IS62WV102416ALL
IS62WV102416BLL
IS65WV102416BLL

1M x 16 HIGH-SPEED LOW POWER ASYNCHRONOUS CMOS STATIC RAM

APRIL 2015

FEATURES

- High-speed access times:
  25, 35 ns
- High-performance, low-power CMOS process
- Multiple center power and ground pins for greater noise immunity
- Easy memory expansion with $\overline{CS1}$ and $\overline{OE}$ options
- $\overline{CS1}$ power-down
- Fully static operation: no clock or refresh required
- TTL compatible inputs and outputs
- Single power supply
  V_{DD} 1.65V to 2.2V (IS62WV102416ALL)
  speed = 35ns for V_{DD} 1.65V to 2.2V
  V_{DD} 2.4V to 3.6V (IS62/65WV102416BLL)
  speed = 25ns for V_{DD} 2.4V to 3.6V
- Packages available:
  – 48-ball miniBGA (9mm x 11mm)
  – 48-pin TSOP (Type I)
- Industrial and Automotive Temperature Support
- Lead-free available
- Data control for upper and lower bytes

DESCRIPTION

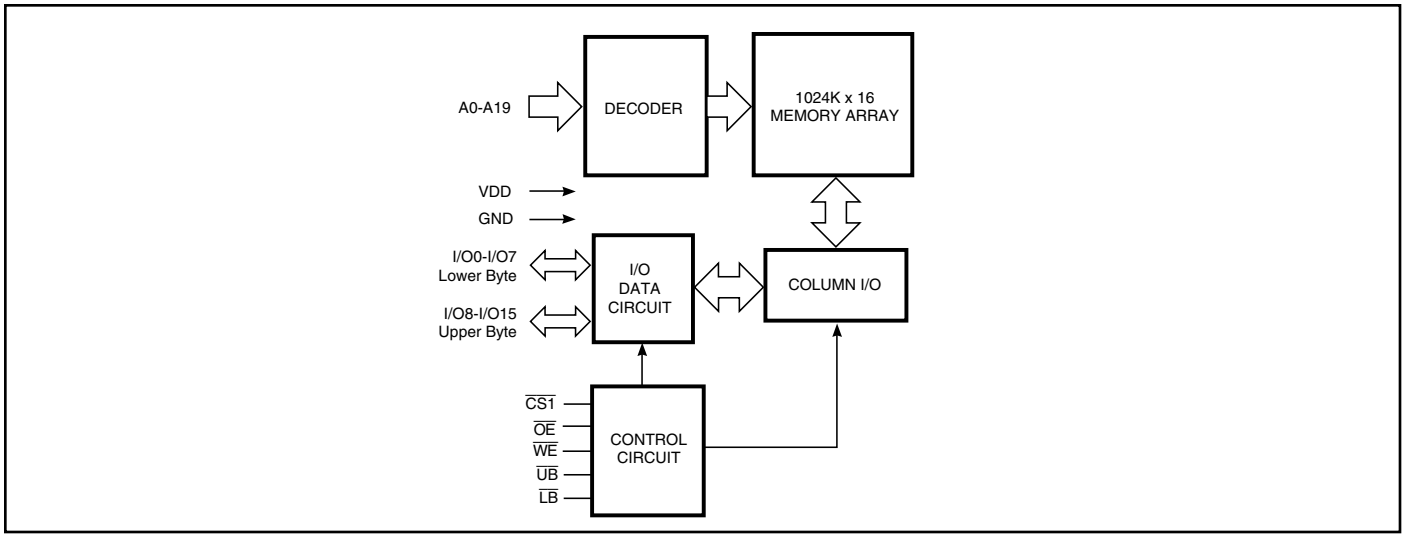
The *ISSI* IS62WV102416ALL/BLL and IS65WV102416BLL are high-speed, 16M-bit static RAMs organized as 1024K words by 16 bits. It is fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields high-performance and low power consumption devices.

When $\overline{CS1}$ is HIGH (deselected) or when CS2 is LOW (deselected) or when $\overline{CS1}$ is LOW, CS2 is HIGH and both $\overline{LB}$ and $\overline{UB}$ are HIGH, 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. The active LOW Write Enable ($\overline{WE}$) controls both writing and reading of the memory. A data byte allows Upper Byte ($\overline{UB}$) and Lower Byte ($\overline{LB}$) access.

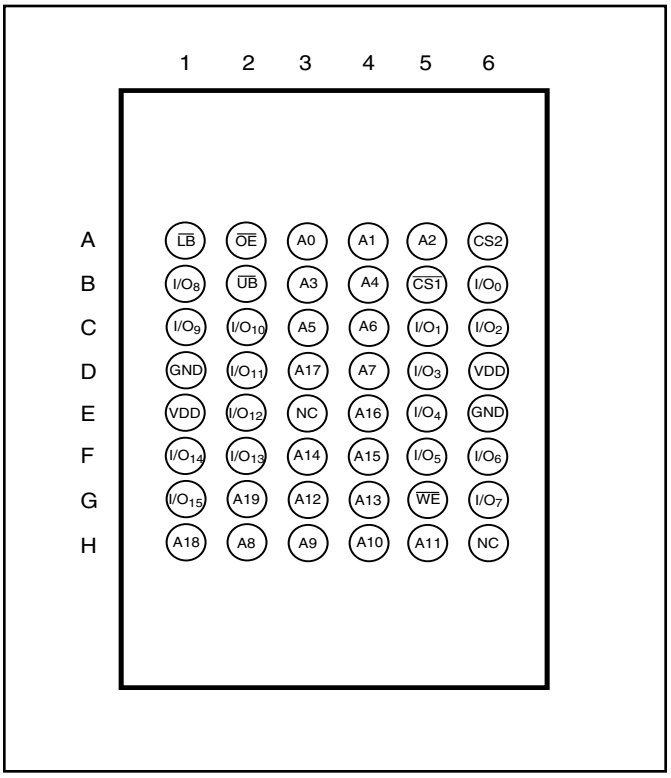
The device is packaged in the JEDEC standard 48-pin TSOP Type I and 48-pin Mini BGA (9mm x 11mm).

FUNCTIONAL BLOCK DIAGRAM



1Mx16 LOW POWER PIN CONFIGURATIONS

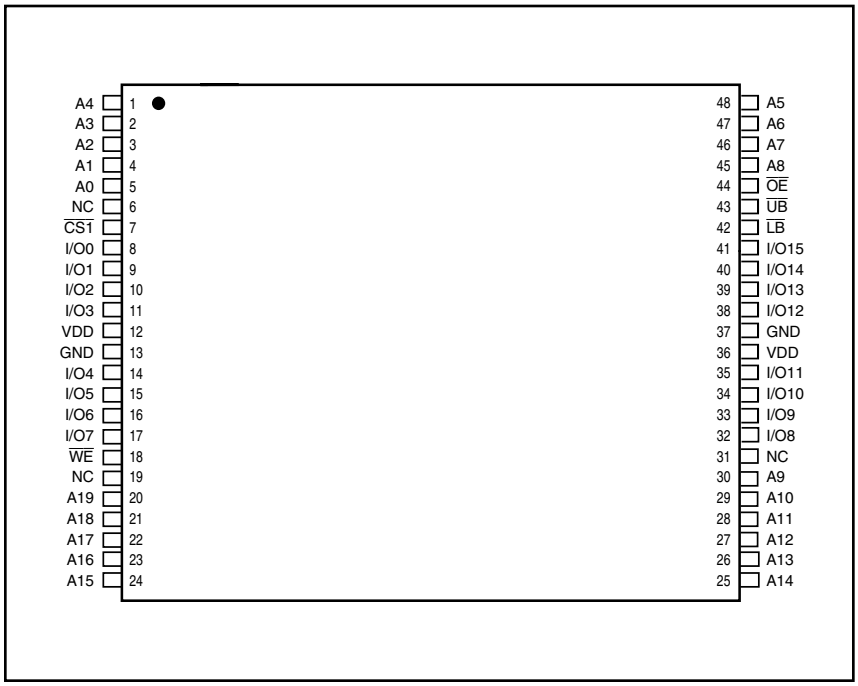
48-Pin mini BGA (9mmx11mm)



PIN DESCRIPTIONS

A0-A19	Address Inputs
I/O0-I/O15	Data Inputs/Outputs
$\overline{CS1}$, CS2	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

48-pin TSOP-I (12mm x 20mm)



PIN DESCRIPTIONS

A0-A19	Address Inputs
I/O0-I/O15	Data Inputs/Outputs
$\overline{CS1}$	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	$\overline{WE}$	$\overline{CS1}$	CS2	$\overline{OE}$	$\overline{LB}$	$\overline{UB}$	I/O PIN I/O0-I/O7	I/O PIN I/O8-I/O15	V_{DD} Current
Not Selected	X	H	X	X	X	X	High-Z	High-Z	I_{SB1}, I_{SB2}
	X	X	L	X	X	X	High-Z	High-Z	I_{SB1}, I_{SB2}
	X	X	X	X	H	H	High-Z	High-Z	I_{SB1}, I_{SB2}
Output Disabled	H	L	H	H	L	X	High-Z	High-Z	I_{CC}
	H	L	H	H	X	L	High-Z	High-Z	I_{CC}
Read	H	L	H	L	L	H	D_{OUT}	High-Z	I_{CC}
	H	L	H	L	H	L	High-Z	D_{OUT}	
	H	L	H	L	L	L	D_{OUT}	D_{OUT}	
Write	L	L	H	X	L	H	D_{IN}	High-Z	I_{CC}
	L	L	H	X	H	L	High-Z	D_{IN}	
	L	L	H	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}) (IS62WV102416ALL)

Range	Ambient Temperature	V_{DD} (35 ns)
Commercial	0°C to +70°C	1.65V-2.2V
Industrial	–40°C to +85°C	1.65V-2.2V
Automotive	–40°C to +125°C	1.65V-2.2V

OPERATING RANGE (V_{DD}) (IS62WV102416BLL)[1]

Range	Ambient Temperature	V_{DD} (25 ns)
Commercial	0°C to +70°C	2.4V-3.6V
Industrial	–40°C to +85°C	2.4V-3.6V

Note:
1. When operated in the range of 2.4V-3.6V, the device meets 10ns.

OPERATING RANGE (V_{DD}) (IS65WV102416BLL)

Range	Ambient Temperature	V_{DD} (25 ns)
Automotive	–40°C to +125°C	2.4V-3.6V

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 < 10 ns). Not 100% tested.
   V_{IH} (max.) = V_{DD} + 0.3V DC; V_{IH} (max.) = V_{DD} + 2.0V AC (pulse width < 10 ns). Not 100% tested.

DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

V_{DD} = 1.65V-2.2V

Symbol	Parameter	Test Conditions	V_{DD}	Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	I_{OH} = -0.1 mA	1.65-2.2V	Vcc – 0.4V	—	V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA	1.65-2.2V	—	0.2	V
V_{IH}	Input HIGH Voltage		1.65-2.2V	1.4	V_{DD} + 0.2	V
V_{IL}[1]	Input LOW Voltage		1.65-2.2V	–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.) = –2.0V AC (pulse width < 10ns). Not 100% tested.
   V_{IH} (max.) = V_{DD} + 0.3V DC; V_{IH} (max.) = V_{DD} + 2.0V AC (pulse width < 10ns). Not 100% tested.

AC TEST CONDITIONS (HIGH SPEED)

Parameter	Unit (2.4V-3.6V)	Unit (1.65V-2.2V)
Input Pulse Level	0.4V to V_{DD}-0.3V	0.4V to V_{DD}-0.2V
Input Rise and Fall Times	1.5ns	1.5ns
Input and Output Timing and Reference Level (V_{Ref})	$V_{DD}/2$	$V_{DD}/2$
Output Load	See Figures 1 and 2	See Figures 1 and 2

AC TEST LOADS

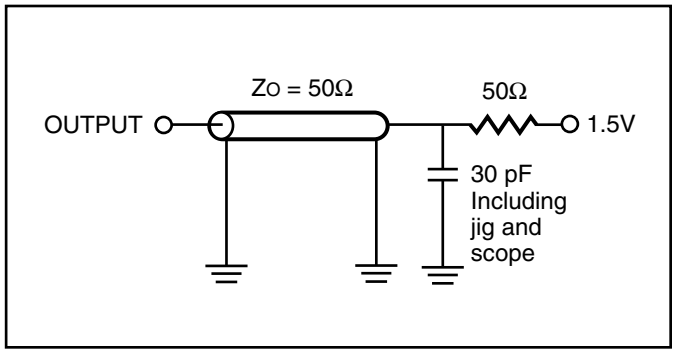


Figure 1.

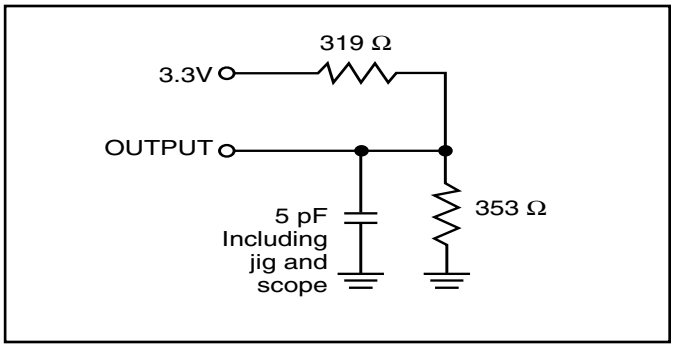


Figure 2.

POWER SUPPLY CHARACTERISTICS[1] (Over Operating Range)

Symbol	Parameter	Test Conditions		-25 Min.	-25 Max.	-35 Min.	-35 Max.	Unit
I_{CC}	V_{DD} Dynamic Operating Supply Current	V_{DD} = Max., I_{OUT} = 0 mA, f = f_{MAX} V_{IN} = 0.4V or V_{DD} –0.3V	Com.	—	30	—	25	mA
			Ind.	—	35	—	30	
			Auto.	—	60	—	60	
			typ.[2]	25				
I_{CC1}	Operating Supply Current	V_{DD} = Max., I_{OUT} = 0 mA, f = 0 V_{IN} = 0.4V or V_{DD} –0.3V	Com.	—	20	—	20	mA
			Ind.	—	30	—	30	
			Auto.	—	50	—	50	
I_{SB1}	TTL Standby Current (TTL Inputs)	V_{DD} = Max., V_{IN} = V_{IH} or V_{IL} $\overline{CS1} \geq V_{IH}$, f = 0	Com.	—	15	—	15	mA
			Ind.	—	20	—	20	
			Auto.	—	40	—	40	
I_{SB2}	CMOS Standby Current (CMOS Inputs)	V_{DD} = Max., $\overline{CS1} \geq V_{DD}$ – 0.2V, $V_{IN} \geq V_{DD}$ – 0.2V, or $V_{IN} \leq$ 0.2V, f = 0	Com.	—	0.8	—	0.8	mA
			Ind.	—	1.2	—	1.2	
			Auto.	—	2	—	2	
			typ.[2]	0.1				

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.

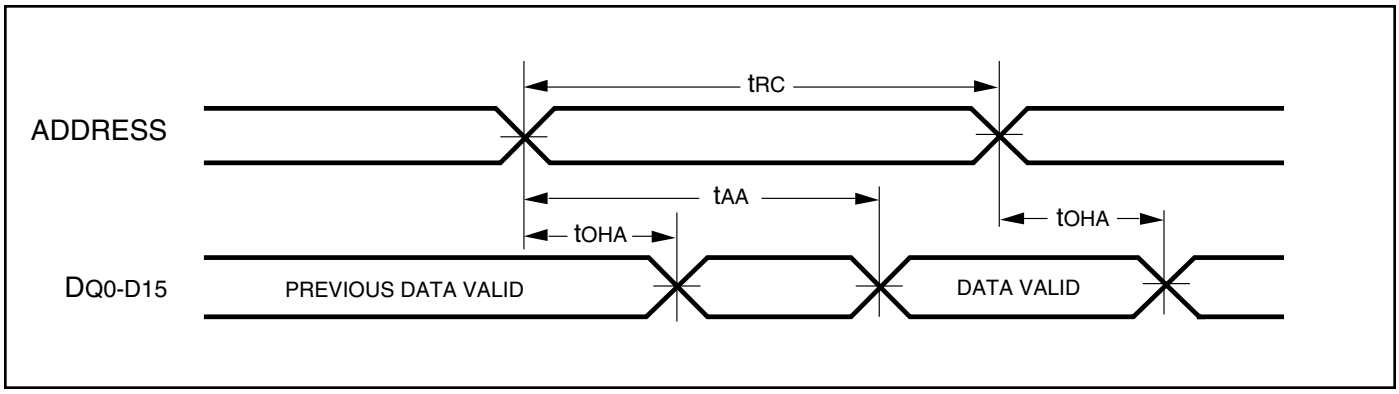
READ CYCLE SWITCHING CHARACTERISTICS[1] (Over Operating Range)

Symbol	Parameter	25 ns Min.	25 ns Max.	35 ns Min.	35 ns Max.	Unit
t_{RC}	Read Cycle Time	25	—	35	—	ns
t_{AA}	Address Access Time	—	25	—	35	ns
t_{OHA}	Output Hold Time	3	—	3	—	ns
t_{ACS1}/t_{ACS2}	$\overline{CS1}$/CS2 Access Time	—	25	—	35	ns
t_{DOE}	$\overline{OE}$ Access Time	—	12	—	15	ns
t_{HZOE}[2]	$\overline{OE}$ to High-Z Output	—	8	—	10	ns
t_{LZOE}[2]	$\overline{OE}$ to Low-Z Output	5	—	5	—	ns
t_{HZCS1}/t_{HZCS2}[2]	$\overline{CS1}$/CS2 to High-Z Output	0	8	0	10	ns
t_{LZCS1}/t_{LZCS2}[2]	$\overline{CS1}$/CS2 to Low-Z Output	10	—	10	—	ns
t_{BA}	$\overline{LB}$, $\overline{UB}$ Access Time	—	25	—	35	ns
t_{HZB}	$\overline{LB}$, $\overline{UB}$ to High-Z Output	0	8	0	10	ns
t_{LZB}	$\overline{LB}$, $\overline{UB}$ to Low-Z Output	0	—	0	—	ns

Notes:
1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 0.9V/1.5V, input pulse levels of 0.4 to V_{DD}-0.2V/0.4V to V_{DD}-0.3V and output loading specified in Figure 1.
2. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.

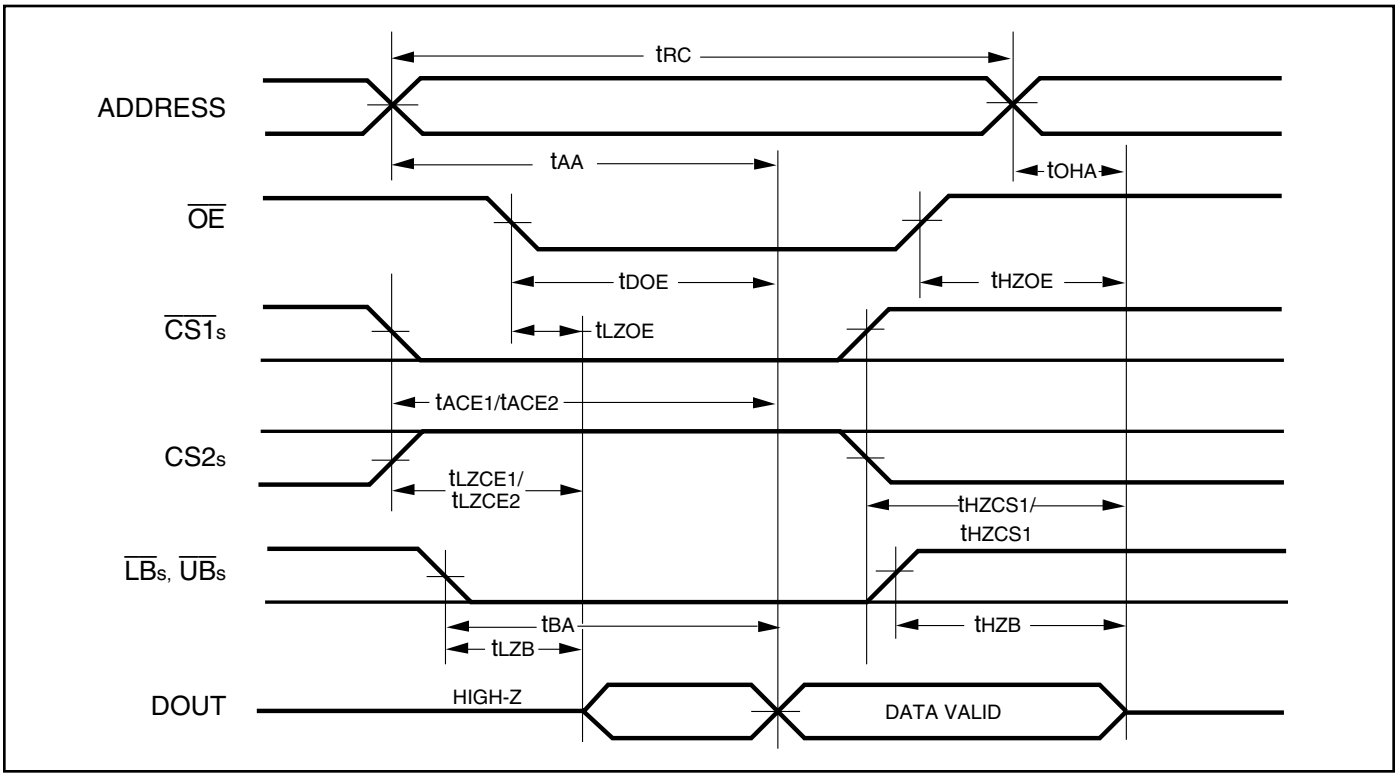
AC WAVEFORMS

READ CYCLE NO. 1[1,2] (Address Controlled) ($\overline{CS1}$ = $\overline{OE}$ = V_{IL}, CS2 = $\overline{WE}$ = V_{IH}, $\overline{UB}$ or $\overline{LB}$ = V_{IL})



AC WAVEFORMS

READ CYCLE NO. 2[1,3] ($\overline{CS1}$, CS2, $\overline{OE}$, AND $\overline{UB}$/$\overline{LB}$ Controlled)



Notes:
1. $\overline{WE}$ is HIGH for a Read Cycle.
2. The device is continuously selected. $\overline{OE}$, $\overline{CS1}$, $\overline{UB}$, or $\overline{LB}$ = V_{IL}. CS2=$\overline{WE}$=V_{IH}.
3. Address is valid prior to or coincident with $\overline{CS1}$ LOW transition.

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

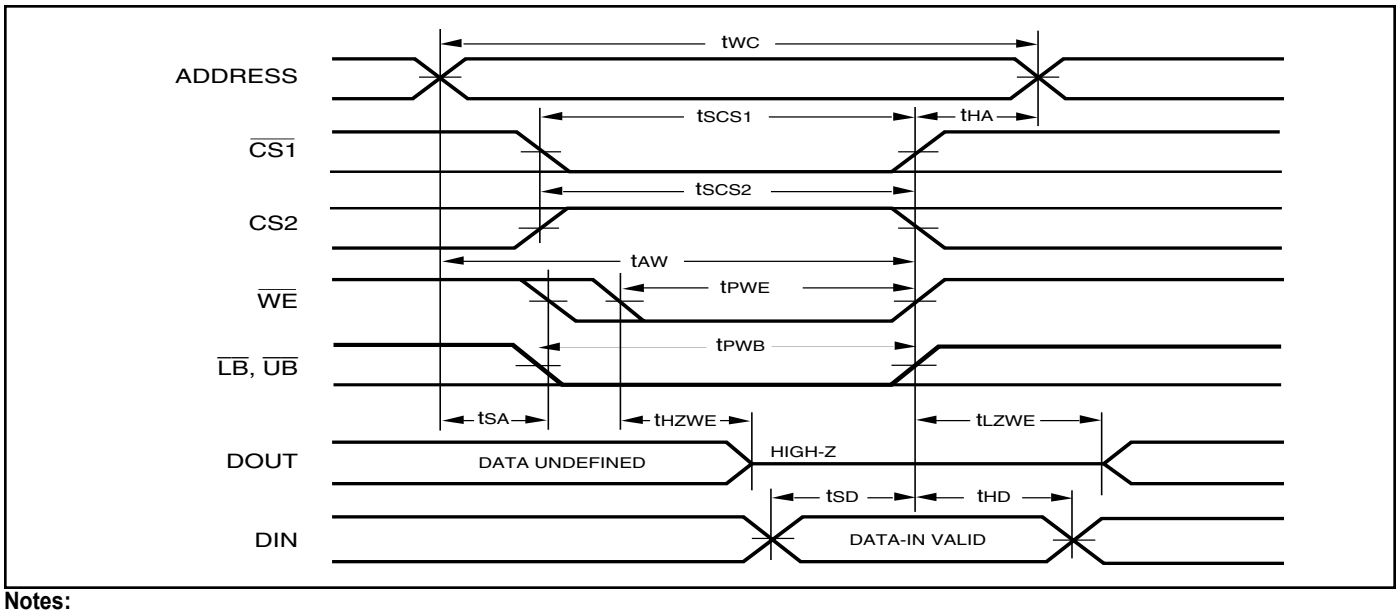
Symbol	Parameter	25ns Min.	25ns Max.	35 ns Min.	35 ns Max.	Unit
t_{WC}	Write Cycle Time	25	—	35	—	ns
t_{SCS1}/t_{SCS2}	$\overline{CS1}$/CS2 to Write End	18	—	25	—	ns
t_{AW}	Address Setup Time to Write End	15	—	25	—	ns
t_{HA}	Address Hold from Write End	0	—	0	—	ns
t_{SA}	Address Setup Time	0	—	0	—	ns
t_{PWB}	$\overline{LB}$, $\overline{UB}$ Valid to End of Write	18	—	25	—	ns
t_{PWE}[4]	$\overline{WE}$ Pulse Width	18	—	30	—	ns
t_{SD}	Data Setup to Write End	12	—	15	—	ns
t_{HD}	Data Hold from Write End	0	—	0	—	ns
t_{HZWE}[3]	$\overline{WE}$ LOW to High-Z Output	—	12	—	20	ns
t_{LZWE}[3]	$\overline{WE}$ HIGH to Low-Z Output	5	—	5	—	ns

Notes:

1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 0.9V/1.5V, input pulse levels of 0.4 to V_{DD}-0.2V/0.4V to V_{DD}-0.3V and output loading specified in Figure 1.
2. The internal write time is defined by the overlap of $\overline{CS1}$ LOW, CS2 HIGH 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.
3. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.
4. $t_{PWE} > t_{HZWE} + t_{SD}$ when $\overline{OE}$ is LOW.

AC WAVEFORMS

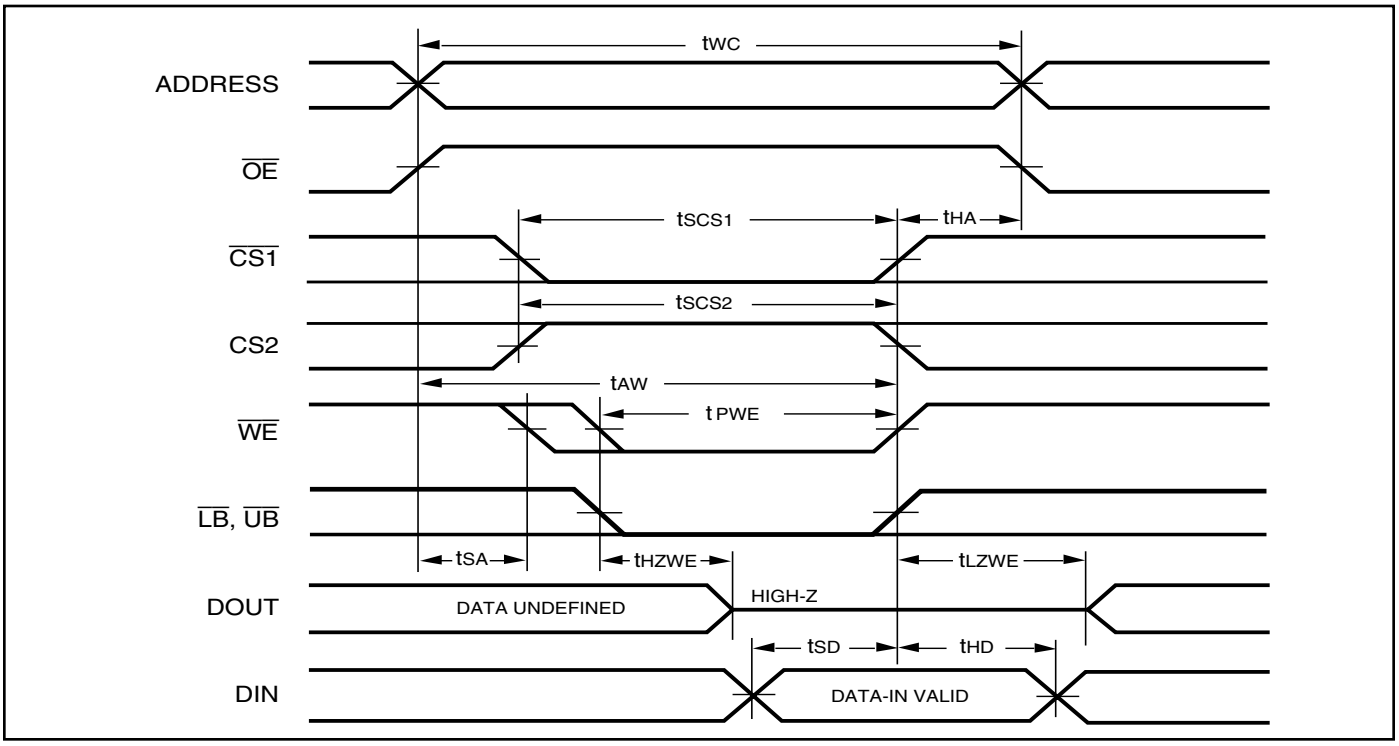
WRITE CYCLE NO. 1[1,2] ($\overline{CS1}$ Controlled, $\overline{OE}$ = HIGH or LOW)



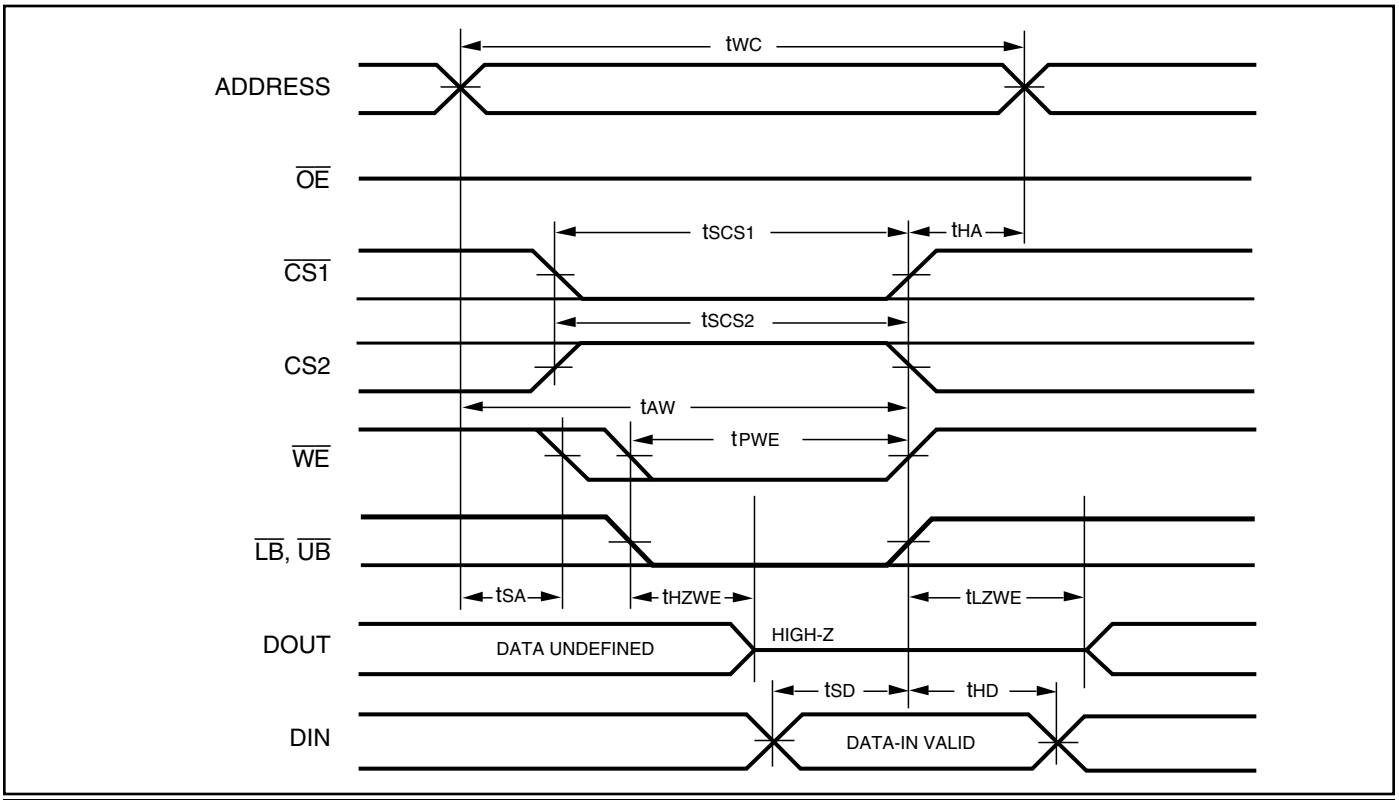
Notes:

1. WRITE is an internally generated signal asserted during an overlap of the LOW states on the $\overline{CS1}$, CS2 and $\overline{WE}$ inputs and at least one of the $\overline{LB}$ and $\overline{UB}$ inputs being in the LOW state.
2. WRITE = ($\overline{CS1}$) [($\overline{LB}$) = ($\overline{UB}$)] ($\overline{WE}$).

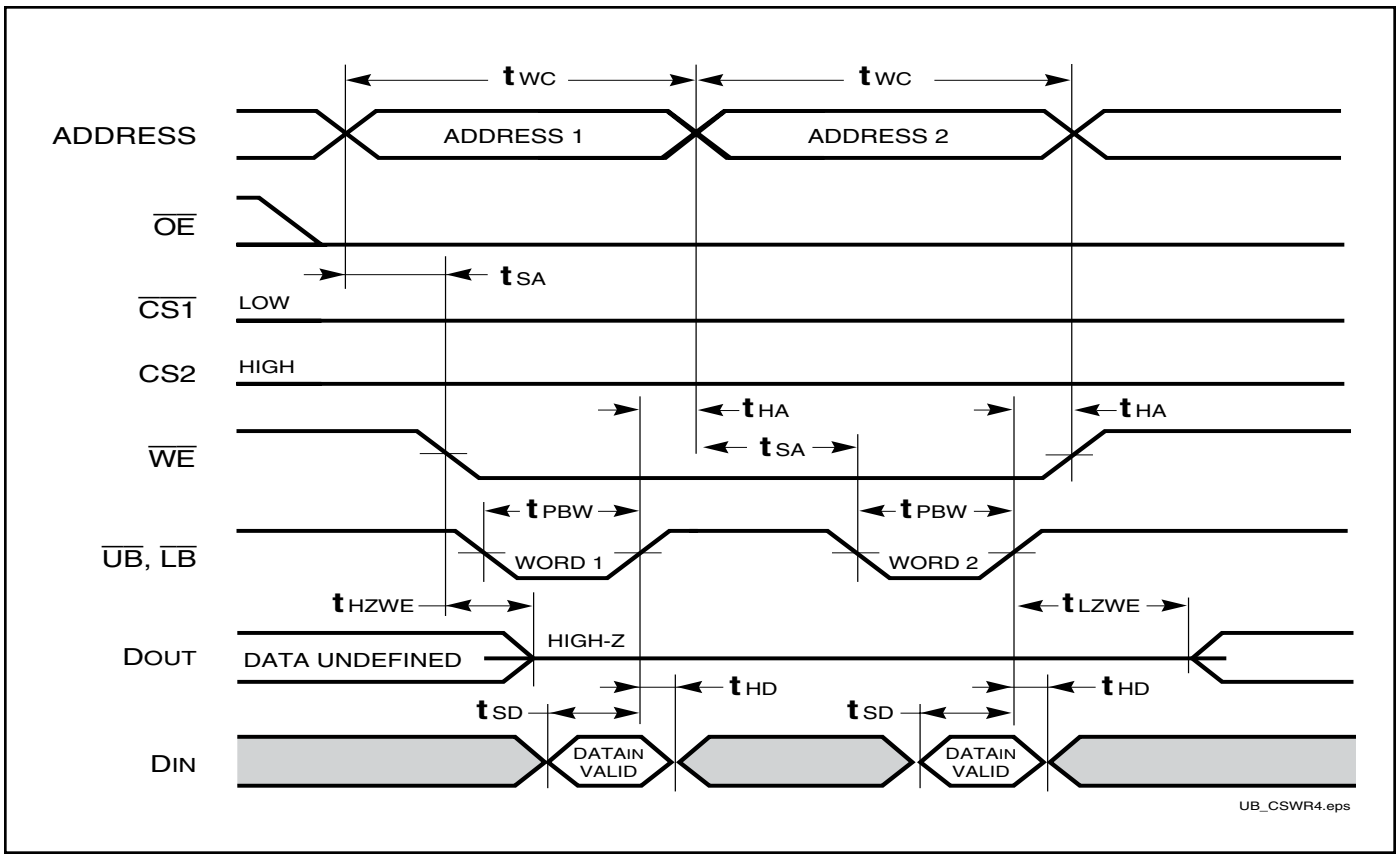
WRITE CYCLE NO. 2 ($\overline{WE}$ Controlled: $\overline{OE}$ is HIGH During Write Cycle)



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



WRITE CYCLE NO. 4 ($\overline{UB}$/$\overline{LB}$ Controlled)

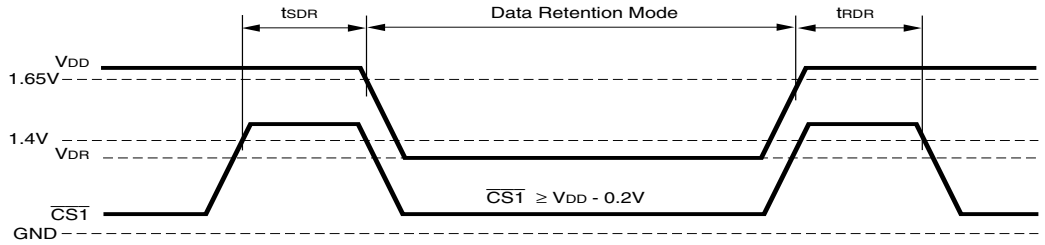


DATA RETENTION SWITCHING CHARACTERISTICS

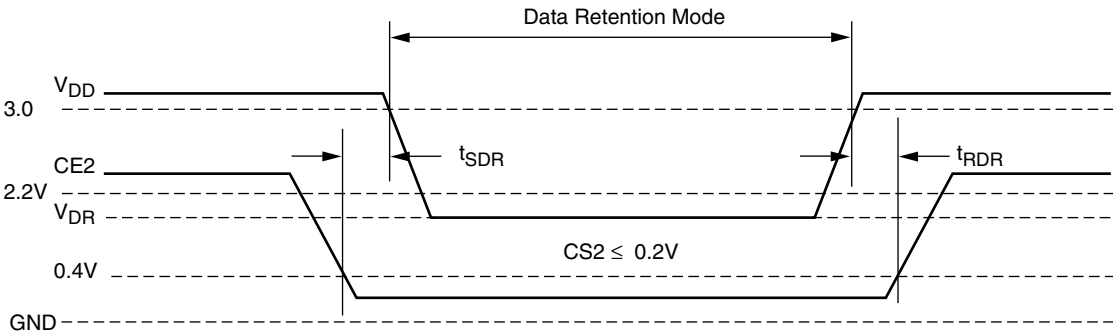
Symbol	Parameter	Test Condition		Min.	Typ.(1)	Max.	Unit
V_{DR}	V_{DD} for Data Retention	See Data Retention Waveform		1.2		3.6	V
I_{DR}	Data Retention Current	V_{DD} = 1.2V, $\overline{CS1} \geq V_{DD} - 0.2V$	Com.	—	0.1	0.8	mA
			Ind.	—	0.1	1.2	
			Auto.	—	0.1	2	
t_{SDR}	Data Retention Setup Time	See 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} = 3.0V, T_A = 25°C and not 100% tested.

DATA RETENTION WAVEFORM ($\overline{CS1}$ Controlled)



DATA RETENTION WAVEFORM (CS2 Controlled)



ORDERING INFORMATION

Industrial Range: -40°C to +85°C

Voltage Range: 2.4V to 3.6V

Speed (ns)	Order Part No.	Package
25	IS62WV102416BLL-25MI	48 mini BGA (9mm x 11mm)
	IS62WV102416BLL-25MLI	48 mini BGA (9mm x 11mm), Lead-free
	IS62WV102416BLL-25TI	TSOP (Type I)
	IS62WV102416BLL-25TLI	TSOP (Type I), Lead-free

Industrial Range: -40°C to +85°C

Voltage Range: 1.65V to 2.2V

Speed (ns)	Order Part No.	Package
35	IS62WV102416ALL-35MI	48 mini BGA (9mm x 11mm)
	IS62WV102416ALL-35MLI	48 mini BGA (9mm x 11mm), Lead-free
	IS62WV102416ALL-35TI	TSOP (Type I)
	IS62WV102416ALL-35TLI	TSOP (Type I), Lead-free

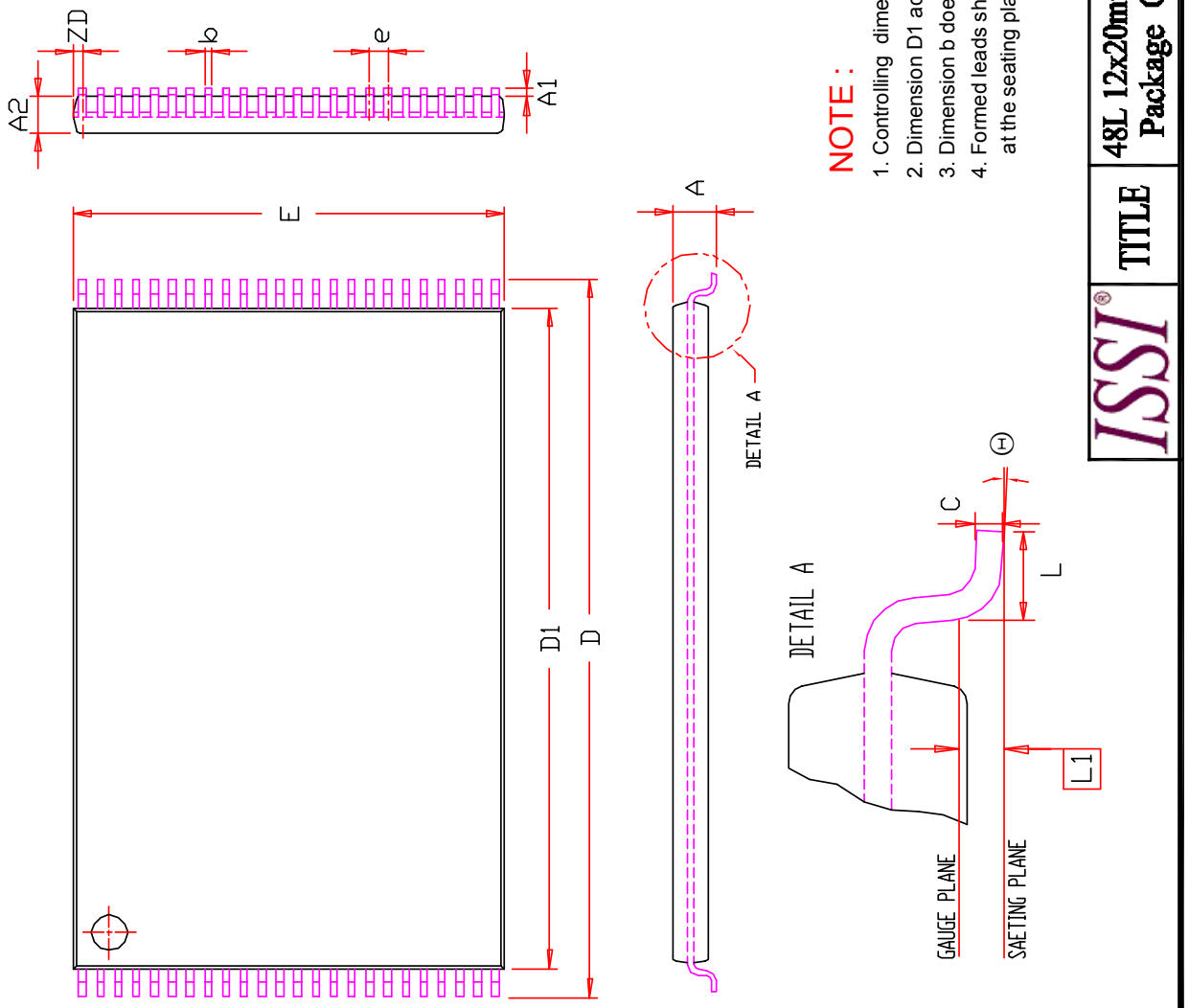
Automotive Range: -40°C to +125°C

Voltage Range: 2.4V to 3.6V

Speed (ns)	Order Part No.	Package
25	IS65WV102416BLL-25MA3	48 mini BGA (9mm x 11mm)
	IS65WV102416BLL-25MLA3	48 mini BGA (9mm x 11mm), Lead-free
	IS65WV102416BLL-25CTA3	TSOP (Type I)
	IS65WV102416BLL-25CTLA3	TSOP (Type I), Lead-free

PACKAGE INFORMATION

SYMBOL	DIMENSION IN MM		
	MIN	NOM	MAX
A			1.20
A1	0.05		0.15
b	0.17	0.22	0.27
C	0.10		0.21
D	19.80	20.00	20.20
D1	18.20	18.40	18.60
E	11.80	12.00	12.20
e		0.50 BSC.	
L	0.50	0.60	0.70
L1		0.25 BSC.	
ZD		0.25 REF.	
θ	0	3°	5°



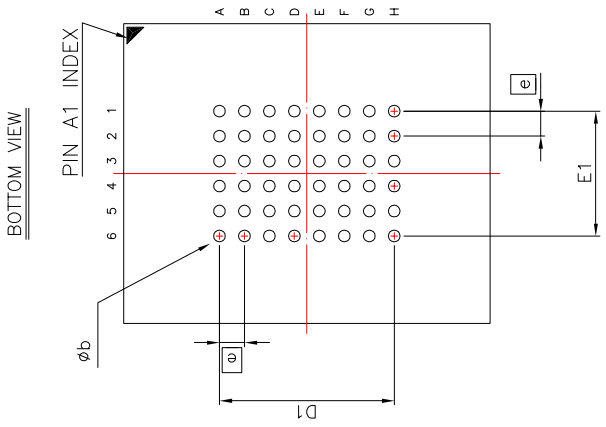
NOTE :
1. Controlling dimension : mm
2. Dimension D1 adn E do not include mold protrusion .
3. Dimension b does not include dambar protrusion/intrusion.
4. Formed leads shall be planar with respect to one another within 0.1mm at the seating plane after final test.

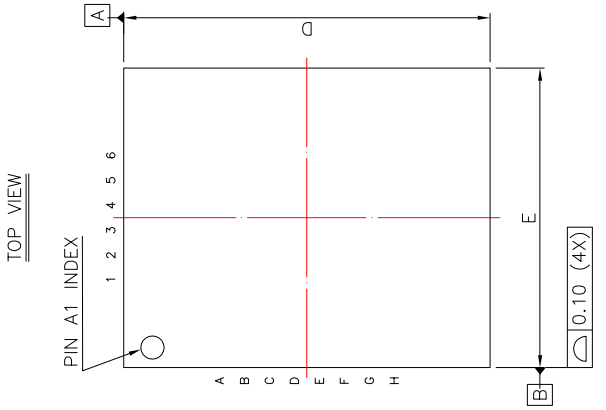
ISSI®	TITLE	48L 12x20mm TSOP-1 Package Outline	REV.	B	DATE	07/06/2006

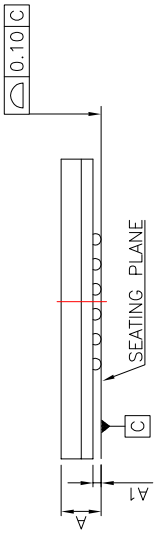
SYM.	DIMENSION (mm)			DIMENSION (INCH)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	—	—	1.20	—	—	0.047
A1	0.20	—	0.30	0.008	—	0.012
b	0.30	0.35	0.40	0.012	0.014	0.016
D	10.90	11.00	11.10	0.429	0.433	0.437
D1	5.25 BSC			0.207 BSC		
E	8.90	9.00	9.10	0.350	0.354	0.358
E1	3.75 BSC			0.148 BSC		
e	0.75 BSC			0.030 BSC		

NOTE :

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







ISSI	TITLE	48L 9x11mm TF-BGA Package Outline	REV.	B	DATE	08/21/2008