128K x 8 HIGH SPEED ASYNCHRONOUS CMOS STATIC RAM WITH ECC

MAY 2020

FEATURES

- High-speed access time: 8, 10 ns
- Low Active Power: 85 mW (typical)
- Low Standby Power: 7 mW (typical) CMOS standby
- Single power supply
- Fully static operation: no clock or refresh required
- Three state outputs
- Industrial and Automotive temperature support
- Lead-free available
- Error Detection and Error Correction

DESCRIPTION

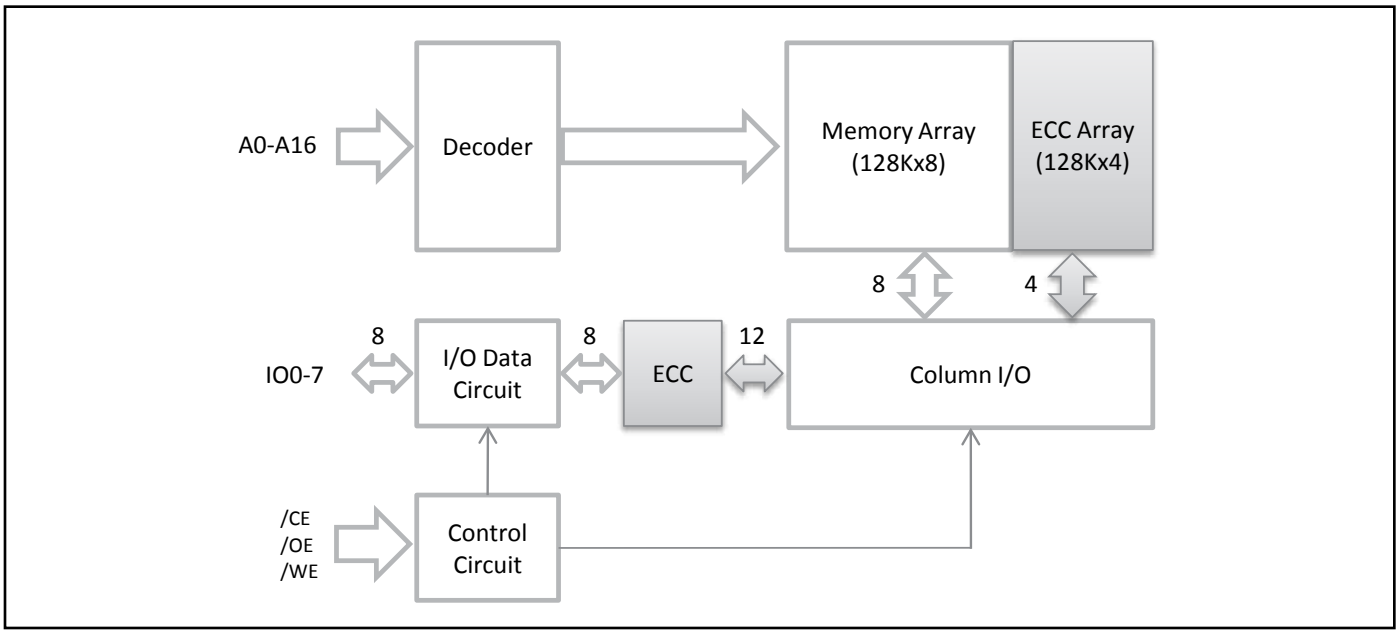
The *ISSI* IS61/64WV1288EEBLL is a high-speed, 1,048,576-bit static RAMs organized as 131,072 words by 8 bits. It is fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields high-performance and low power consumption devices.

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

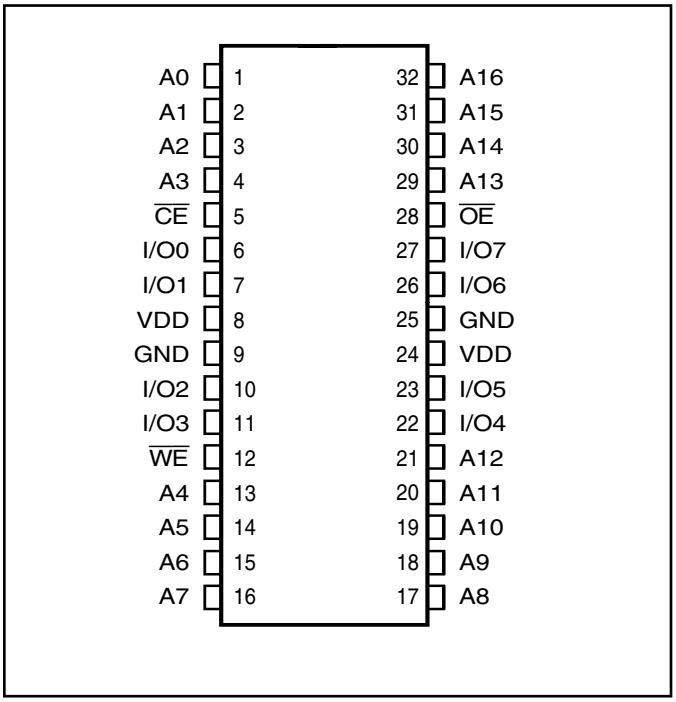
Easy memory expansion is provided by using Chip Enable and Output Enable inputs, $\overline{CE}$ and $\overline{OE}$. The active LOW Write Enable ($\overline{WE}$) controls both writing and reading of the memory.

The IS61/64WV1288EEBLL is packaged in the JEDEC standard 32-pin SOJ, TSOP-II, sTSOP-I, and 48-ball BGA (6mmx8mm).

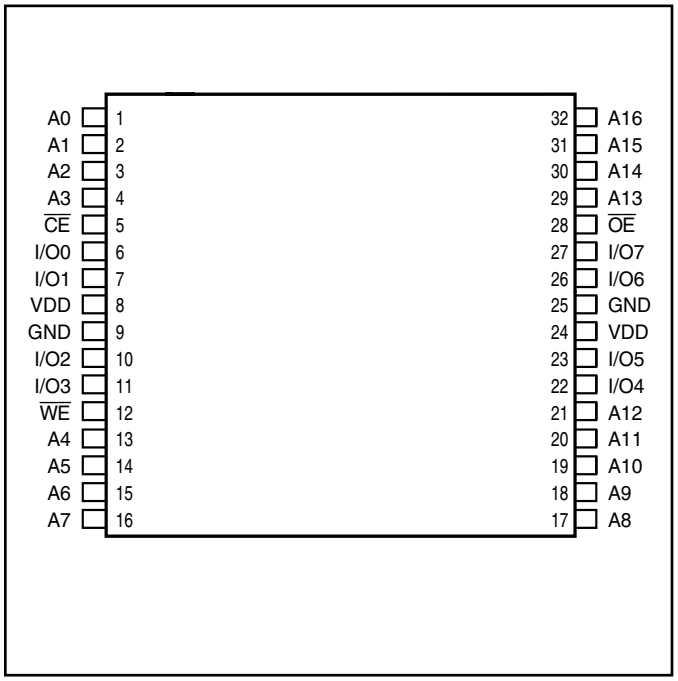
FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION
32-Pin SOJ



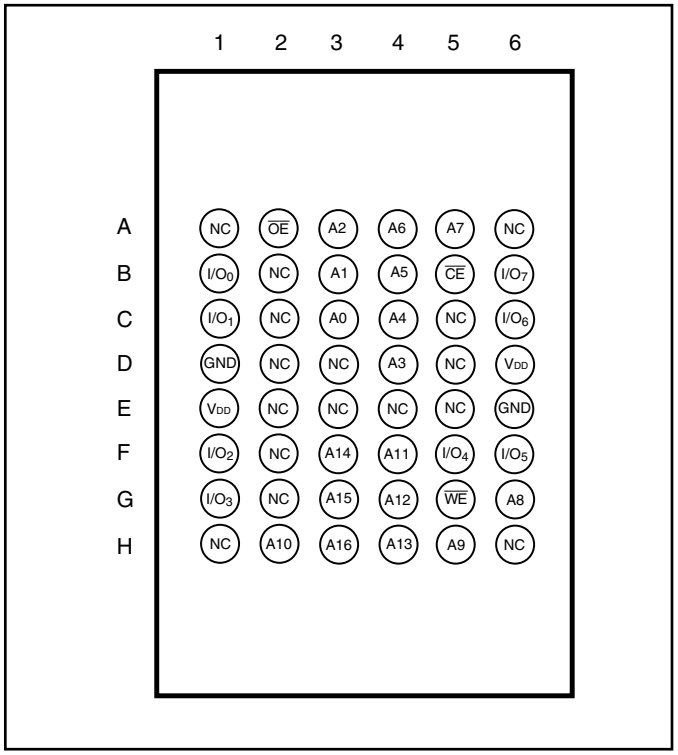
PIN CONFIGURATION
32-Pin TSOP (Type II) (T)
32-Pin sTSOP (Type I) (H)



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	Bidirectional Ports
V_{DD}	Power
GND	Ground

PIN CONFIGURATION
48-mini BGA (B) (6 mm x 8 mm)



ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Parameter	Value	Unit
V_{TERM}	Terminal Voltage with Respect to GND	–0.5 to V_{DD} + 0.5	V
V_{DD}	V_{DD} Relates to GND	–0.3 to 4.0	V
T_{STG}	Storage Temperature	–65 to +150	°C
P_T	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.

CAPACITANCE[1,2]

Symbol	Parameter	Conditions	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	6	pF
$C_{I/O}$	Input/Output Capacitance	V_{OUT} = 0V	8	pF

Notes:
1. Tested initially and after any design or process changes that may affect these parameters.
2. Test conditions: T_A = 25°C, f = 1 MHz, V_{DD} = 3.3V.

ERROR DETECTION AND ERROR CORRECTION

- Independent ECC with hamming code for each byte
- Detect and correct one bit error per byte
- Better reliability than parity code schemes which can only detect an error but not correct an error
- Backward Compatible: Drop in replacement to current in industry standard devices (without ECC)

TRUTH TABLE

Mode	$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	I/O Operation	V_{DD} Current
Not Selected (Power-down)	H	X	X	High-Z	I_{SB1}, I_{SB2}
Output Disabled	L	H	H	High-Z	I_{CC}
Read	L	H	L	D_{OUT}	I_{CC}
Write	L	L	X	D_{IN}	I_{CC}

OPERATING RANGE (V_{DD})[1]

Range	Ambient Temperature	IS61WV1288EEBLL V_{DD} (8, 10ns)	IS64WV1288EEBLL V_{DD} (8, 10ns)
Industrial	–40°C to +85°C	2.4V-3.6V	—
Automotive (A1)	–40°C to +85°C	—	2.4V-3.6V (8,10ns)
Automotive (A3)	–40°C to +125°C	—	2.4V-3.6V (10ns)

Note:
1. Contact SRAM@issi.com for 1.8V option

DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

V_{DD} = 3.3V ± 10%

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{DD} = Min., I_{OH} = –4.0 mA	2.4	—	V
V_{OL}	Output LOW Voltage	V_{DD} = Min., I_{OL} = 8.0 mA	—	0.4	V
V_{IH}	Input HIGH Voltage		2	V_{DD} + 0.3	V
V_{IL}	Input LOW Voltage[1]		–0.3	0.8	V
I_{LI}	Input Leakage	GND ≤ V_{IN} ≤ V_{DD}	–1	1	µA
I_{LO}	Output Leakage	GND ≤ V_{OUT} ≤ V_{DD}, Outputs Disabled	–1	1	µA

Note:
1. V_{IL} (min.) = –0.3V DC; V_{IL} (min.) = –2.0V AC (pulse width < 2 ns). Not 100% tested.
   V_{IH} (max.) = V_{DD} + 0.3V DC; V_{IH} (max.) = V_{DD} + 2.0V AC (pulse width < 2 ns). Not 100% tested.

DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

V_{DD} = 2.4V-3.6V

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{DD} = Min., I_{OH} = –1.0 mA	1.8	—	V
V_{OL}	Output LOW Voltage	V_{DD} = Min., I_{OL} = 1.0 mA	—	0.4	V
V_{IH}	Input HIGH Voltage		2.0	V_{DD} + 0.3	V
V_{IL}	Input LOW Voltage[1]		–0.3	0.8	V
I_{LI}	Input Leakage	GND ≤ V_{IN} ≤ V_{DD}	–1	1	µA
I_{LO}	Output Leakage	GND ≤ V_{OUT} ≤ V_{DD}, Outputs Disabled	–1	1	µA

Note:
1. V_{IL} (min.) = –0.3V DC; V_{IL} (min.) = –2.0V AC (pulse width < 2 ns). Not 100% tested.
   V_{IH} (max.) = V_{DD} + 0.3V DC; V_{IH} (max.) = V_{DD} + 2.0V AC (pulse width < 2 ns). Not 100% tested.

POWER SUPPLY CHARACTERISTICS[1] (Over Operating Range)

				-8		-10		-20		
Symbol	Parameter	Test Conditions		Min.	Max.	Min.	Max.	Min.	Max.	Unit
I_{CC}	V_{DD} Dynamic Operating Supply Current	V_{DD} = Max., I_{OUT} = 0 mA, f = f_{MAX}	Com.	—	25	—	20	—	15	mA
			Ind.	—	30	—	25	—	20	
			Auto.	—	—	—	35	—	30	
			typ.[2]	15		15				
I_{CC1}	Operating Supply Current	V_{DD} = Max., I_{OUT} = 0 mA, f = 0	Com.	—	10	—	10	—	10	mA
			Ind.	—	12	—	12	—	12	
			Auto.	—	—	—	15	—	15	
I_{SB1}	TTL Standby Current (TTL Inputs)	V_{DD} = Max., V_{IN} = V_{IH} or V_{IL} $\overline{CE}$ ≥ V_{IH}, f = 0	Com.	—	10	—	10	—	10	mA
			Ind.	—	12	—	12	—	12	
			Auto.	—	—	—	20	—	20	
I_{SB2}	CMOS Standby Current (CMOS Inputs)	V_{DD} = Max., $\overline{CE}$ ≥ V_{DD} – 0.2V, V_{IN} ≥ V_{DD} – 0.2V or V_{IN} ≤ 0.2V, f = 0	Com.	—	3	—	3	—	3	mA
			Ind.	—	4	—	4	—	4	
			Auto.	—	—	—	10	—	10	
			typ.[2]	1		1				

Note:
1. At f = f_{MAX}, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.
2. Typical values are measured at V_{DD} = 3.0V, T_A = 25°C and not 100% tested.

AC TEST CONDITIONS

Parameter	Unit (2.4V-3.6V)
Input Pulse Level	0.4V to V_{DD}-0.3V
Input Rise and Fall Times	1V/ ns
Input and Output Timing and Reference Level (V_{Ref})	V_{DD}/2
Output Load	See Figures 1 and 2

AC TEST LOADS

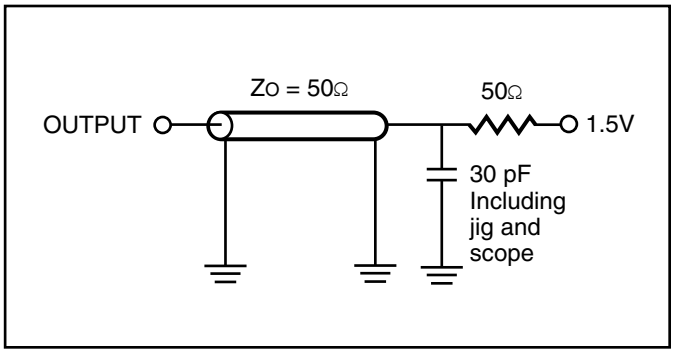


Figure 1.

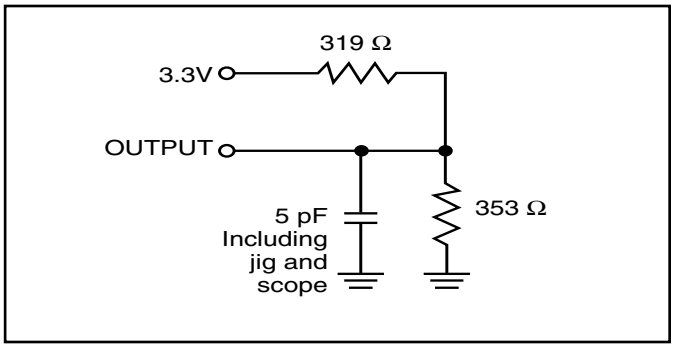


Figure 2.

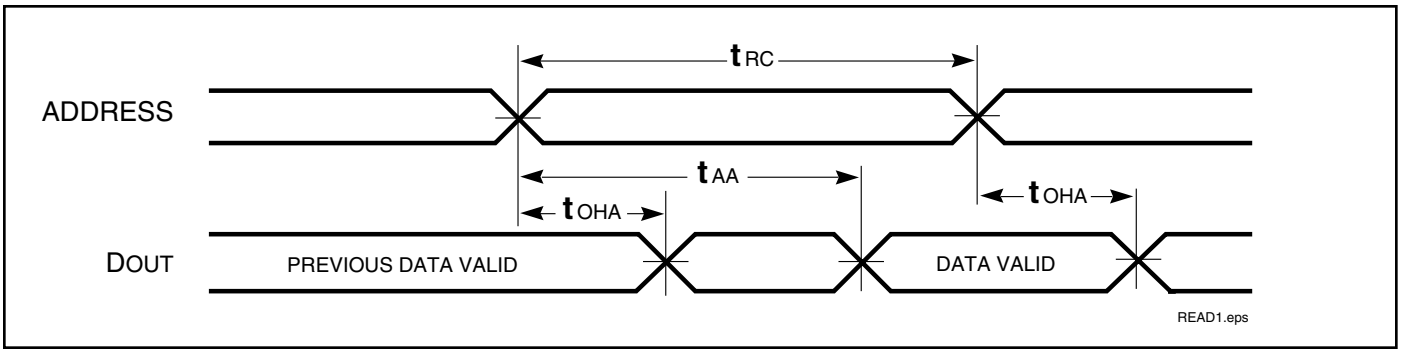
READ CYCLE SWITCHING CHARACTERISTICS[1] (Over Operating Range)

Symbol	Parameter	-8 Min.	-8 Max.	-10 Min.	-10 Max.	-20 Min.	-20 Max.	Unit
t_{RC}	Read Cycle Time	8	—	10	—	20	—	ns
t_{AA}	Address Access Time	—	8	—	10	—	20	ns
t_{OHA}	Output Hold Time	2.0	—	2.0	—	2.5	—	ns
t_{ACE}	$\overline{CE}$ Access Time	—	8	—	10	—	20	ns
t_{DOE}	$\overline{OE}$ Access Time	—	4.5	—	4.5	—	8	ns
t_{HZOE}[2]	$\overline{OE}$ to High-Z Output	—	3	—	4	—	8	ns
t_{LZOE}[2]	$\overline{OE}$ to Low-Z Output	0	—	0	—	0	—	ns
t_{HZCE}[2	$\overline{CE}$ to High-Z Output	0	3	0	4	0	8	ns
t_{LZCE}[2]	$\overline{CE}$ to Low-Z Output	3	—	3	—	3	—	ns
t_{PU}	Power Up Time	0	—	0	—	0	—	ns
t_{PD}	Power Down Time	—	8	—	10	—	20	ns

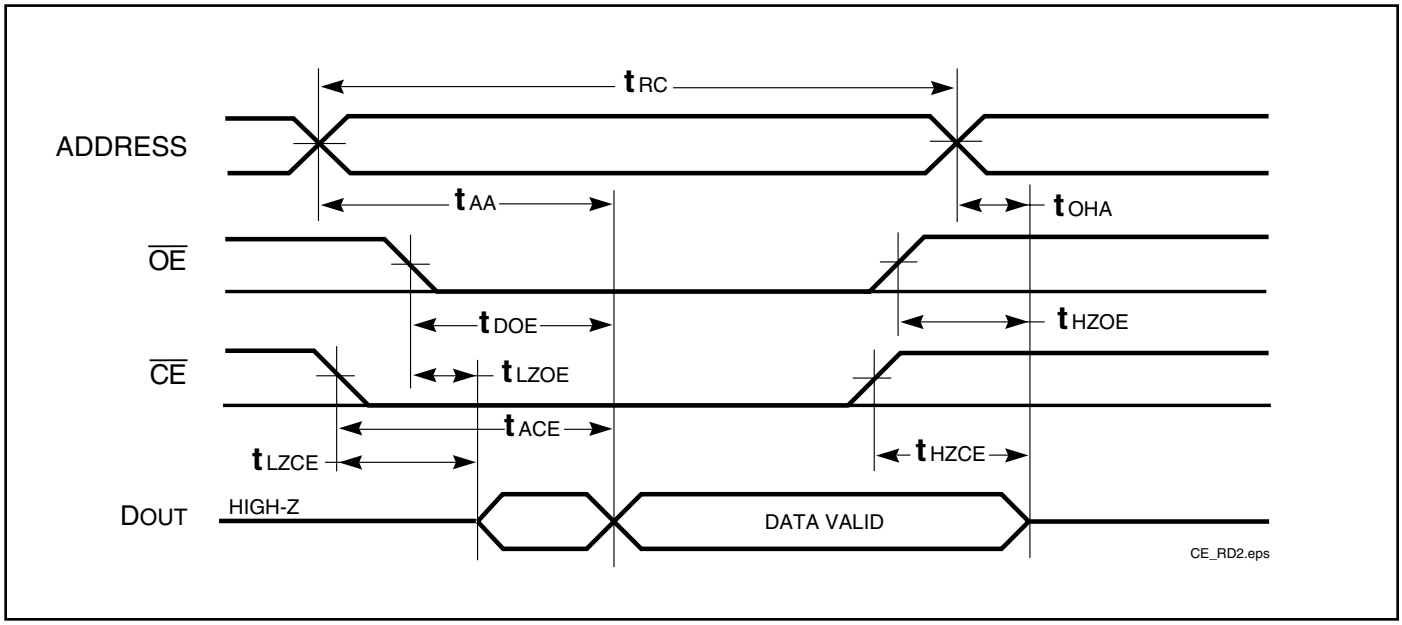
Notes:
1. Test conditions and output loading conditions are specified in the AC Test Conditions and AC Test Loads (Figure 1).
2. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage.

AC WAVEFORMS

READ CYCLE NO. 1[1,2] (Address Controlled) ($\overline{CE}$ = $\overline{OE}$ = V_{IL})



READ CYCLE NO. 2[1,3] ($\overline{CE}$ and $\overline{OE}$ Controlled)



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.

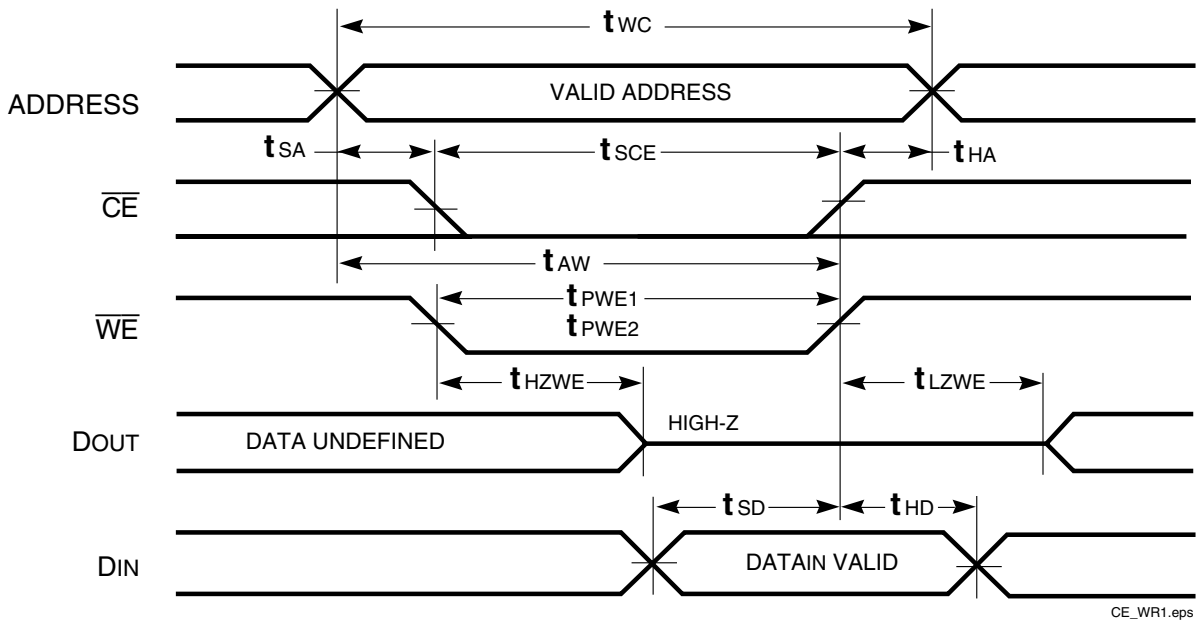
WRITE CYCLE SWITCHING CHARACTERISTICS[1,3] (Over Operating Range)

Symbol	Parameter	-8 Min.	-8 Max.	-10 Min.	-10 Max.	-20 Min.	-20 Max.	Unit
t_{WC}	Write Cycle Time	8	—	10	—	20	—	ns
t_{SCE}	$\overline{CE}$ to Write End	6.5	—	8	—	12	—	ns
t_{AW}	Address Setup Time to Write End	6.5	—	8	—	12	—	ns
t_{HA}	Address Hold from Write End	0	—	0	—	0	—	ns
t_{SA}	Address Setup Time	0	—	0	—	0	—	ns
t_{PWE1}	$\overline{WE}$ Pulse Width	6.5	—	8	—	12	—	ns
t_{PWE2}	$\overline{WE}$ Pulse Width ($\overline{OE}$ = LOW)	8.0	—	10	—	17	—	ns
t_{SD}	Data Setup to Write End	5	—	6	—	9	—	ns
t_{HD}	Data Hold from Write End	0	—	0	—	0	—	ns
t_{HZWE}[2]	$\overline{WE}$ LOW to High-Z Output	—	3.5	—	5	—	9	ns
t_{LZWE}[2]	$\overline{WE}$ HIGH to Low-Z Output	2	—	2	—	2	—	ns

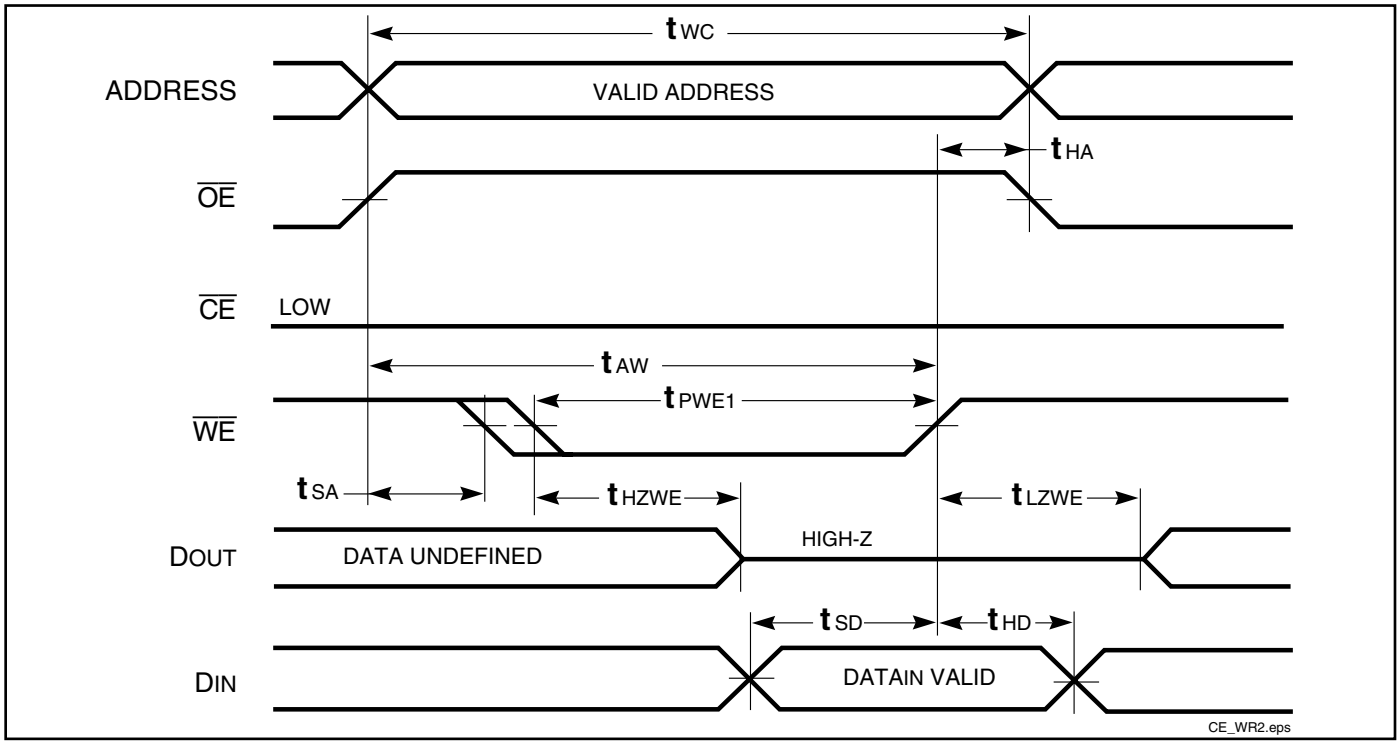
Notes:
1. Test conditions and output loading conditions are specified in the AC Test Conditions and AC Test Loads (Figure 1).
2. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.
3. The internal write time is defined by the overlap of $\overline{CE}$ 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. Shaded area product in development

AC WAVEFORMS

WRITE CYCLE NO. 1[1,2] ($\overline{CE}$ Controlled, $\overline{OE}$ = HIGH or LOW)



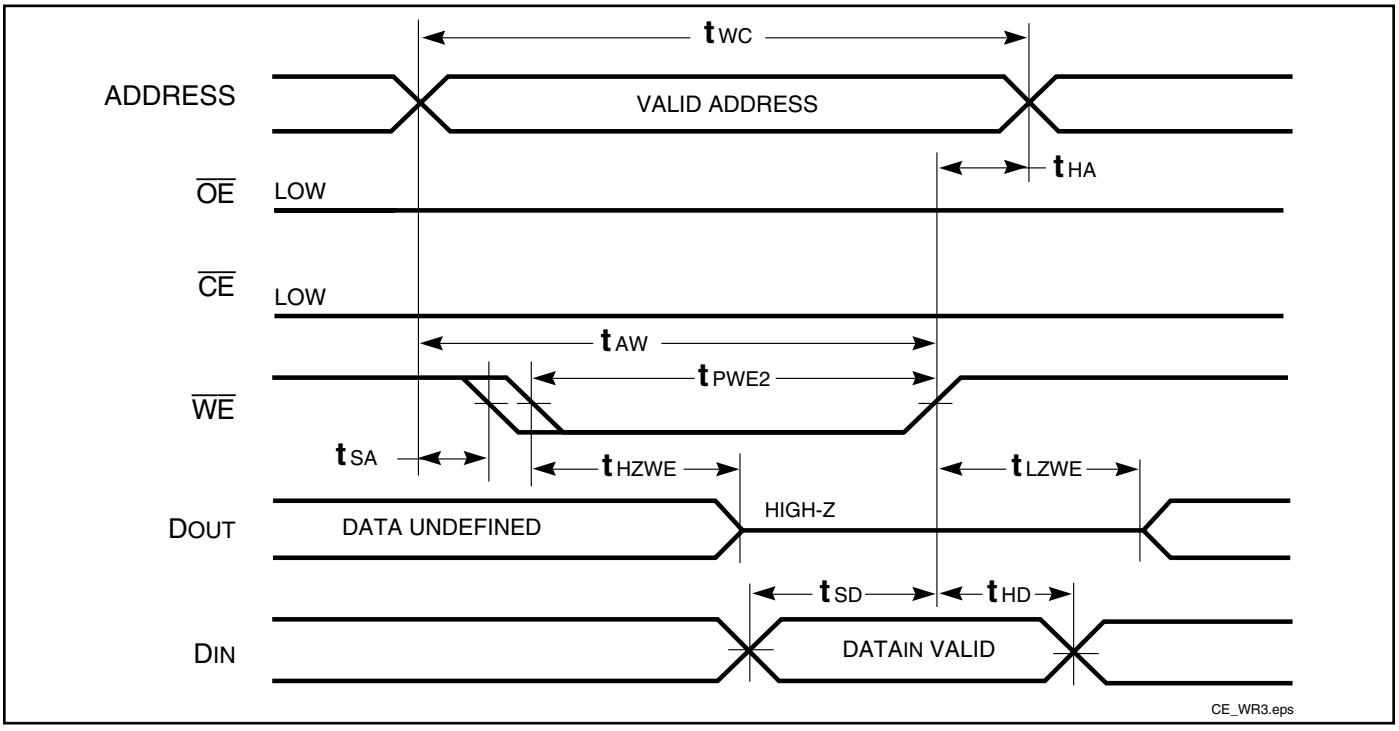
WRITE CYCLE NO. 2[1,2] ($\overline{WE}$ Controlled: $\overline{OE}$ is HIGH During Write Cycle)



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}.

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



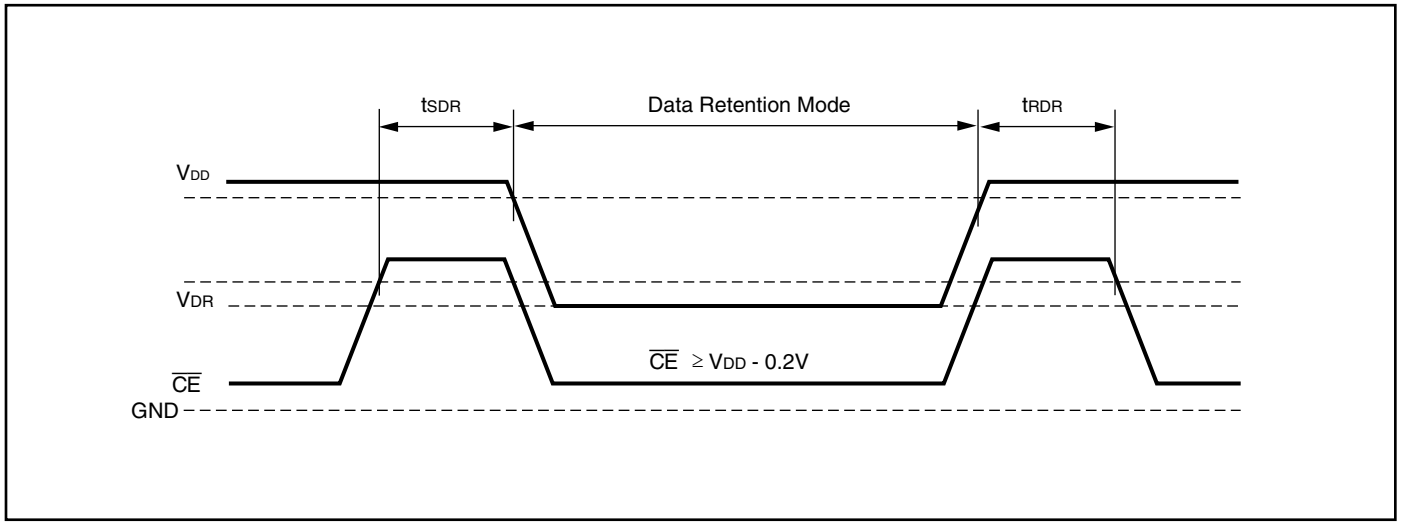
HIGH SPEED

DATA RETENTION SWITCHING CHARACTERISTICS (2.4V-3.6V)

Symbol	Parameter	Test Condition	Options	Min.	Typ.(1)	Max.	Unit
V_{DR}	V_{DD} for Data Retention	See Data Retention Waveform		2.0	—	3.6	V
I_{DR}	Data Retention Current	$V_{DD} = V_{DR}$(min), $\overline{CE} \geq V_{DD} - 0.2V$,	Com.	—	0.5	3	mA
		$V_{IN} \geq V_{DD} - 0.2V$ or	Ind.	—	—	4	
		$V_{IN} \leq 0.2V$	Auto.			10	
t_{SDR}	Data Retention Setup Time	See Data Retention Waveform		0	—	—	ns
t_{RDR}	Recovery Time	See Data Retention Waveform		t_{RC}	—	—	ns

Note 1: Typical values are measured at $V_{DD} = V_{DR}$(min), $T_A = 25°C$ and not 100% tested.

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



ORDERING INFORMATION (HIGH SPEED)

Industrial Range: -40°C to +85°C

Speed (ns)	Order Part No.	Package
8	IS61WV1288EEBLL-8BLI	48 mini BGA (6mm x 8mm), Lead-free
	IS61WV1288EEBLL-8TLI	TSOP (Type II), Lead-free
10	IS61WV1288EEBLL-10BLI	48 mini BGA (6mm x 8mm), Lead-free
	IS61WV1288EEBLL-10HLI	sTSOP (Type I) (8mm x 13.4mm), Lead-free
	IS61WV1288EEBLL-10TLI	TSOP (Type II), Lead-free

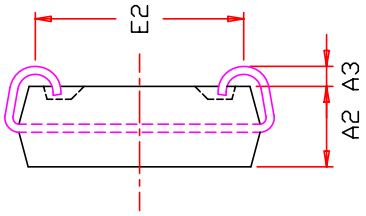
Automotive A1 Range: -40°C to +85°C

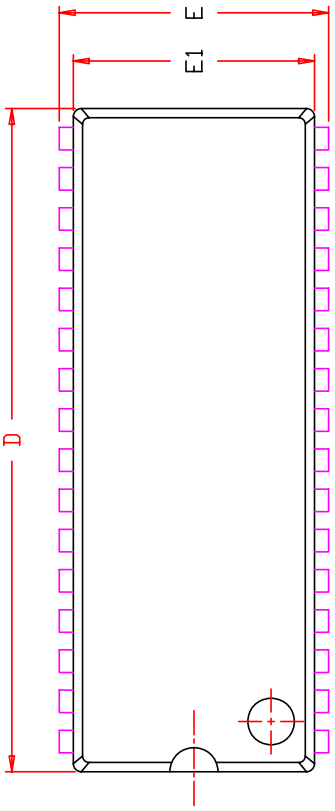
Speed (ns)	Order Part No.	Package
8	IS64WV1288EEBLL-8BLA1	48 mini BGA (6mm x 8mm), Lead-free
	IS64WV1288EEBLL-8CTLA1	TSOP (Type II), Lead-free, Copper Leadframe
10	IS64WV1288EEBLL-10BLA1	48 mini BGA (6mm x 8mm), Lead-free
	IS64WV1288EEBLL-10CTLA1	TSOP (Type II), Lead-free, Copper Leadframe

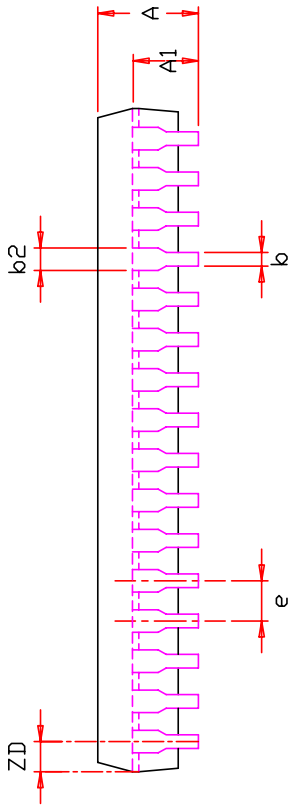
Automotive A3 Range: -40°C to +125°C

Speed (ns)	Order Part No.	Package
10	IS64WV1288EEBLL-10BLA3	48 mini BGA (6mm x 8mm), Lead-free
	IS64WV1288EEBLL-10CTLA3	TSOP (Type II), Lead-free, Copper Leadframe

SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	3.05	—	3.76	0.120	—	0.148
A1	2.08	—	2.41	0.082	—	0.095
A2	2.41	2.54	2.67	0.095	0.100	0.105
A3	0.64	—	1.09	0.025	—	0.043
b	0.41	—	0.51	0.016	—	0.020
b2	0.66	—	0.81	0.026	—	0.032
D	20.82	—	21.09	0.820	—	0.830
E	8.38	8.51	8.64	0.330	0.335	0.340
E1	7.49	7.62	7.75	0.295	0.300	0.305
E2	6.48	—	6.99	0.255	—	0.275
e	1.27 BSC.			0.050 BSC.		
ZD	0.95 REF.			0.037 REF.		





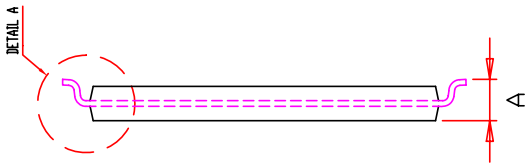


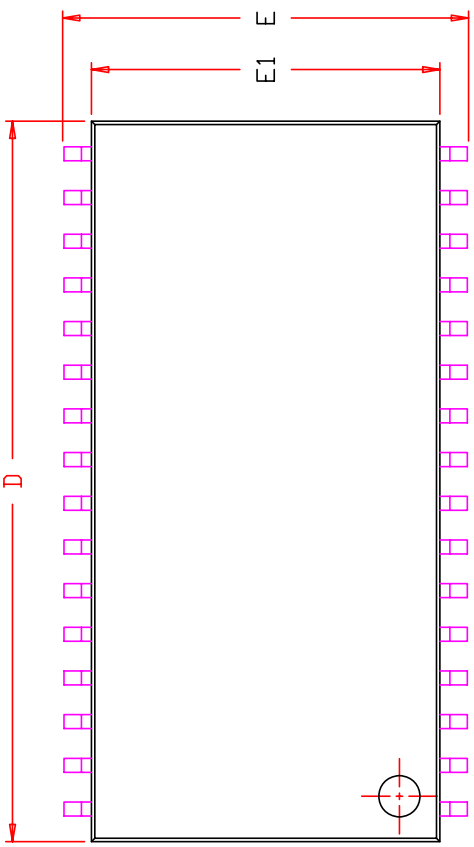
NOTE :

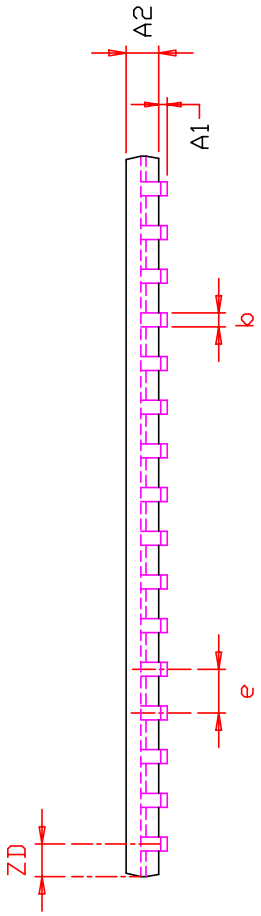
1. CONTROLLING DIMENSION : MM
2. DIMENSION D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
3. DIMENSION b2 DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION.

TITLE	32L 300mil SOJ Package Outline	REV.	C	DATE	08/14/2009

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	1.05	0.037	0.039	0.041
b	0.30	—	0.52	0.012	—	0.020
D	20.82	20.95	21.08	0.820	0.825	0.830
E	11.56	11.76	11.96	0.455	0.463	0.471
E1	10.03	10.16	10.29	0.395	0.400	0.405
e	1.27 BSC.			0.050 BSC.		
L	0.40	0.50	0.60	0.016	0.020	0.024
L1	0.25 BSC.			0.010 BSC.		
ZD	0.95 REF.			0.037 REF.		
θ	0	—	8°	0	—	8°

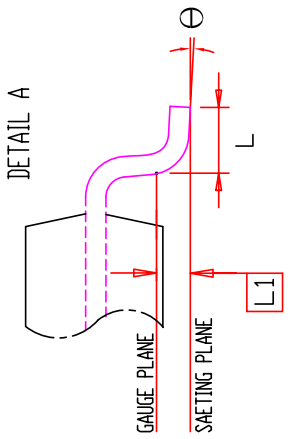






NOTE :

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

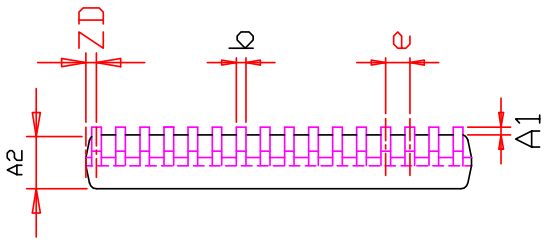


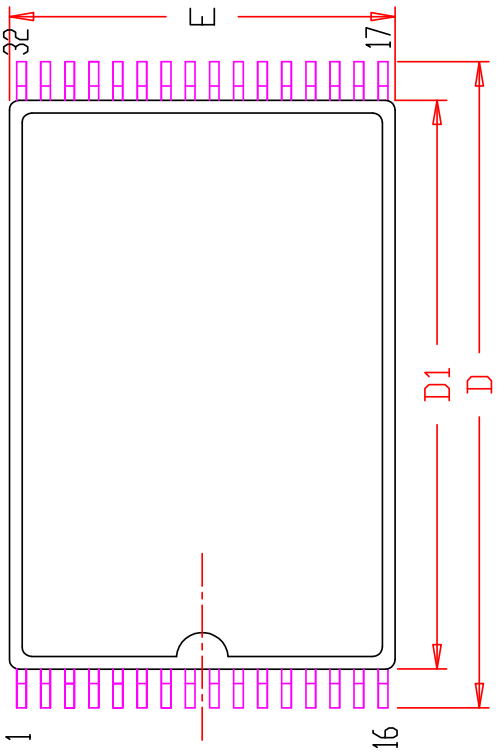
TITLE	32L 400mil TSOP-2 Package Outline	REV.	E	DATE 06/23/2009

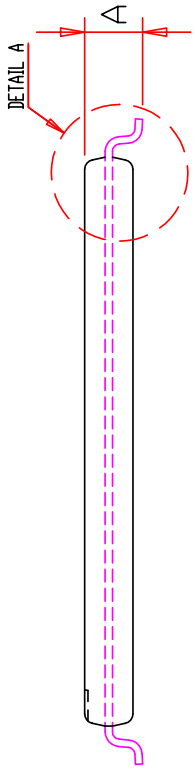
SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.95	—	1.25	0.037	—	0.049
A1	0.05	—	0.15	0.002	—	0.008
A2	0.90	—	1.05	0.035	—	0.041
b	0.16	—	0.27	0.006	—	0.011
D	13.10	13.40	13.70	0.516	0.528	0.539
D1	11.70	11.80	11.90	0.461	0.465	0.469
E	7.90	8.00	8.10	0.311	0.315	0.319
e	0.50 BSC.			0.020 BSC.		
L	0.30	0.50	0.70	0.012	0.020	0.028
L1	0.25 BSC.			0.010 BSC.		
ZD	0.25 REF,			0.010 REF,		
Θ	0	3°	5°	0	3°	5°

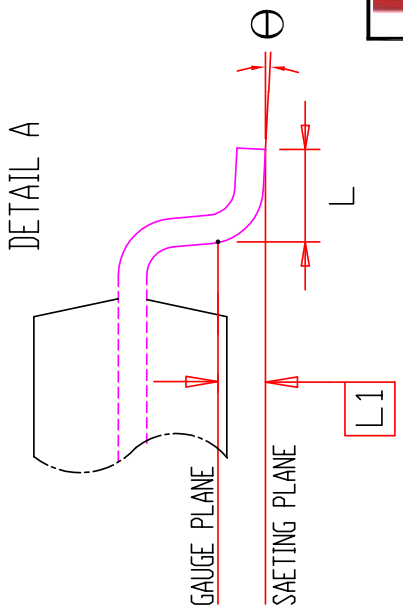
NOTE :

1. CONTROLLING DIMENSION : MM
2. DIMENSION D1 AND E DO NOT INCLUDE MOLD PROTRUSION.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION.
4. Reference Document : JEDEC MO-183







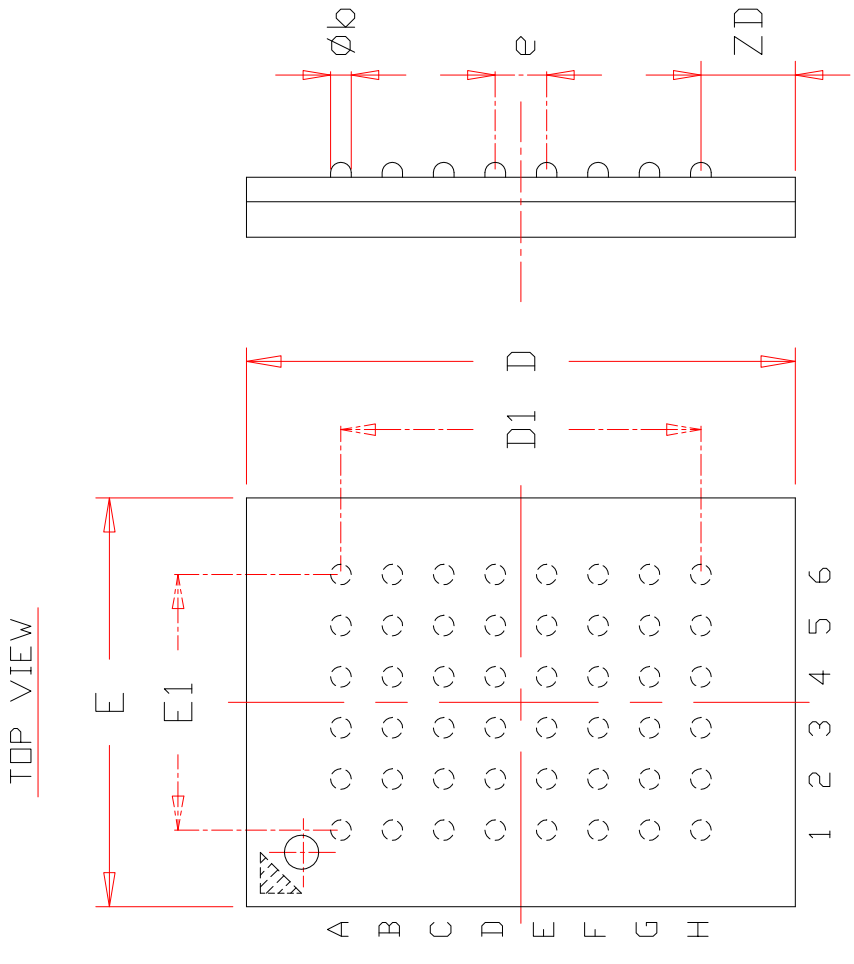


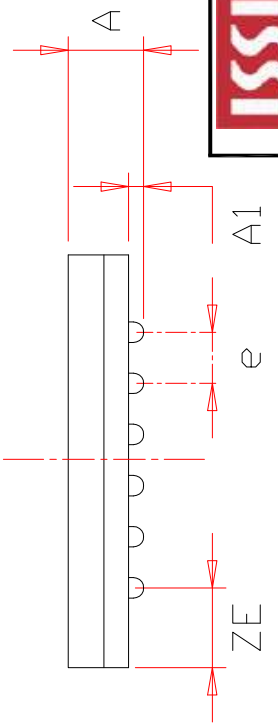
ISSI	TITLE	32L 8x13.4mm TSOP-1 Package Outline	REV.	E	DATE	04/24/2009

SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A			1.20			0.047
A1	0.20		0.30	0.008		0.012
ϕb	0.30	0.35	0.40	0.012	0.014	0.016
D	7.90	8.00	8.10	0.311	0.315	0.319
D1		5.25 BSC			0.207 BSC	
E	5.90	6.00	6.10	0.232	0.236	0.240
E1		3.75 BSC			0.148 BSC	
e		0.75 BSC.			0.030 BSC.	
ZD		1.375 REF.			0.054 REF.	
ZE		1.125 REF.			0.044 REF.	

NOTE :

1. CONTROLLING DIMENSION : MM .
2. Reference document : JEDEC MO-207





	TITLE	REV.	DATE
ISSI	48L 6x8mm TF-BGA Package Outline	C	08/12/2008