

# IS62C5128EL, IS65C5128EL

NOVEMBER 2021

## 512Kx8 HIGH SPEED, ULTRA LOW POWER CMOS STATIC RAM

### KEY FEATURES

- High-speed access time: 45ns, 55ns
- CMOS low power operation
  - Operating Current: 22 mA (max) at 85°C
  - CMOS Standby Current: 5.0uA (typ) at 25°C
- TTL compatible interface levels
- Single 5V  $\pm$  10 % power supply
- Three state outputs
- Industrial and Automotive temperature support
- Lead-free available

### DESCRIPTION

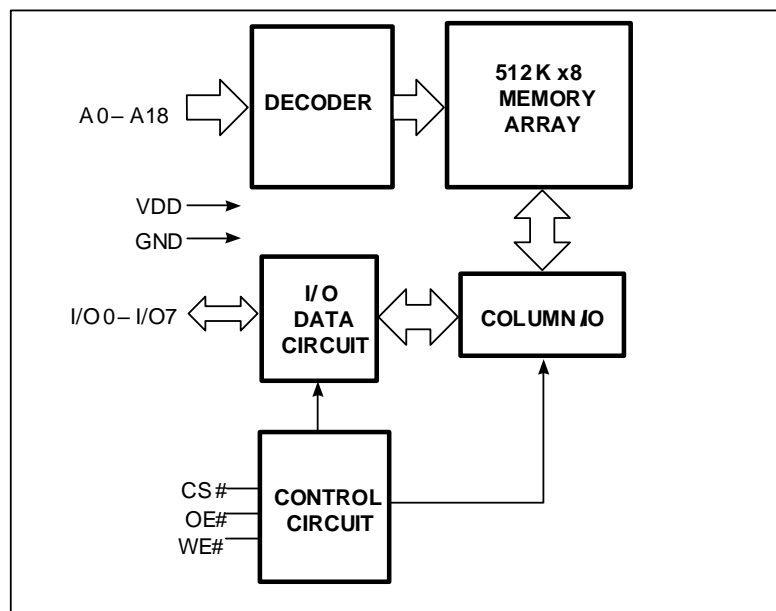
The ISSI IS62/65C5128EL are high-speed, 4M bit static RAMs organized as 512K words by 8 bits. It is fabricated using ISSI's high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields high-performance and low power consumption devices.

When CS# is HIGH (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 (WE#) controls both writing and reading of the memory.

The IS62/65C5128EL are packaged in the JEDEC standard 32-pin sTSSOP (TYPE I), 32-pin SOP and TSOP (TYPE II).

### FUNCTIONAL BLOCK DIAGRAM



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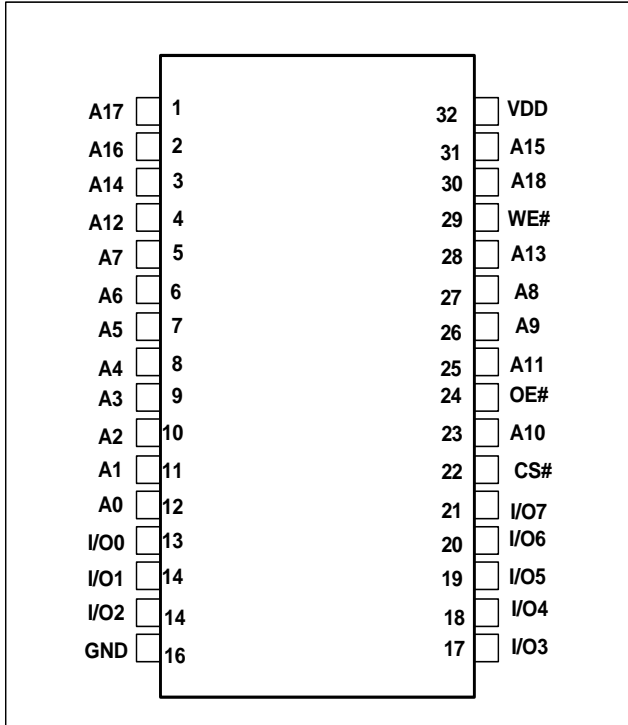
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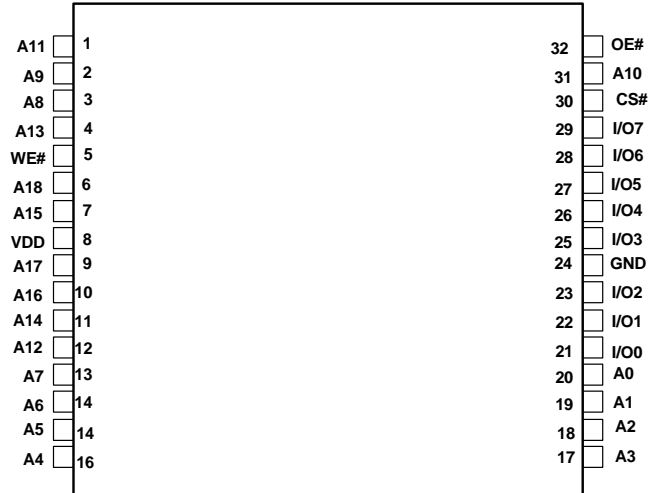
## PIN CONFIGURATIONS

32-Pin SOP

32-Pin TSOP (Type II)



32-Pin sTSOP(Type I)



## PIN DESCRIPTIONS

|           |                     |
|-----------|---------------------|
| A0-A18    | Address Inputs      |
| I/O0-I/O7 | Data Inputs/Outputs |
| CS#       | Chip Enable Input   |
| OE#       | Output Enable Input |
| WE#       | Write Enable Input  |
| NC        | No Connection       |
| VDD       | Power               |
| GND       | Ground              |

## FUNCTION DESCRIPTION

SRAM is one of random access memories. SRAM has three different modes supported. Each function is described below with Truth Table.

### STANDBY MODE

Device enters standby mode when deselected (CS# HIGH). The input and output pins (I/O0-7) are placed in a high impedance state. CMOS input in this mode will maximize saving power.

### WRITE MODE

Write operation issues with Chip selected (CS# LOW) and Write Enable (WE#) input LOW. The input and output pins (I/O0-7) are in data input mode. Output buffers are closed during this time even if OE# is LOW.

### READ MODE

Read operation issues with Chip selected (CS# LOW) and Write Enable (WE#) input HIGH. When OE# is LOW, output buffer turns on to make data output. Any input to I/O pins during READ mode is not permitted.

In the READ mode, output buffers can be turned off by pulling OE# HIGH. In this mode, internal device operates as READ but I/Os are in a high impedance state. Since device is in READ mode, active current is used.

## TRUTH TABLE

| Mode            | CS# | WE# | OE# | I/O0-I/O7 | VDD Current |
|-----------------|-----|-----|-----|-----------|-------------|
| Not Selected    | H   | X   | X   | High-Z    | ISB2        |
| Output Disabled | L   | H   | H   | High-Z    | ICC,ICC1    |
| Write           | L   | L   | X   | DIN       | ICC,ICC1    |
| Read            | L   | H   | L   | DOUT      | ICC,ICC1    |

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## ABSOLUTE MAXIMUM RATINGS AND Operating Range

### 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> <sup>(2)</sup> | 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.

### OPERATING RANGE

| Range      | Ambient Temperature | VDD       | Speed(ns) |
|------------|---------------------|-----------|-----------|
| Commercial | 0°C to +70°C        | 5V ± 10 % | 45        |
| Industrial | -40°C to +85°C      | 5V ± 10 % | 45        |
| Automotive | -40°C to +125°C     | 5V ± 10 % | 55        |

### PIN CAPACITANCE <sup>(1)</sup>

| Parameter                | Symbol           | Test Condition                                                            | Max | Units |
|--------------------------|------------------|---------------------------------------------------------------------------|-----|-------|
| Input capacitance        | C <sub>IN</sub>  | T <sub>A</sub> = 25°C, f = 1 MHz, V <sub>DD</sub> = V <sub>DD</sub> (typ) | 6   | pF    |
| DQ capacitance (IO0–IO7) | C <sub>I/O</sub> |                                                                           | 8   | pF    |

Note:

1. These parameters are guaranteed by design and tested by a sample basis only.

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## AC TEST CONDITIONS (OVER THE OPERATING RANGE)

| Parameter                                   | Unit                    |
|---------------------------------------------|-------------------------|
| Input Pulse Level                           | 0V to 3.5V              |
| Input Rise and Fall Time                    | 3ns                     |
| Input and Output Timing and Reference Level | 1.5V                    |
| R1                                          | 1838 $\Omega$           |
| R2                                          | 994 $\Omega$            |
| V <sub>TM</sub>                             | 5V                      |
| Output Load Conditions                      | Refer to Figure 1 and 2 |

## OUTPUT LOAD CONDITIONS FIGURES

FIGURE 1

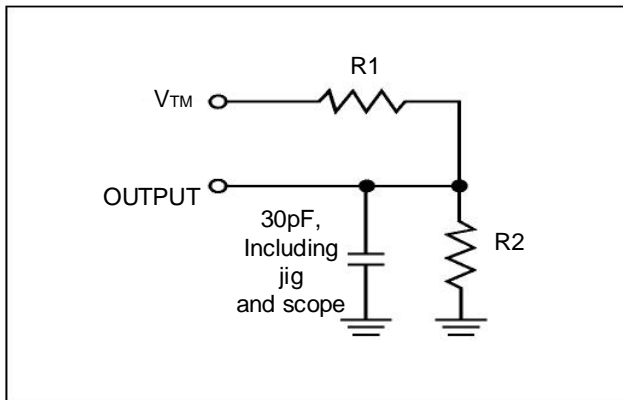
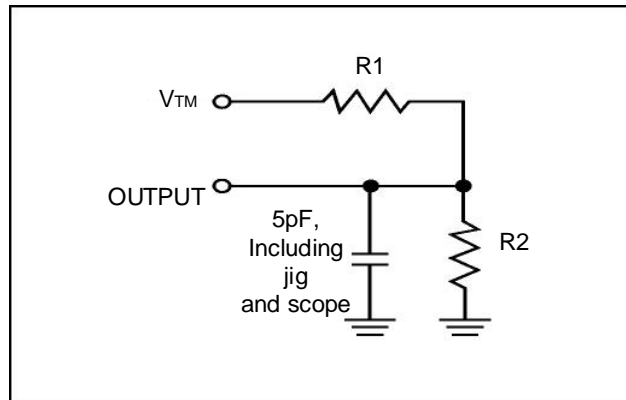


FIGURE 2



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## ELECTRICAL CHARACTERISTICS

### DC ELECTRICAL CHARACTERISTICS-I (OVER THE 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> = -1.0 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> <sup>(1)</sup> | Input HIGH Voltage  |                                                           | 2.2   | V <sub>DD</sub> + 0.5 | V    |    |
| V <sub>IL</sub> <sup>(1)</sup> | Input LOW Voltage   |                                                           | -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>IN</sub> < V <sub>DD</sub> , Output Disabled | Com.  | -1                    | 1    | μA |
|                                |                     |                                                           | Ind.  | -2                    | 2    |    |
|                                |                     |                                                           | Auto. | -5                    | 5    |    |

Notes:

- V<sub>ILL</sub>(min) = -2.0V AC (pulse width < 10ns). Not 100% tested.  
V<sub>IHH</sub>(max) = V<sub>DD</sub> + 2.0V AC (pulse width < 10ns). Not 100% tested.

### DC ELECTRICAL CHARACTERISTICS-II FOR POWER (OVER THE OPERATING RANGE)

| Symbol           | Parameter                                        | Test Conditions                                                                                                                                  | Grade    | 45/55ns            |     | Unit |    |
|------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------|-----|------|----|
|                  |                                                  |                                                                                                                                                  |          | Typ <sup>(1)</sup> | Max |      |    |
| I <sub>CC</sub>  | V <sub>DD</sub> Dynamic Operating Supply Current | V <sub>DD</sub> = V <sub>DD</sub> (max), I <sub>OUT</sub> = 0mA, f = f <sub>max</sub> , CS# = V <sub>IL</sub>                                    | Com.     | -                  | 20  | mA   |    |
|                  |                                                  |                                                                                                                                                  | Ind.     | -                  | 22  |      |    |
|                  |                                                  |                                                                                                                                                  | Auto. A3 | -                  | 22  |      |    |
| I <sub>CC1</sub> | V <sub>DD</sub> Static Operating Supply Current  | V <sub>DD</sub> = V <sub>DD</sub> (max), I <sub>OUT</sub> = 0mA, f = 0, CS# = V <sub>IL</sub>                                                    | Com.     | -                  | 5   | mA   |    |
|                  |                                                  |                                                                                                                                                  | Ind.     | -                  | 5   |      |    |
|                  |                                                  |                                                                                                                                                  | Auto. A3 | -                  | 5   |      |    |
| I <sub>SB2</sub> | CMOS Standby Current (CMOS Inputs)               | V <sub>DD</sub> = V <sub>DD</sub> (max), f = 0, CS# ≥ V <sub>DD</sub> - 0.2V, V <sub>IN</sub> ≤ 0.2V or V <sub>IN</sub> ≥ V <sub>DD</sub> - 0.2V | Com.     | 25°C               | 5.0 | 8    | μA |
|                  |                                                  |                                                                                                                                                  |          | 40°C               | -   | 9    |    |
|                  |                                                  |                                                                                                                                                  |          | 70°C               | -   | 11   |    |
|                  |                                                  |                                                                                                                                                  | Ind.     | 85°C               | -   | 16   |    |
|                  |                                                  |                                                                                                                                                  | Auto. A3 | 125°C              | -   | 30   |    |

Note:

- V<sub>ILL</sub>(min) = -2.0V AC (pulse width < 10ns). Not 100% tested.  
V<sub>IHH</sub>(max) = V<sub>DD</sub> + 2.0V AC (pulse width < 10ns). Not 100% tested.

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## AC CHARACTERISTICS<sup>(6)</sup> (OVER OPERATING RANGE)

### READ CYCLE AC CHARACTERISTICS

| Parameter            | Symbol | 45ns |     | 55ns |     | unit | notes |
|----------------------|--------|------|-----|------|-----|------|-------|
|                      |        | Min  | Max | Min  | Max |      |       |
| Read Cycle Time      | tRC    | 45   | -   | 55   | -   | ns   | 1,5   |
| Address Access Time  | tAA    | -    | 45  | -    | 55  | ns   | 1     |
| Output Hold Time     | tOHA   | 10   | -   | 10   | -   | ns   | 1     |
| CS# Access Time      | tACS   | -    | 45  | -    | 55  | ns   | 1     |
| OE# Access Time      | tDOE   | -    | 20  | -    | 25  | ns   | 1     |
| OE# to High-Z Output | tHZOE  | -    | 15  | -    | 15  | ns   | 2     |
| OE# to Low-Z Output  | tLZOE  | 5    | -   | 5    | -   | ns   | 2     |
| CS# to High-Z Output | tHZCS  | -    | 15  | -    | 15  | ns   | 2     |
| CS# to Low-Z Output  | tLZCS  | 5    | -   | 5    | -   | ns   | 2     |

### WRITE CYCLE AC CHARACTERISTICS

| Parameter                       | Symbol | 45ns |     | 55ns |     | unit | notes |
|---------------------------------|--------|------|-----|------|-----|------|-------|
|                                 |        | Min  | Max | Min  | Max |      |       |
| Write Cycle Time                | tWC    | 45   | -   | 55   | -   | ns   | 1,3,5 |
| CS# to Write End                | tSCS   | 35   | -   | 35   | -   | ns   | 1,3   |
| Address Setup Time to Write End | tAW    | 35   | -   | 35   | -   | ns   | 1,3   |
| Address Hold from Write End     | tHA    | 0    | -   | 0    | -   | ns   | 1,3   |
| Address Setup Time              | tSA    | 0    | -   | 0    | -   | ns   | 1,3   |
| WE# Pulse Width                 | tPWE   | 35   | -   | 35   | -   | ns   | 1,3,4 |
| Data Setup to Write End         | tSD    | 20   | -   | 25   | -   | ns   | 1,3   |
| Data Hold from Write End        | tHD    | 0    | -   | 0    | -   | ns   | 1,3   |
| WE# LOW to High-Z Output        | tHZWE  | -    | 15  | -    | 15  | ns   | 2,3   |
| WE# HIGH to Low-Z Output        | tLZWE  | 5    | -   | 5    | -   | ns   | 2,3   |

#### Notes:

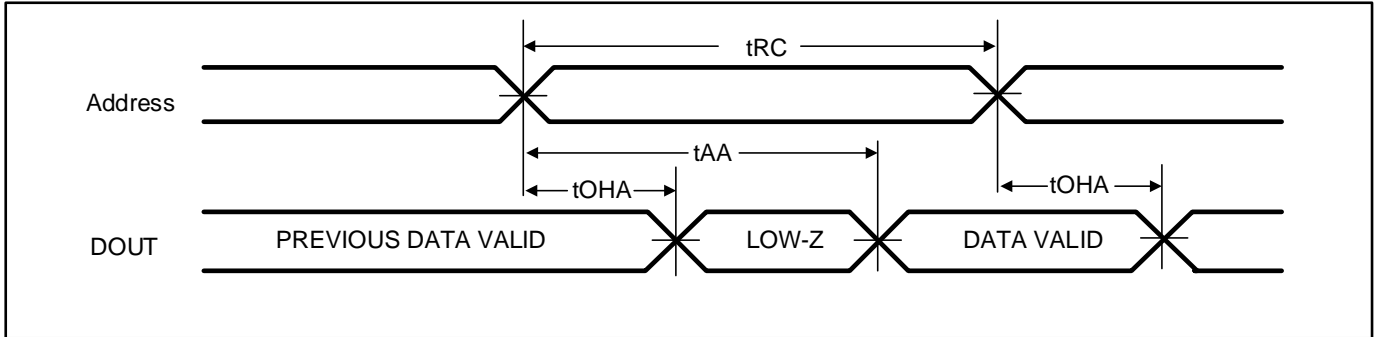
1. Tested with the load in Figure 1.
2. Tested with the load in Figure 2. Transition is measured  $\pm 500$  mV from steady-state voltage. tHZOE, tHZCS, tHZB, and tHZWE transitions are measured when the output enters a high impedance state. Not 100% tested.
3. The internal write time is defined by the overlap of CS#=LOW, and WE#=LOW. All four conditions must be in valid states to initiate a Write, but any condition 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.
4. tPWE > tHZWE + tSD when OE# is LOW.
5. Address inputs must meet V<sub>IH</sub> and V<sub>IL</sub> SPEC during this period. Any glitch or unknown inputs are not permitted. Unknown input with standby mode is acceptable.
6. Data retention characteristics are defined later in DATA RETENTION CHARACTERISTICS.

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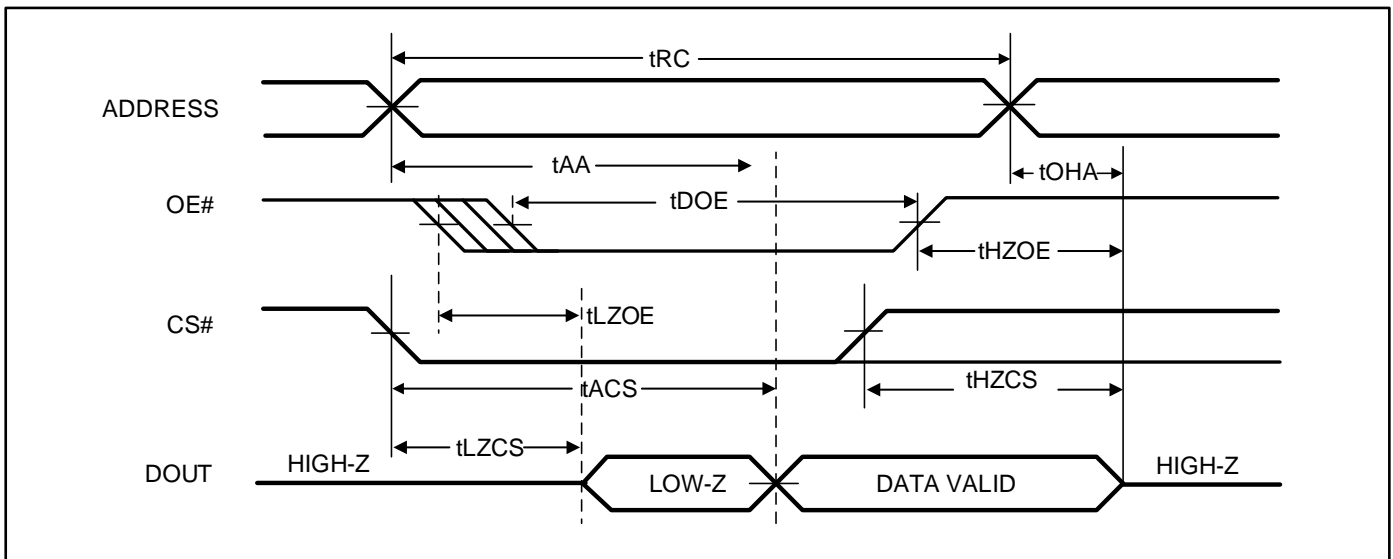


## TIMING DIAGRAM

### READ CYCLE NO. 1<sup>(1)</sup> (ADDRESS CONTROLLED, CS# = OE# = LOW, WE# = HIGH)



### READ CYCLE NO. 2<sup>(1,2)</sup> (CS#, OE# CONTROLLED)



Note:

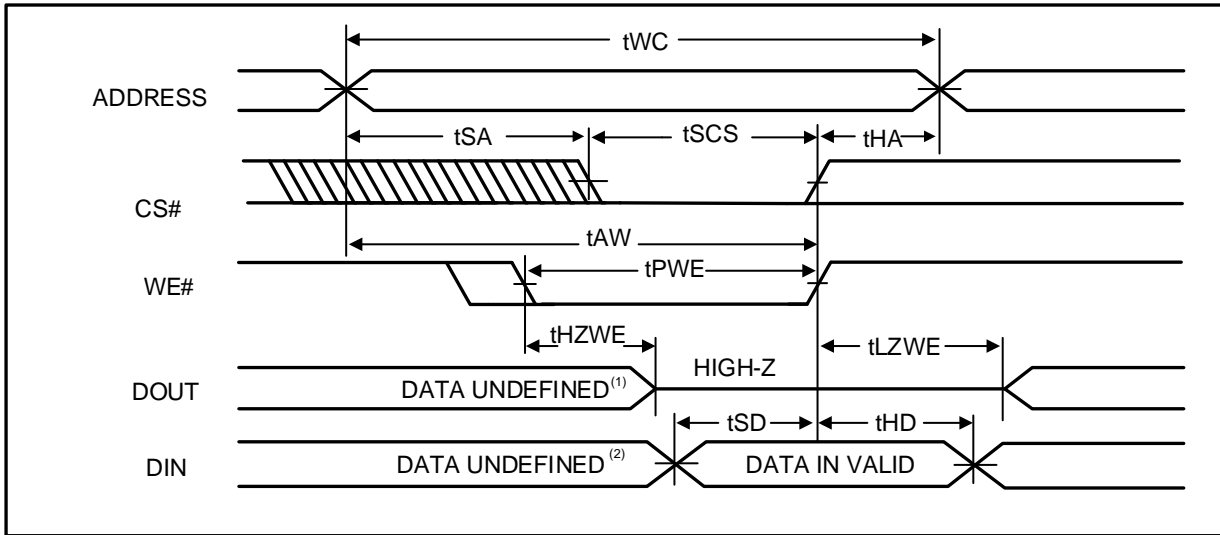
1. Address is valid prior to or coincident with CS# LOW transition.



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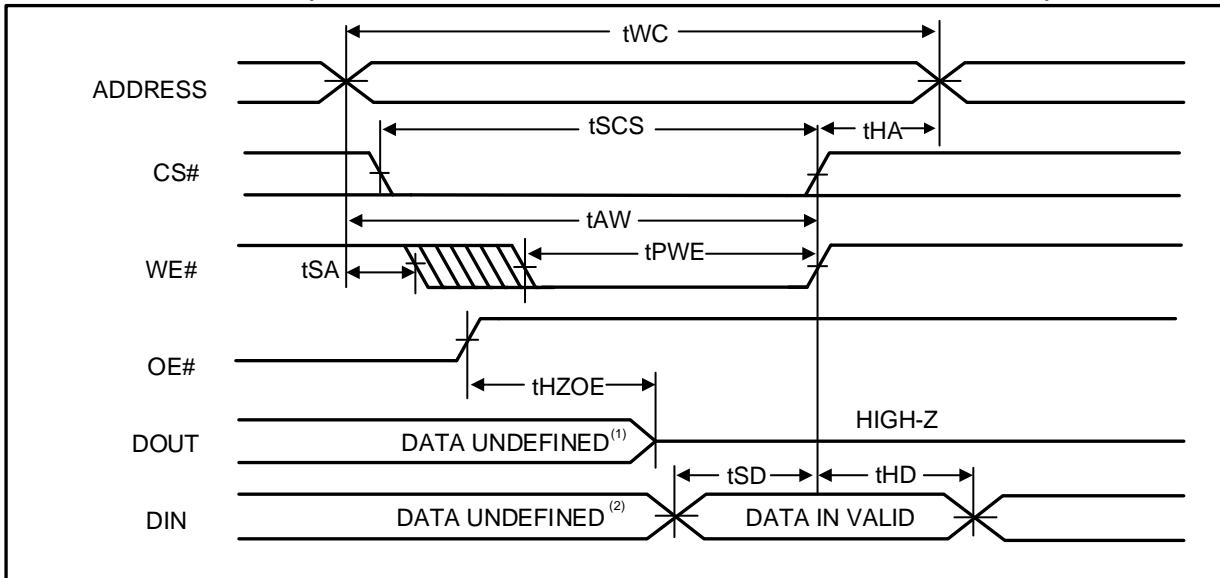
## WRITE CYCLE NO. 1 <sup>(1,2)</sup> (CS# Controlled, OE# = HIGH or LOW)



Notes:

1. tHZWE is based on the assumption when tSA=0nS after READ operation. Actual DOUT for tHZWE may not appear if OE# goes high before Write Cycle. tHZOE is the time DOUT goes to High-Z after OE# goes high.
2. During this period, the I/Os are in output state. Do not apply input signals.

## WRITE CYCLE NO. 2 <sup>(1,2)</sup> (WE# CONTROLLED: OE# IS HIGH DURING WRITE CYCLE)



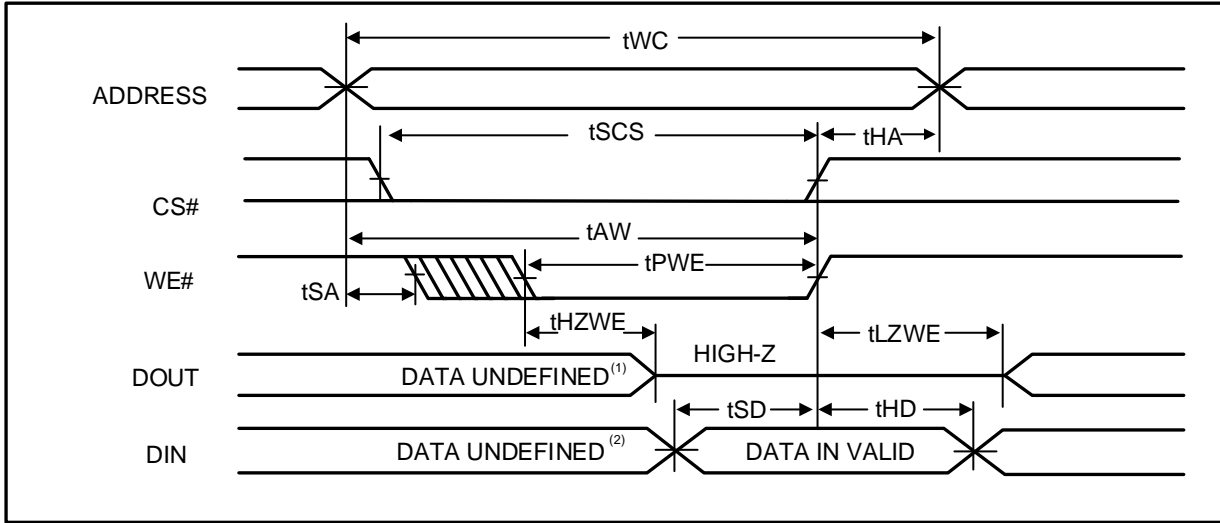
Notes:

1. tHZOE is the time DOUT goes to High-Z after OE# goes high.
2. During this period the I/Os are in output state. Do not apply input signals.

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WRITE CYCLE NO. 3<sup>(1)</sup> (WE# CONTROLLED: OE# IS LOW DURING WRITE CYCLE)



Note:

1. If OE# is low during write cycle, tHZWE must be met in the application. Do not apply input signal during this period. Data output from the previous READ operation will drive IO BUS.

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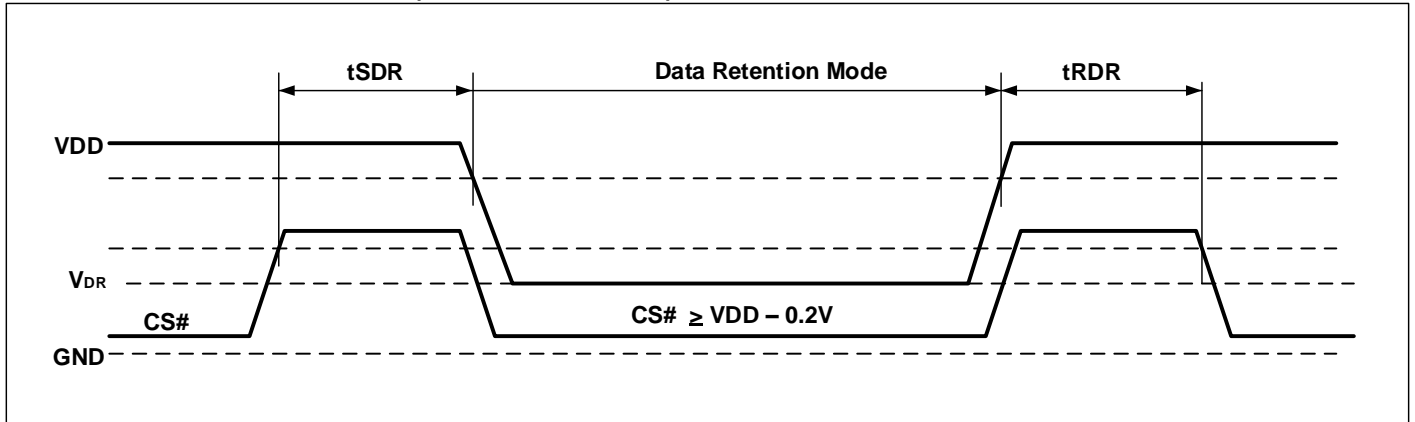
## DATA RETENTION CHARACTERISTICS

| Symbol                          | Parameter                          | Test Condition                                                                                                            | OPTION | Min             | Typ <sup>(1)</sup> | Max | Unit |
|---------------------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------|-----------------|--------------------|-----|------|
| V <sub>DR</sub>                 | V <sub>DD</sub> for Data Retention | See Data Retention Waveform                                                                                               |        | 2.0             | -                  | -   | V    |
| I <sub>DR</sub>                 | Data Retention Current             | V <sub>DD</sub> = V <sub>DR</sub> (min),<br>CS# ≥ V <sub>DD</sub> - 0.2V or<br>VIN ≤ 0.2V or VIN ≥ V <sub>DD</sub> - 0.2V | 25°C   | -               | 5.0                | 8   | μA   |
|                                 |                                    |                                                                                                                           | 85°C   | -               | -                  | 16  |      |
|                                 |                                    |                                                                                                                           | 125°C  | -               | -                  | 30  |      |
| t <sub>SDR</sub> <sup>(2)</sup> | Data Retention Setup Time          | See Data Retention Waveform                                                                                               |        | -               | -                  | -   | ns   |
| t <sub>RDR</sub>                | Recovery Time                      | See Data Retention Waveform                                                                                               |        | t <sub>RC</sub> | -                  | -   | ns   |

Notes:

1. Typical value indicates the value for the center of distribution at V<sub>DD</sub> = V<sub>DR</sub> (min.), and not 100% tested.
2. V<sub>DD</sub> power down slope must be longer than 100 us/volt when enter into Data Retention Mode.

### DATA RETENTION WAVEFORM (CS# CONTROLLED)



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## ORDERING INFORMATION

### IS62C5128EL

#### Industrial Range: -40°C to +85°C

| Speed (ns) | Order Part No.    | Package                        |
|------------|-------------------|--------------------------------|
| 45         | IS62C5128EL-45QLI | 450-mil Plastic SOP, Lead-free |
| 45         | IS62C5128EL-45HLI | 32-pin sTSOP-I, Lead-free      |
| 45         | IS62C5128EL-45TLI | 32-pin TSOP-II, Lead-free      |

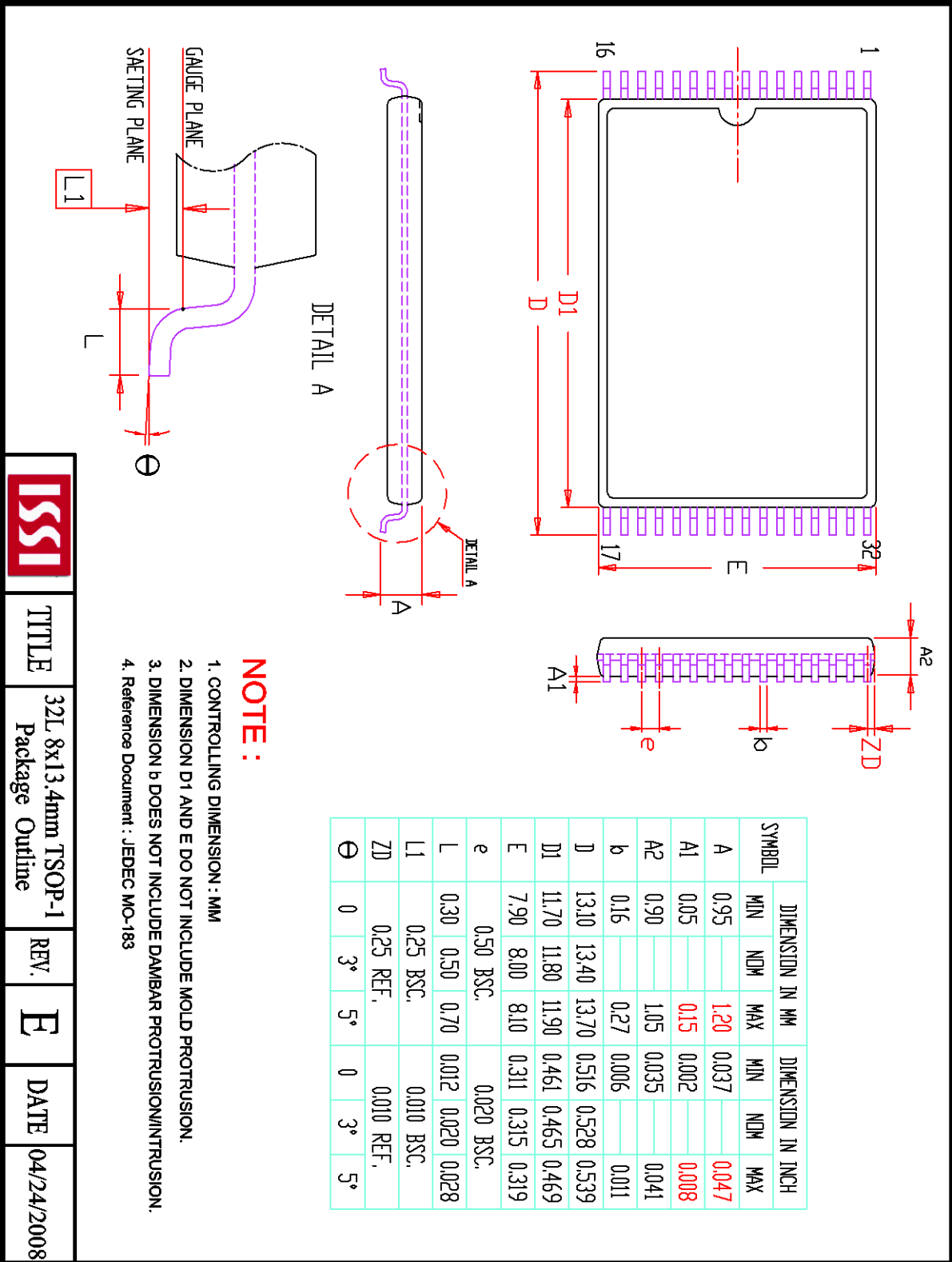
#### AUTOMOTIVE RANGE (A3): -40°C TO +125°C

| Speed (ns) | Order Part No.      | Package                                     |
|------------|---------------------|---------------------------------------------|
| 45         | IS62C5128EL-45CTLA3 | 32-pin TSOP-II, Lead-free, Copper Leadframe |

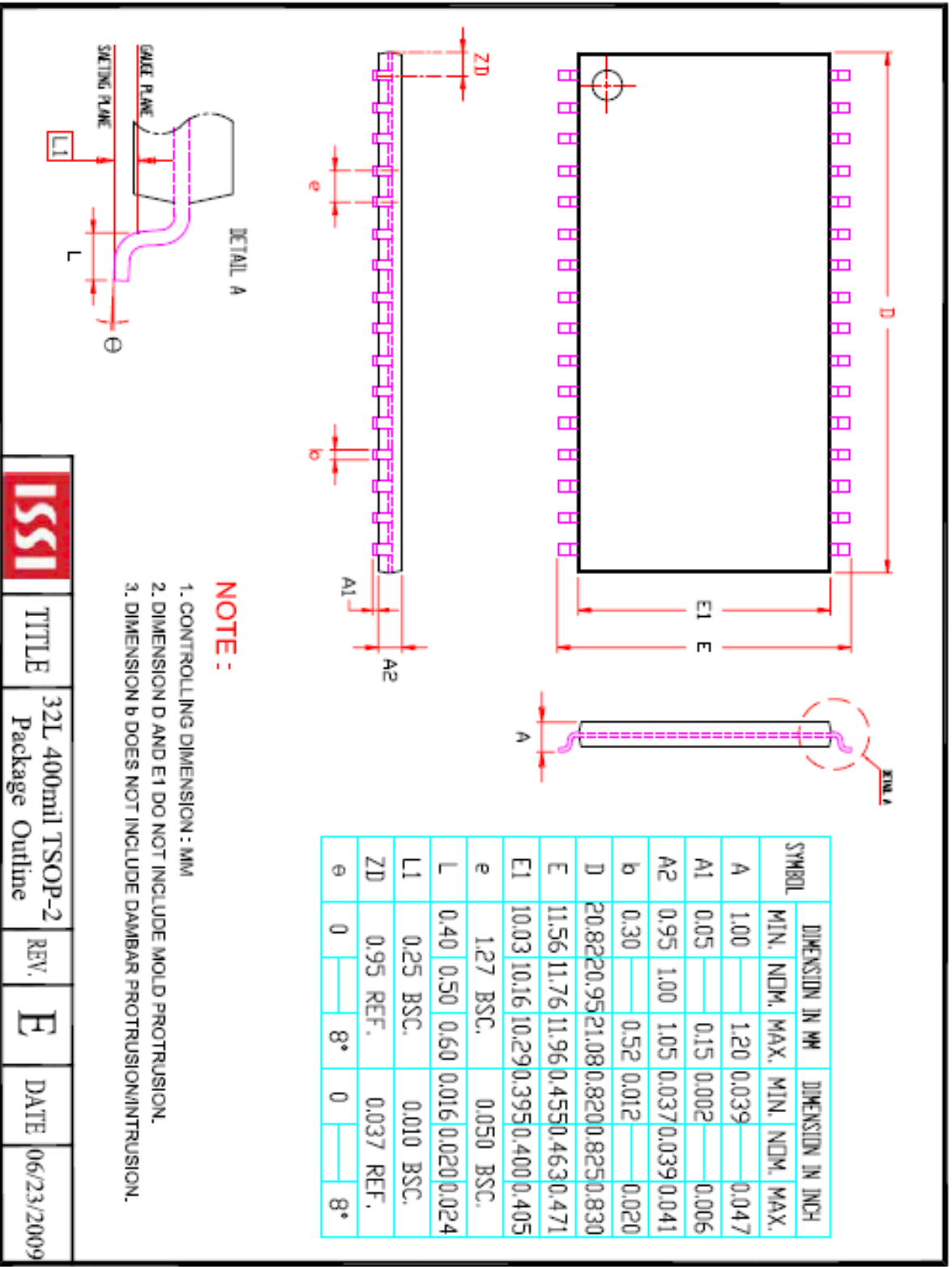
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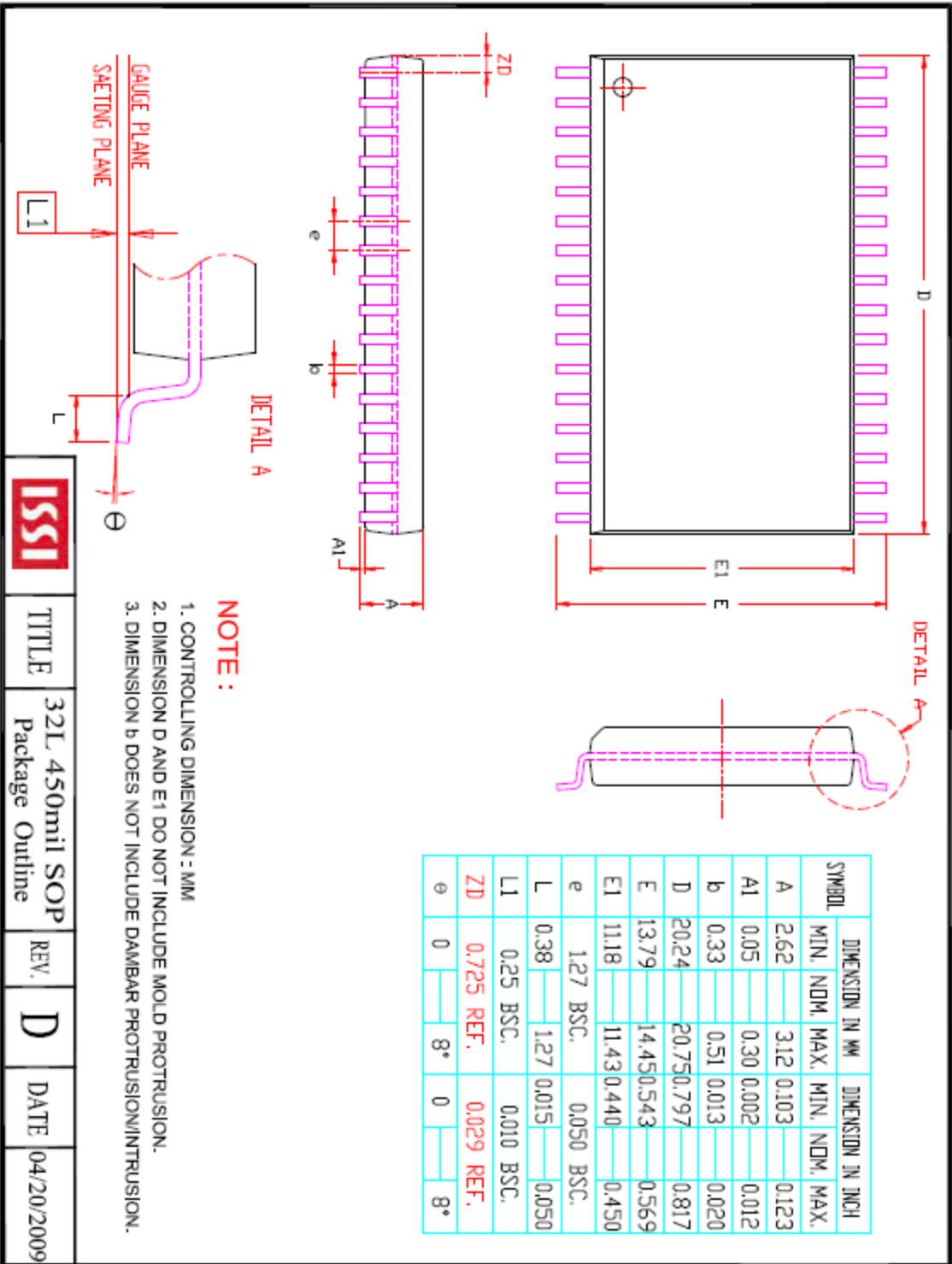
## PACKAGE INFORMATION



|  |       |                                        |      |   |      |            |
|--|-------|----------------------------------------|------|---|------|------------|
|  | TITLE | 32L 8x13.4mm TSOP-1<br>Package Outline | REV. | E | DATE | 04/24/2008 |
|--|-------|----------------------------------------|------|---|------|------------|



|             |       |                                      |      |          |      |            |
|-------------|-------|--------------------------------------|------|----------|------|------------|
| <b>ISSI</b> | TITLE | 32L 400mil TSOP-2<br>Package Outline | REV. | <b>E</b> | DATE | 06/23/2009 |
|-------------|-------|--------------------------------------|------|----------|------|------------|



|  |       |                                |      |   |      |            |
|--|-------|--------------------------------|------|---|------|------------|
|  | TITLE | 32L 450mil SOP Package Outline | REV. | D | DATE | 04/20/2009 |
|--|-------|--------------------------------|------|---|------|------------|