# IS61C1024AL
# IS64C1024AL

ISSI®

## 128K x 8 HIGH-SPEED CMOS STATIC RAM

**JANUARY 2005**

### FEATURES

- High-speed access time: 12, 15 ns
- Low active power: 160 mW (typical)
- Low standby power: 1000 µW (typical) CMOS standby
- Output Enable ($\overline{OE}$) and two Chip Enable ($\overline{CE1}$ and CE2) inputs for ease in applications
- Fully static operation: no clock or refresh required
- TTL compatible inputs and outputs
- Single 5V (±10%) power supply
- Commercial, industrial, and automotive temperature ranges available
- Lead free available

### DESCRIPTION

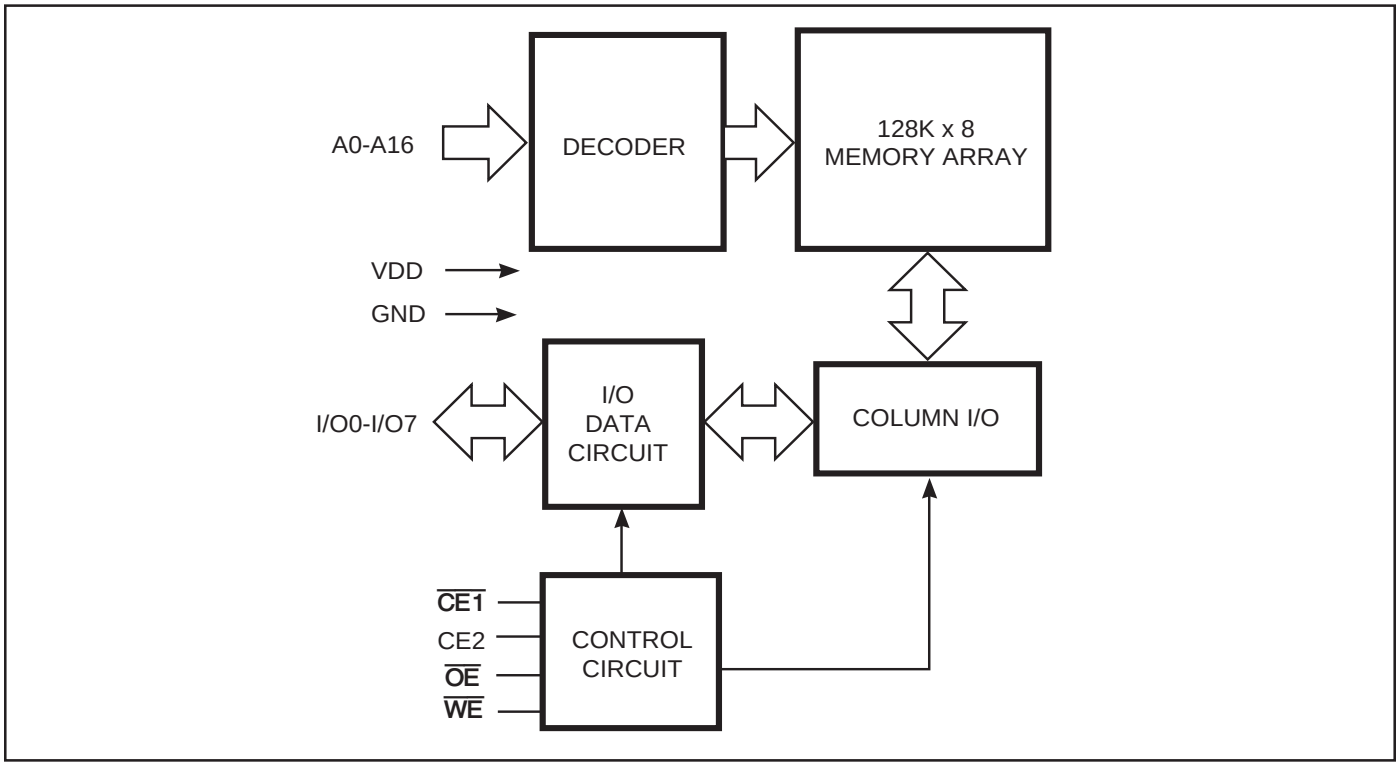
The *ISSI* IS61C1024AL/IS64C1024AL is a very high-speed, low power, 131,072-word by 8-bit CMOS static RAMs. They are fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields higher performance and low power consumption devices.

When $\overline{CE1}$ is HIGH or CE2 is LOW (deselected), the device assumes a standby mode at which the power dissipation can be reduced by using CMOS input levels.

Easy memory expansion is provided by using two Chip Enable inputs, $\overline{CE1}$ and CE2. The active LOW Write Enable ($\overline{WE}$) controls both writing and reading of the memory.

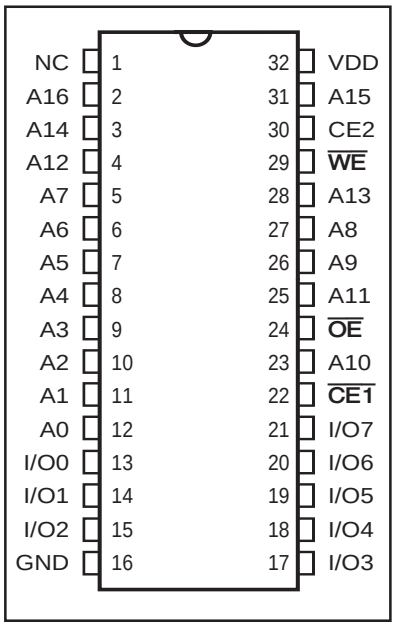
The IS61C1024AL/IS64C1024AL is available in 32-pin 300-mil SOJ, 32-pin 400-mil SOJ, 32-pin TSOP (Type I, 8x20), and 32-pin sTSOP (Type I, 8 x 13.4) packages.

### FUNCTIONAL BLOCK DIAGRAM

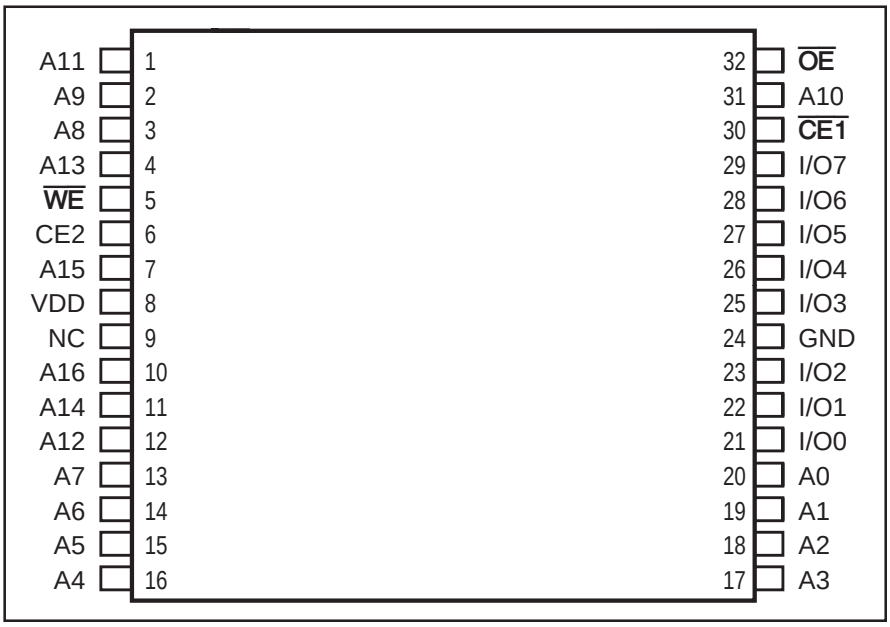



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## PIN CONFIGURATION
### 32-Pin SOJ




## PIN CONFIGURATION
### 32-Pin TSOP (Type 1) (T) and sTSOP (Type 1) (H)




## PIN DESCRIPTIONS

| | |
|---|---|
| A0-A16 | Address Inputs |
| $\overline{CE1}$ | Chip Enable 1 Input |
| CE2 | Chip Enable 2 Input |
| $\overline{OE}$ | Output Enable Input |
| $\overline{WE}$ | Write Enable Input |
| I/O0-I/O7 | Input/Output |
| $V_{DD}$ | Power |
| GND | Ground |

## OPERATING RANGE (IS61C1024AL)

| Range | Ambient Temperature | $V_{DD}$ |
|---|---|---|
| Commercial | 0°C to +70°C | 5V ± 10% |
| Industrial | -40°C to +85°C | 5V ± 10% |

## OPERATING RANGE (IS64C1024AL)

| Range | Ambient Temperature | $V_{DD}$ |
|---|---|---|
| Automotive | -40°C to +125°C | 5V ± 10% |

## TRUTH TABLE

| Mode | $\overline{WE}$ | $\overline{CE1}$ | CE2 | $\overline{OE}$ | I/O Operation | $V_{DD}$ Current |
|---|---|---|---|---|---|---|
| Not Selected | X | H | X | X | High-Z | $I_{SB1}$, $I_{SB2}$ |
| (Power-down) | X | X | L | X | High-Z | $I_{SB1}$, $I_{SB2}$ |
| Output Disabled | H | L | H | H | High-Z | $I_{CC1}$, $I_{CC2}$ |
| Read | H | L | H | L | $D_{OUT}$ | $I_{CC1}$, $I_{CC2}$ |
| Write | L | L | H | X | $D_{IN}$ | $I_{CC1}$, $I_{CC2}$ |

## ABSOLUTE MAXIMUM RATINGS[1]

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{TERM}$ | Terminal Voltage with Respect to GND | –0.5 to +7.0 | V |
| $T_{STG}$ | Storage Temperature | –65 to +150 | °C |
| $P_T$ | Power Dissipation | 1.5 | W |
| $I_{OUT}$ | 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.

## CAPACITANCE[1,2]

| Symbol | Parameter | Conditions | Max. | Unit |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{IN}$ = 0V | 5 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{OUT}$ = 0V | 7 | 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, $V_{DD}$ = 5.0V.

## DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

| Symbol | Parameter | Test Conditions | | Min. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{OH}$ | Output HIGH Voltage | $V_{DD}$ = Min., $I_{OH}$ = –4.0 mA | | 2.4 | — | V |
| $V_{OL}$ | Output LOW Voltage | $V_{DD}$ = Min., $I_{OL}$ = 8.0 mA | | — | 0.4 | V |
| $V_{IH}$ | Input HIGH Voltage | | | 2.2 | $V_{DD}$ + 0.5 | V |
| $V_{IL}$ | Input LOW Voltage[1] | | | –0.3 | 0.8 | V |
| $I_{LI}$ | Input Leakage | GND ≤ $V_{IN}$ ≤ $V_{DD}$ | Com.<br>Ind.<br>Auto. | –1<br>–2<br>–5 | 1<br>2<br>5 | µA |
| $I_{LO}$ | Output Leakage | GND ≤ $V_{OUT}$ ≤ $V_{DD}$<br>Outputs Disabled | Com.<br>Ind.<br>Auto. | –1<br>–2<br>–5 | 1<br>2<br>5 | µA |

**Note:**
1. $V_{IL}$ = –3.0V for pulse width less than 10 ns.

## IS61C1024AL/IS64C1024AL POWER SUPPLY CHARACTERISTICS[1] (Over Operating Range)

| Symbol | Parameter | Test Conditions | | -12 ns Min. | -12 ns Max. | -15 ns Min. | -15 ns Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| $I_{CC1}$ | $V_{DD}$ Operating Supply Current | $V_{DD} = V_{DD\ MAX.}$, $\overline{CE1} = V_{IL}$<br>$I_{OUT} = 0$ mA, f = 0 | Com.<br>Ind.<br>Auto. | —<br>— | 35<br>40 | —<br>— | 45 | mA |
| $I_{CC2}$ | $V_{DD}$ Dynamic Operating Supply Current | $V_{DD} = V_{DD\ MAX.}$, $\overline{CE1} = V_{IL}$<br>$I_{OUT} = 0$ mA, f = $f_{MAX}$ | Com.<br>Ind.<br>Auto.<br>typ.[2] | —<br>—<br>— | 45<br>50<br>32 | —<br>— | 55 | mA |
| $I_{SB1}$ | TTL Standby Current (TTL Inputs) | $V_{DD} = V_{DD\ MAX.}$,<br>$V_{IN} = V_{IH}$ or $V_{IL}$<br>$\overline{CE1} \geq V_{IH}$, f = 0 or<br>CE2 $\leq V_{IL}$, f = 0 | Com.<br>Ind.<br>Auto. | —<br>— | 1<br>1.5 | —<br>— | 2 | mA |
| $I_{SB2}$ | CMOS Standby Current (CMOS Inputs) | $V_{DD} = V_{DD\ MAX.}$,<br>$\overline{CE1} \geq V_{DD} - 0.2V$,<br>CE2 $\leq 0.2V$<br>$V_{IN} \geq V_{DD} - 0.2V$, or<br>$V_{IN} \leq 0.2V$, f = 0 | Com.<br>Ind.<br>Auto.<br>typ.[2] | —<br>—<br>— | 400<br>450<br>200 | —<br>— | 500 | µA |

**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 $V_{DD}$ = 5V, $T_A$ = 25°C and not 100% tested.

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

| Symbol | Parameter | -12 Min. | -12 Max. | -15 Min. | -15 Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{RC}$ | Read Cycle Time | 12 | — | 15 | — | ns |
| $t_{AA}$ | Address Access Time | — | 12 | — | 15 | ns |
| $t_{OHA}$ | Output Hold Time | 3 | — | 3 | — | ns |
| $t_{ACE1}$ | $\overline{CE1}$ Access Time | — | 12 | — | 15 | ns |
| $t_{ACE2}$ | CE2 Access Time | — | 12 | — | 15 | ns |
| $t_{DOE}$ | $\overline{OE}$ Access Time | — | 6 | — | 7 | ns |
| $t_{LZOE}$[2] | $\overline{OE}$ to Low-Z Output | 0 | — | 0 | — | ns |
| $t_{HZOE}$[2] | $\overline{OE}$ to High-Z Output | 0 | 6 | 0 | 6 | ns |
| $t_{LZCE1}$[2] | $\overline{CE1}$ to Low-Z Output | 2 | — | 2 | — | ns |
| $t_{LZCE2}$[2] | CE2 to Low-Z Output | 2 | — | 2 | — | ns |
| $t_{HZCE}$[2] | $\overline{CE1}$ or CE2 to High-Z Output | 0 | 7 | 0 | 8 | ns |
| $t_{PU}$[3] | $\overline{CE1}$ or CE2 to Power-Up | 0 | — | 0 | — | ns |
| $t_{PD}$[3] | $\overline{CE1}$ or CE2 to Power-Down | — | 12 | — | 12 | ns |

**Notes:**
1. Test conditions assume signal transition times of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V 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.
3. Not 100% tested.

## AC TEST CONDITIONS

| Parameter | Unit |
|---|---|
| Input Pulse Level | 0V to 3.0V |
| Input Rise and Fall Times | 3 ns |
| Input and Output Timing and Reference Level | 1.5V |
| Output Load | See Figures 1 and 2 |

## AC TEST LOADS

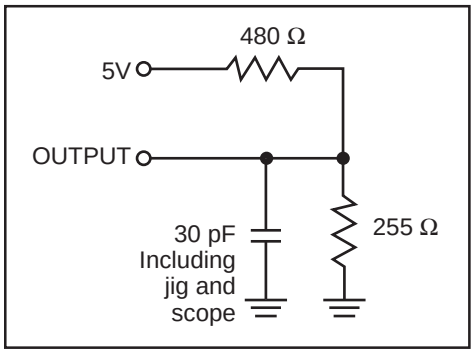



**Figure 1**

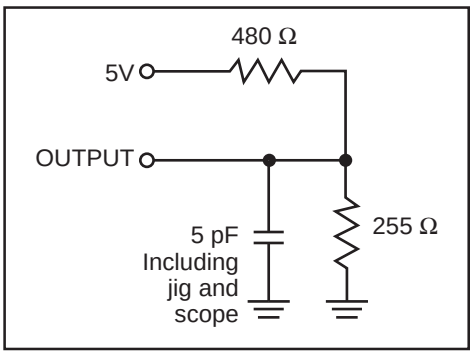
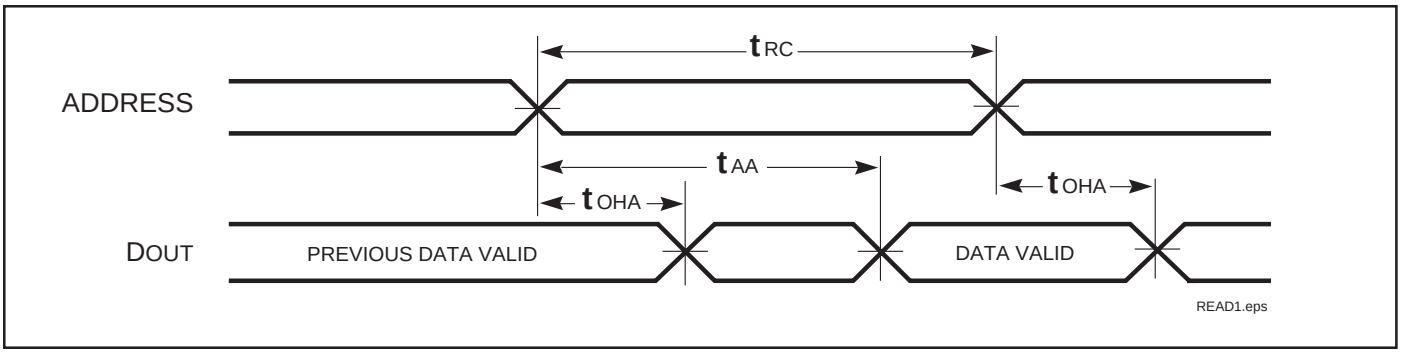


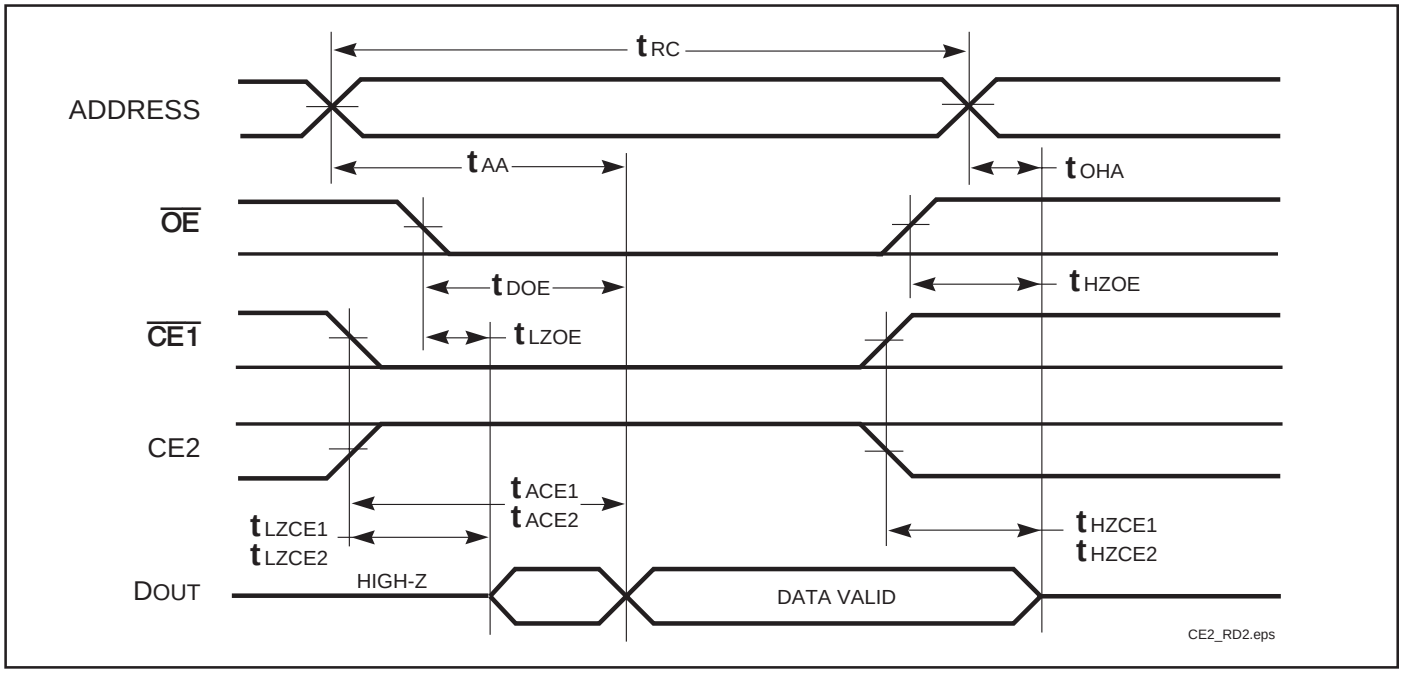

**Figure 2**

## AC WAVEFORMS

### READ CYCLE NO. 1[1,2]




### READ CYCLE NO. 2[1,3]




**Notes:**
1. $\overline{WE}$ is HIGH for a Read Cycle.
2. The device is continuously selected. $\overline{OE}$, $\overline{CE1}$ = $V_{IL}$, CE2 = $V_{IH}$.
3. Address is valid prior to or coincident with $\overline{CE1}$ LOW and CE2 HIGH transitions.

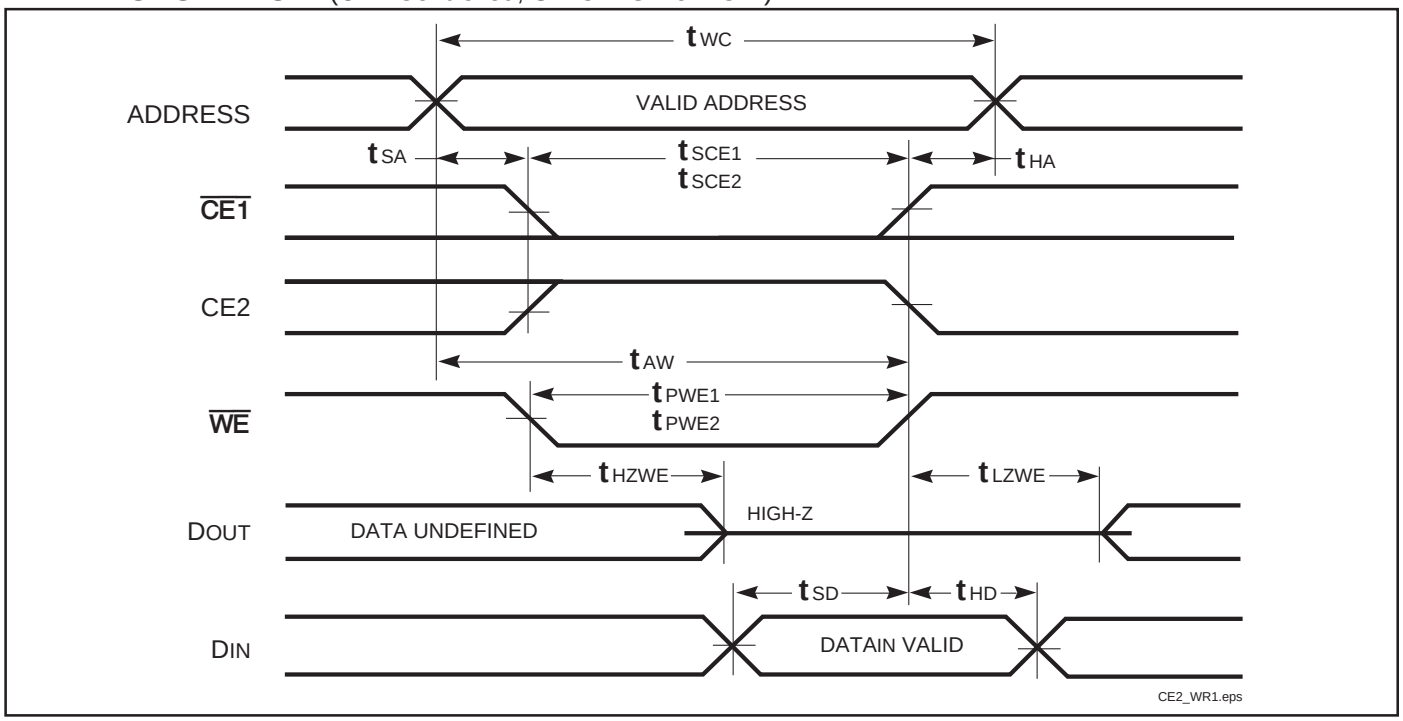
## WRITE CYCLE SWITCHING CHARACTERISTICS[1,2] (Over Operating Range, Standard and Low Power)

| Symbol | Parameter | -12 ns Min. | -12 ns Max. | -15 ns Min. | -15 ns Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{WC}$ | Write Cycle Time | 12 | — | 15 | — | ns |
| $t_{SCE1}$ | $\overline{CE1}$ to Write End | 10 | — | 12 | — | ns |
| $t_{SCE2}$ | CE2 to Write End | 10 | — | 12 | — | ns |
| $t_{AW}$ | Address Setup Time to Write End | 10 | — | 12 | — | ns |
| $t_{HA}$ | Address Hold from Write End | 0 | — | 0 | — | ns |
| $t_{SA}$ | Address Setup Time | 0 | — | 0 | — | ns |
| $t_{PWE}$[3] | $\overline{WE}$ Pulse Width | 10 | — | 12 | — | ns |
| $t_{SD}$ | Data Setup to Write End | 7 | — | 10 | — | ns |
| $t_{HD}$ | Data Hold from Write End | 0 | — | 0 | — | ns |
| $t_{HZWE}$[4] | $\overline{WE}$ LOW to High-Z Output | — | 7 | — | 7 | ns |
| $t_{LZWE}$[4] | $\overline{WE}$ HIGH to Low-Z Output | 2 | — | 2 | — | ns |

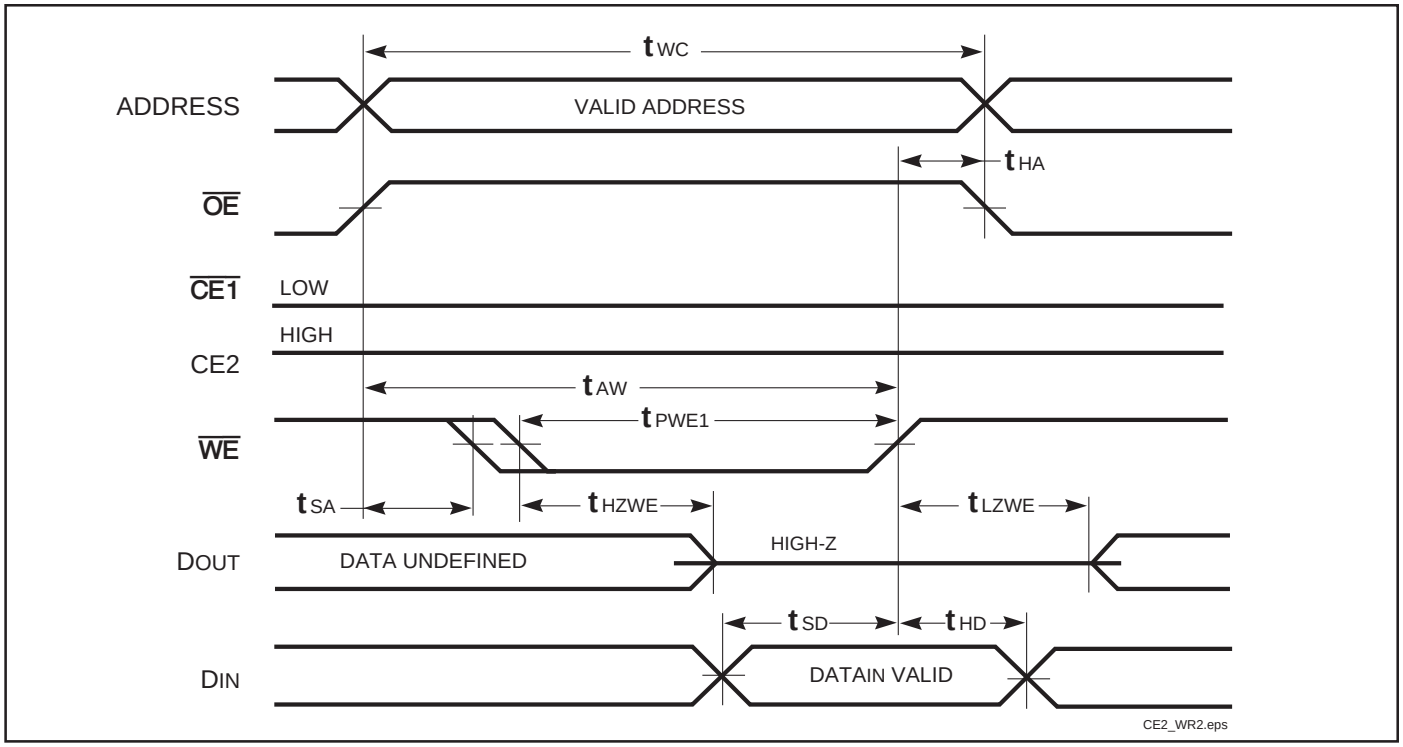
**Notes:**
1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V and output loading specified in Figure 1.
2. The internal write time is defined by the overlap of $\overline{CE1}$ LOW, CE2 HIGH and $\overline{WE}$ LOW. All 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 $\overline{OE}$ HIGH.
4. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.

## AC WAVEFORMS

### WRITE CYCLE NO. 1 ($\overline{CE1}$ Controlled, $\overline{OE}$ is HIGH or LOW) (1)



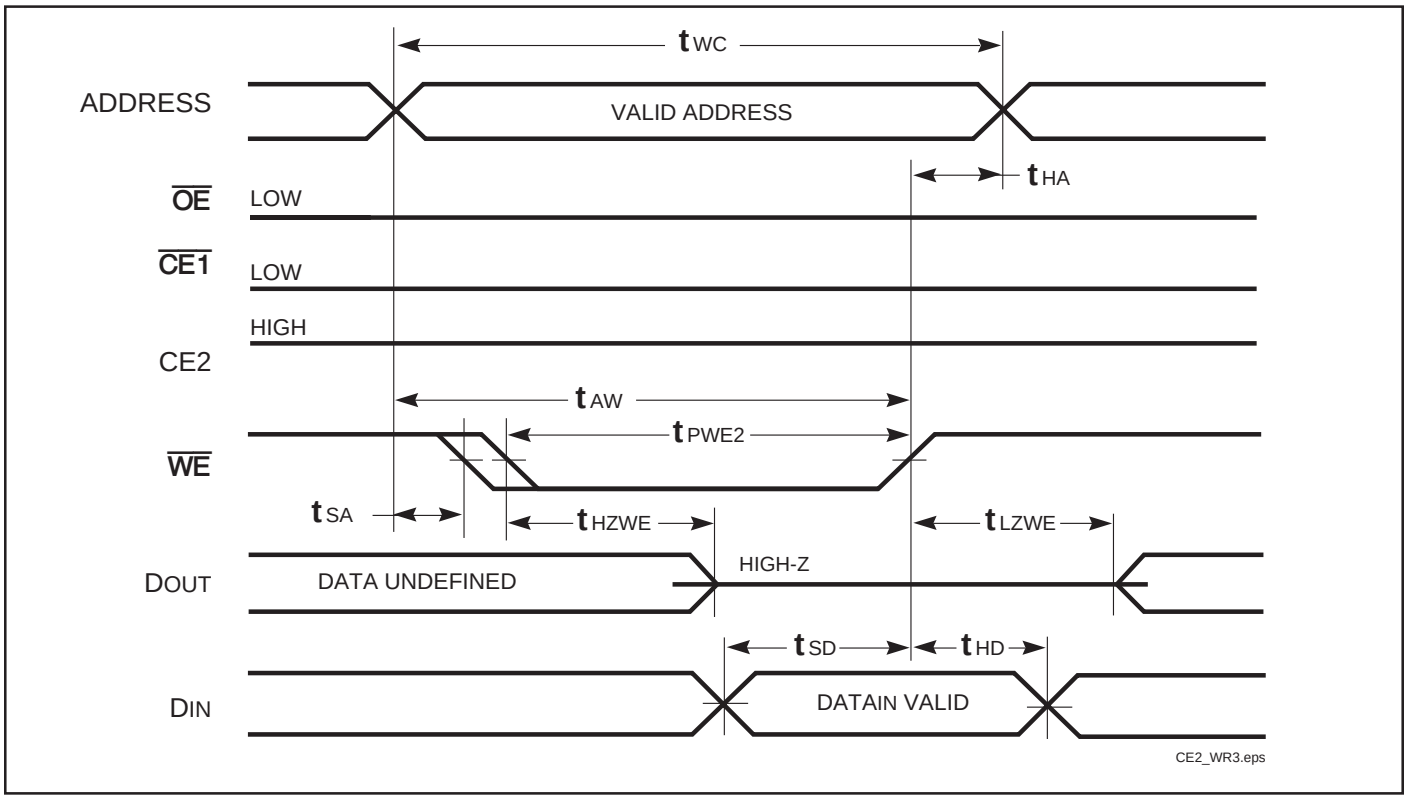

### WRITE CYCLE NO. 2 ($\overline{OE}$ is HIGH During Write Cycle) (1,2)




**Notes:**

1. The internal write time is defined by the overlap of $\overline{CE1}$ LOW, CE2 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.
2. I/O will assume the High-Z state if $\overline{OE}$ = $V_{IH}$.

## WRITE CYCLE NO. 3 ($\overline{OE}$ is LOW During Write Cycle) [1]

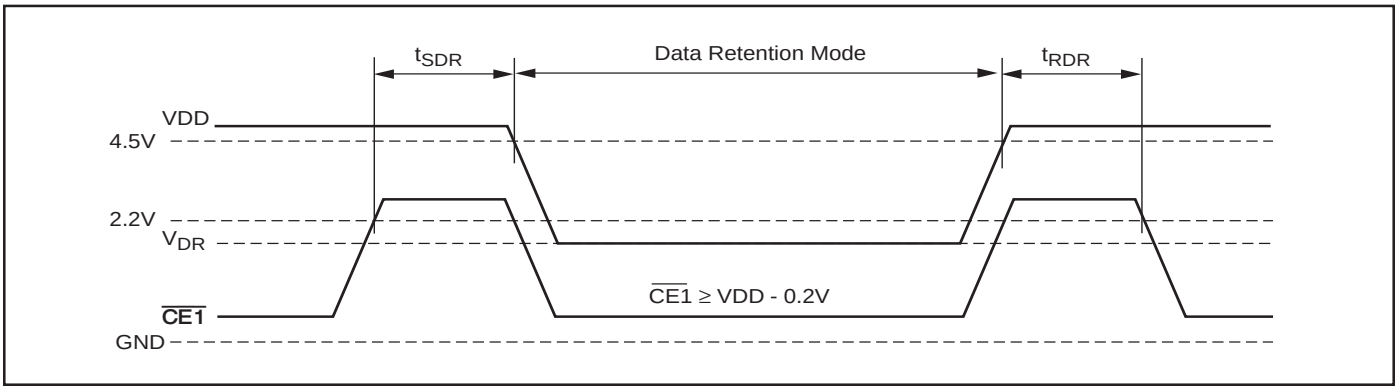


## DATA RETENTION SWITCHING CHARACTERISTICS

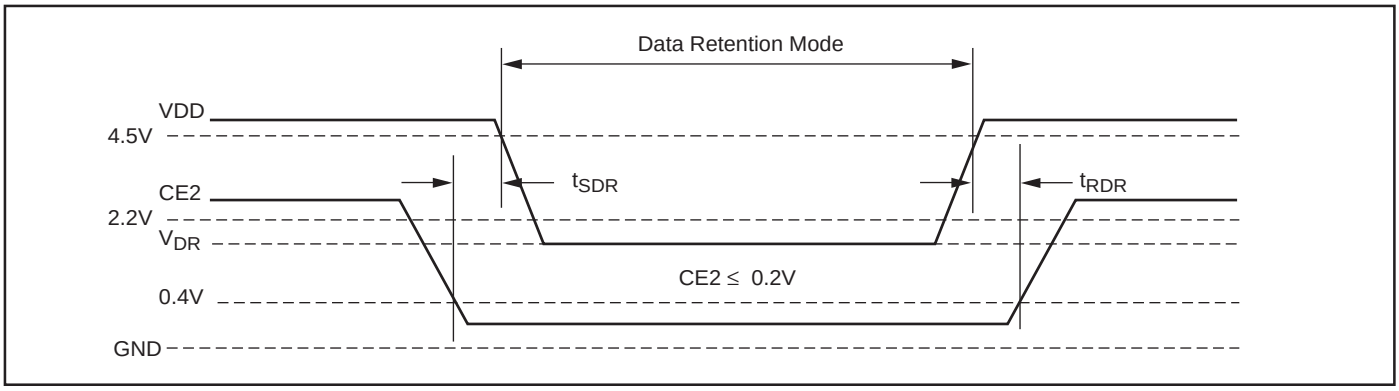
| Symbol | Parameter | Test Condition | | Min. | Typ.(1) | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{DR}$ | $V_{DD}$ for Data Retention | See Data Retention Waveform | | 2.0 | | 5.5 | V |
| $I_{DR}$ | Data Retention Current | $V_{DD}$ = 2.0V, $\overline{CE1} \geq V_{DD} - 0.2V$ | Com. | — | 200 | 400 | µA |
| | | or CE2 ≤ 0.2V | Ind. | — | — | 450 | |
| | | $V_{IN} \geq V_{DD} - 0.2V$, or $V_{IN} \leq V_{SS} + 0.2V$ | Auto. | — | — | 500 | |
| $t_{SDR}$ | 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 $V_{DD}$ = 5V, $T_A$ = 25°C and not 100% tested.

## DATA RETENTION WAVEFORM ($\overline{CE1}$ Controlled)




## DATA RETENTION WAVEFORM (CE2 Controlled)



## ORDERING INFORMATION: IS61C1024AL
## Commercial Range: 0°C to +70°C

| Speed (ns) | Order Part No. | Package |
|---|---|---|
| 12 | IS61C1024AL-12J | 300-mil Plastic SOJ |
| | IS61C1024AL-12T | TSOP (Type I) |

## ORDERING INFORMATION: IS61C1024AL
## Industrial Range: –40°C to +85°C

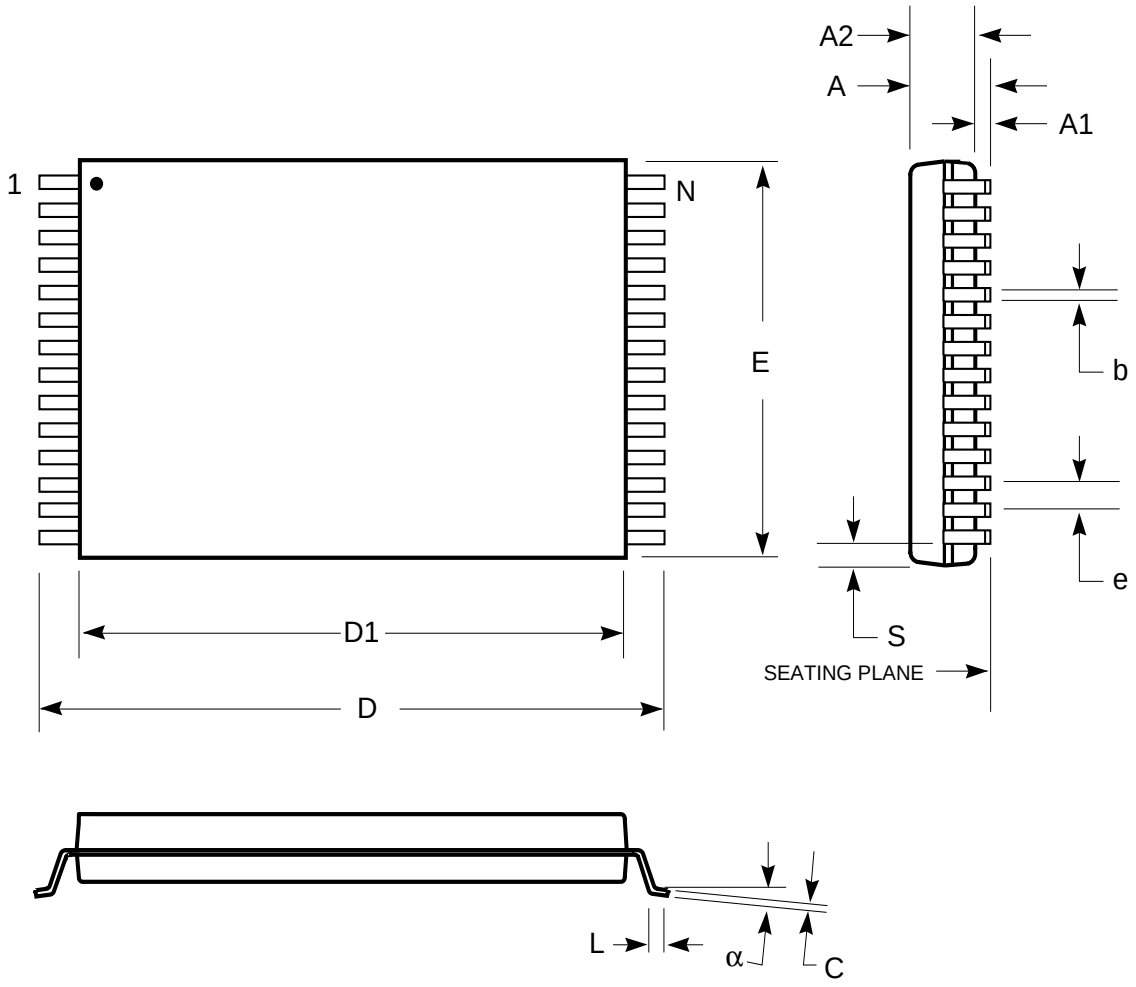
| Speed (ns) | Order Part No. | Package |
|---|---|---|
| 12 | IS61C1024AL-12JI | 300-mil Plastic SOJ |
| | IS61C1024AL-12JLI | 300-mil Plastic SOJ, Lead-free |
| | IS61C1024AL-12KI | 400-mil Plastic SOJ |
| | IS61C1024AL-12KLI | 400-mil Plastic SOJ, Lead-free |
| | IS61C1024AL-12HI | sTSOP (Type I) |
| | IS61C1024AL-12TI | TSOP (Type I) |
| | IS61C1024AL-12TLI | TSOP (Type I), Lead-free |

## ORDERING INFORMATION: IS64C1024AL
## Automotive Range: –40°C to +125°C

| Speed (ns) | Order Part No. | Package |
|---|---|---|
| 15 | IS64C1024AL-15KA3 | 400-mil Plastic SOJ |
| | IS64C1024AL-15TA3 | TSOP (Type I) |

# PACKAGING INFORMATION

**Plastic STSOP - 32 pins**
**Package Code: H (Type I)**

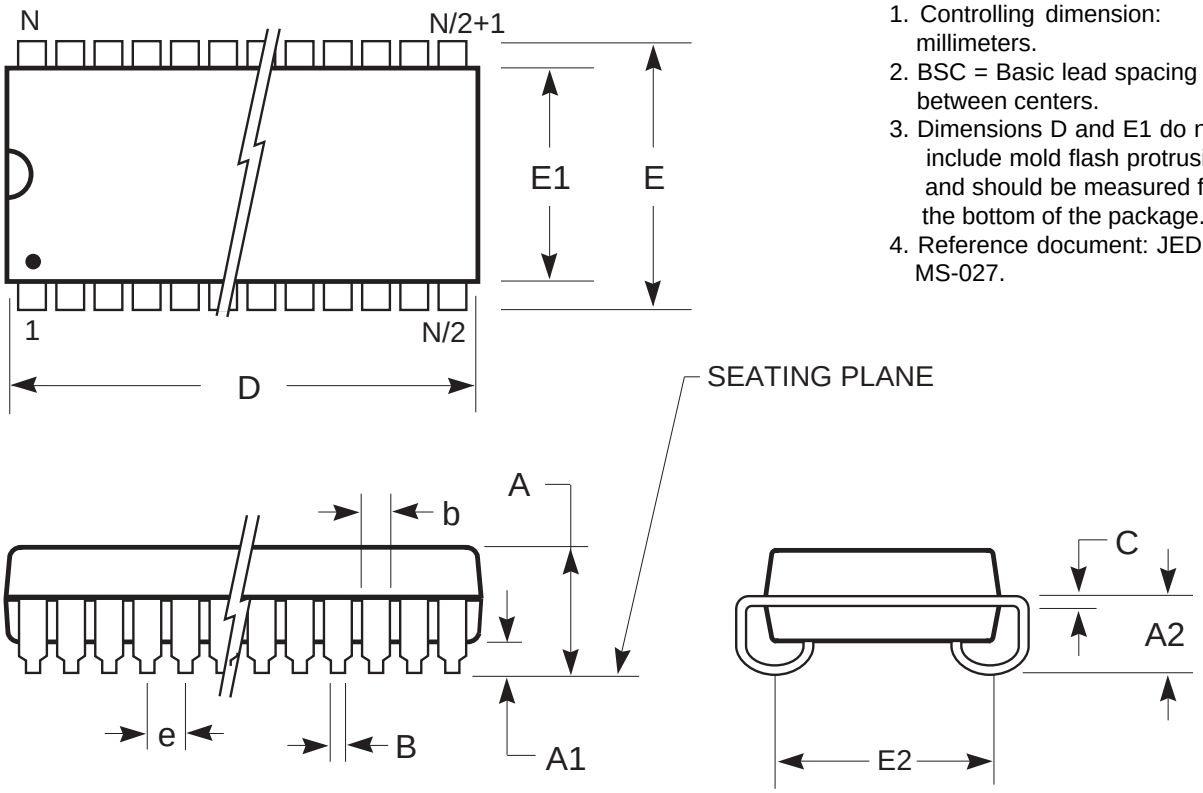



| Plastic STSOP (H - Type I) | | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| Symbol | Min | Max | Min | Max |
| Ref. Std. | | | | |
| N | | 32 | | |
| A | — | 1.25 | — | 0.049 |
| A1 | 0.05 | — | 0.002 | — |
| A2 | 0.95 | 1.05 | 0.037 | 0.041 |
| b | 0.17 | 0.23 | 0.007 | 0.009 |
| C | 0.14 | 0.16 | 0.0055 | 0.0063 |
| D | 13.20 | 13.60 | 0.520 | 0.535 |
| D1 | 11.70 | 11.90 | 0.461 | 0.469 |
| E | 7.90 | 8.10 | 0.311 | 0.319 |
| e | 0.50 BSC | | 0.020 BSC | |
| L | 0.30 | 0.70 | 0.012 | 0.028 |
| S | 0.28 Typ. | | 0.011 Typ. | |
| α | 0° | 5° | 0° | 5° |

**Notes:**
1. Controlling dimension: millimeters, unless otherwise specified.
2. BSC = Basic lead spacing between centers.
3. Dimensions D1 and E do not include mold flash protrusions and should be measured from the bottom of the package.
4. Formed leads shall be planar with respect to one another within 0.004 inches at the seating plane.

# PACKAGING INFORMATION

**400-mil Plastic SOJ**
**Package Code: K**




**Notes:**
1. Controlling dimension: millimeters.
2. BSC = Basic lead spacing between centers.
3. Dimensions D and E1 do not include mold flash protrusions and should be measured from the bottom of the package.
4. Reference document: JEDEC MS-027.

| | Millimeters | | Inches | | Millimeters | | Inches | | Millimeters | | Inches | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Symbol** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** |
| No. Leads (N) | | **28** | | | | **32** | | | | **36** | | |
| A | 3.25 | 3.75 | 0.128 | 0.148 | 3.25 | 3.75 | 0.128 | 0.148 | 3.25 | 3.75 | 0.128 | 0.148 |
| A1 | 0.64 | — | 0.025 | — | 0.64 | — | 0.025 | — | 0.64 | — | 0.025 | — |
| A2 | 2.08 | — | 0.082 | — | 2.08 | — | 0.082 | — | 2.08 | — | 0.082 | — |
| B | 0.38 | 0.51 | 0.015 | 0.020 | 0.38 | 0.51 | 0.015 | 0.020 | 0.38 | 0.51 | 0.015 | 0.020 |
| b | 0.66 | 0.81 | 0.026 | 0.032 | 0.66 | 0.81 | 0.026 | 0.032 | 0.66 | 0.81 | 0.026 | 0.032 |
| C | 0.18 | 0.33 | 0.007 | 0.013 | 0.18 | 0.33 | 0.007 | 0.013 | 0.18 | 0.33 | 0.007 | 0.013 |
| D | 18.29 | 18.54 | 0.720 | 0.730 | 20.82 | 21.08 | 0.820 | 0.830 | 23.37 | 23.62 | 0.920 | 0.930 |
| E | 11.05 | 11.30 | 0.435 | 0.445 | 11.05 | 11.30 | 0.435 | 0.445 | 11.05 | 11.30 | 0.435 | 0.445 |
| E1 | 10.03 | 10.29 | 0.395 | 0.405 | 10.03 | 10.29 | 0.395 | 0.405 | 10.03 | 10.29 | 0.395 | 0.405 |
| E2 | 9.40 BSC | | 0.370 BSC | | 9.40 BSC | | 0.370 BSC | | 9.40 BSC | | 0.370 BSC | |
| e | 1.27 BSC | | 0.050 BSC | | 1.27 BSC | | 0.050 BSC | | 1.27 BSC | | 0.050 BSC | |

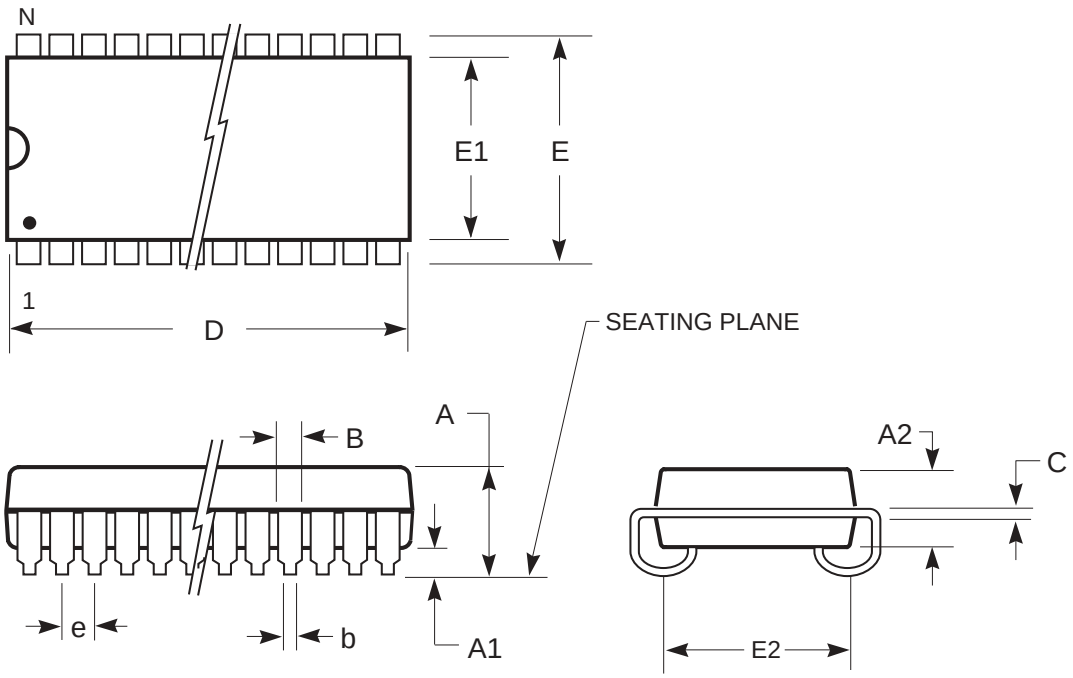
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| | Millimeters | | Inches | | Millimeters | | Inches | | Millimeters | | Inches | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Symbol | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| No. Leads (N) | | 40 | | | | 42 | | | | 44 | | |
| A | 3.25 | 3.75 | 0.128 | 0.148 | 3.25 | 3.75 | 0.128 | 0.148 | 3.25 | 3.75 | 0.128 | 0.148 |
| A1 | 0.64 | — | 0.025 | — | 0.64 | — | 0.025 | — | 0.64 | — | 0.025 | — |
| A2 | 2.08 | — | 0.082 | — | 2.08 | — | 0.082 | — | 2.08 | — | 0.082 | — |
| B | 0.38 | 0.51 | 0.015 | 0.020 | 0.38 | 0.51 | 0.015 | 0.020 | 0.38 | 0.51 | 0.015 | 0.020 |
| b | 0.66 | 0.81 | 0.026 | 0.032 | 0.66 | 0.81 | 0.026 | 0.032 | 0.66 | 0.81 | 0.026 | 0.032 |
| C | 0.18 | 0.33 | 0.007 | 0.013 | 0.18 | 0.33 | 0.007 | 0.013 | 0.18 | 0.33 | 0.007 | 0.013 |
| D | 25.91 | 26.16 | 1.020 | 1.030 | 27.18 | 27.43 | 1.070 | 1.080 | 28.45 | 28.70 | 1.120 | 1.130 |
| E | 11.05 | 11.30 | 0.435 | 0.445 | 11.05 | 11.30 | 0.435 | 0.445 | 11.05 | 11.30 | 0.435 | 0.445 |
| E1 | 10.03 | 10.29 | 0.395 | 0.405 | 10.03 | 10.29 | 0.395 | 0.405 | 10.03 | 10.29 | 0.395 | 0.405 |
| E2 | 9.40 BSC | | 0.370 BSC | | 9.40 BSC | | 0.370 BSC | | 9.40 BSC | | 0.370 BSC | |
| e | 1.27 BSC | | 0.050 BSC | | 1.27 BSC | | 0.050 BSC | | 1.27 BSC | | 0.050 BSC | |

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# PACKAGING INFORMATION

## 300-mil Plastic SOJ
## Package Code: J




| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| **Sym.** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** |
| N0. Leads | | **24/26** | | | | |
| A | — | — | 3.56 | — | — | 0.140 |
| A1 | 0.64 | — | — | 0.025 | — | — |
| A2 | 2.41 | — | 2.67 | 0.095 | — | 0.105 |
| b | 0.41 | — | 0.51 | 0.016 | — | 0.020 |
| B | 0.66 | — | 0.81 | 0.026 | — | 0.032 |
| C | 0.20 | — | 0.25 | 0.008 | — | 0.010 |
| D | 17.02 | — | 17.27 | 0.670 | — | 0.680 |
| E | 8.26 | — | 8.76 | 0.325 | — | 0.345 |
| E1 | 7.49 | — | 7.75 | 0.295 | — | 0.305 |
| E2 | 6.27 | — | 7.29 | 0.247 | — | 0.287 |
| e | 1.27 BSC | | | 0.050 BSC | | |

**Notes:**
1. Controlling dimension: inches, unless otherwise specified.
2. BSC = Basic lead spacing between centers.
3. Dimensions D and E1 do not include mold flash protrusions and should be measured from the bottom of the package.
4. Formed leads shall be planar with respect to one another within 0.004 inches at the seating plane.

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# PACKAGING INFORMATION

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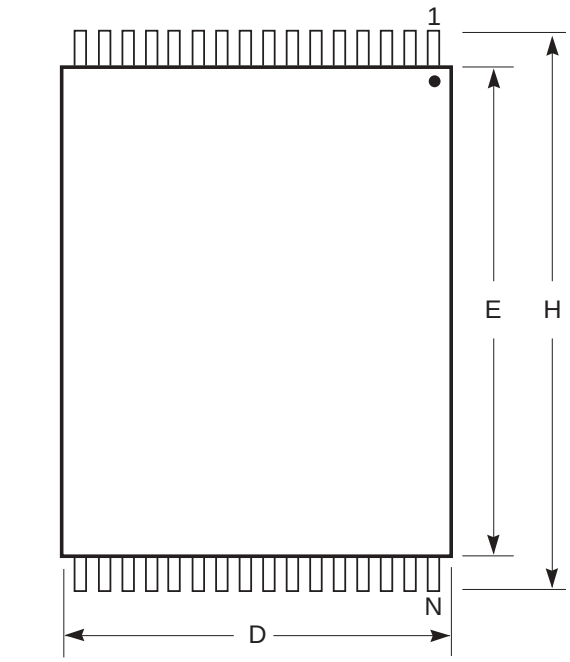
## 300-mil Plastic SOJ
## Package Code: J

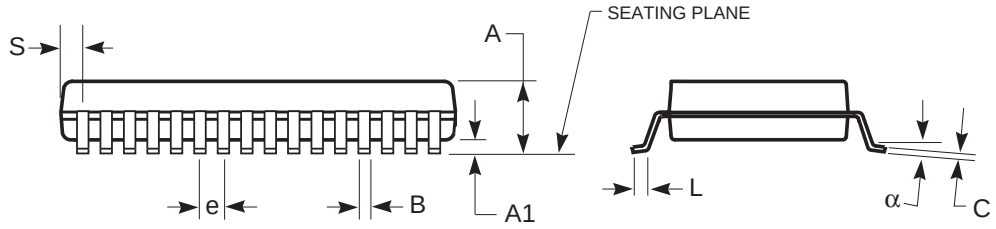
| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| **Sym.** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** |
| N0. Leads | | **28** | | | | |
| A | — | — | 3.56 | — | — | 0.140 |
| A1 | 0.64 | — | — | 0.025 | — | — |
| A2 | 2.41 | — | 2.67 | 0.095 | — | 0.105 |
| b | 0.41 | — | 0.51 | 0.016 | — | 0.020 |
| B | 0.66 | — | 0.81 | 0.026 | — | 0.032 |
| C | 0.20 | — | 0.25 | 0.008 | — | 0.010 |
| D | 18.29 | — | 18.54 | 0.720 | — | 0.730 |
| E | 8.26 | — | 8.76 | 0.325 | — | 0.345 |
| E1 | 7.49 | — | 7.75 | 0.295 | — | 0.305 |
| E2 | 6.27 | — | 7.29 | 0.247 | — | 0.287 |
| e | 1.27 BSC | | | 0.050 BSC | | |

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| **Sym.** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** |
| N0. Leads | | **32** | | | | |
| A | — | — | 3.56 | — | — | 0.140 |
| A1 | 0.64 | — | — | 0.025 | — | — |
| A2 | 2.41 | — | 2.67 | 0.095 | — | 0.105 |
| b | 0.41 | — | 0.51 | 0.016 | — | 0.020 |
| B | 0.66 | — | 0.81 | 0.026 | — | 0.032 |
| C | 0.20 | — | 0.25 | 0.008 | — | 0.010 |
| D | 20.83 | — | 21.08 | 0.820 | — | 0.830 |
| E | 8.26 | — | 8.76 | 0.325 | — | 0.345 |
| E1 | 7.49 | — | 7.75 | 0.295 | — | 0.305 |
| E2 | 6.27 | — | 7.29 | 0.247 | — | 0.287 |
| e | 1.27 BSC | | | 0.050 BSC | | |

# PACKAGING INFORMATION

## Plastic TSOP-Type I
## Package Code: T (32-pin)




| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| **Symbol** | **Min.** | **Max.** | **Min.** | **Max.** |
| No. Leads | | **32** | | |
| A | — | 1.20 | — | 0.047 |
| A1 | 0.05 | 0.25 | 0.002 | 0.010 |
| B | 0.17 | 0.23 | 0.007 | 0.009 |
| C | 0.12 | 0.17 | 0.005 | 0.007 |
| D | 7.90 | 8.10 | 0.311 | 0.319 |
| E | 18.30 | 18.50 | 0.720 | 0.728 |
| H | 19.80 | 20.20 | 0.780 | 0.795 |
| e | 0.50 BSC | | 0.020 BSC | |
| L | 0.40 | 0.60 | 0.016 | 0.024 |
| α | 0° | 8° | 0° | 8° |
| S | 0.25 REF | | 0.010 REF | |

**Notes:**
1. Controlling dimension: millimeters, unless otherwise specified.
2. BSC = Basic lead spacing between centers.
3. Dimensions D and E do not include mold flash protrusions and should be measured from the bottom of the package.
4. Formed leads shall be planar with respect to one another within 0.004 inches at the seating plane.

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