

IS66WV51216DALL IS66WV51216DBLL



PRELIMINARY INFORMATION
MARCH 2011

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

FEATURES

- High-speed access time:
 - 70ns (IS66WV51216DALL/DBLL)
 - 55ns (IS66WV51216DBLL)
- CMOS low power operation
- Single power supply
 - $V_{DD} = 1.7V - 1.95V$ (IS66WV51216DALL)
 - $V_{DD} = 2.5V - 3.6V$ (IS66WV51216DBLL)
- Three state outputs
- Data control for upper and lower bytes
- Industrial temperature available
- Lead-free available

DESCRIPTION

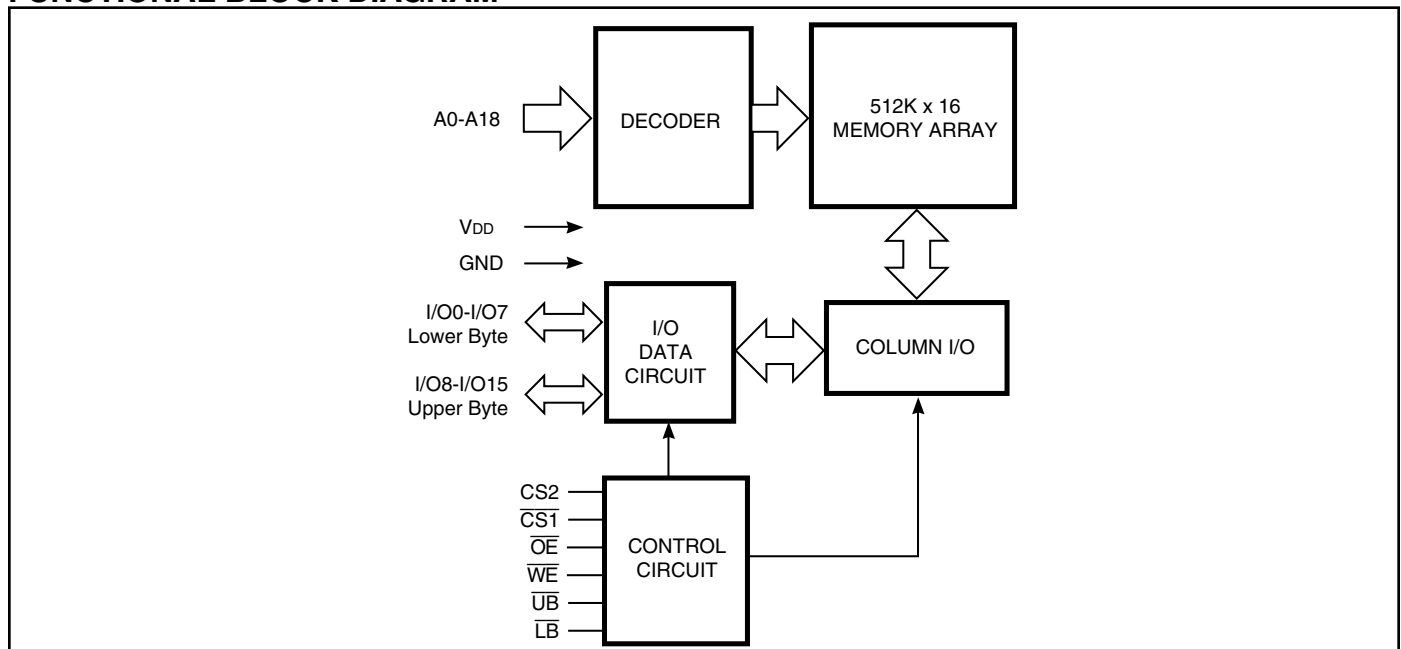
The *ISSI* IS66WV51216DALL/DBLL is a high-speed, 8M bit static RAMs organized as 512K words by 16 bits. It is fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields high-performance and low power consumption devices.

When $\overline{CS1}$ is HIGH (deselected) or when 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 IS66WV51216DALL/DBLL is 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



Copyright © 2011 Integrated Silicon Solution, Inc. All rights reserved. ISSI reserves the right to make changes to this specification and its products at any time without notice. ISSI assumes no liability arising out of the application or use of any information, products or services described herein. Customers are advised to obtain the latest version of this device specification before relying on any published information and before placing orders for products.

Integrated Silicon Solution, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless Integrated Silicon Solution, Inc. receives written assurance to its satisfaction, that:

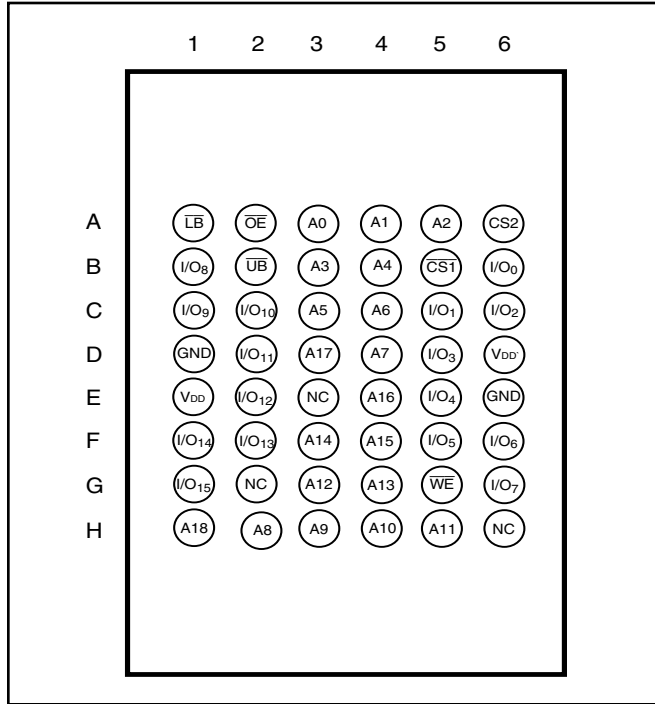
- a.) the risk of injury or damage has been minimized;
- b.) the user assume all such risks; and
- c.) potential liability of Integrated Silicon Solution, Inc is adequately protected under the circumstances

Integrated Silicon Solution, Inc. — www.issi.com

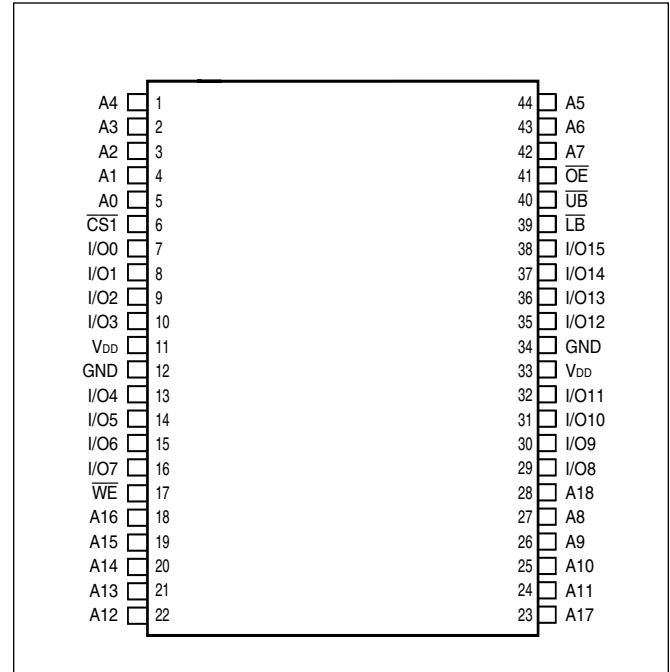
Rev. 00C
02/22/2011

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 |
| | X | X | X | X | H | H | 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} |
| Read | H | L | H | L | L | H | DOUT | High-Z | I _{CC} |
| | H | L | H | L | H | L | High-Z | DOUT | |
| | H | L | H | L | L | L | DOUT | DOUT | |
| Write | L | L | H | X | L | H | DIN | High-Z | I _{CC} |
| | L | L | H | X | H | L | High-Z | DIN | |
| | L | L | H | X | L | L | DIN | DIN | |

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 | (70ns) | (55ns) |
|------------|---------------------|---------------------------|-------------|
| Commercial | 0°C to +70°C | 1.7V - 1.95V, 2.5V - 3.6V | 2.5V - 3.6V |
| Industrial | -40°C to +85°C | 1.7V - 1.95V, 2.5V - 3.6V | 2.5V - 3.6V |
| Automotive | -40°C to +105°C | 2.5V-3.6V | |

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 | | 2.5-3.6V | 2.2 | V _{DD} + 0.3 | V |
| V _{IL} ⁽¹⁾ | Input LOW Voltage | | 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:

- V_{IL} (min.) = -2.0V AC (pulse width < 10ns). Not 100% tested.
V_{IH} (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 | | 1.7-1.95V | 1.4 | V _{DD} + 0.2 | V |
| V _{IL} ⁽¹⁾ | Input LOW Voltage | | 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:

- V_{IL} (min.) = -1.0V AC (pulse width < 10ns). Not 100% tested.
V_{IH} (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

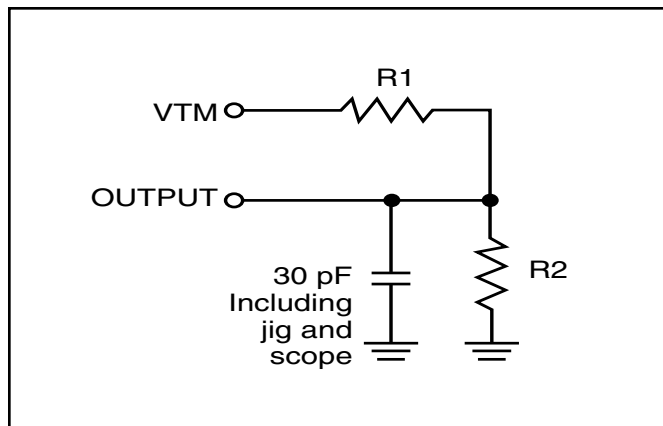


Figure 1

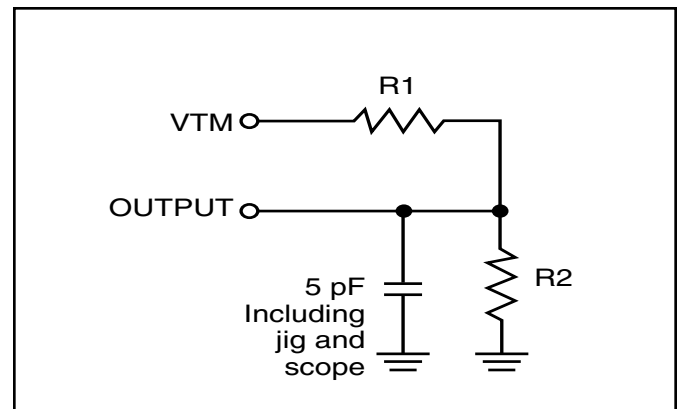


Figure 2

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 | |
| | OR | | | | |
| | ULB Control | V _{DD} = Max., V _{IN} = V _{IH} or V _{IL} $\overline{CS1} = V_{IL}$, f = 0, $\overline{UB} = V_{IH}$, $\overline{LB} = V_{IH}$ | | | |
| 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, V _{IN} ≥ V _{DD} - 0.2V, or V _{IN} ≤ 0.2V, f = 0 | Auto. | 150 | |
| | OR | | | | |
| | ULB Control | V _{DD} = Max., $\overline{CS1} = V_{IL}$, CS2=V _{IH} V _{IN} ≥ V _{DD} - 0.2V, or V _{IN} ≤ 0.2V, f = 0; $\overline{UB} / \overline{LB} = V_{DD} - 0.2V$ | | | |

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 | | | |
| OR | | | | | |
| | ULB Control | V _{DD} = Max., V _{IN} = V _{IH} or V _{IL} $\overline{CS1} = V_{IL}$, f = 0, $\overline{UB} = V_{IH}$, $\overline{LB} = V_{IH}$ | | | |
| 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 V _{IN} ≤ 0.2V, f = 0 | typ. ⁽²⁾ | 75 | |
| OR | | | | | |
| | ULB Control | V _{DD} = Max., $\overline{CS1} = V_{IL}$, CS2 = V _{IH} V _{IN} ≥ V _{DD} - 0.2V, or V _{IN} ≤ 0.2V, f = 0; $\overline{UB} / \overline{LB} = V_{DD} - 0.2V$ | | | |

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)

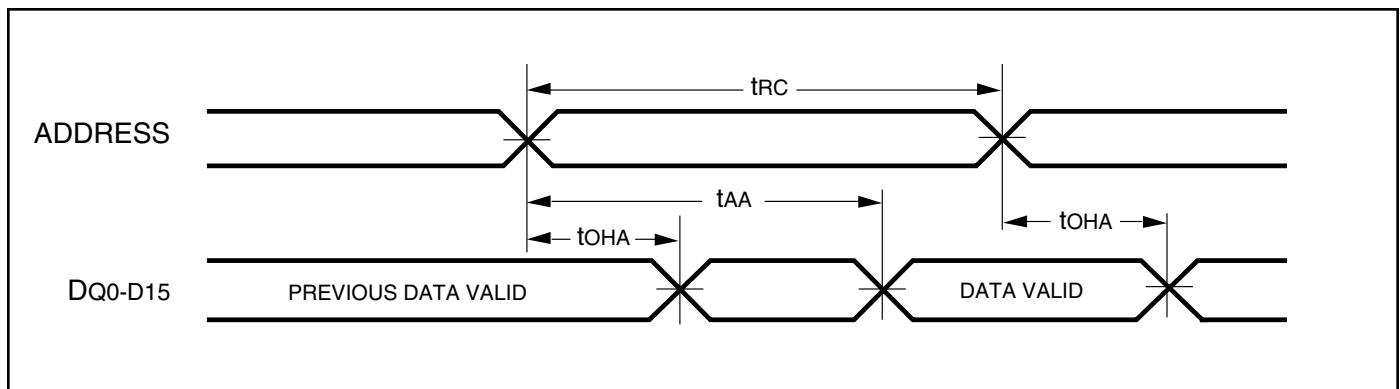
| Symbol | Parameter | 55 ns | | 70 ns | | Unit |
|---|---|-------|------|-------|------|------|
| | | Min. | Max. | Min. | Max. | |
| t _{RC} | Read Cycle Time | 55 | — | 70 | — | ns |
| t _{AA} | Address Access Time | — | 55 | — | 70 | ns |
| t _{OHA} | Output Hold Time | 10 | — | 10 | — | ns |
| t _{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.

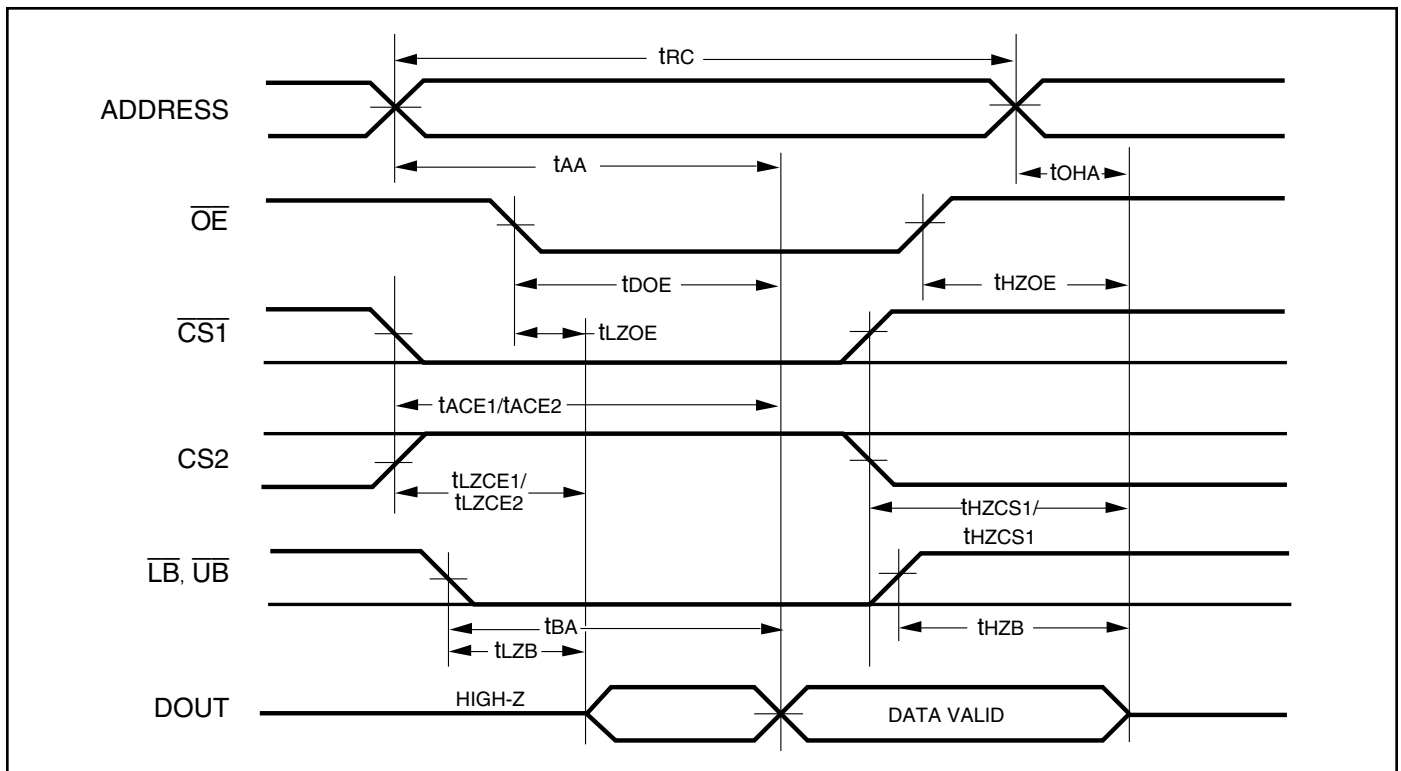
AC WAVEFORMS

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)

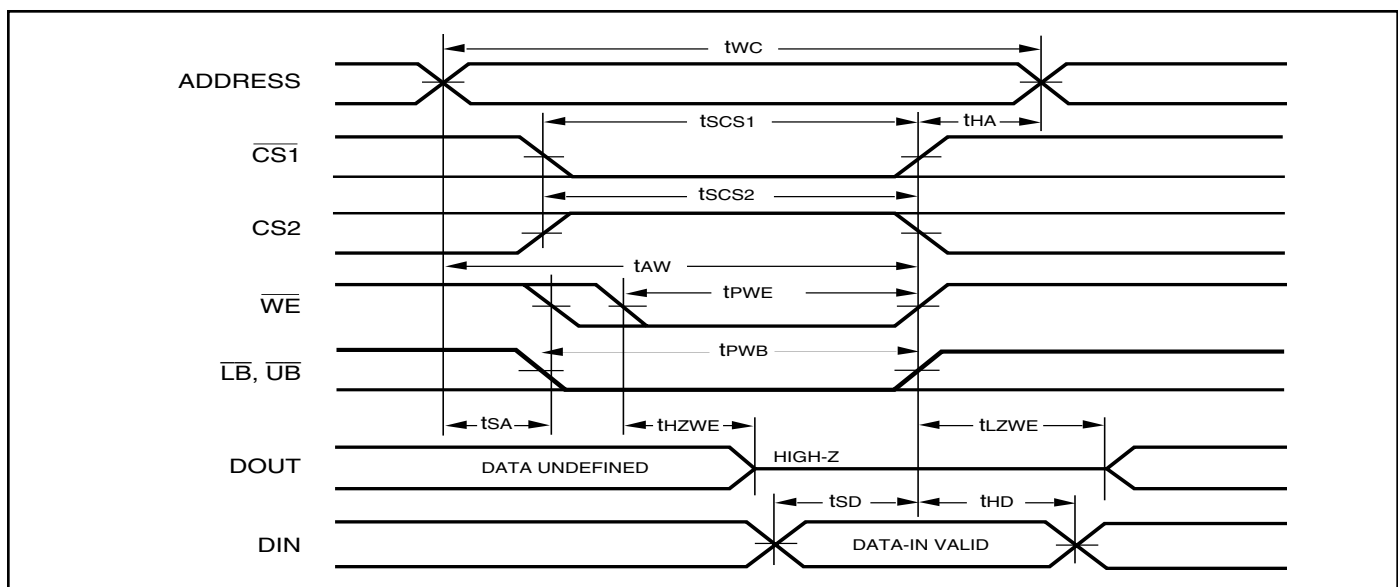
| Symbol | Parameter | 55 ns | | 70 ns | | Unit |
|--------------------------------------|---|-------|--------|-------|--------|------|
| | | Min. | Max. | Min. | Max. | |
| t _{wc} | Write Cycle Time | 55 | — | 70 | — | ns |
| t _{sCS1} /t _{sCS2} | $\overline{CS1}/CS2$ to Write End | 45 | — | 60 | — | 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 | 60 | 15,000 | 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.

AC WAVEFORMS

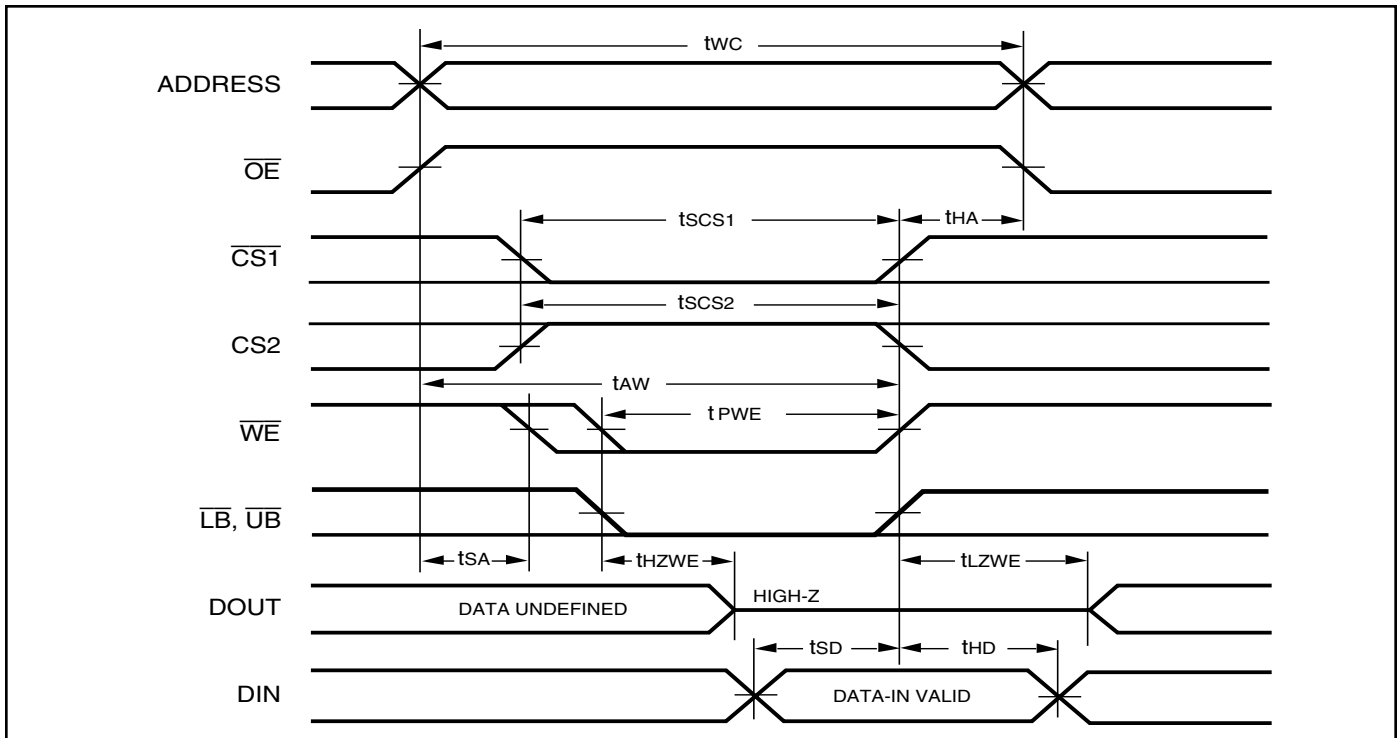
WRITE CYCLE NO. 1^(1,2) ($\overline{CS1}$ Controlled, \overline{OE} = HIGH or LOW)



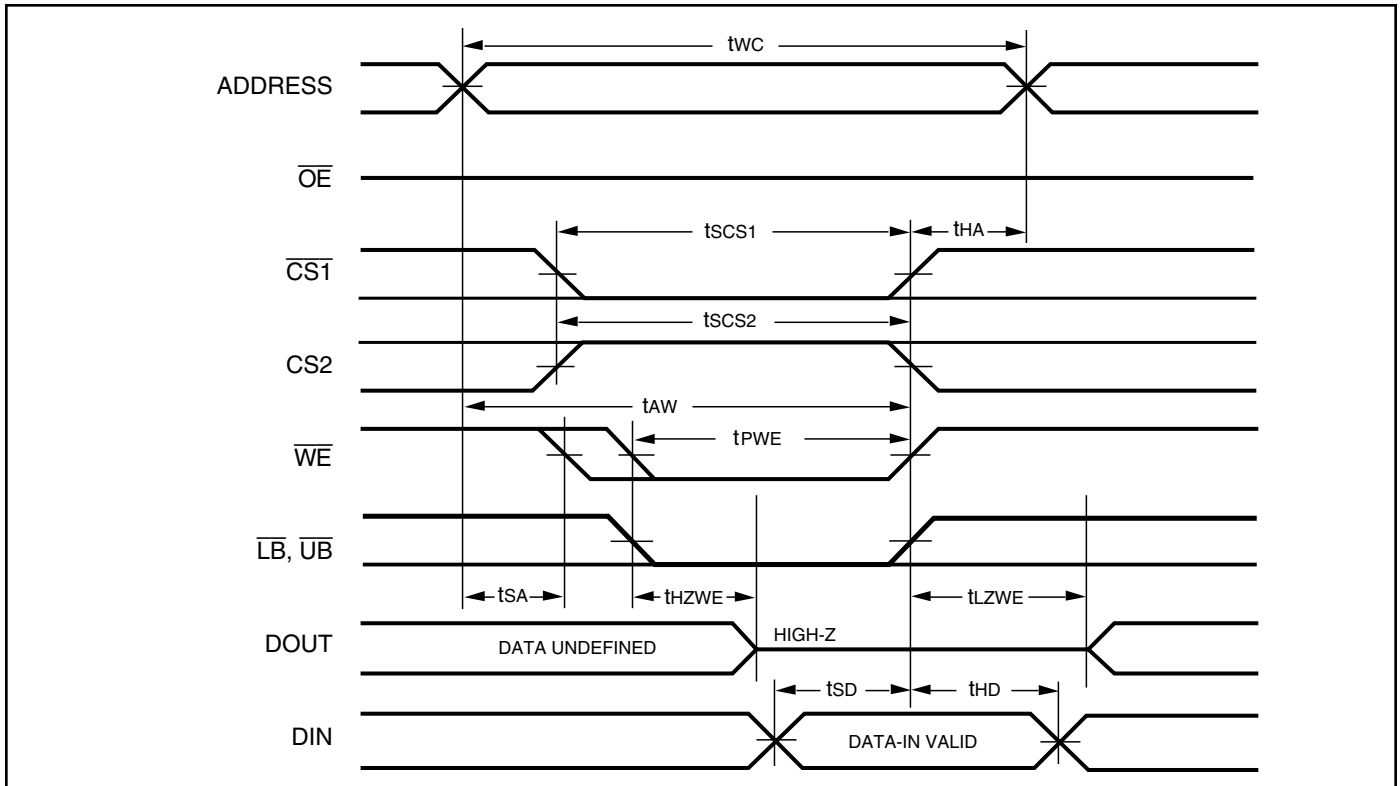
Notes:

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)

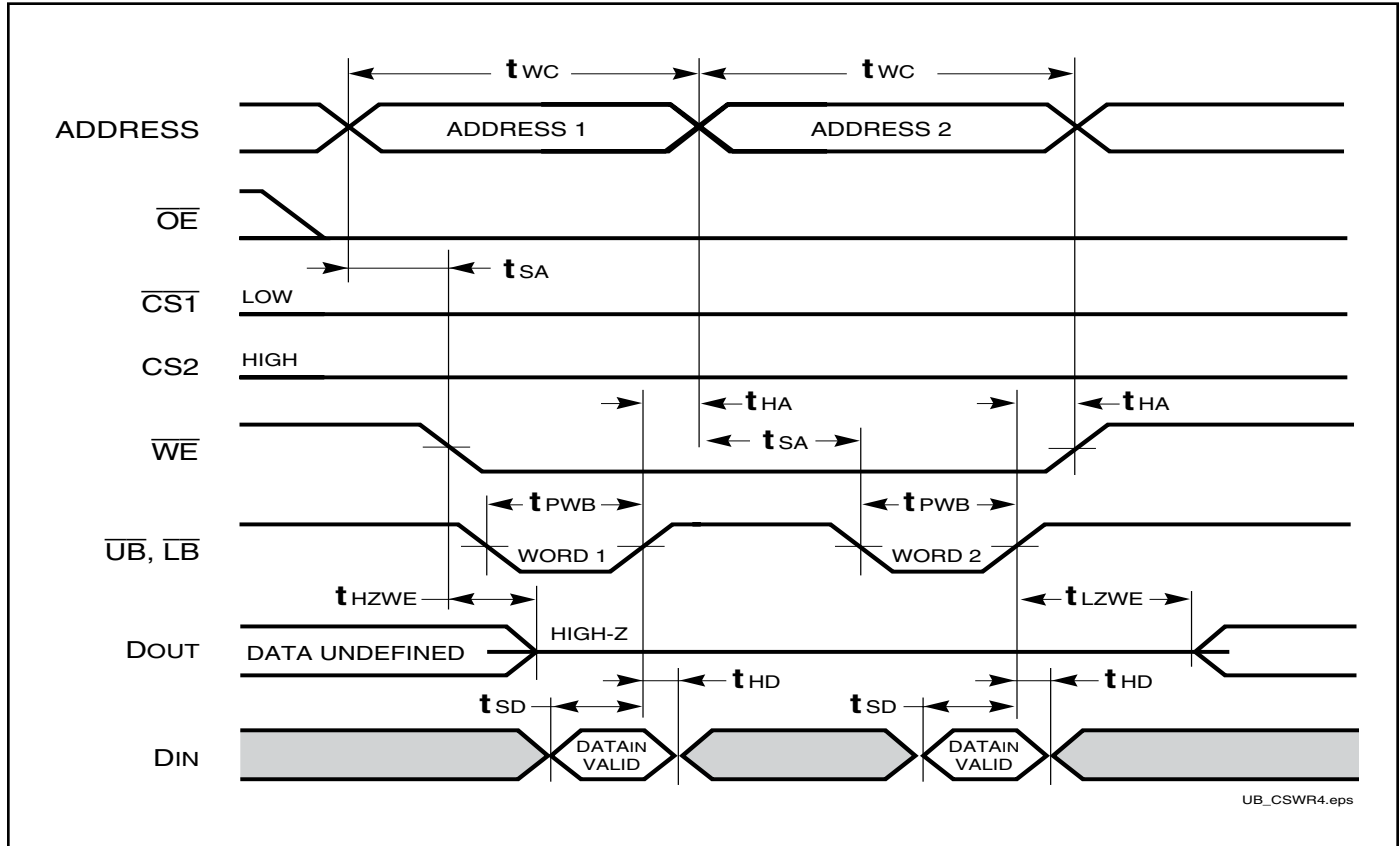


Figure 1: Avoidable Timing

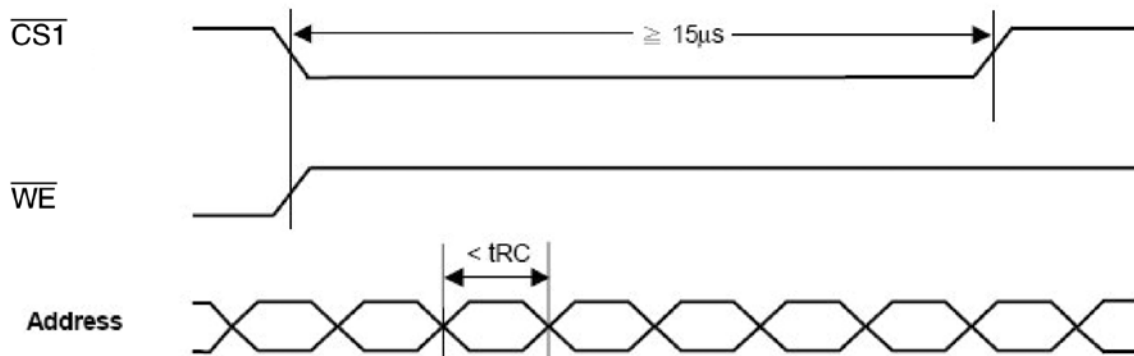


Figure 2:

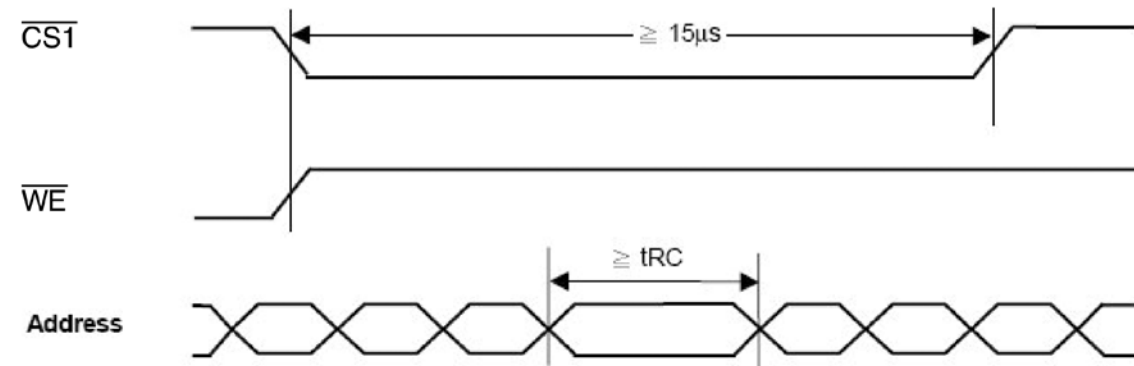
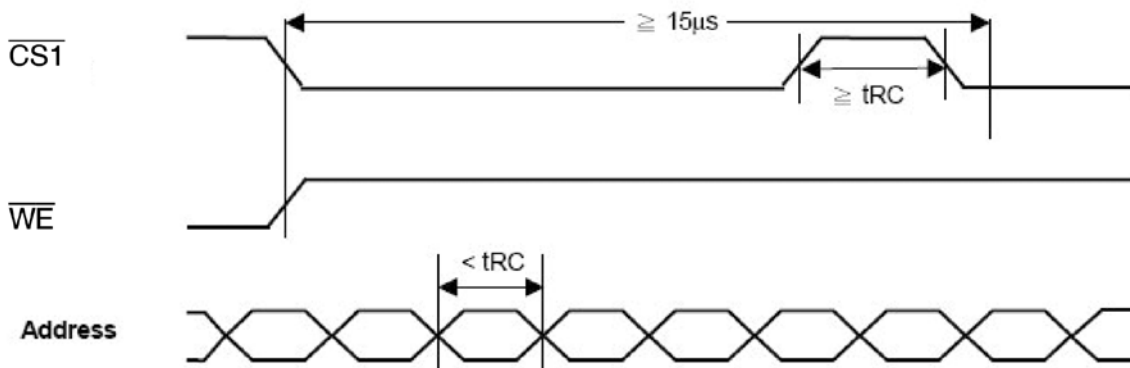


Figure 3:



Please avoid address change for less than t_{RC} during the cycle time longer than $15\mu s$ (Figure 1). Figure 2 & 3 provide work around solution for this issue.

IS66WV51216DALL

Industrial Range: -40°C to +85°C

Voltage Range: 1.7V to 1.95V

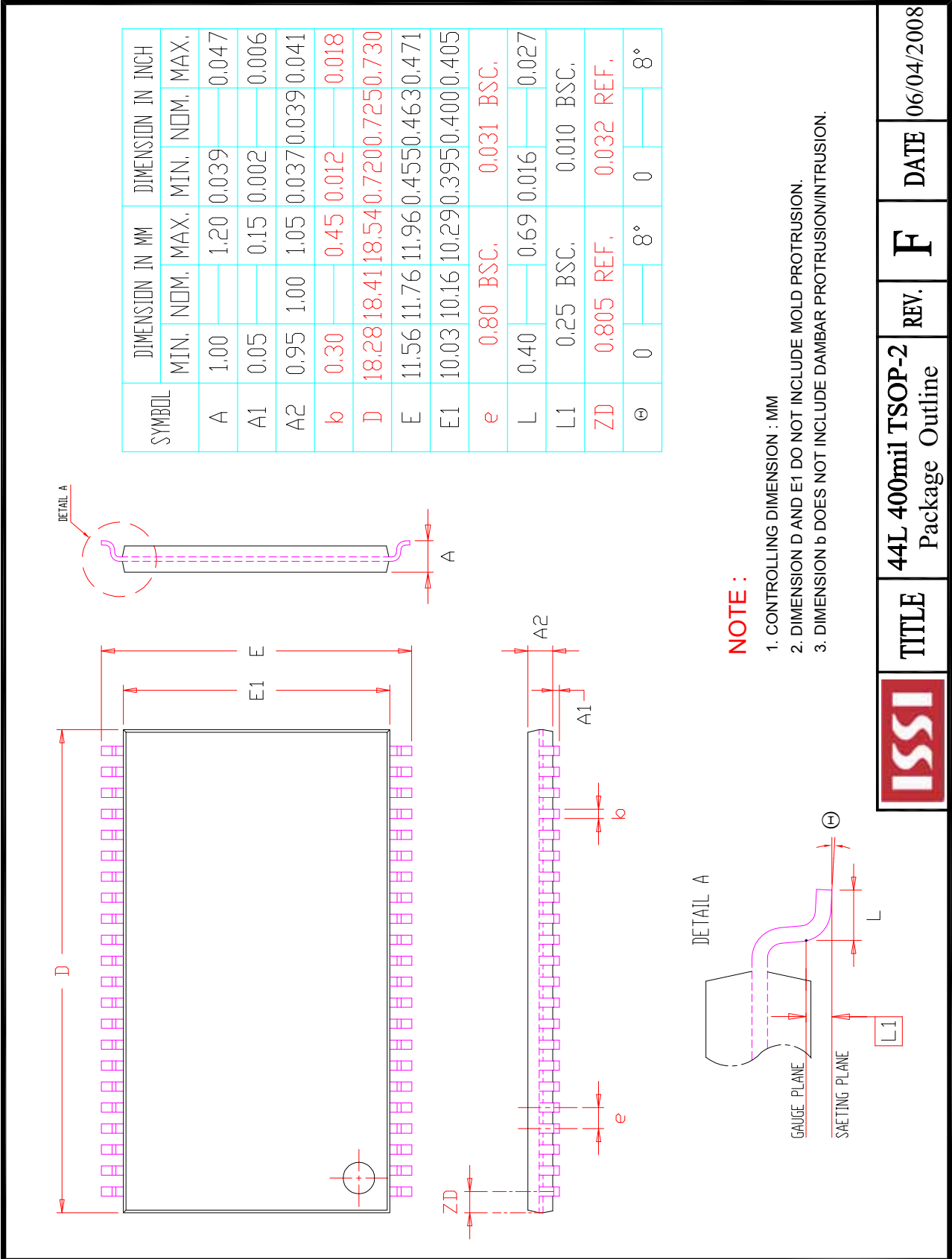
| Speed (ns) | Order Part No. | Package |
|-------------------|-----------------------|---------------------------------|
| 70 | IS66WV51216DALL-70TLI | TSOP-II, Lead-free |
| | IS66WV51216DALL-70BLI | mini BGA (6mm x 8mm), Lead-free |

IS66WV51216DBLL

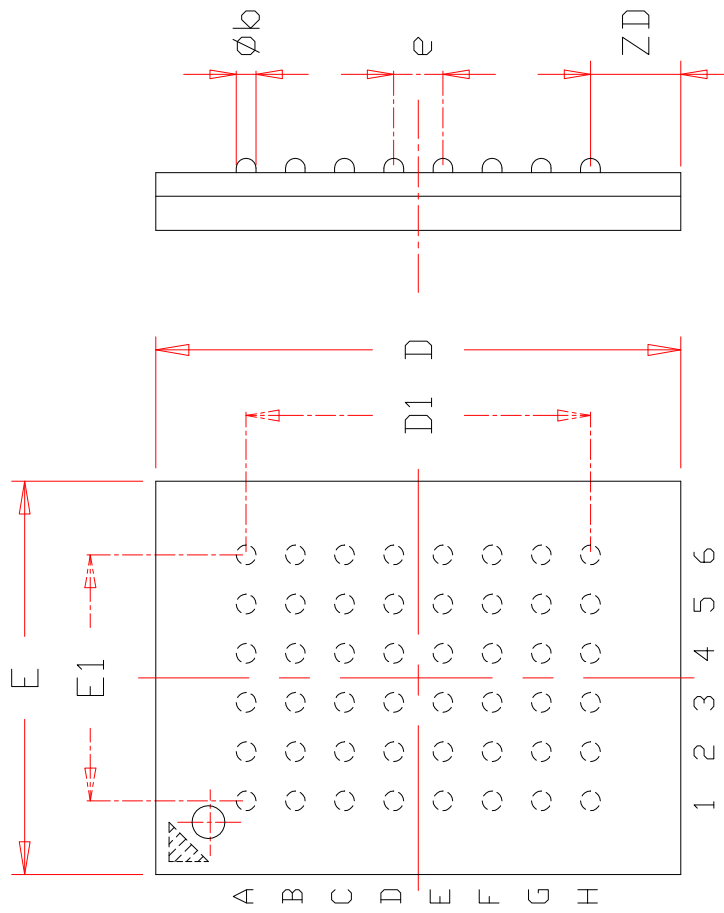
Industrial Range: -40°C to +85°C

Voltage Range: 2.5V to 3.6V

| Speed (ns) | Order Part No. | Package |
|-------------------|-----------------------|---------------------------------|
| 55 | IS66WV51216DBLL-55TLI | TSOP-II, Lead-free |
| | IS66WV51216DBLL-55BLI | mini BGA (6mm x 8mm), Lead-free |
| 70 | IS66WV51216DBLL-70TLI | TSOP-II, Lead-free |
| | IS66WV51216DBLL-70BLI | mini BGA (6mm x 8mm), Lead-free |



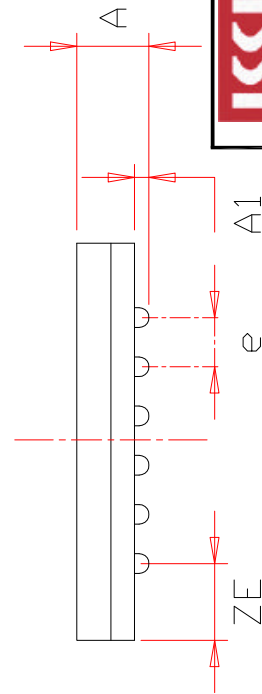
TOP VIEW



| 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

48L 6x8mm TF-BGA
Package Outline

REV.

C

DATE

08/12/2008