024L-8TI	TSOP (Type II)
	IS63LV1024L-8KI	400-mil Plastic SOJ
	IS63LV1024L-8BI	mBGA (8mmx10mm)
10	IS63LV1024L-10HI	sTSOP (Type I) (8mm x13.4mm)
	IS63LV1024L-10JLI	300-mil Plastic SOJ, Lead-free
	IS63LV1024L-10KLI	400-mil Plastic SOJ, Lead-free
	IS63LV1024L-10TLI	TSOP (Type II), Lead-free
12	IS63LV1024L-12BI	mBGA (8mmx10mm)
	IS63LV1024L-12BLI	mBGA (8mmx10mm), Lead-free
	IS63LV1024L-12TI	TSOP (Type II)
	IS63LV1024L-12TLI	TSOP (Type II), Lead-free

**Special Part Numbers**

**Industrial Range: -40° C to +85° C**

Speed (ns)	Top Mark	Order Part No.	Package
8	IS63LV1024L-10KLI	U788B-8KLI	400-mil Plastic SOJ, Lead-free
	IS63LV1024L-10TLI	U788A-8TLI	TSOP (Type II), Lead-free



NOTE :

1. CONTROLLING DIMENSION : MM
2. DIMENSION D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
3. DIMENSION b2 DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION.



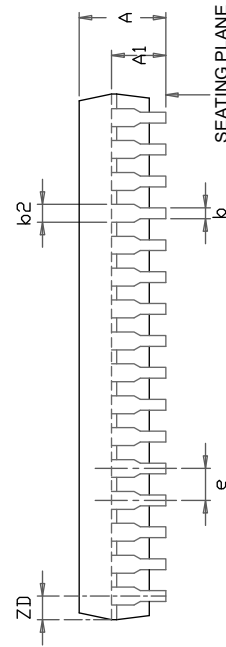
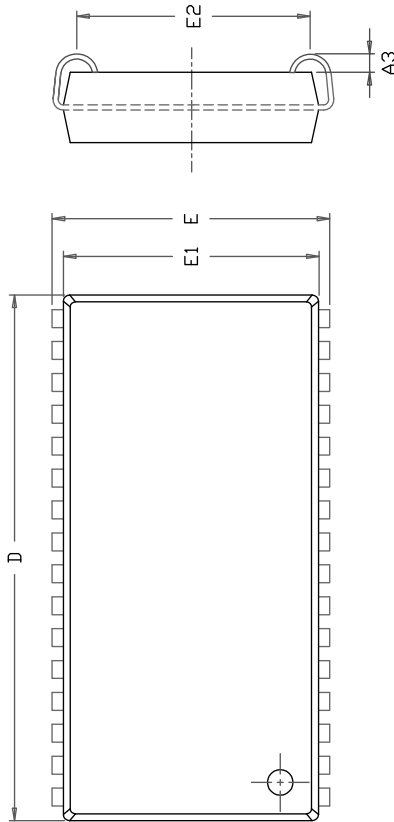
32L 300mil SOJ  
Package Outline

REV. C

DATE 08/14/2009

TITLE

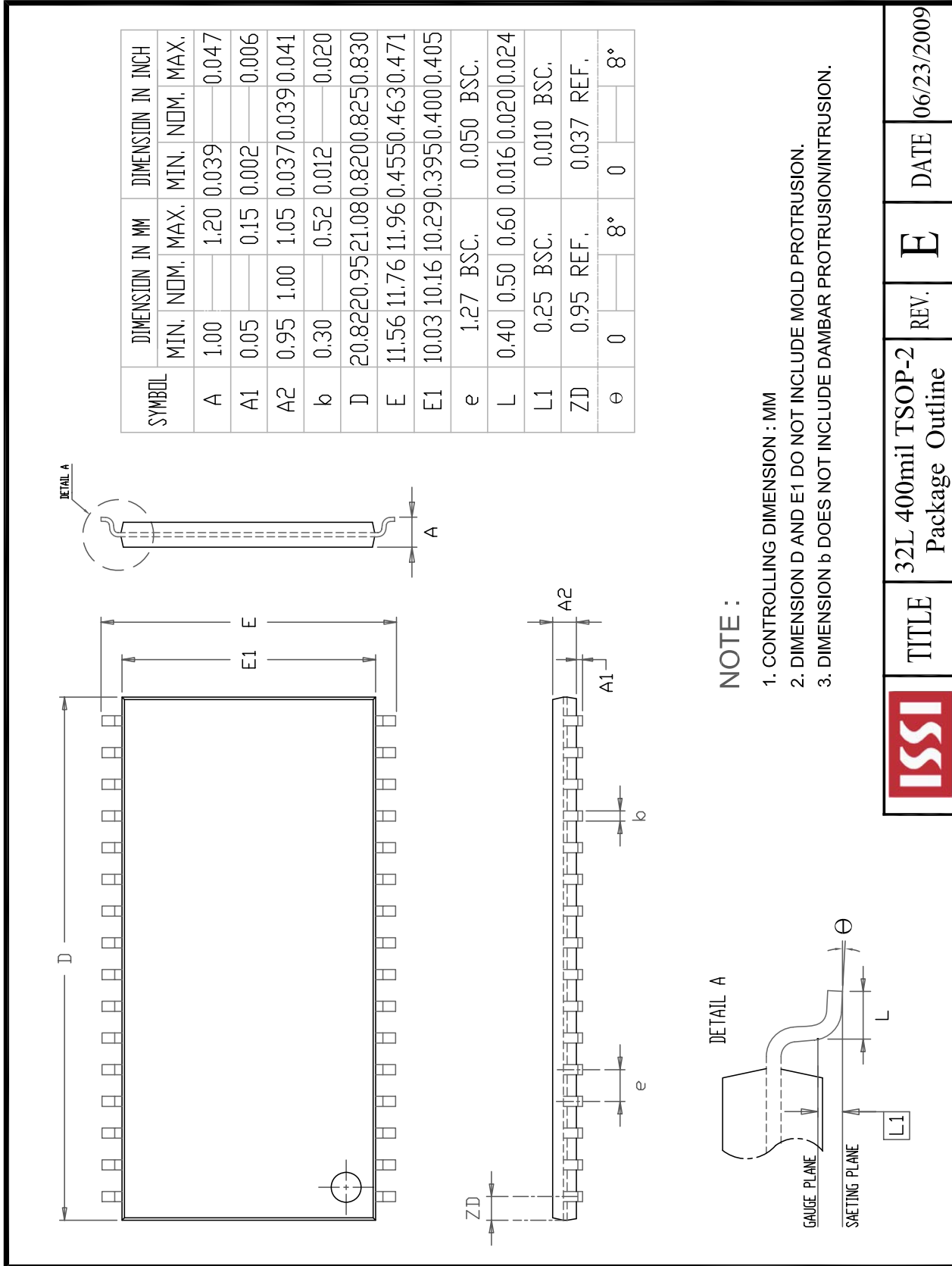
SYMBOL	DIMENSION IN MM		DIMENSION IN INCH	
	MIN.	NOM. MAX.	MIN.	NOM. MAX.
A	3.25	3.76	0.128	0.148
A1	2.08		0.082	
A3	0.635		0.025	
b	0.38	0.51	0.015	0.020
b2	0.66	0.71	0.026	0.028
D	20.82	20.95	0.820	0.825
E	11.05	11.18	0.435	0.440
E1	10.03	10.16	0.395	0.400
E2	9.40	BSC	0.370	BSC
e	1.27	BSC.	0.050	BSC.
ZD	0.95	REF	0.037	REF



NOTE :

1. Controlling dimension : mm
2. Dimension D and E1 do not include mold protrusion .
3. Dimension b2 does not include dambar protrusion/intrusion.
4. Formed leads shall be planar with respect to one another within 0.1mm at the seating plane after final test.
5. Reference document : JEDEC SPEC MS-027.

	TITLE	32L 400mil SOJ Package Outline	REV.	E	DATE	12/19/2007
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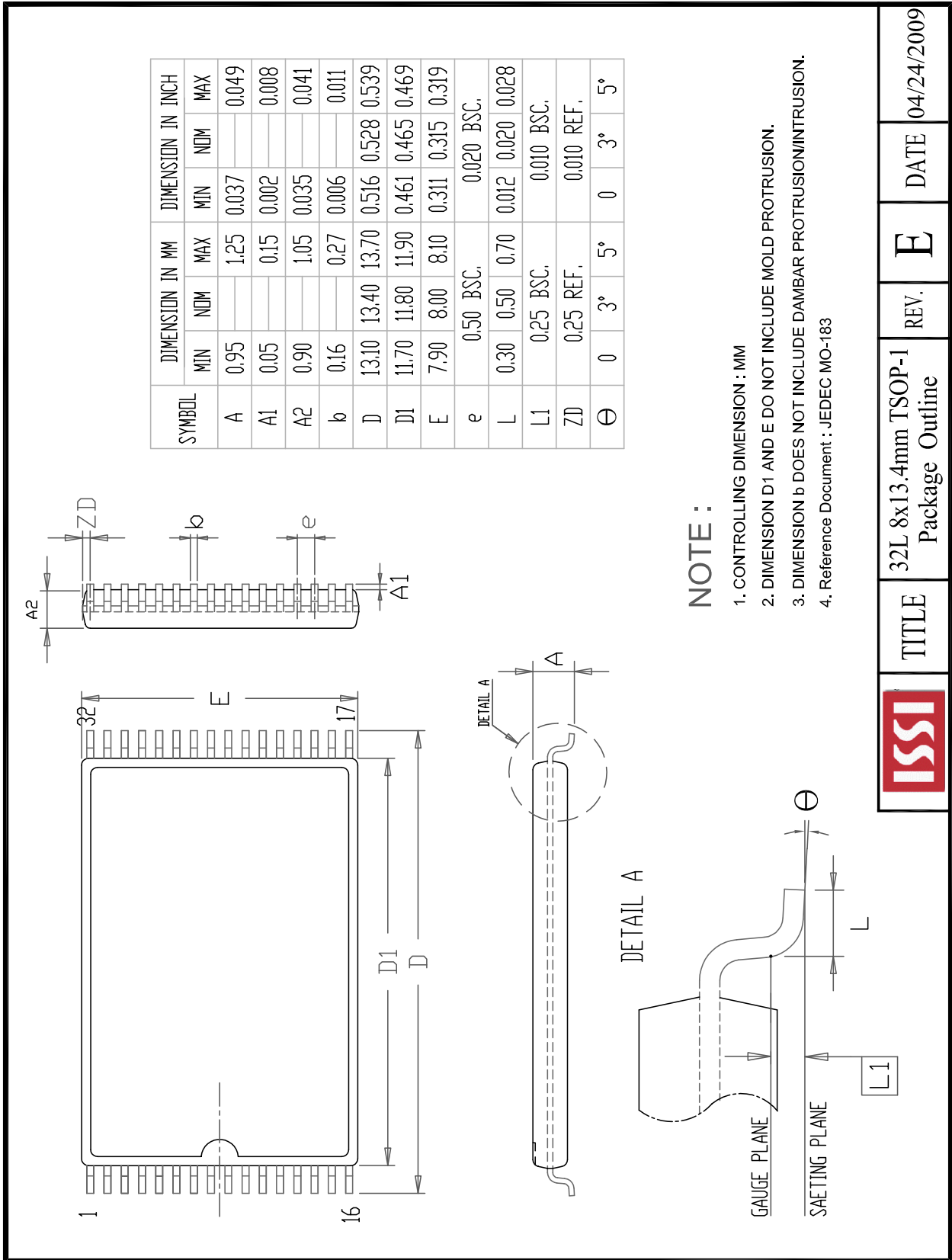


SYMBOL	DIMENSION IN MM		DIMENSION IN INCH	
	MIN.	NOM. MAX.	MIN.	NOM. MAX.
A	1.00	1.20	0.039	0.047
A1	0.05	0.15	0.002	0.006
A2	0.95	1.00	0.037	0.039
b	0.30	0.52	0.012	0.020
D	20.82	20.95	21.08	0.820
E	11.56	11.76	11.96	0.455
E1	10.03	10.16	10.29	0.395
e	1.27 BSC.		0.050 BSC.	
L	0.40	0.50	0.60	0.016
L1	0.25 BSC.		0.010 BSC.	
ZD	0.95 REF.		0.037 REF.	
theta	0	8°	0	8°

**NOTE :**

1. CONTROLLING DIMENSION : MM
2. DIMENSION D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION.

	TITLE	REV.	DATE
	32L 400mil TSOP-2 Package Outline	E	06/23/2009



ISSI	TITLE	32L 8x13.4mm TSOP-1 Package Outline	REV.	E	DATE	04/24/2009
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Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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