

## 1M x 8 LOW VOLTAGE, ULTRA LOW POWER CMOS STATIC RAM

PRELIMINARY INFORMATION  
DECEMBER 2010

### FEATURES

- High-speed access time: 45ns, 55ns
- CMOS low power operation
  - 36 mW (typical) operating
  - 12  $\mu$ W (typical) CMOS standby
- TTL compatible interface levels
- Single power supply
  - 4.5V--5.5V  $V_{DD}$
- Three state outputs
- Automotive temperature (-40°C to +125°C)
- Lead-free available

### DESCRIPTION

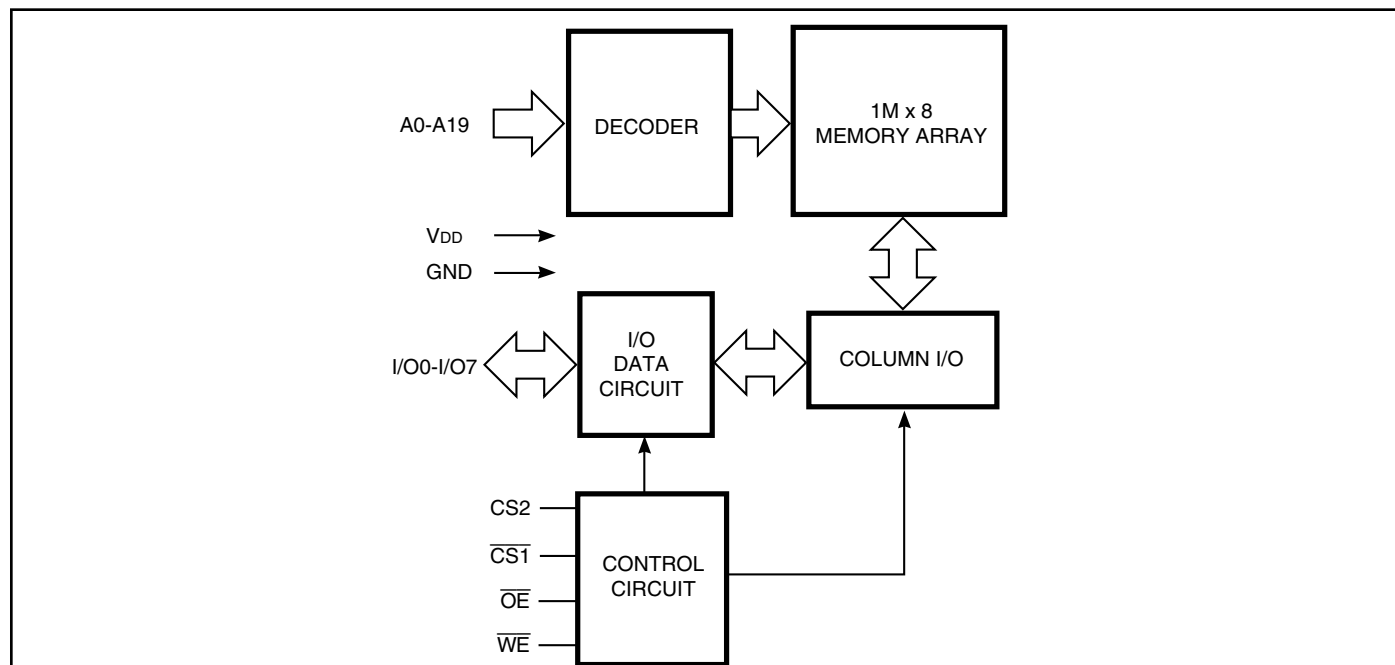
The *ISSI* IS62C10248AL/IS65C10248AL are high-speed, 8M bit static RAMs organized as 1M words by 8 bits. It is fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields high-performance and low power consumption devices.

When  $\overline{CS1}$  is HIGH (deselected) or when 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.

The IS62C10248AL and IS65C10248AL are packaged in the JEDEC standard 48-pin mini BGA (9mm x 11mm) and 44-Pin TSOP (TYPE II).

### FUNCTIONAL BLOCK DIAGRAM



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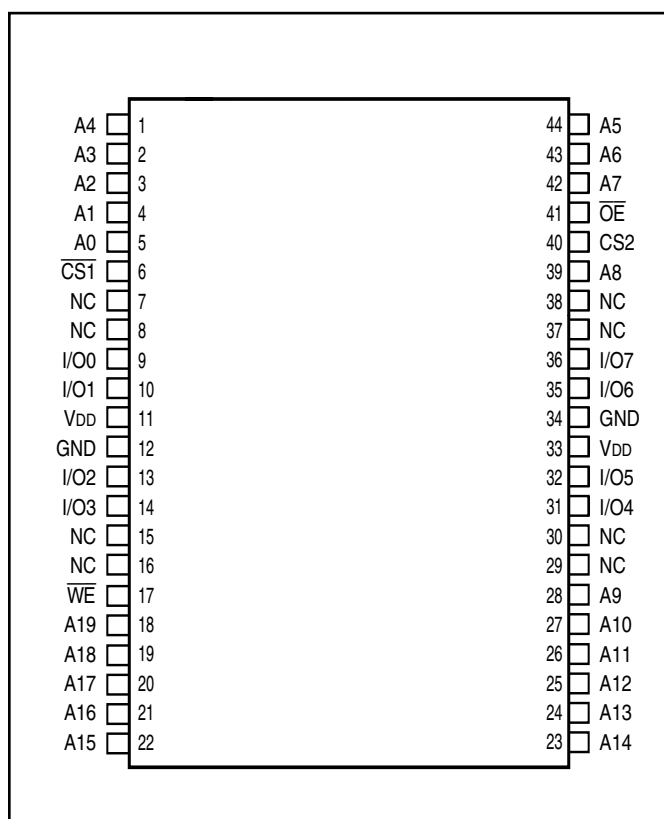
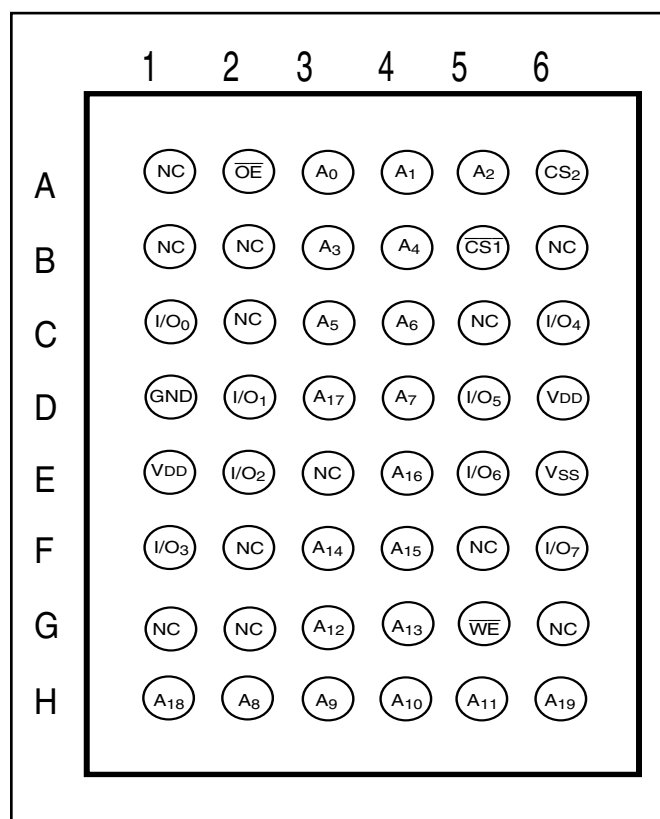
- a.) the risk of injury or damage has been minimized;
- b.) the user assume all such risks; and
- c.) potential liability of Integrated Silicon Solution, Inc is adequately protected under the circumstances

# IS62C10248AL, IS65C10248AL

## PIN CONFIGURATION (1M x 8 Low Power)

48-pin mini BGA (B) (9mm x 11mm)

44-pin TSOP (Type II)



## PIN DESCRIPTIONS

|           |                     |
|-----------|---------------------|
| A0-A19    | Address Inputs      |
| CS1       | Chip Enable 1 Input |
| CS2       | Chip Enable 2 Input |
| OE        | Output Enable Input |
| WE        | Write Enable Input  |
| I/O0-I/O7 | Input/Output        |
| NC        | No Connection       |
| VDD       | Power               |
| GND       | Ground              |

**TRUTH TABLE**

| Mode            | $\overline{WE}$ | $\overline{CS1}$ | CS2 | $\overline{OE}$ | I/O Operation    | V <sub>DD</sub> Current             |
|-----------------|-----------------|------------------|-----|-----------------|------------------|-------------------------------------|
| Not Selected    | X               | H                | X   | X               | High-Z           | I <sub>SB1</sub> , I <sub>SB2</sub> |
| (Power-down)    | X               | X                | L   | X               | High-Z           | I <sub>SB1</sub> , I <sub>SB2</sub> |
| Output Disabled | H               | L                | H   | H               | High-Z           | I <sub>CC</sub>                     |
| Read            | H               | L                | H   | L               | D <sub>OUT</sub> | I <sub>CC</sub>                     |
| Write           | L               | L                | H   | X               | D <sub>IN</sub>  | I <sub>CC</sub>                     |

**OPERATING RANGE (V<sub>DD</sub>)**

| Range      | Ambient Temperature | V <sub>DD</sub> | Speed |
|------------|---------------------|-----------------|-------|
| Commercial | 0°C to +70°C        | 4.5V - 5.5V     | 45ns  |
| Industrial | -40°C to +85°C      | 4.5V - 5.5V     | 55ns  |
| Automotive | -40°C to +125°C     | 4.5V - 5.5V     | 55ns  |

**CAPACITANCE<sup>(1,2)</sup>**

| Symbol           | Parameter          | Conditions            | Max. | Unit |
|------------------|--------------------|-----------------------|------|------|
| C <sub>IN</sub>  | Input Capacitance  | V <sub>IN</sub> = 0V  | 5    | pF   |
| C <sub>OUT</sub> | Output Capacitance | V <sub>OUT</sub> = 0V | 7    | pF   |

**Notes:**

1. Tested initially and after any design or process changes that may affect these parameters.
2. Test conditions: T<sub>A</sub> = 25°C, f = 1 MHz, V<sub>DD</sub> = 5.0V.

**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

| Symbol            | Parameter                            | Value        | Unit |
|-------------------|--------------------------------------|--------------|------|
| V <sub>TERM</sub> | Terminal Voltage with Respect to GND | −0.5 to +7.0 | V    |
| T <sub>STG</sub>  | Storage Temperature                  | −65 to +150  | °C   |
| P <sub>T</sub>    | Power Dissipation                    | 1.5          | W    |
| I <sub>OUT</sub>  | DC Output Current (LOW)              | 20           | mA   |

**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.

**DC ELECTRICAL CHARACTERISTICS** (Over Operating Range)

| Symbol          | Parameter                        | Test Conditions                                              |       | Min. | Max.                  | Unit |
|-----------------|----------------------------------|--------------------------------------------------------------|-------|------|-----------------------|------|
| V <sub>OH</sub> | Output HIGH Voltage              | V <sub>DD</sub> = Min., I <sub>OH</sub> = −1 mA              |       | 2.4  | —                     | V    |
| V <sub>OL</sub> | Output LOW Voltage               | V <sub>DD</sub> = Min., I <sub>OL</sub> = 2.1 mA             |       | —    | 0.4                   | V    |
| V <sub>IH</sub> | Input HIGH Voltage               |                                                              |       | 2.2  | V <sub>DD</sub> + 0.5 | V    |
| V <sub>IL</sub> | Input LOW Voltage <sup>(1)</sup> |                                                              |       | −0.3 | 0.8                   | V    |
| I <sub>LI</sub> | Input Leakage                    | GND ≤ V <sub>IN</sub> ≤ V <sub>DD</sub>                      | Com.  | −1   | 1                     | μA   |
|                 |                                  |                                                              | Ind.  | −2   | 2                     |      |
|                 |                                  |                                                              | Auto. | −5   | 5                     |      |
| I <sub>LO</sub> | Output Leakage                   | GND ≤ V <sub>OUT</sub> ≤ V <sub>DD</sub><br>Outputs Disabled | Com.  | −1   | 1                     | μA   |
|                 |                                  |                                                              | Ind.  | −2   | 2                     |      |
|                 |                                  |                                                              | Auto. | −5   | 5                     |      |

**Note:**

1. V<sub>IL</sub> (min) = −0.3V DC; V<sub>IL</sub> (min) = −2.0V AC (pulse width −2.0 ns). Not 100% tested.  
V<sub>IH</sub> (max) = V<sub>DD</sub> + 0.3V DC; V<sub>IH</sub> (max) = V<sub>DD</sub> + 2.0V AC (pulse width −2.0 ns). Not 100% tested.

## AC TEST CONDITIONS

| Parameter                                   | Unit                |
|---------------------------------------------|---------------------|
| Input Pulse Level                           | 0V to 3.0V          |
| Input Rise and Fall Times                   | 5 ns                |
| Input and Output Timing and Reference Level | 1.5V                |
| Output Load                                 | See Figures 1 and 2 |

## AC TEST LOADS

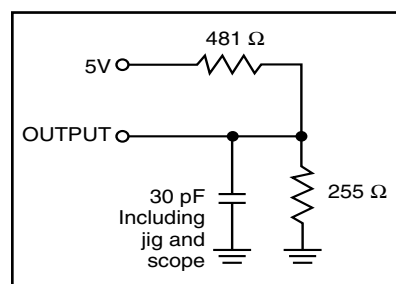


Figure 1

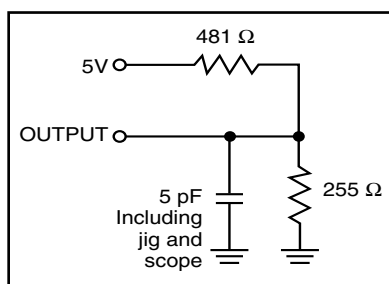


Figure 2

**POWER SUPPLY CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

| Symbol           | Parameter                          | Test Conditions                                                                      |                    | -45 ns |      | -55 ns |      | Unit |
|------------------|------------------------------------|--------------------------------------------------------------------------------------|--------------------|--------|------|--------|------|------|
|                  |                                    |                                                                                      |                    | Min.   | Max. | Min.   | Max. |      |
| I <sub>CC</sub>  | V <sub>DD</sub> Dynamic Operating  | V <sub>DD</sub> = Max., $\overline{CS1} = V_{IL}$ , CS2 = V <sub>IH</sub>            | Com.               | —      | 25   |        |      | mA   |
|                  | Supply Current                     | I <sub>OUT</sub> = 0 mA                                                              | Ind.               |        |      | —      | 25   |      |
|                  |                                    | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                 | Auto.              |        |      | —      | 40   |      |
|                  |                                    | f = f <sub>MAX</sub>                                                                 | typ <sup>(2)</sup> | 13     |      | 12     |      |      |
| I <sub>CC1</sub> | Average operating Current          | $\overline{CS1} = V_{IL}$ , CS2 = V <sub>IH</sub>                                    | Com.               | —      | 10   |        |      | mA   |
|                  |                                    | I <sub>I/O</sub> = 0 mA                                                              | Ind.               |        |      | —      | 10   |      |
|                  |                                    | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                 | Auto.              |        |      | —      | 20   |      |
| I <sub>SB1</sub> | TTL Standby Current (TTL Inputs)   | V <sub>DD</sub> = Max., $\overline{CS1} \geq V_{IH}$ , CS2 ≤ V <sub>IL</sub>         | Com.               | —      | 1    |        |      | mA   |
|                  |                                    | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                 | Ind.               |        |      | —      | 1.5  |      |
|                  |                                    | f = 0                                                                                | Auto.              |        |      | —      | 2    |      |
| I <sub>SB2</sub> | CMOS Standby Current (CMOS Inputs) | V <sub>DD</sub> = Max.,                                                              | Com.               | —      | 40   |        |      | μA   |
|                  |                                    | $\overline{CS1} \geq V_{DD} - 0.2V$ and CS2 ≤ V <sub>SS</sub> + 0.2V                 | Ind.               |        |      | —      | 60   |      |
|                  |                                    | V <sub>IN</sub> ≥ V <sub>DD</sub> - 0.2V or V <sub>IN</sub> ≤ V <sub>SS</sub> + 0.2V | Auto.              |        |      | —      | 180  |      |
|                  |                                    | f = 0                                                                                | typ <sup>(2)</sup> | 15     |      |        |      |      |

**Note:**

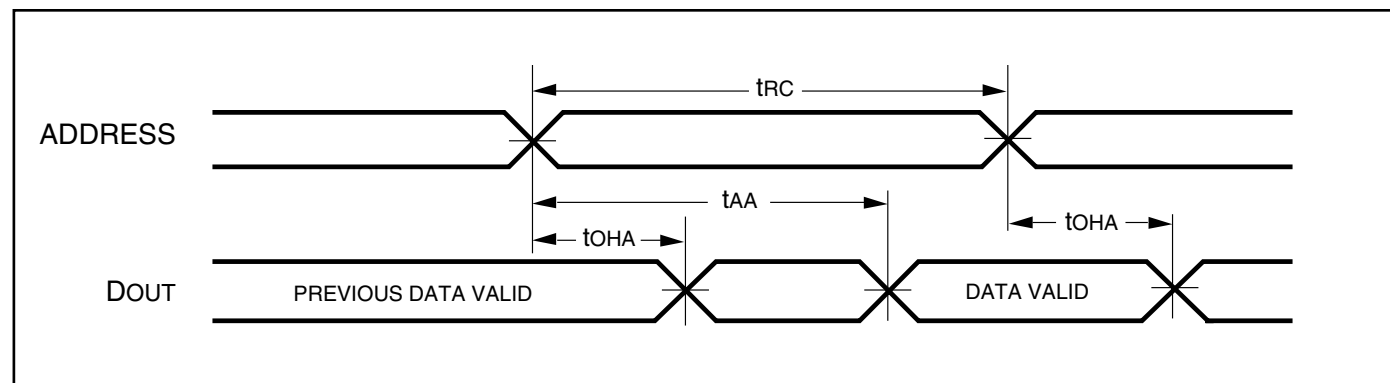
- At f = f<sub>MAX</sub>, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.
- Typical Values are measured at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C and not 100% tested.

**READ CYCLE SWITCHING CHARACTERISTICS<sup>(1)</sup> (Over Operating Range)**

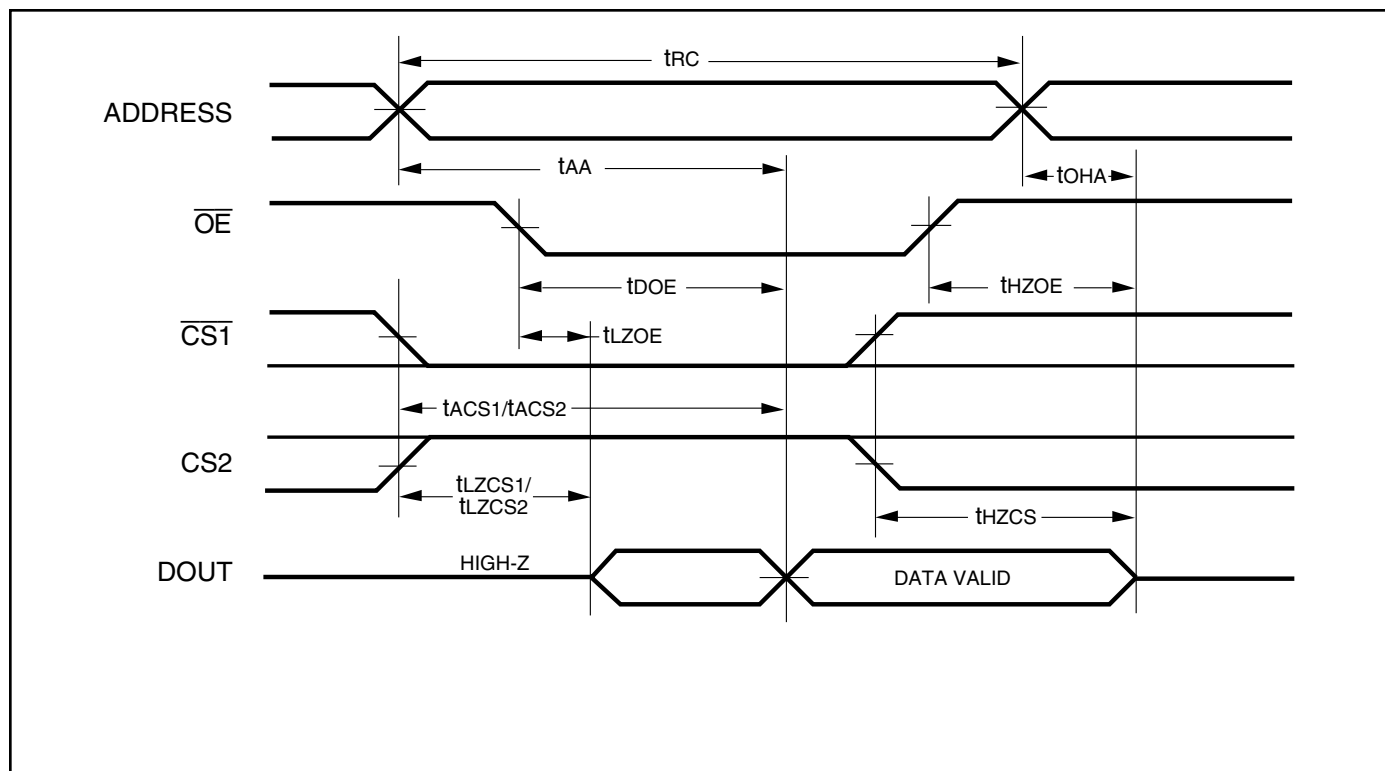
| Symbol                      | Parameter                             | 45 ns |      | 55 ns |      | Unit |
|-----------------------------|---------------------------------------|-------|------|-------|------|------|
|                             |                                       | Min.  | Max. | Min.  | Max. |      |
| $t_{RC}$                    | Read Cycle Time                       | 45    | —    | 55    | —    | ns   |
| $t_{AA}$                    | Address Access Time                   | —     | 45   | —     | 55   | ns   |
| $t_{OHA}$                   | Output Hold Time                      | 10    | —    | 10    | —    | ns   |
| $t_{ACS1}/t_{ACS2}$         | $\overline{CS1}/CS2$ Access Time      | —     | 45   | —     | 55   | ns   |
| $t_{DOE}$                   | $\overline{OE}$ Access Time           | —     | 20   | —     | 25   | ns   |
| $t_{HZOE}^{(2)}$            | $\overline{OE}$ to High-Z Output      | —     | 15   | —     | 20   | 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     | 15   | 0     | 20   | ns   |
| $t_{LZCS1}/t_{LZCS2}^{(2)}$ | $\overline{CS1}/CS2$ to Low-Z Output  | 10    | —    | 10    | —    | ns   |

**Notes:**

1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0V to 3.0V and output loading specified in Figure 1.
2. Tested with the load in Figure 2. Transition is measured  $\pm 500$  mV from steady-state voltage. Not 100% tested.

**AC WAVEFORMS**
**READ CYCLE NO. 1<sup>(1,2)</sup> (Address Controlled) ( $\overline{CS1} = \overline{OE} = V_{IL}$ ,  $CS2 = \overline{WE} = V_{IH}$ )**


## AC WAVEFORMS

READ CYCLE NO. 2<sup>(1,3)</sup> ( $\overline{CS1}$ ,  $CS2$ , AND  $\overline{OE}$  Controlled)**Notes:**

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

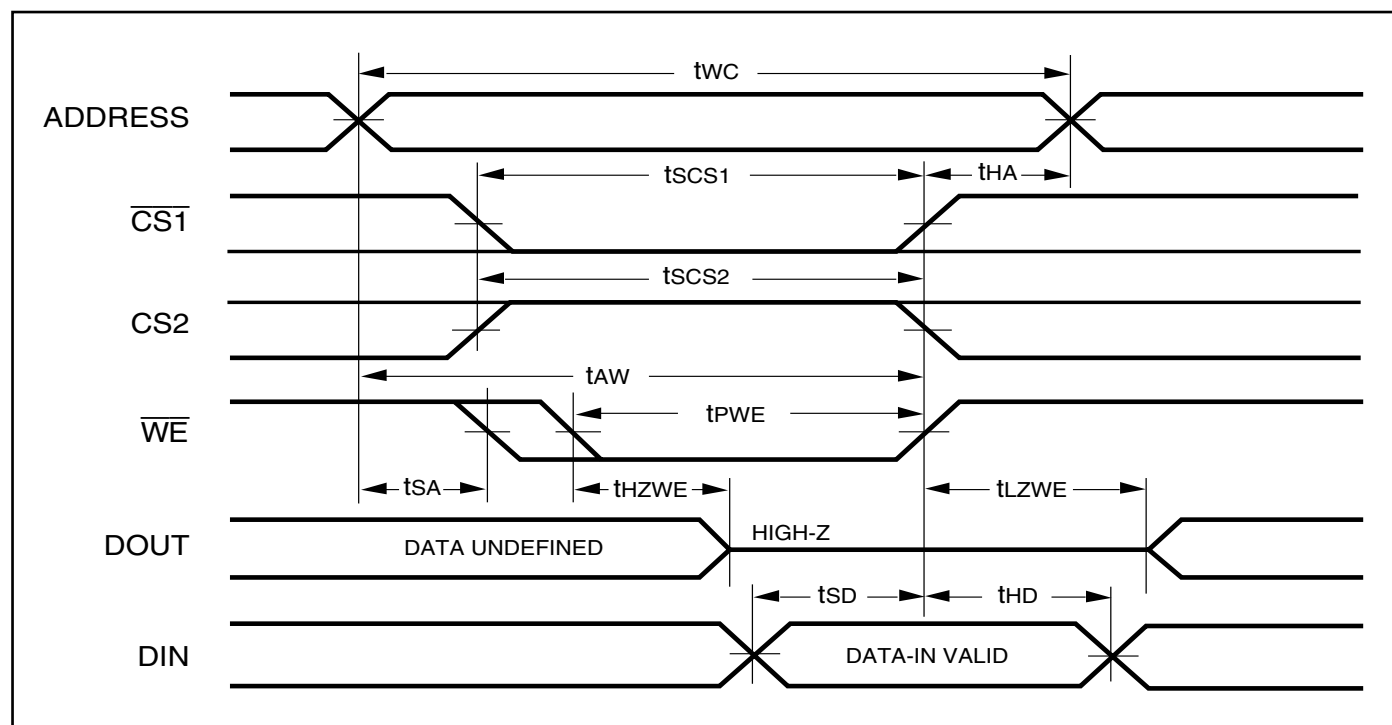


**WRITE CYCLE SWITCHING CHARACTERISTICS<sup>(1,2)</sup> (Over Operating Range)**

| Symbol                               | Parameter                            | 45ns |      | 55 ns |      | Unit |
|--------------------------------------|--------------------------------------|------|------|-------|------|------|
|                                      |                                      | Min. | Max. | Min.  | Max. |      |
| t <sub>WC</sub>                      | Write Cycle Time                     | 45   | —    | 55    | —    | ns   |
| t <sub>SCS1</sub> /t <sub>SCS2</sub> | CS1/CS2 to Write End                 | 35   | —    | 45    | —    | ns   |
| t <sub>AW</sub>                      | Address Setup Time to Write End      | 35   | —    | 45    | —    | ns   |
| t <sub>HA</sub>                      | Address Hold from Write End          | 0    | —    | 0     | —    | ns   |
| t <sub>SA</sub>                      | Address Setup Time                   | 0    | —    | 0     | —    | ns   |
| t <sub>PWE</sub> <sup>(4)</sup>      | $\overline{WE}$ Pulse Width          | 35   | —    | 40    | —    | ns   |
| t <sub>SD</sub>                      | Data Setup to Write End              | 25   | —    | 30    | —    | ns   |
| t <sub>HD</sub>                      | Data Hold from Write End             | 0    | —    | 0     | —    | ns   |
| t <sub>HZWE</sub> <sup>(3)</sup>     | $\overline{WE}$ LOW to High-Z Output | —    | 20   | —     | 20   | ns   |
| t <sub>LZWE</sub> <sup>(3)</sup>     | $\overline{WE}$ HIGH to Low-Z Output | 5    | —    | 5     | —    | ns   |

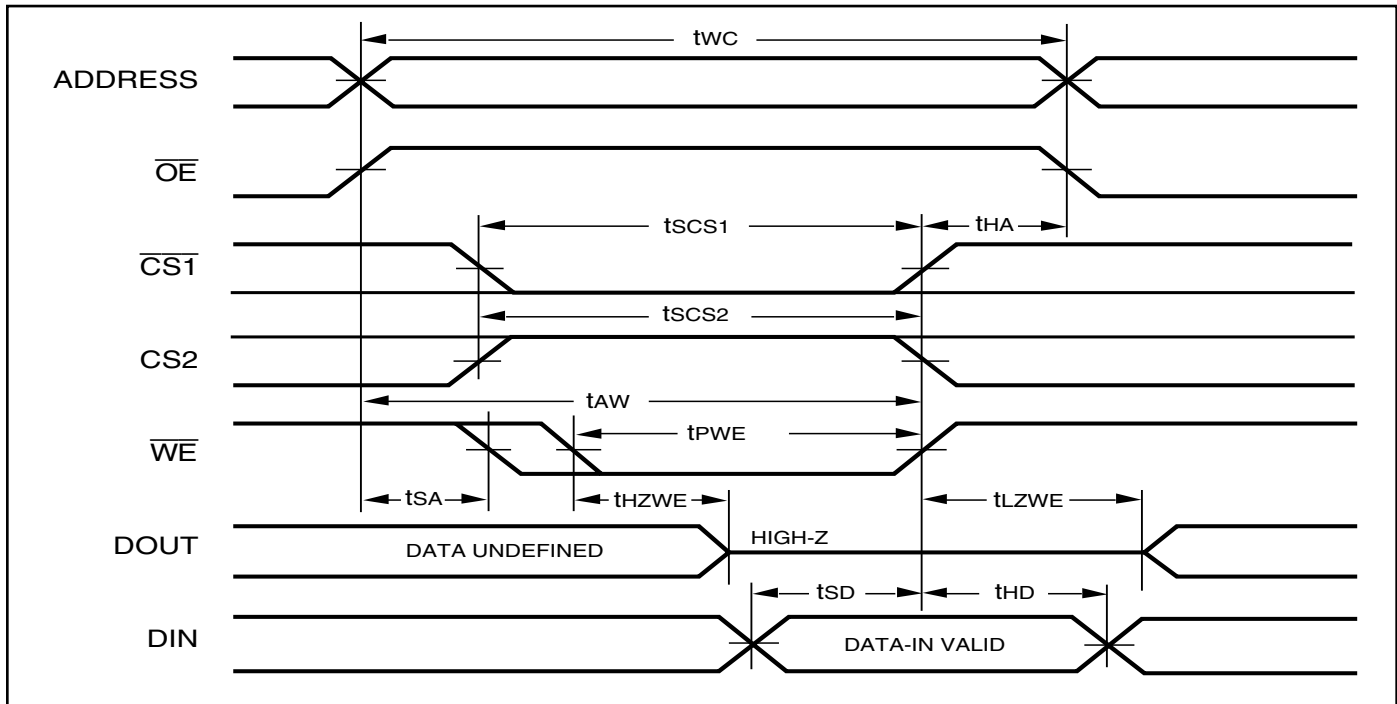
**Notes:**

1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0V to 3.0V and output loading specified in Figure 1.
2. The internal write time is defined by the overlap of  $\overline{CS1}$  LOW, CS2 HIGH, and  $\overline{WE}$  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  $\pm 500$  mV from steady-state voltage. Not 100% tested.
4. t<sub>PWE</sub> > t<sub>HZWE</sub> + t<sub>SD</sub> when  $\overline{OE}$  is LOW.

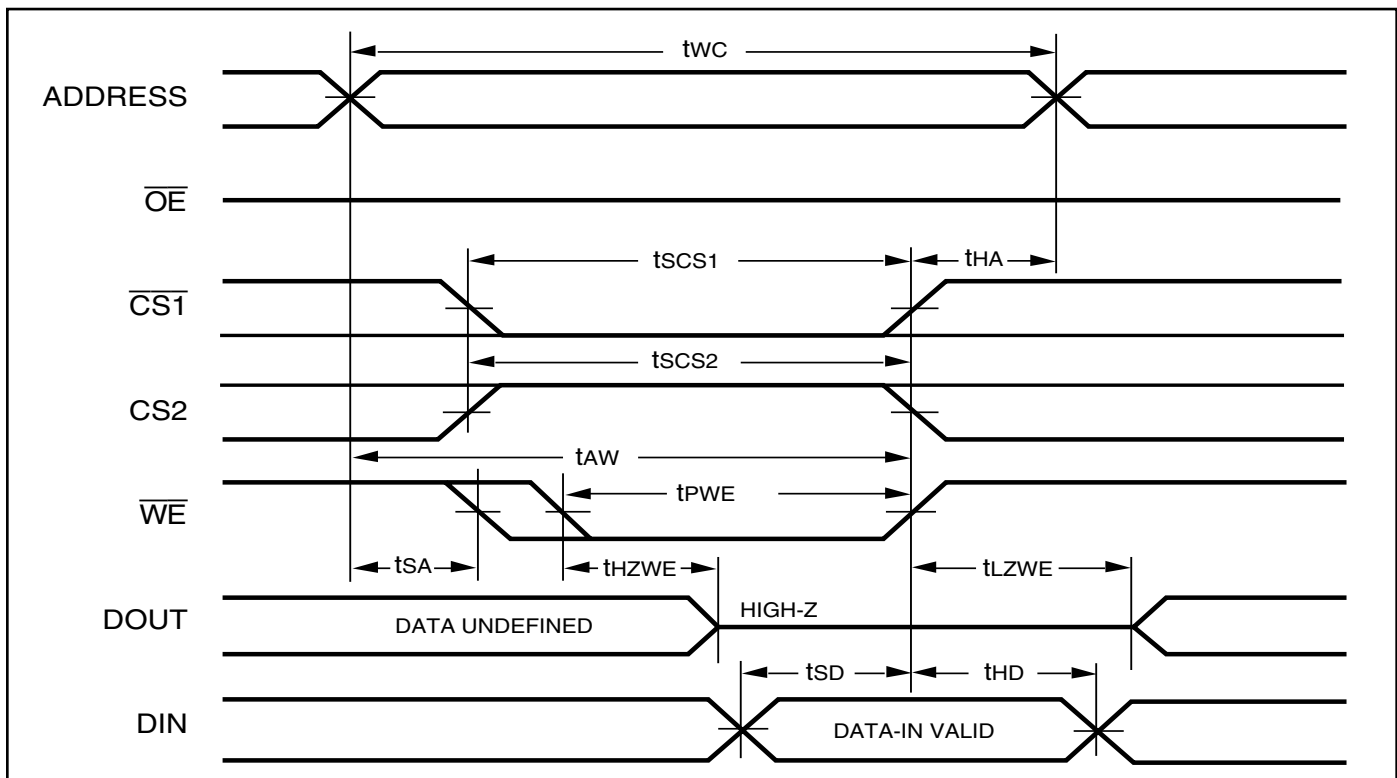
**AC WAVEFORMS**
**WRITE CYCLE NO. 1 ( $\overline{CS1}$ /CS2 Controlled,  $\overline{OE}$  = HIGH or LOW)**


# IS62C10248AL, IS65C10248AL

## 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)



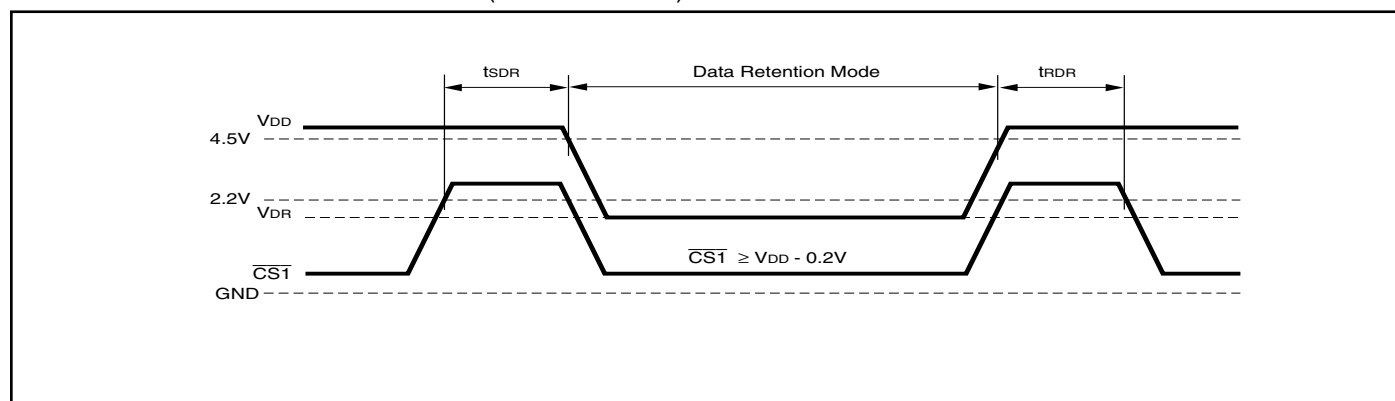
## DATA RETENTION SWITCHING CHARACTERISTICS (4.5V - 5.5V)

| Symbol           | Parameter                          | Test Condition                                                                                                                | Min.            | Typ. <sup>(1)</sup> | Max.                  | Unit |
|------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------|-----------------------|------|
| V <sub>DR</sub>  | V <sub>DD</sub> for Data Retention | See Data Retention Waveform                                                                                                   | 2.0             |                     | 5.5                   | V    |
| I <sub>DR</sub>  | Data Retention Current             | V <sub>DD</sub> = 2.0V and<br>CS1 ≥ V <sub>DD</sub> - 0.2V and<br>(a) CS2 ≥ V <sub>DD</sub> - 0.2V or<br>(b) CS2 ≤ GND + 0.2V | —               | 15                  | 20<br>40<br>60<br>180 | μA   |
| t <sub>SDR</sub> | Data Retention Setup Time          | See Data Retention Waveform                                                                                                   | 0               |                     | —                     | ns   |
| t <sub>RDR</sub> | Recovery Time                      | See Data Retention Waveform                                                                                                   | t <sub>RC</sub> |                     | —                     | ns   |

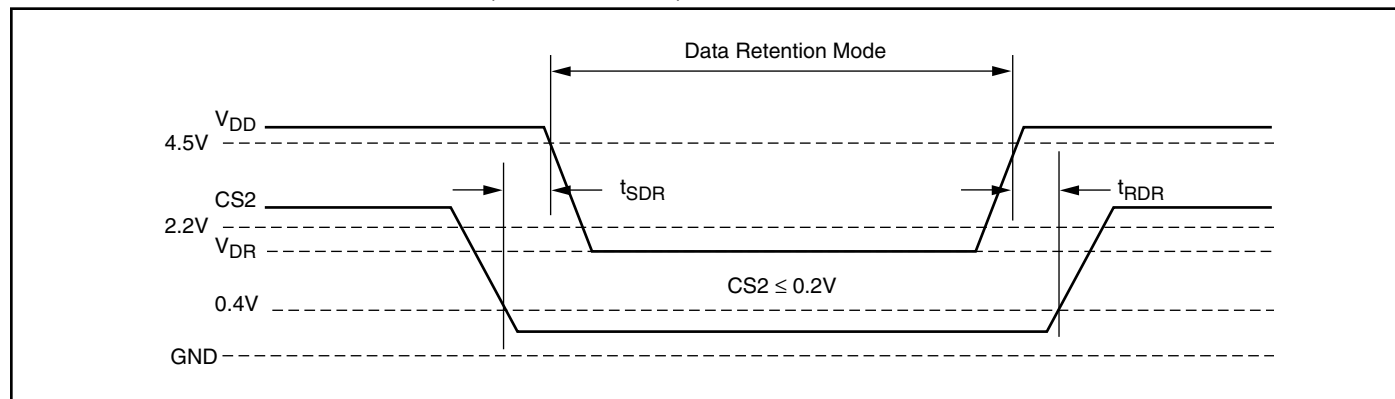
### Note:

1. Typical Values are measured at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C and not 100% tested.

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



## DATA RETENTION WAVEFORM (CS2 Controlled)



## IS62C10248AL, IS65C10248AL

### IS62C10248AL (4.5V - 5.5V)

**Industrial Range: -40°C to +85°C**

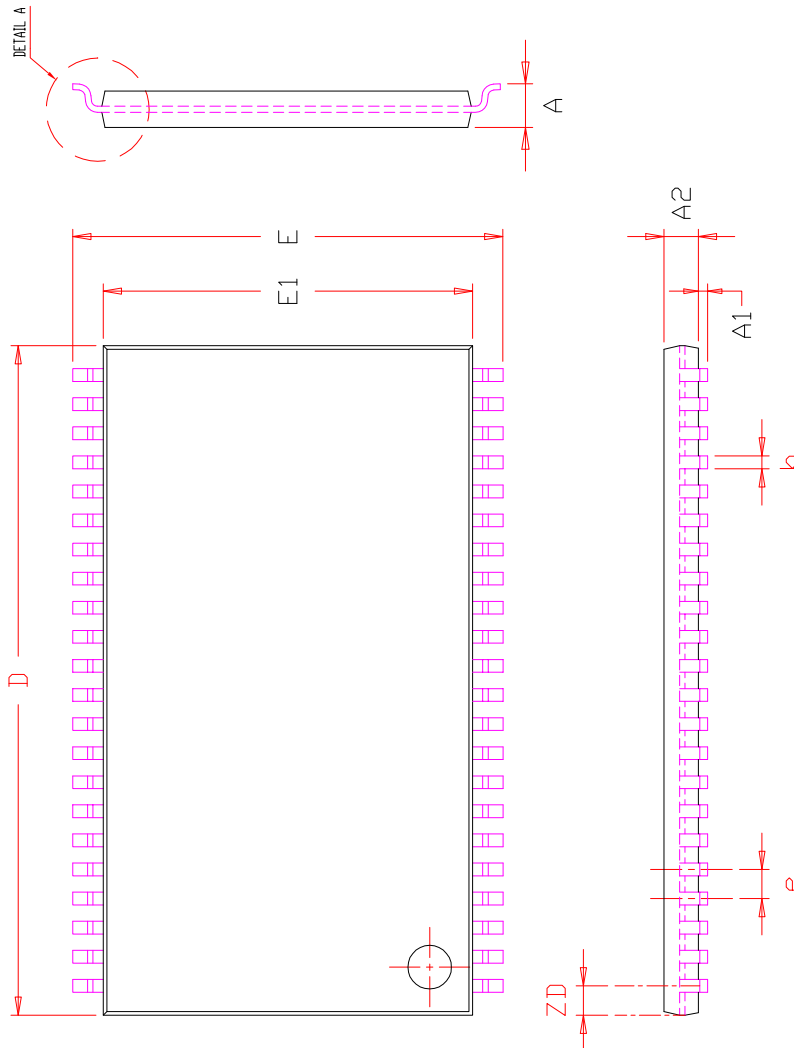
| Speed (ns) | Order Part No.*    | Package                        |
|------------|--------------------|--------------------------------|
| 55         | IS62C10248AL-55TLI | TSOP-II, Lead-free             |
|            | IS62C10248AL-55MLI | mini BGA, Lead-free (9mmx11mm) |

\*Devices will meet 45ns when used in 0°C to +70°C temperature range.

### IS65C10248AL (4.5V - 5.5V)

**Industrial Range: -40°C to +125°C**

| Speed (ns) | Order Part No.       | Package                               |
|------------|----------------------|---------------------------------------|
| 55         | IS65C10248AL-55CTLA3 | TSOP-II, Lead-free, Copper Lead-frame |
|            | IS65C10248AL-55MLA3  | mini BGA, Lead-free (9mmx11mm)        |


**NOTE :**

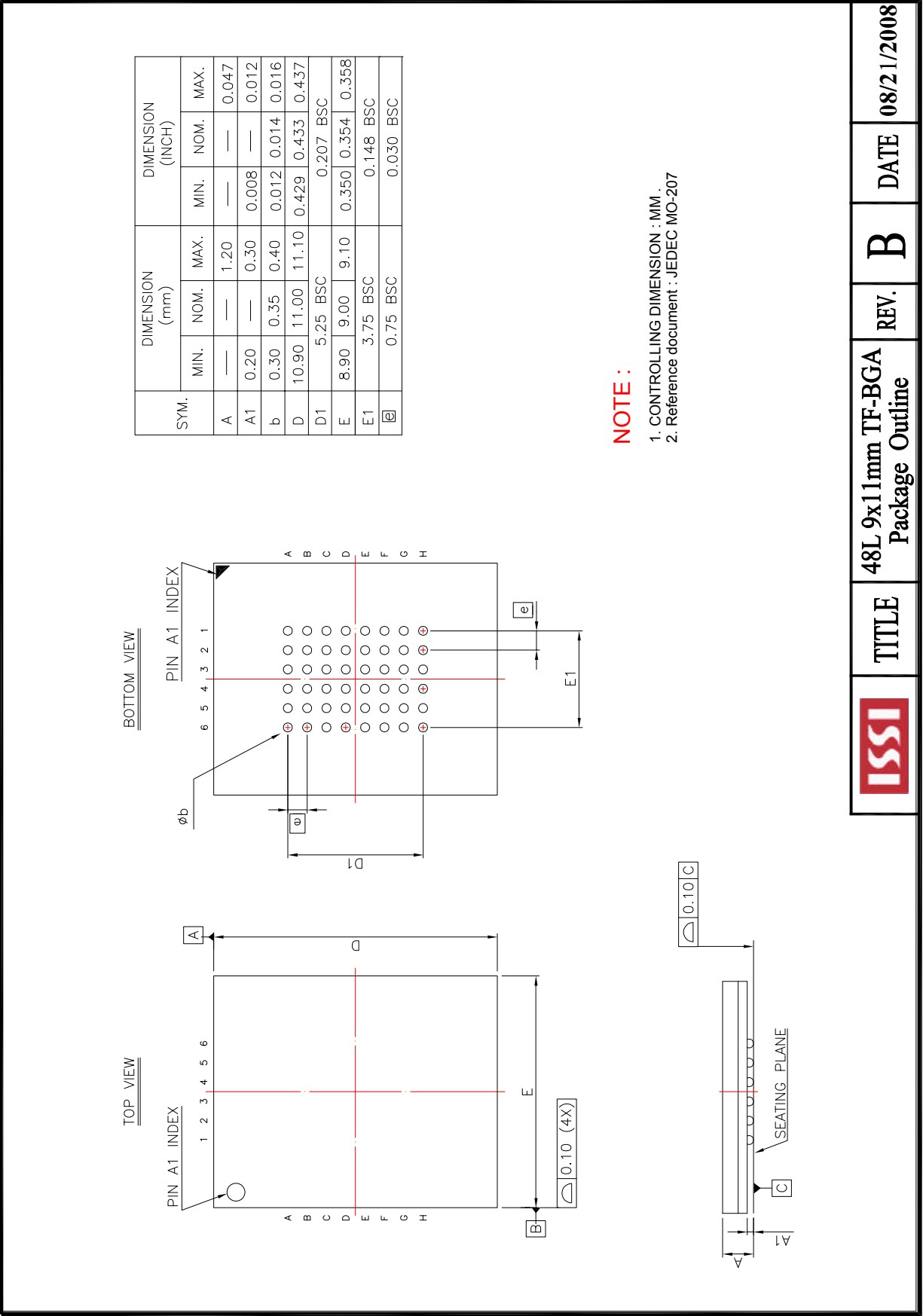
1. CONTROLLING DIMENSION : MM
2. DIMENSION D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION.

| 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°    |


**TITLE**
**44L 400mil TSOP-2**  
Package Outline

**REV.**
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