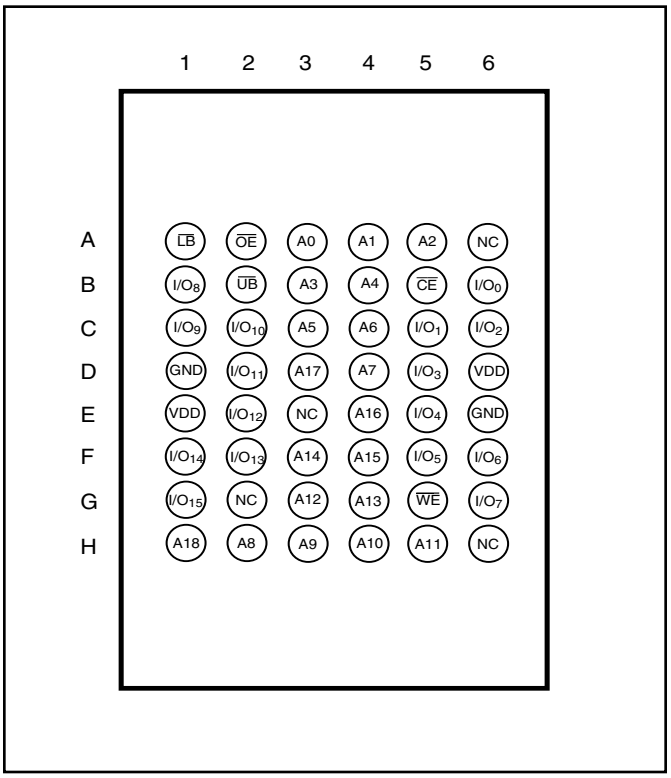
48-pin mini BGA (6mm x 8mm)

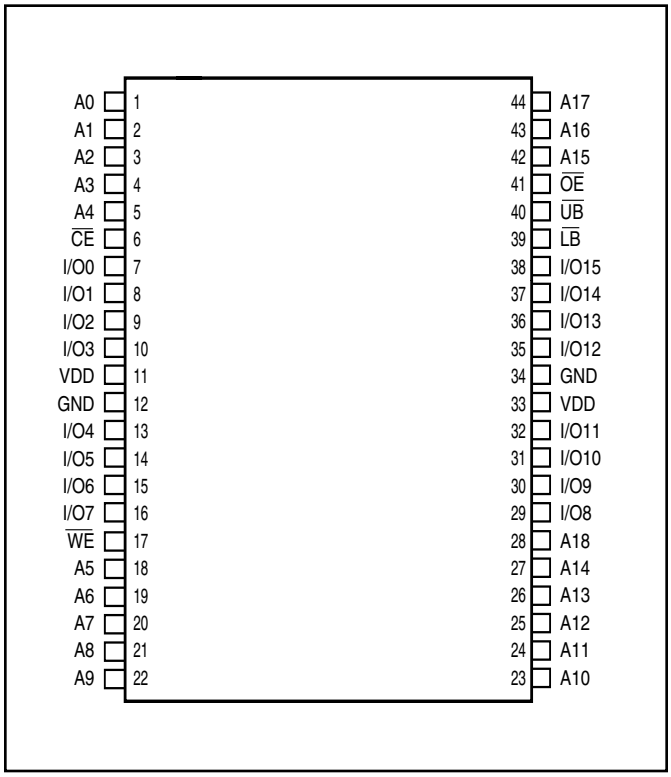


PIN DESCRIPTIONS

A0-A18	Address Inputs
I/O0-I/O15	Data Inputs/Outputs
$\overline{CE}$	Chip Enable Input
$\overline{OE}$	Output Enable Input
$\overline{WE}$	Write Enable Input
$\overline{LB}$	Lower-byte Control (I/O0-I/O7)
$\overline{UB}$	Upper-byte Control (I/O8-I/O15)
NC	No Connection
V_{DD}	Power
GND	Ground

PIN CONFIGURATIONS

44-Pin TSOP (Type II)



PIN DESCRIPTIONS

A0-A18	Address Inputs
I/O0-I/O15	Data Inputs/Outputs
$\overline{CE}$	Chip Enable Input
$\overline{OE}$	Output Enable Input
$\overline{WE}$	Write Enable Input
$\overline{LB}$	Lower-byte Control (I/O0-I/O7)
$\overline{UB}$	Upper-byte Control (I/O8-I/O15)
NC	No Connection
V_{DD}	Power
GND	Ground

TRUTH TABLE

Mode	$\overline{WE}$	$\overline{CE}$	$\overline{OE}$	$\overline{LB}$	$\overline{UB}$	I/O PIN I/O0-I/O7	I/O PIN I/O8-I/O15	V_{DD} Current
Not Selected	X	H	X	X	X	High-Z	High-Z	I_{SB1}, I_{SB2}
Output Disabled	H	L	H	X	X	High-Z	High-Z	I_{CC}
	X	L	X	H	H	High-Z	High-Z	
Read	H	L	L	L	H	D_{OUT}	High-Z	I_{CC}
	H	L	L	H	L	High-Z	D_{OUT}	
	H	L	L	L	L	D_{OUT}	D_{OUT}	
Write	L	L	X	L	H	D_{IN}	High-Z	I_{CC}
	L	L	X	H	L	High-Z	D_{IN}	
	L	L	X	L	L	D_{IN}	D_{IN}	

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.

OPERATING RANGE (V_{DD})

Range	Ambient Temperature	IS61WV51216EDALL V_{DD} (20ns)	IS61WV51216EDBLL V_{DD} (8, 10ns)	IS64WV51216EDBLL V_{DD} (10ns)
Industrial	–40°C to +85°C	1.65V-2.2V	2.4V-3.6V	—
Automotive (A1)	–40°C to +85°C	—	—	2.4V-3.6V
Automotive (A3)	–40°C to +125°C	—	—	2.4V-3.6V

ERROR DETECTION AND ERROR CORRECTION

- Independent ECC 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)

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.

DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

V_{DD} = 1.65V-2.2V

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	I_{OH} = -0.1 mA	1.4	—	V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA	—	0.2	V
V_{IH}	Input HIGH Voltage		1.4	V_{DD} + 0.2	V
V_{IL}	Input LOW Voltage		–0.2	0.4	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

Notes:
1. V_{IL} (min.) = –0.3V DC; V_{IL} (min.) = –1.0V AC (pulse width < 2 ns). Not 100% tested.
   V_{IH} (max.) = V_{DD} + 0.3V DC; V_{IH} (max.) = V_{DD} + 1.0V AC (pulse width < 2 ns). Not 100% tested.

AC TEST CONDITIONS

Parameter	Unit (2.4V-3.6V)	Unit (3.3V ± 5%)	Unit (1.65V-2.2V)
Input Pulse Level	0.4V to V_{DD} - 0.3V	0.4V to V_{DD} - 0.3V	0.4V to V_{DD} - 0.3V
Input Rise and Fall Times	1V/ ns	1V/ ns	1V/ ns
Input and Output Timing and Reference Level (V_{Ref})	VDD /2	$\frac{VDD}{2}$ + 0.05	0.9V
Output Load	See Figures 1 and 2	See Figures 1 and 2	See Figures 1 and 2
R1 (Ω)	1909	317	13500
R2 (Ω)	1105	351	10800
V_{TM} (V)	3.0V	3.3V	1.8V

AC TEST LOADS

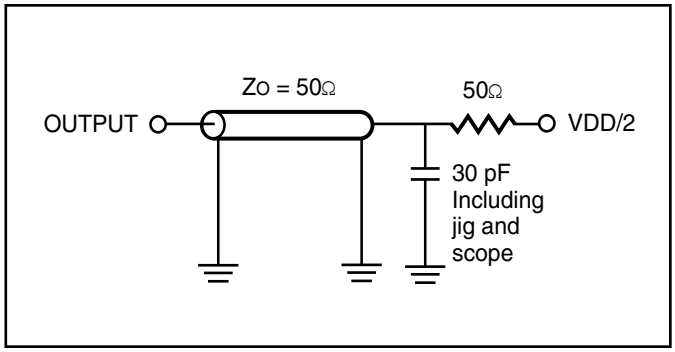


Figure 1.

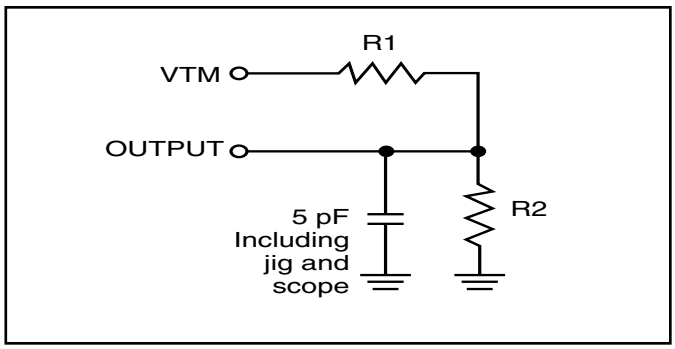


Figure 2.

POWER SUPPLY CHARACTERISTICS[1] (Over Operating Range)

Symbol	Parameter	Test Conditions		-8 Min.	-8 Max.	-10 Min.	-10 Max.	-20 Min.	-20 Max.	Unit
I_{CC}	V_{DD} Dynamic Operating Supply Current	V_{DD} = Max., I_{OUT} = 0 mA, f = f_{MAX}	Com.	—	50	—	45	—	35	mA
			Ind.	—	60	—	55	—	45	
			Auto.	—	—	—	65	—	60	
			typ.[2]			15				
I_{CC1}	Operating Supply Current	V_{DD} = Max., I_{OUT} = 0 mA, f = 0	Com.	—	20	—	20	—	20	mA
			Ind.	—	25	—	25	—	25	
			Auto.	—	—	—	50	—	50	
I_{SB1}	TTL Standby Current (TTL Inputs)	V_{DD} = Max., V_{IN} = V_{IH} or V_{IL} $\overline{CE} \geq V_{IH}$, f = 0	Com.	—	20	—	20	—	20	mA
			Ind.	—	25	—	25	—	25	
			Auto.	—	—	—	45	—	45	
I_{SB2}	CMOS Standby Current (CMOS Inputs)	V_{DD} = Max., $\overline{CE} \geq V_{DD}$ – 0.2V, $V_{IN} \geq V_{DD}$ – 0.2V, or $V_{IN} \leq$ 0.2V, f = 0	Com.	—	10	—	10	—	10	mA
			Ind.	—	15	—	15	—	15	
			Auto.	—	—	—	35	—	35	
			typ.[2]			2				

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.

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

Symbol	Parameter	-8 Min.	-8 Max.	-10 Min.	-10 Max.	Unit
t_{RC}	Read Cycle Time	8	—	10	—	ns
t_{AA}	Address Access Time	—	8	—	10	ns
t_{OHA}	Output Hold Time	2.5	—	2.5	—	ns
t_{ACE}	$\overline{CE}$ Access Time	—	8	—	10	ns
t_{DOE}	$\overline{OE}$ Access Time	—	5.5	—	6.5	ns
t_{HZOE}[2]	$\overline{OE}$ to High-Z Output	—	3	—	4	ns
t_{LZOE}[2]	$\overline{OE}$ to Low-Z Output	0	—	0	—	ns
t_{HZCE}[2	$\overline{CE}$ to High-Z Output	0	3	0	4	ns
t_{LZCE}[2]	$\overline{CE}$ to Low-Z Output	3	—	3	—	ns
t_{BA}	$\overline{LB}$, $\overline{UB}$ Access Time	—	5.5	—	6.5	ns
t_{HZB}[2]	$\overline{LB}$, $\overline{UB}$ to High-Z Output	0	3	0	3	ns
t_{LZB}[2]	$\overline{LB}$, $\overline{UB}$ to Low-Z Output	0	—	0	—	ns
t_{PU}	Power Up Time	0	—	0	—	ns
t_{PD}	Power Down Time	—	8	—	10	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.

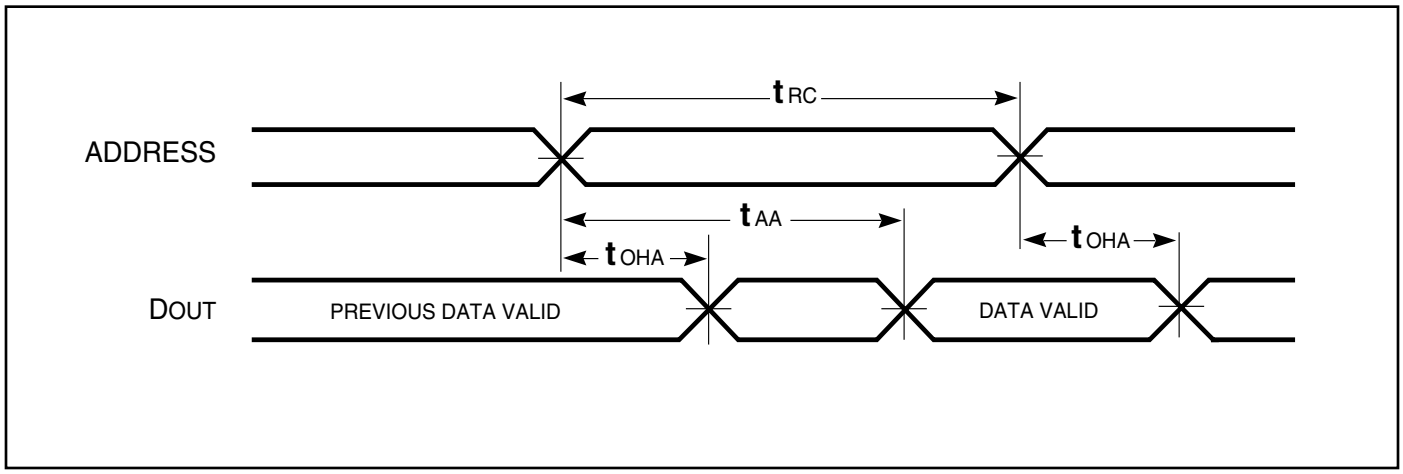
READ CYCLE SWITCHING CHARACTERISTICS[1] (Over Operating Range)

Symbol	Parameter	-20 ns Min.	-20 ns Max.	Unit
t_{RC}	Read Cycle Time	20	—	ns
t_{AA}	Address Access Time	—	20	ns
t_{OHA}	Output Hold Time	2.5	—	ns
t_{ACE}	$\overline{CE}$ Access Time	—	20	ns
t_{DOE}	$\overline{OE}$ Access Time	—	8	ns
t_{HZOE}[2]	$\overline{OE}$ to High-Z Output	0	8	ns
t_{LZOE}[2]	$\overline{OE}$ to Low-Z Output	0	—	ns
t_{HZCE}[2	$\overline{CE}$ to High-Z Output	0	8	ns
t_{LZCE}[2]	$\overline{CE}$ to Low-Z Output	3	—	ns
t_{BA}	$\overline{LB}$, $\overline{UB}$ Access Time	—	8	ns
t_{HZB}	$\overline{LB}$, $\overline{UB}$ to High-Z Output	0	8	ns
t_{LZB}	$\overline{LB}$, $\overline{UB}$ to Low-Z Output	0	—	ns

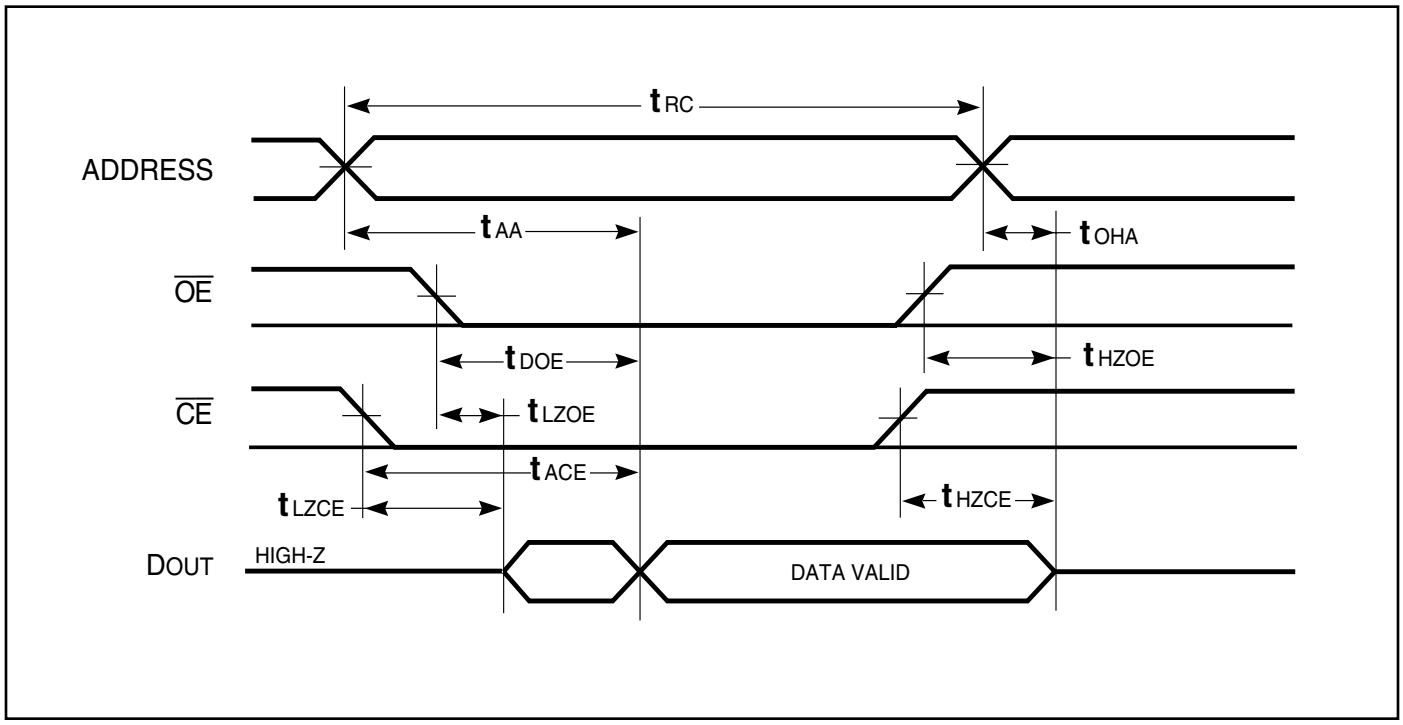
Notes:
1. Test conditions and output loading conditions are specified in the AC Test Conditions and AC Test Loads (Figure 1).
2. Tested with the load in Figure 1b. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.
3. Not 100% tested.

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.	Unit
t_{WC}	Write Cycle Time	8	—	10	—	ns
t_{SCE}	$\overline{CE}$ to Write End	6.5	—	8	—	ns
t_{AW}	Address Setup Time to Write End	6.5	—	8	—	ns
t_{HA}	Address Hold from Write End	0	—	0	—	ns
t_{SA}	Address Setup Time	0	—	0	—	ns
t_{PWB}	$\overline{LB}$, $\overline{UB}$ Valid to End of Write	6.5	—	8	—	ns
t_{PWE1}	$\overline{WE}$ Pulse Width	6.5	—	8	—	ns
t_{PWE2}	$\overline{WE}$ Pulse Width ($\overline{OE}$ = LOW)	8.0	—	10	—	ns
t_{SD}	Data Setup to Write End	5	—	6	—	ns
t_{HD}	Data Hold from Write End	0	—	0	—	ns
t_{HZWE}[2]	$\overline{WE}$ LOW to High-Z Output	—	3.5	—	5	ns
t_{LZWE}[2]	$\overline{WE}$ HIGH to Low-Z Output	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 $\overline{UB}$ or $\overline{LB}$, 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

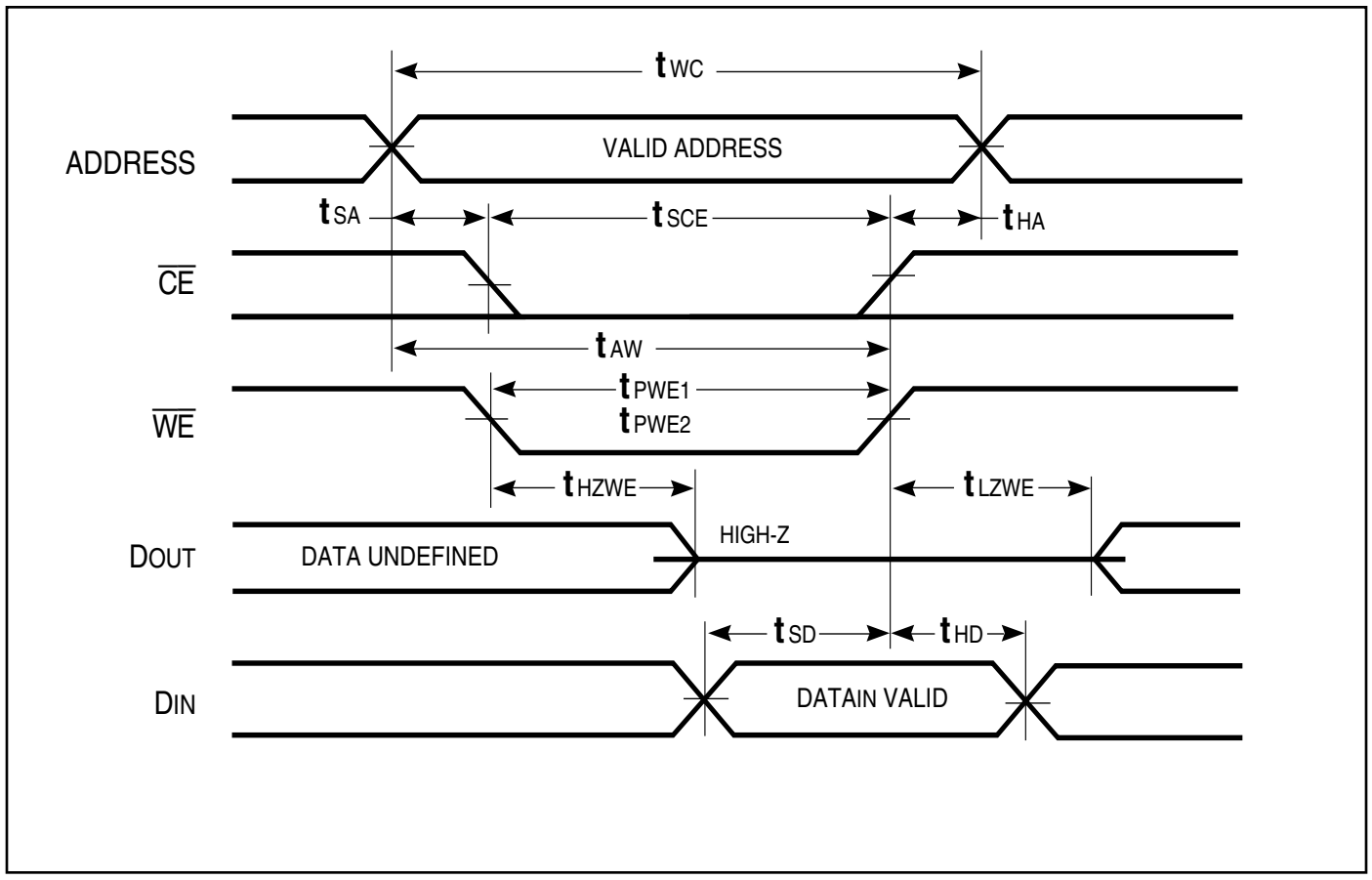
WRITE CYCLE SWITCHING CHARACTERISTICS[1,2] (Over Operating Range)

Symbol	Parameter	-20 ns Min.	-20 ns Max.	Unit
t_{WC}	Write Cycle Time	20	—	ns
t_{SCE}	$\overline{CE}$ to Write End	12	—	ns
t_{AW}	Address Setup Time to Write End	12	—	ns
t_{HA}	Address Hold from Write End	0	—	ns
t_{SA}	Address Setup Time	0	—	ns
t_{PWB}	$\overline{LB}$, $\overline{UB}$ Valid to End of Write	12	—	ns
t_{PWE1}	$\overline{WE}$ Pulse Width ($\overline{OE}$ = HIGH)	12	—	ns
t_{PWE2}	$\overline{WE}$ Pulse Width ($\overline{OE}$ = LOW)	17	—	ns
t_{SD}	Data Setup to Write End	9	—	ns
t_{HD}	Data Hold from Write End	0	—	ns
t_{HZWE}[2]	$\overline{WE}$ LOW to High-Z Output	—	9	ns
t_{LZWE}[2]	$\overline{WE}$ HIGH to Low-Z Output	3	—	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 1b. 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 $\overline{UB}$ or $\overline{LB}$, 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.

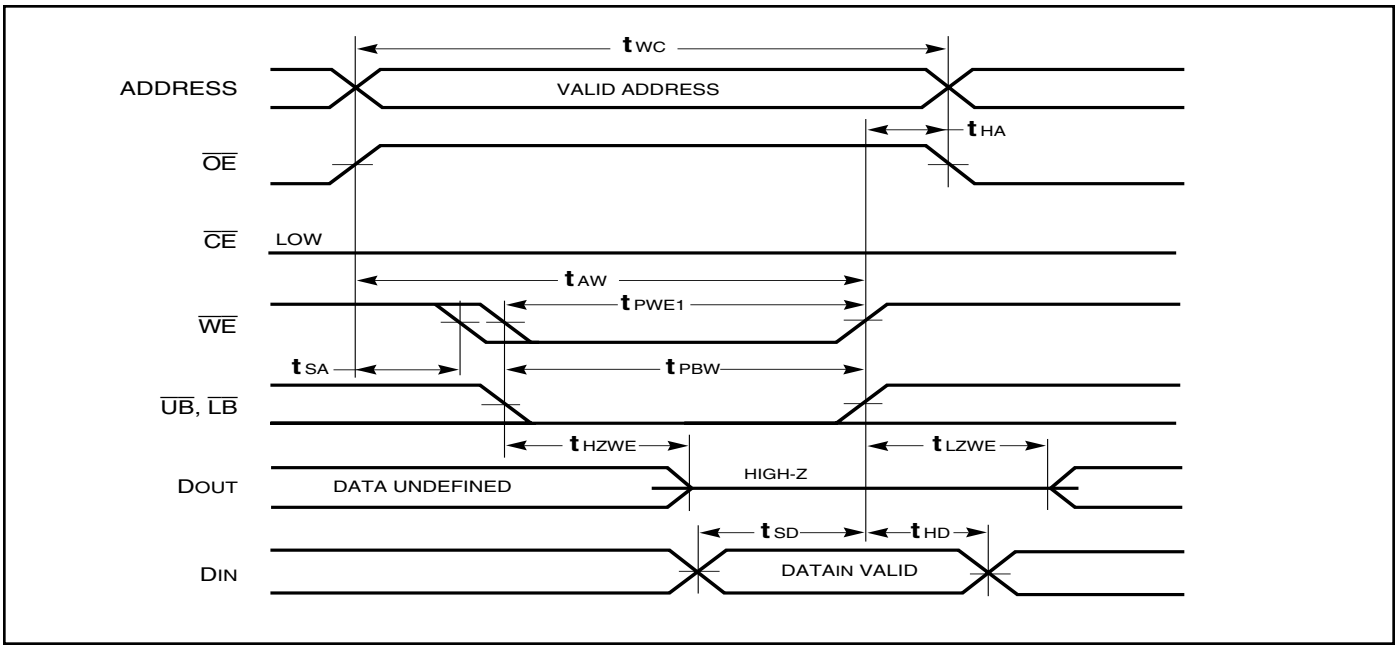
AC WAVEFORMS

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

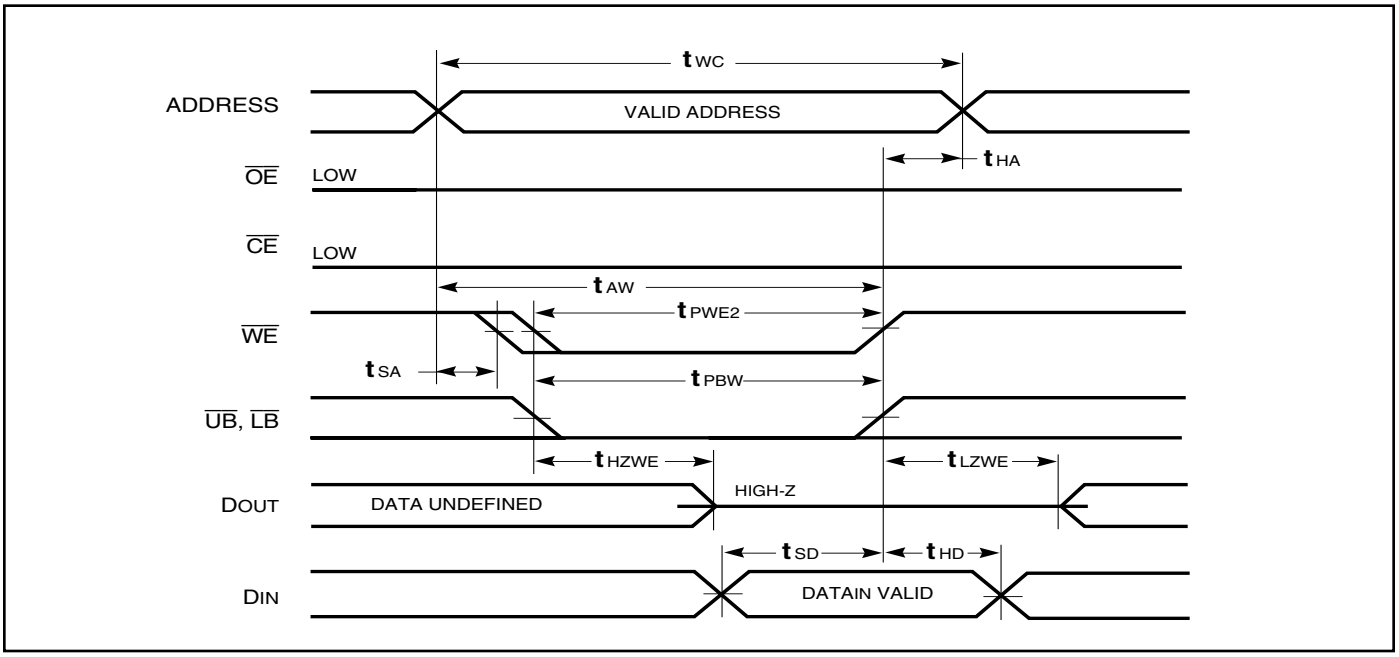


AC WAVEFORMS

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

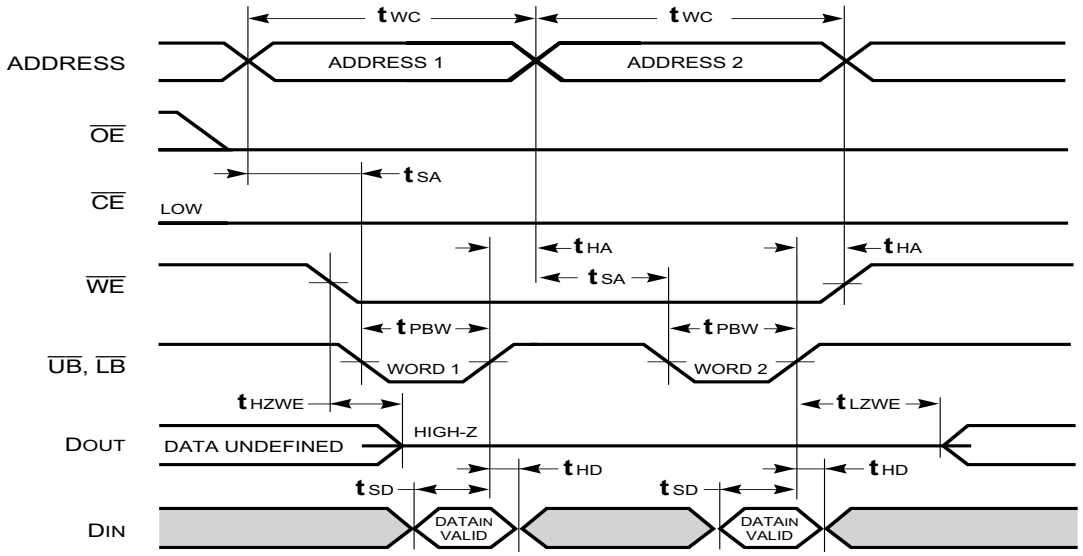


WRITE CYCLE NO. 3 ($\overline{WE}$ Controlled. $\overline{OE}$ is LOW During Write Cycle) [1]



AC WAVEFORMS

WRITE CYCLE NO. 4 ($\overline{LB}$, $\overline{UB}$ Controlled, Back-to-Back Write) [1,3]



Notes:

1. The internal Write time is defined by the overlap of $\overline{CE}$ = LOW, $\overline{UB}$ and/or $\overline{LB}$ = LOW, and $\overline{WE}$ = LOW. All signals must be in valid states to initiate a Write, but any can be deasserted to terminate the Write. The t_{SA}, t_{HA}, t_{SD}, and t_{HD} timing is referenced to the rising or falling edge of the signal that terminates the Write.
2. Tested with $\overline{OE}$ HIGH for a minimum of 4 ns before $\overline{WE}$ = LOW to place the I/O in a HIGH-Z state.
3. $\overline{WE}$ may be held LOW across many address cycles and the $\overline{LB}$, $\overline{UB}$ pins can be used to control the Write function.

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.	—	2	10	mA
			Ind.	—	—	15	
			Auto.			35	
t_{SDR}	Data Retention Setup Time	See Data Retention Waveform		0	—	—	ns
t_{RDR}	Recovery Time	See Data Retention Waveform		t_{RC}	—	—	ns

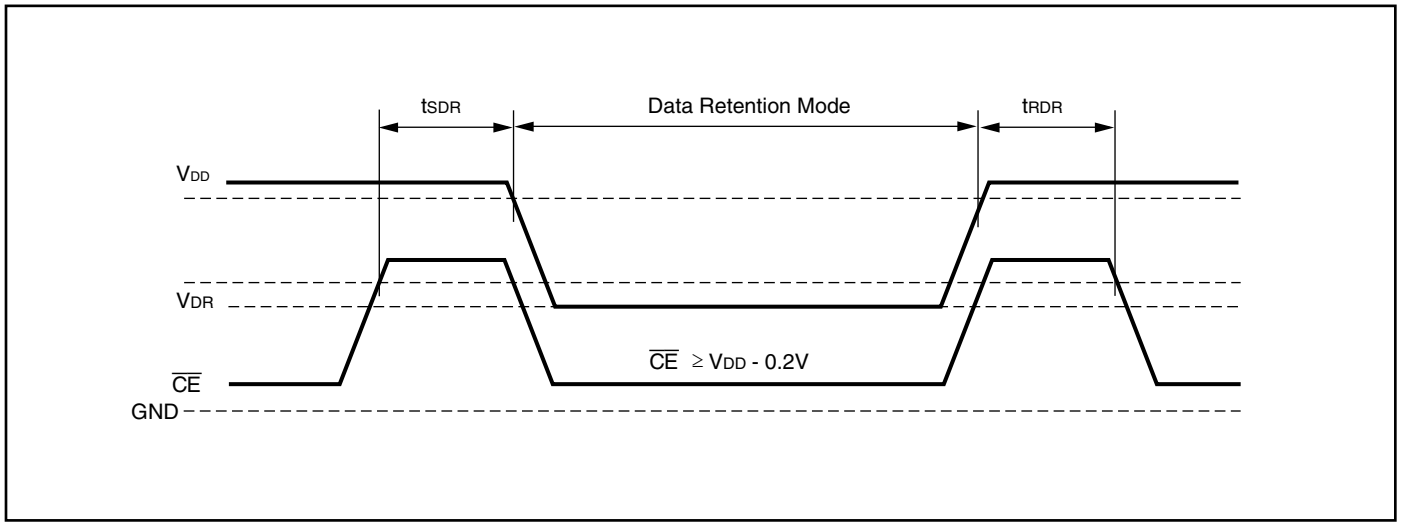
Note 1: Typical values are measured at $V_{DD} = V_{DR(MIN)}$ $T_A = 25°C$ and not 100% tested.

DATA RETENTION SWITCHING CHARACTERISTICS (1.65V-2.2V)

Symbol	Parameter	Test Condition	Options	Min.	Typ.(1)	Max.	Unit
V_{DR}	V_{DD} for Data Retention	See Data Retention Waveform		1.2	—	3.6	V
I_{DR}	Data Retention Current	$V_{DD} = V_{DR(MIN)}$, $\overline{CE} \geq V_{DD} - 0.2V$	Com.	—	2	10	mA
			Ind.	—	—	15	
			Auto.	—	—	35	
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

Industrial Range: -40°C to +85°C
Voltage Range: 2.4V to 3.6V

Speed (ns)	Order Part No.	Package
8	IS61WV51216EDBLL-8BLI	48 mini BGA (6mm x 8mm), Lead-free
	IS61WV51216EDBLL-8TLI	TSOP (Type II), Lead-free
10	IS61WV51216EDBLL-10BLI	48 mini BGA (6mm x 8mm), Lead-free
	IS61WV51216EDBLL-10TLI	TSOP (Type II), Lead-free

Industrial Range: -40°C to +85°C
Voltage Range: 1.65V to 2.2V

Speed (ns)	Order Part No.	Package
20	IS61WV51216EDALL-20BLI	48 mini BGA (6mm x 8mm), Lead-free
	IS61WV51216EDALL-20TLI	TSOP (Type II), Lead-free

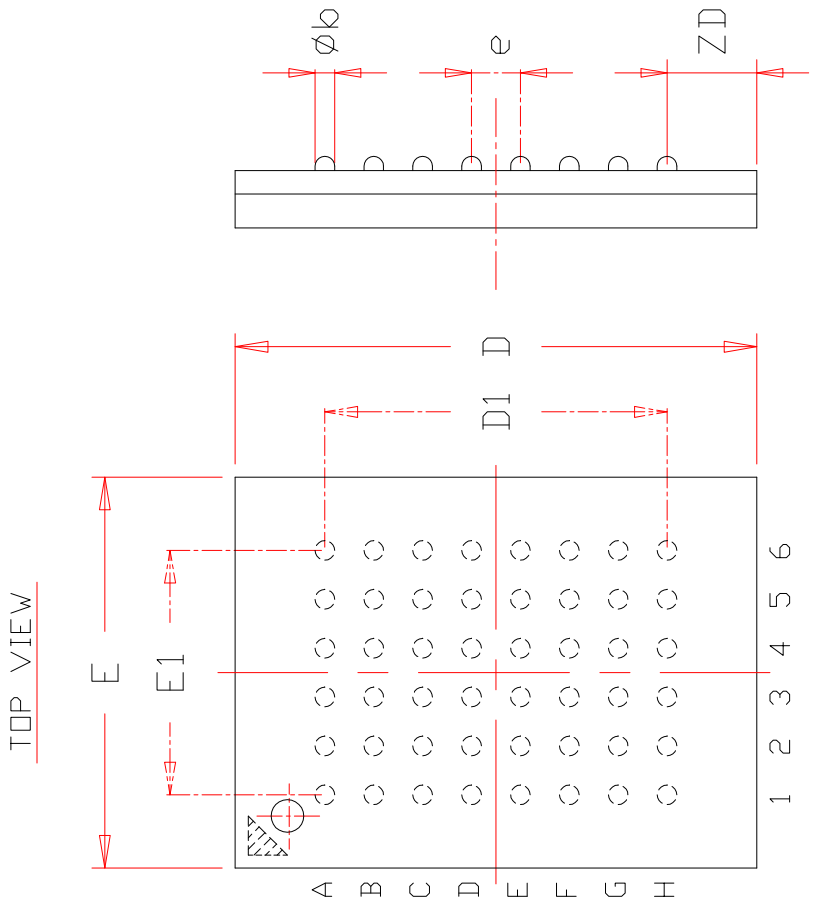
Automotive Range: -40°C to +125°C
Voltage Range: 2.4V to 3.6V

Speed (ns)	Order Part No.	Package
10	IS64WV51216EDBLL-10BLA3	48 mini BGA (6mm x 8mm), Lead-free
	IS64WV51216EDBLL-10CTLA3	TSOP (Type II), Lead-free, Copper Leadframe

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
øb	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.		

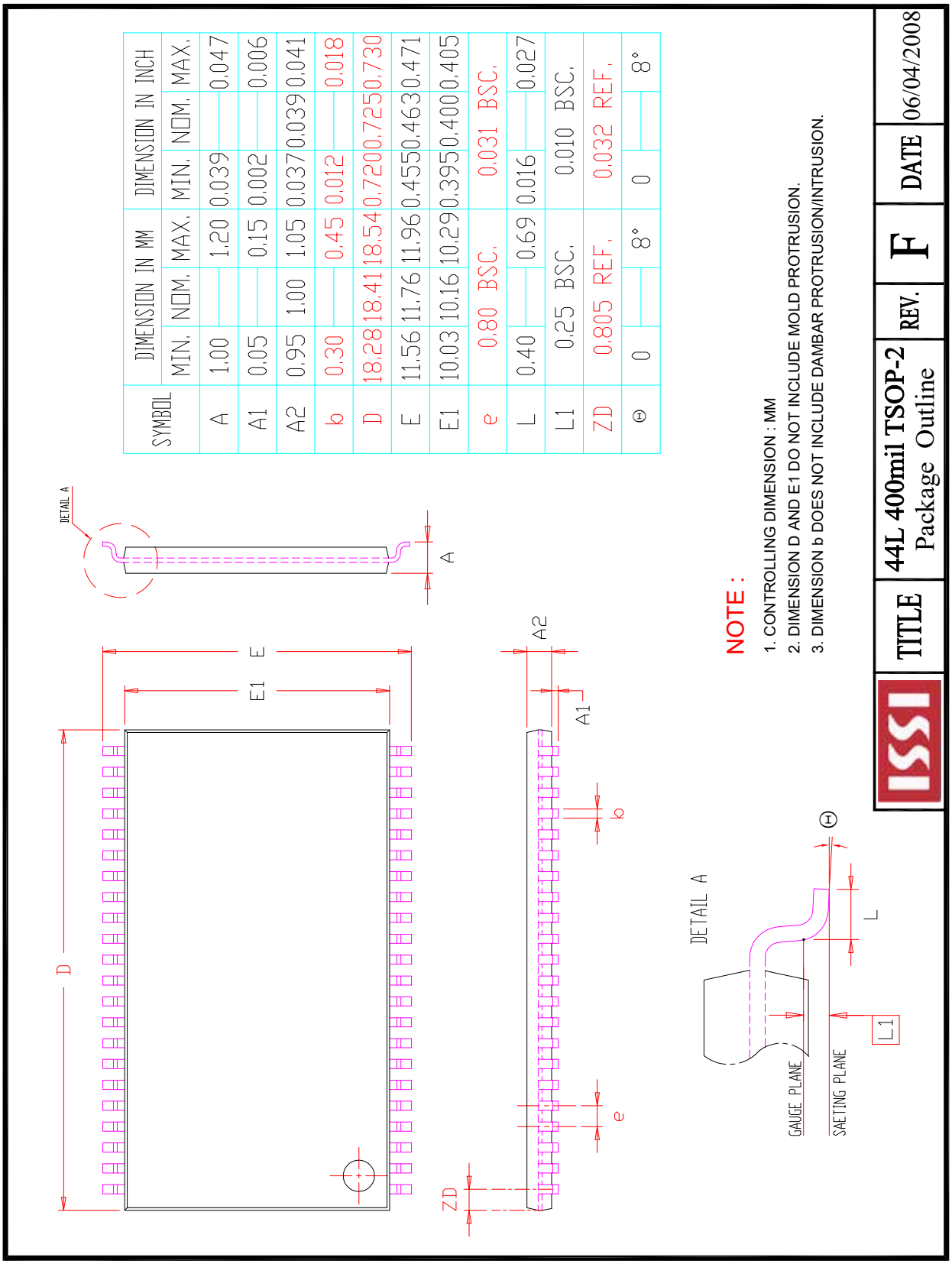
NOTE :

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



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

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	—	0.45	0.012	—	0.018
D	18.28	18.41	18.54	0.720	0.725	0.730
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	0.80 BSC.			0.031 BSC.		
L	0.40	—	0.69	0.016	—	0.027
L1	0.25 BSC.			0.010 BSC.		
ZD	0.805 REF.			0.032 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	44L 400mil TSOP-2 Package Outline	REV.	F	DATE	06/04/2008