

IS66WV51216EALL IS66/67WV51216EBLL



ADVANCED INFORMATION
NOVEMBER 2013

8Mb LOW VOLTAGE, ULTRA LOW POWER PSEUDO CMOS STATIC RAM

FEATURES

- High-speed access time:
 - 70ns (IS66WV51216EALL, IS66/67WV51216EBLL)
 - 55ns (IS66/67WV51216EBLL)
- CMOS low power operation
- Single power supply
 - $V_{DD} = 1.7V-1.95V$ (IS66WV51216EALL)
 - $V_{DD} = 2.5V-3.6V$ (IS66/67WV51216EBLL)
- Three state outputs
- Data control for upper and lower bytes
- Industrial temperature available
- Lead-free available

DESCRIPTION

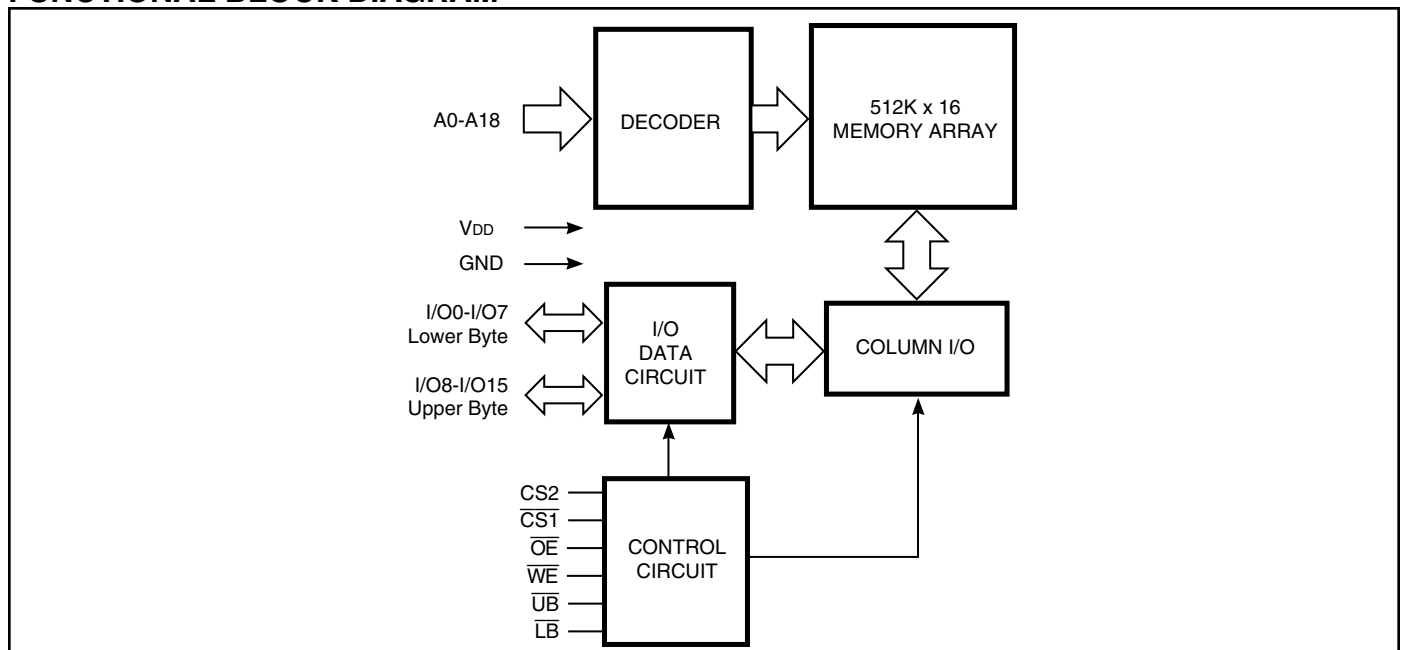
The *ISSI* IS66WV51216EALL and IS66/67WV51216EBLL are high-speed, 8M bit static RAMs organized as 512K words by 16 bits. It is fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields high-performance and low power consumption devices.

When $\overline{CS1}$ is HIGH (deselected) or when $\overline{CS2}$ is LOW (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. 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 IS66WV51216EALL and IS66/67WV51216EBLL are packaged in the JEDEC standard 48-ball mini BGA (6mm x 8mm) and 44-Pin TSOP (TYPE II). The device is also available for die sales.

FUNCTIONAL BLOCK DIAGRAM



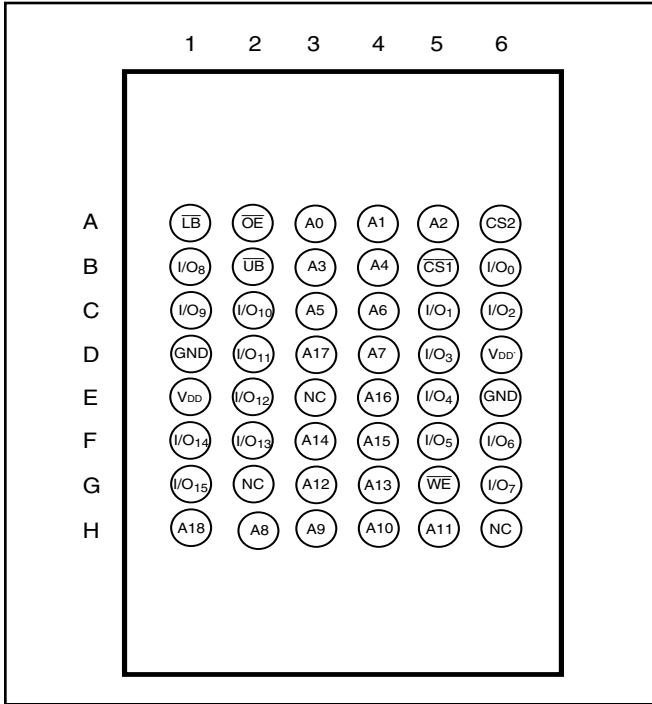
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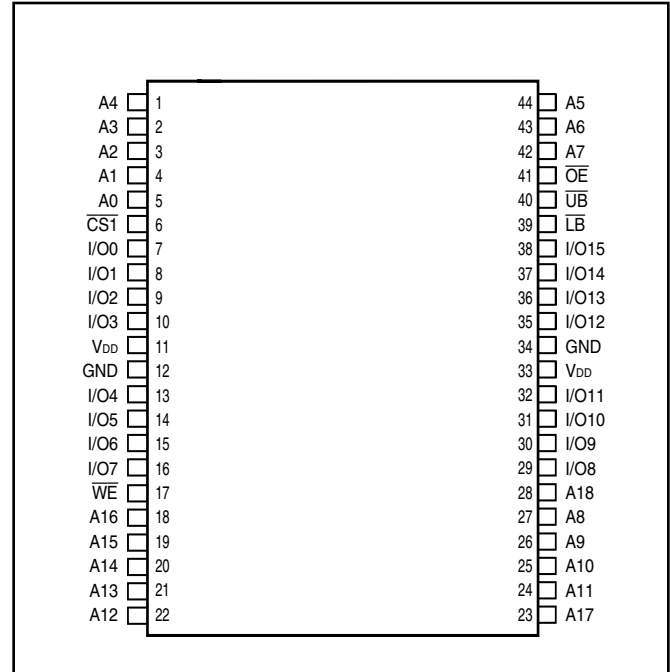
- a.) the risk of injury or damage has been minimized;
- b.) the user assume all such risks; and
- c.) potential liability of Integrated Silicon Solution, Inc is adequately protected under the circumstances

PIN CONFIGURATIONS:

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



44-Pin TSOP (Type II)



PIN DESCRIPTIONS

A0-A18	Address Inputs
I/O0-I/O15	Data Inputs/Outputs
CS1, CS2	Chip Enable Input
OE	Output Enable Input
WE	Write Enable Input
LB	Lower-byte Control (I/O0-I/O7)
UB	Upper-byte Control (I/O8-I/O15)
NC	No Connection
VDD	Power
GND	Ground

TRUTH TABLE

Mode	\overline{WE}	$\overline{CS1}$	CS2	\overline{OE}	\overline{LB}	\overline{UB}	I/O PIN		V _{DD} Current
							I/O0-I/O7	I/O8-I/O15	
Not Selected	X	H	X	X	X	X	High-Z	High-Z	ISB1, ISB2
	X	X	L	X	X	X	High-Z	High-Z	ISB1, ISB2
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}
	X	L	H	X	H	H	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}	

Note:

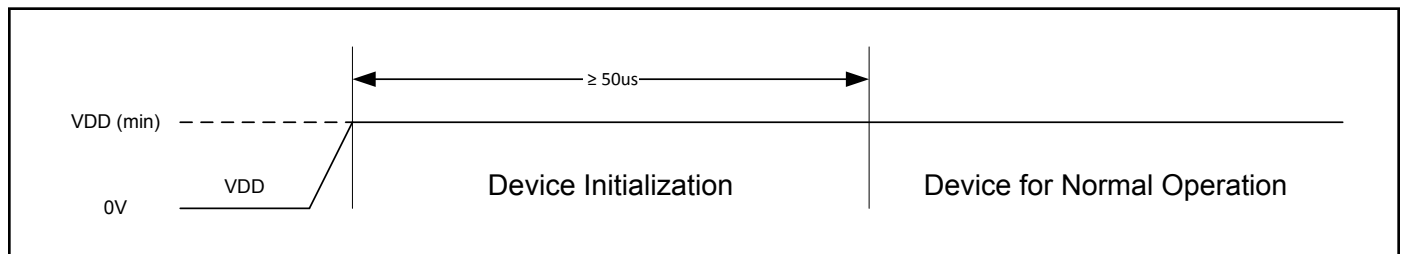
CS2 input signal pin is only available for 48-ball mini BGA package parts. CS2 input is internally enabled for 44-pin TSOP-II package parts.

OPERATING RANGE (V_{DD})

Range	Ambient Temperature	IS66WV51216EALL (70ns)	IS66WV51216EBLL (55ns, 70ns)	IS67WV51216EBLL (55ns, 70ns)
Industrial	-40°C to +85°C	1.7V - 1.95V	2.5V - 3.6V	-
Automotive, A1	-40°C to +85°C	-	-	2.5V - 3.6V
Automotive, A2	-40°C to +105°C	-	-	2.5V - 3.6V

POWER-UP INITIALIZATION

IS66WV51216EALL/EBLL and IS67WV51216EBLL include an on-chip voltage sensor used to launch the power-up initialization process. When V_{DD} reaches a stable level at or above the V_{DD} (min), the device will require 50µs to complete its self-initialization process. During the initialization period, \overline{CS} should remain HIGH. When initialization is complete, the device is ready for normal operation.



ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Parameter	Value	Unit
V _{TERM}	Terminal Voltage with Respect to GND	-0.2 to V _{DD} +0.3	V
T _{BIAS}	Temperature Under Bias	-40 to +85	°C
V _{DD}	V _{DD} Related to GND	-0.2 to +3.8	V
T _{STG}	Storage Temperature	-65 to +150	°C
P _T	Power Dissipation	1.0	W

Note:

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.

DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

V_{DD} = 2.5V-3.6V

Symbol	Parameter	Test Conditions	V _{DD}	Min.	Max.	Unit
V _{OH}	Output HIGH Voltage	I _{OH} = -1 mA	2.5-3.6V	2.2	—	V
V _{OL}	Output LOW Voltage	I _{OL} = 2.1 mA	2.5-3.6V	—	0.4	V
V _{IH}	Input HIGH Voltage ⁽¹⁾		2.5-3.6V	2.2	V _{DD} + 0.3	V
V _{IL}	Input LOW Voltage ⁽¹⁾		2.5-3.6V	-0.2	0.6	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_{ILL} (min.) = -2.0V AC (pulse width < 10ns). Not 100% tested.
V_{IHH} (max.) = V_{DD} + 2.0V AC (pulse width < 10ns). Not 100% tested.

DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

V_{DD} = 1.7V-1.95V

Symbol	Parameter	Test Conditions	V _{DD}	Min.	Max.	Unit
V _{OH}	Output HIGH Voltage	I _{OH} = -0.1 mA	1.7-1.95V	1.4	—	V
V _{OL}	Output LOW Voltage	I _{OL} = 0.1 mA	1.7-1.95V	—	0.2	V
V _{IH}	Input HIGH Voltage ⁽¹⁾		1.7-1.95V	1.4	V _{DD} + 0.2	V
V _{IL}	Input LOW Voltage ⁽¹⁾		1.7-1.95V	-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_{ILL} (min.) = -1.0V AC (pulse width < 10ns). Not 100% tested.
V_{IHH} (max.) = V_{DD} + 1.0V AC (pulse width < 10ns). Not 100% tested.

CAPACITANCE⁽¹⁾

Symbol	Parameter	Conditions	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	8	pF
C _{OUT}	Input/Output Capacitance	V _{OUT} = 0V	10	pF

Note:

1. Tested initially and after any design or process changes that may affect these parameters.

AC TEST CONDITIONS

Parameter	1.7V-1.95V (Unit)	2.5V-3.6V (Unit)
Input Pulse Level	0.4V to V _{DD} -0.2	0.4V to V _{DD} -0.3V
Input Rise and Fall Times	5 ns	5ns
Input and Output Timing and Reference Level	V _{REF}	V _{REF}
Output Load	See Figures 1 and 2	See Figures 1 and 2

	1.7V - 1.95V	2.5V - 3.6V
R1(Ω)	3070	1029
R2(Ω)	3150	1728
V _{REF}	0.9V	1.4V
V _{TM}	1.8V	2.8V

AC TEST LOADS

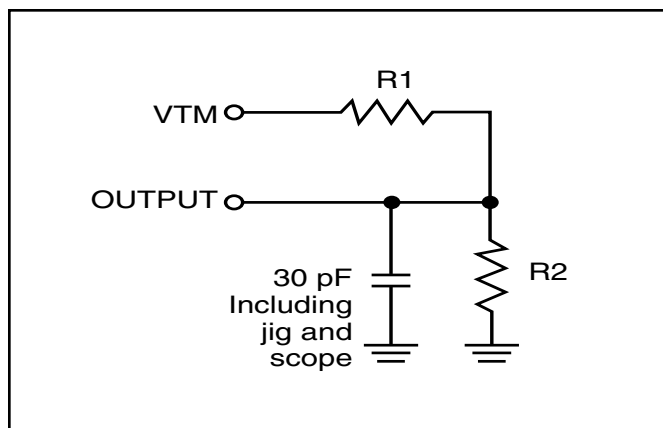


Figure 1

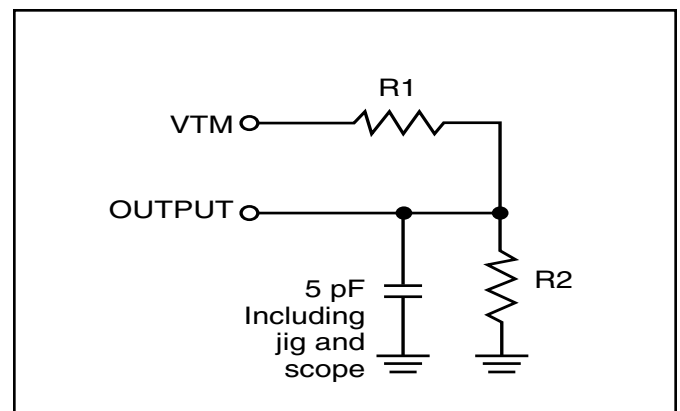


Figure 2

1.7V-1.95V POWER SUPPLY CHARACTERISTICS (Over Operating Range)

Symbol	Parameter	Test Conditions		Max. 70ns	Unit
I _{CC}	V _{DD} Dynamic Operating Supply Current	V _{DD} = Max.,	Com.	20	mA
		I _{OUT} = 0 mA, f = f _{MAX}	Ind.	25	
		All Inputs 0.4V or V _{DD} - 0.2V	Auto.	30	
I _{CC1}	Operating Supply Current	V _{DD} = Max., $\overline{CS1} = 0.2V$	Com.	4	mA
		$\overline{WE} = V_{DD} - 0.2V$	Ind.	4	
		CS2 = V _{DD} - 0.2V, f = 1MHz	Auto.	10	
I _{SB1}	TTL Standby Current (TTL Inputs)	V _{DD} = Max.,	Com.	0.6	mA
		V _{IN} = V _{IH} or V _{IL}	Ind.	0.6	
		$\overline{CS1} = V_{IH}$, CS2 = V _{IL} , f = 1 MHz	AUTO.	1	
I _{SB2}	CMOS Standby Current (CMOS Inputs)	V _{DD} = Max.,	Com.	100	μA
		$\overline{CS1} \geq V_{DD} - 0.2V$,	Ind.	120	
		CS2 ≤ 0.2V,	Auto.	150	
		V _{IN} ≥ V _{DD} - 0.2V, or V _{IN} ≤ 0.2V, f = 0			

Note:

1. At f = f_{MAX}, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.

2.5V-3.6V POWER SUPPLY CHARACTERISTICS (Over Operating Range)

Symbol	Parameter	Test Conditions		Max. 55ns	Unit
I _{CC}	V _{DD} Dynamic Operating Supply Current	V _{DD} = Max.,	Com.	25	mA
		I _{OUT} = 0 mA, f = f _{MAX}	Ind.	28	
		All Inputs 0.4V	Auto.	35	
		or V _{DD} - 0.3V	typ. ⁽²⁾	15	
I _{CC1}	Operating Supply Current	V _{DD} = Max., $\overline{CS1} = 0.2V$	Com.	5	mA
		$\overline{WE} = V_{DD} - 0.2V$	Ind.	5	
		CS2 = V _{DD} - 0.2V, f = 1MHz	AUTO.	10	
I _{SB1}	TTL Standby Current (TTL Inputs)	V _{DD} = Max.,	Com.	0.6	mA
		V _{IN} = V _{IH} or V _{IL}	Ind.	0.6	
		$\overline{CS1} = V_{IH}$, CS2 = V _{IL} ,	AUTO.	1	
		f = 1 MHz			
I _{SB2}	CMOS Standby Current (CMOS Inputs)	V _{DD} = Max.,	Com.	100	μA
		$\overline{CS1} \geq V_{DD} - 0.2V$,	Ind.	130	
		CS2 ≤ 0.2V,	Auto.	150	
		V _{IN} ≥ V _{DD} - 0.2V, or	typ. ⁽²⁾	75	
		V _{IN} ≤ 0.2V, f = 0			

Note:

- At f = f_{MAX}, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.
- 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)

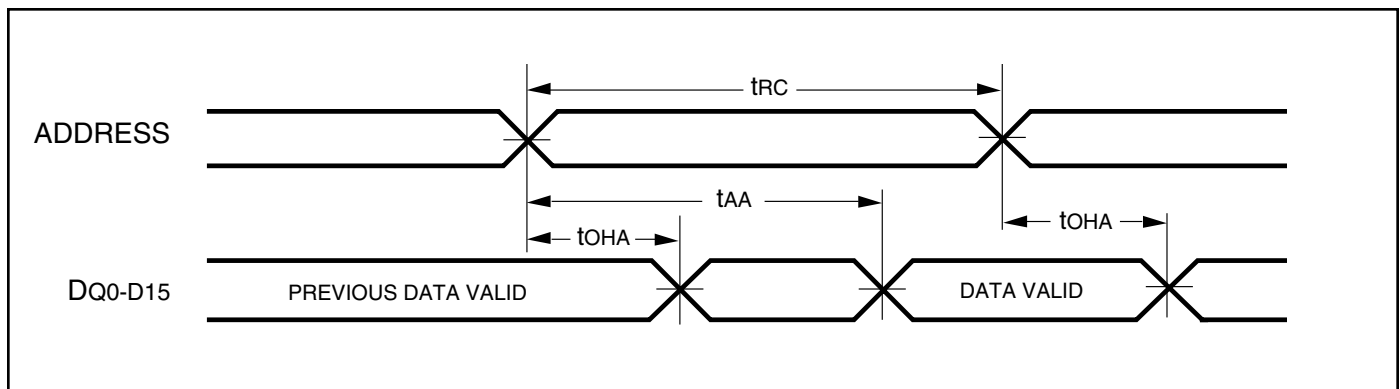
Symbol	Parameter	55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	
t _{RC}	Read Cycle Time	55	15,000	70	15,000	ns
t _{AA}	Address Access Time	—	55	—	70	ns
t _{OHA}	Output Hold Time	10	—	10	—	ns
t _{ACS1} /t _{ACS2}	$\overline{CS1}/CS2$ Access Time	—	55	—	70	ns
t _{DOE}	\overline{OE} Access Time	—	25	—	35	ns
t _{HZOE} ⁽²⁾	\overline{OE} to High-Z Output	—	20	—	25	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	20	0	25	ns
t _{LZCS1} /t _{LZCS2} ⁽²⁾	$\overline{CS1}/CS2$ to Low-Z Output	10	—	10	—	ns
t _{BA}	$\overline{LB}, \overline{UB}$ Access Time	—	55	—	70	ns
t _{HZB}	$\overline{LB}, \overline{UB}$ to High-Z Output	0	20	0	25	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 ±100 mV from steady-state voltage. Not 100% tested.

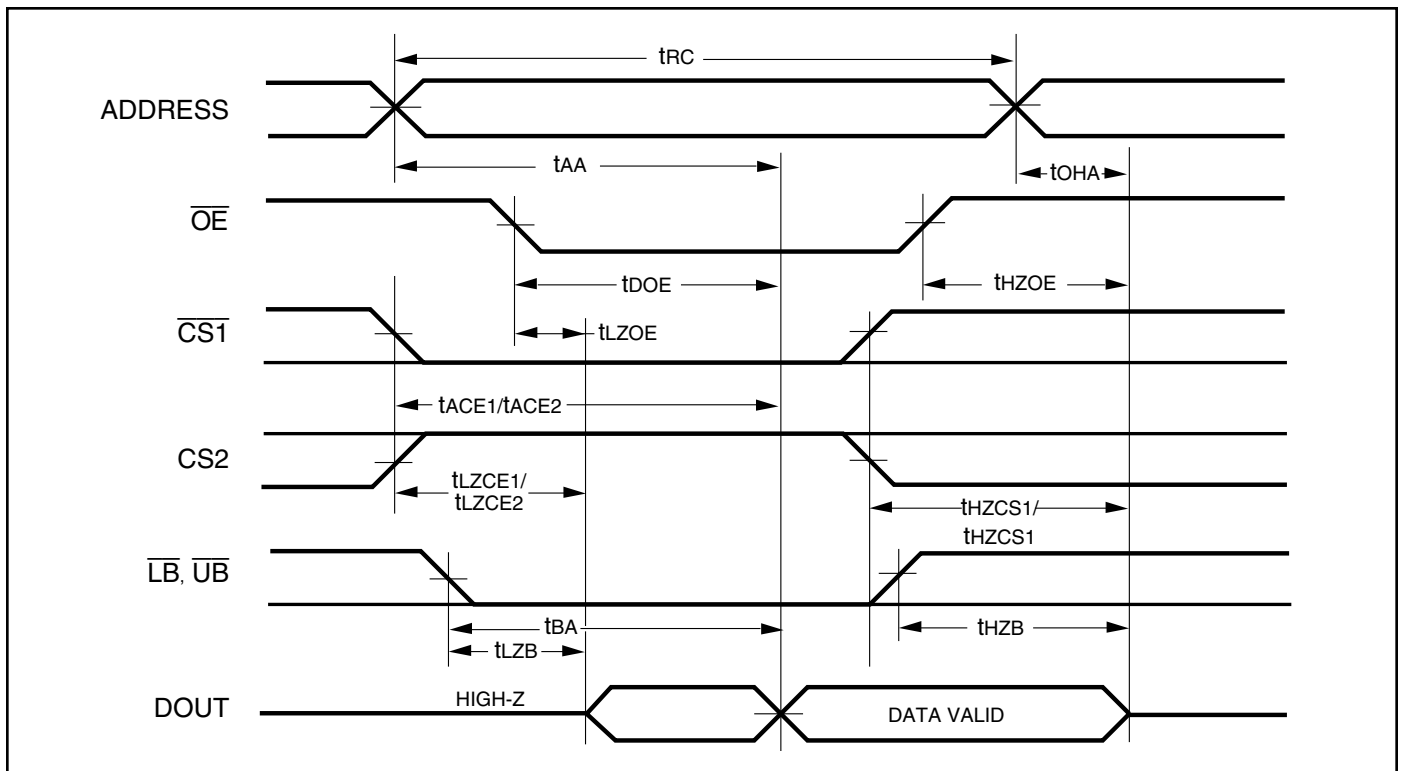
AC WAVEFORMS

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)

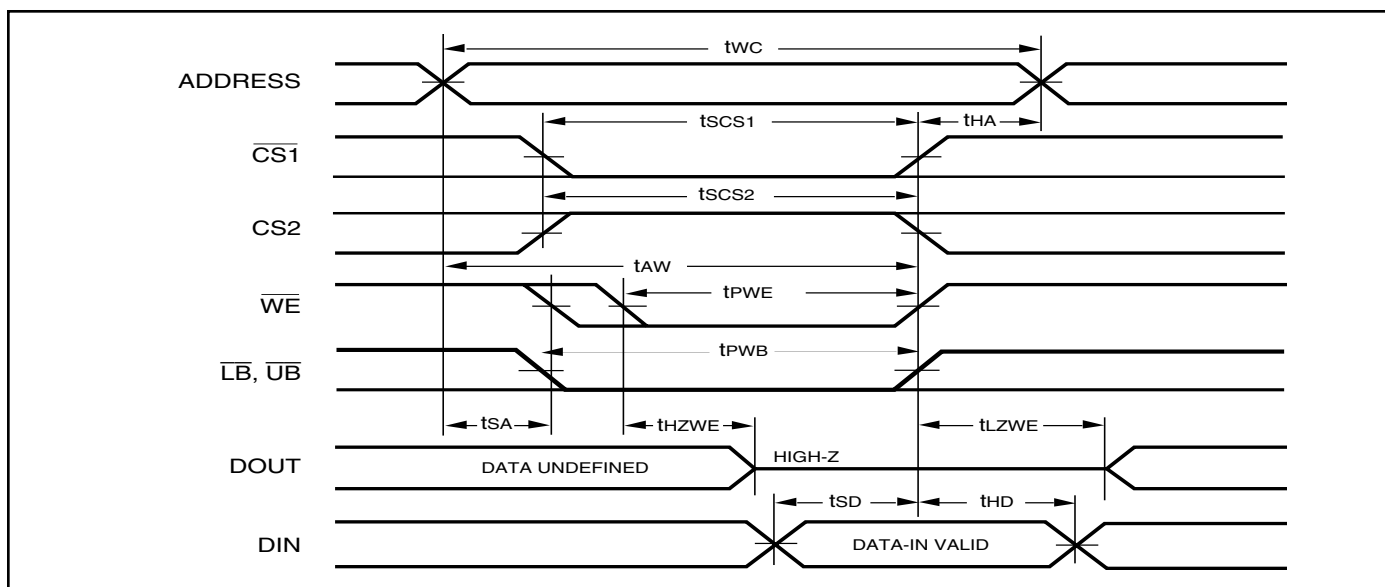
Symbol	Parameter	55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	
t _{wc}	Write Cycle Time	55	15,000	70	15,000	ns
t _{sCS1} /t _{sCS2}	$\overline{CS1}/CS2$ to Write End	45	—	60	—	ns
t _{aw}	Address Setup Time to Write End	45	—	60	—	ns
t _{ha}	Address Hold from Write End	0	—	0	—	ns
t _{sa}	Address Setup Time	0	—	0	—	ns
t _{pWB}	\overline{LB} , \overline{UB} Valid to End of Write	45	—	60	—	ns
t _{pWE} ⁽⁴⁾	\overline{WE} Pulse Width	45	15,000 ⁽⁵⁾	60	15,000 ⁽⁵⁾	ns
t _{sd}	Data Setup to Write End	25	—	30	—	ns
t _{hd}	Data Hold from Write End	0	—	0	—	ns
t _{hzWE} ⁽³⁾	\overline{WE} LOW to High-Z Output	—	20	—	30	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 ± 100 mV from steady-state voltage. Not 100% tested.
4. t_{pWE} > t_{hzWE} + t_{sd} when \overline{OE} is LOW.
5. Refer to Avoidable Timing and Recommendations for clear definition.

AC WAVEFORMS

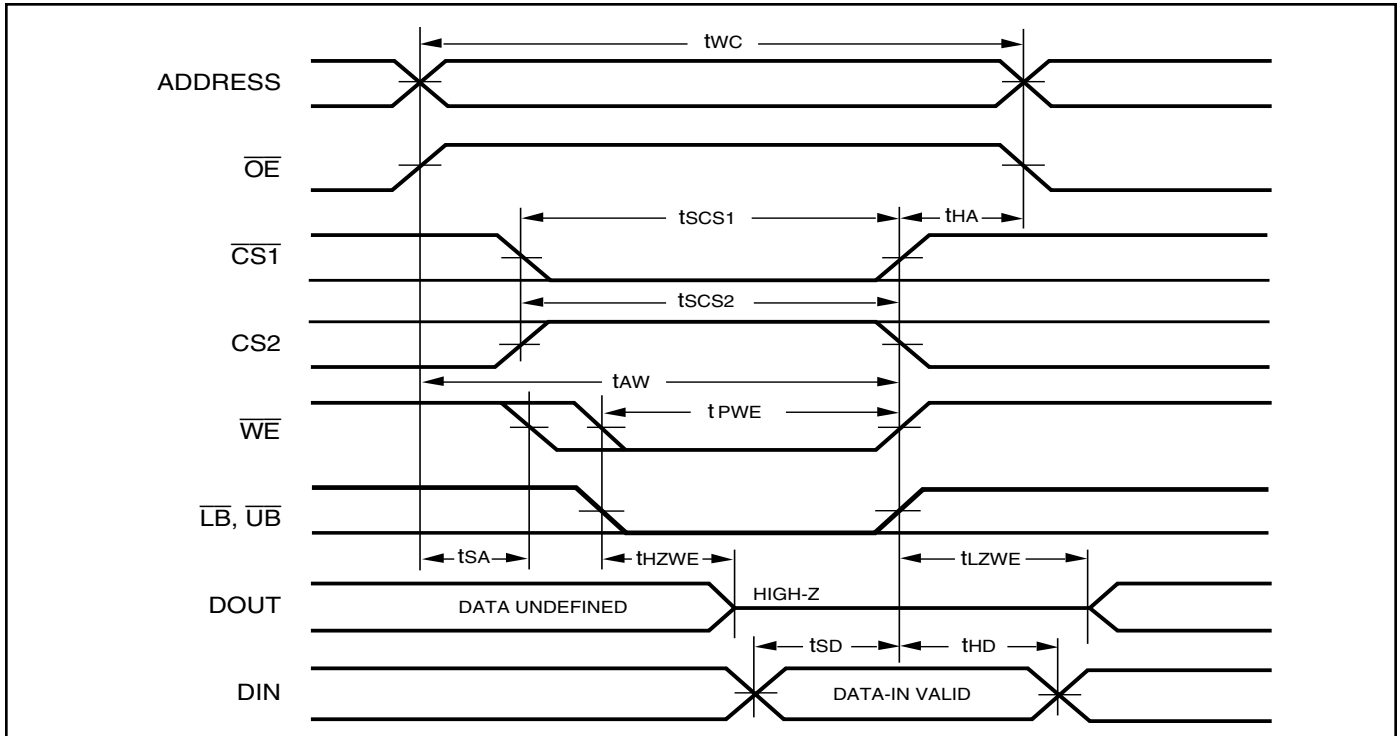
WRITE CYCLE NO. 1^(1,2) ($\overline{CS1}$ Controlled, \overline{OE} = HIGH or LOW)



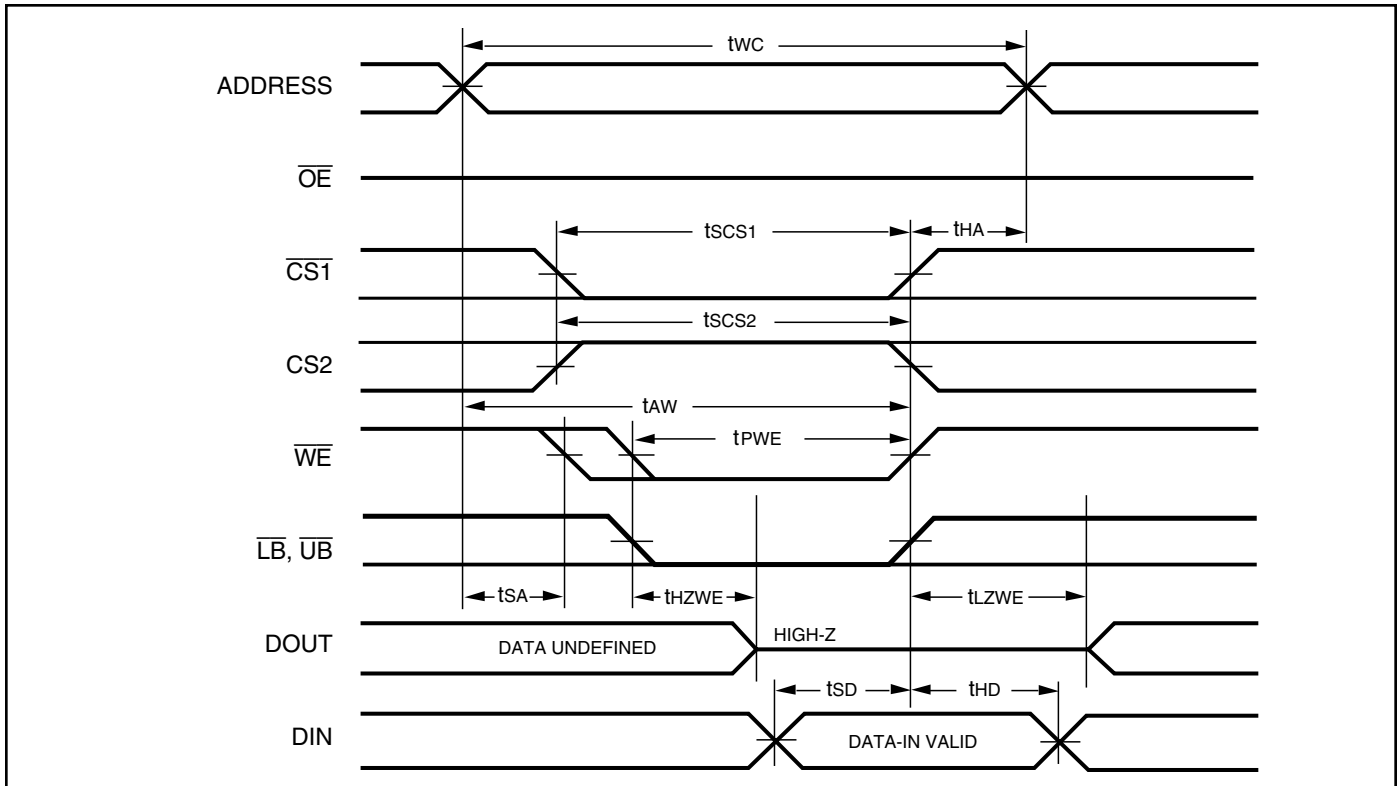
Notes:

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}).

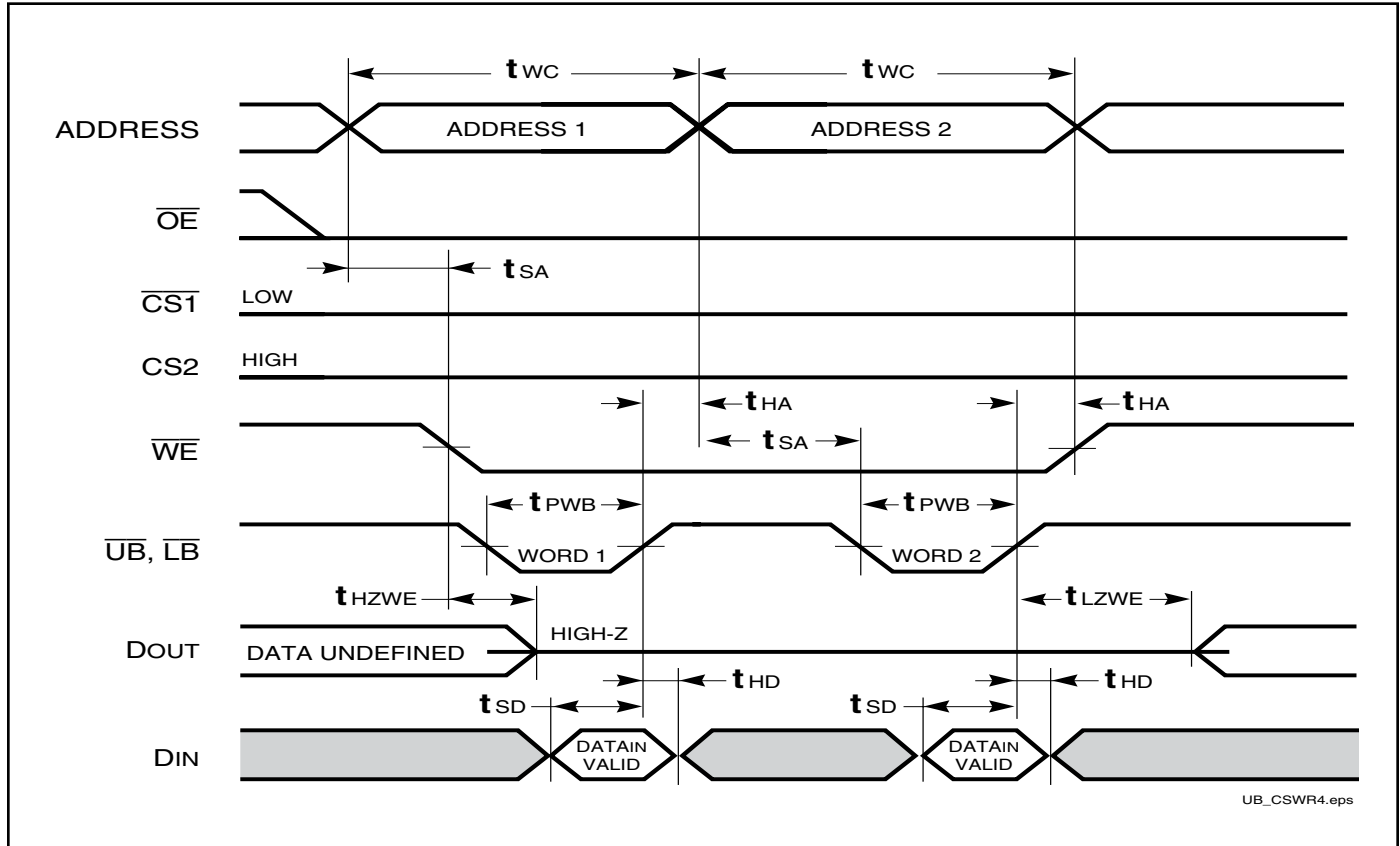
WRITE CYCLE NO. 2 (\overline{WE} Controlled: \overline{OE} is HIGH During Write Cycle)



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



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



AVOIDABLE TIMING AND RECOMMENDATIONS

Figure 3a

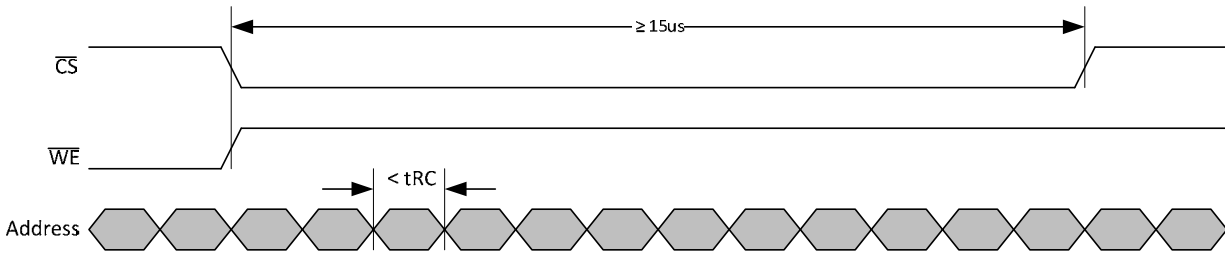


Figure 3b

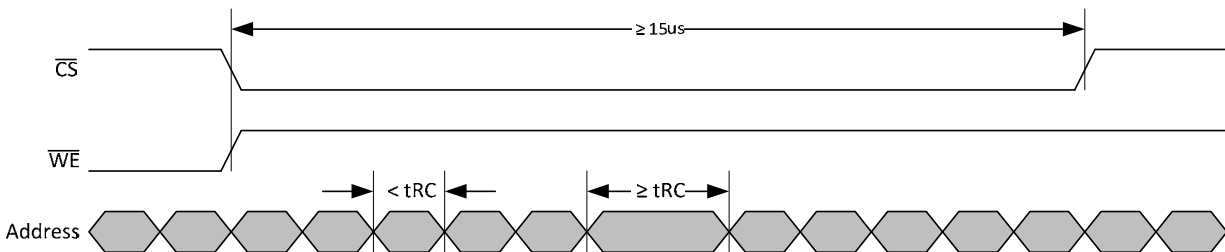


Figure 3c

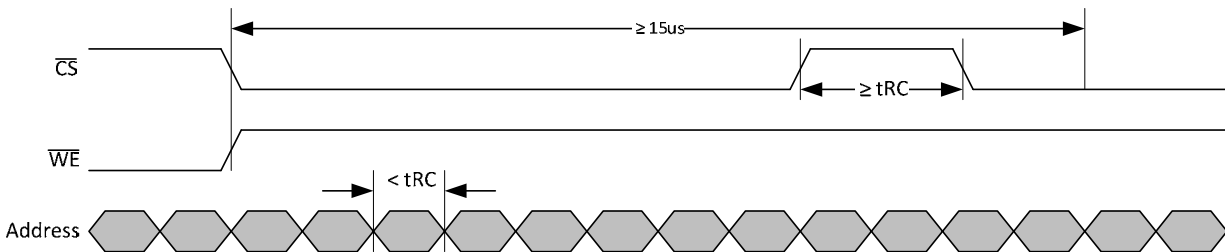
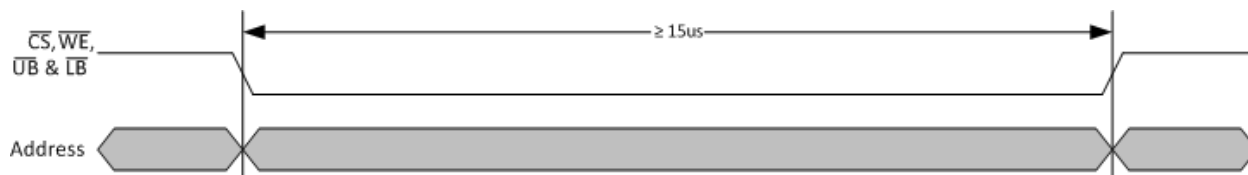


Figure 4a



AVOIDABLE TIMING AND RECOMMENDATIONS

Figure 4b

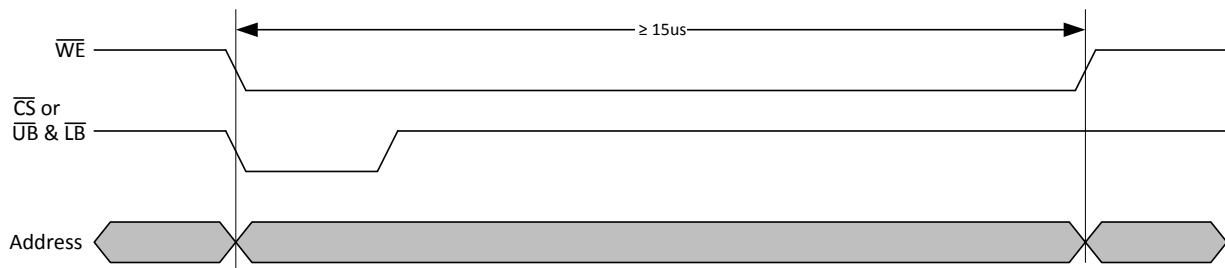
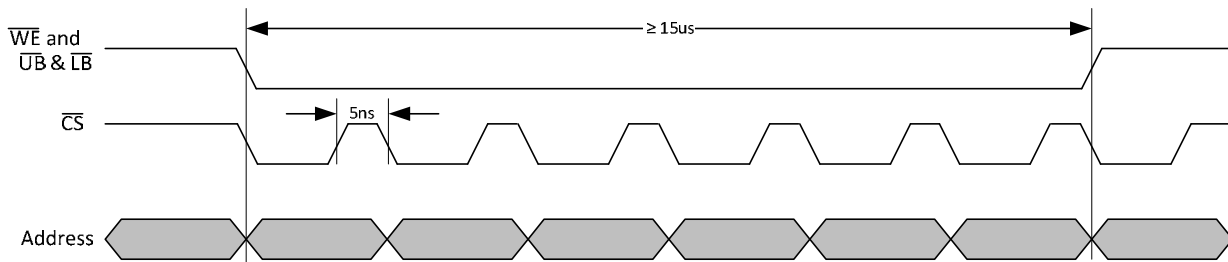


Figure 5



Notes:

1. PSRAM uses DRAM cell which needs a REFRESH action periodically to retain the information. This REFRESH action is performed internally as part of a READ cycle or when the device is not selected. A hidden REFRESH action has to be executed by the device at least once every 15 μ s.
2. Figure 3a shows a timing example in which consecutive READ cycles occurs in intervals less than the tRC spec while the device is selected for a period of 15 μ s. This timing should be avoided because output data from these READ cycles are not guaranteed to be valid due to violation of the tRC spec. This timing also prohibits the device from performing a hidden REFRESH action properly. Examples on how to avoid the timing in Figure 3a are shown in Figure 3b and 3c.
3. Figure 4a shows a timing example in which a single WRITE operation is maintained for a period greater than 15 μ s. Since a REFRESH action cannot be performed during a WRITE operation, information stored in the device will not be retained if this timing occurs. A WRITE operation is initiated when active LOW signals \overline{WE} , \overline{CS} , \overline{UB} and \overline{LB} are enabled (logic LOW) but any one of these signals can be disabled (logic HIGH) to complete the WRITE operation. Figure 4b is a timing example of using signal \overline{CS} being disabled to complete the WRITE operation.
4. Since a REFRESH action cannot be performed during a WRITE operation, consecutive WRITE cycles occurring for a total period greater than 15 μ s are not permitted. However, executing consecutive WRITE cycles greater than 15 μ s is acceptable if either \overline{WE} , \overline{CS} , or both \overline{UB} and \overline{LB} are disabled (logic HIGH) for a period of at least 5ns or higher and can be done once or multiple times. An example using \overline{CS} signal is shown in Figure 5.

IS66WV51216EALL

IS66/67WV51216EBLL

IS66WV51216EALL

Industrial Range: -40°C to +85°C

Voltage Range: 1.7V to 1.95V

Speed (ns)	Order Part No.	Package
70	IS66WV51216EALL-70TLI	TSOP-II, Lead-free
	IS66WV51216EALL-70BLI	mini BGA (6mm x 8mm), Lead-free

IS66WV51216EBLL

Industrial Range: -40°C to +85°C

Voltage Range: 2.5V to 3.6V

Speed (ns)	Order Part No.	Package
55	IS66WV51216EBLL-55TLI	TSOP-II, Lead-free
	IS66WV51216EBLL-55BLI	mini BGA (6mm x 8mm), Lead-free
70	IS66WV51216EBLL-70TLI	TSOP-II, Lead-free
	IS66WV51216EBLL-70BLI	mini BGA (6mm x 8mm), Lead-free

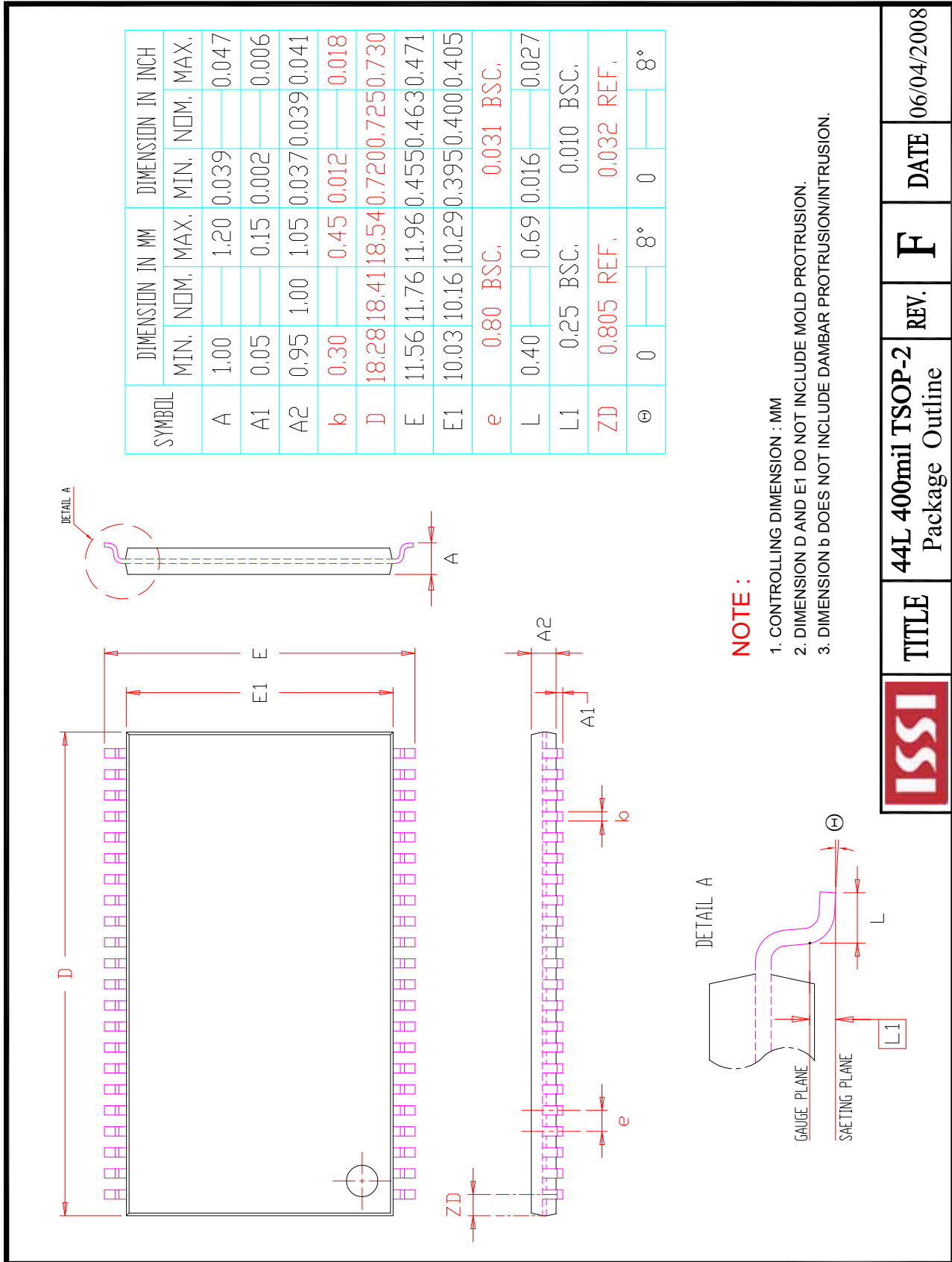
IS67WV51216EBLL

Automotive (A1) Range: -40°C to +85°C

Voltage Range: 2.5V to 3.6V

Speed (ns)	Order Part No.	Package
55	IS67WV51216EBLL-55TLA1	TSOP-II, Lead-free
	IS67WV51216EBLL-55BLA1	mini BGA (6mm x 8mm), Lead-free
70	IS67WV51216EBLL-70TLA1	TSOP-II, Lead-free
	IS67WV51216EBLL-70BLA1	mini BGA (6mm x 8mm), Lead-free

Please contact ISSI at SRAM@issi.com if you need -40°C to +105°C product.



	TITLE	REV.	DATE
	44L 400mil TSOP-2 Package Outline	F	06/04/2008

