

## 512K x 8 HIGH-SPEED CMOS STATIC RAM

MARCH 2008

### FEATURES

#### HIGH SPEED: (IS61/64C5128AL)

- High-speed access time: 10ns, 12 ns
- Low Active Power: 150 mW (typical)
- Low Standby Power: 10 mW (typical)  
CMOS standby

#### LOW POWER: (IS61/64C5128AS)

- High-speed access time: 25ns
- Low Active Power: 75 mW (typical)
- Low Standby Power: 1 mW (typical)  
CMOS standby
- TTL compatible interface levels
- Single 5V  $\pm$  10% power supply
- Fully static operation: no clock or refresh required
- Available in 36-pin SOJ (400-mil), 32-pin sTSOP-I, 32-pin SOP, 44-pin TSOP-II and 32-pin TSOP-II packages
- Commercial, Industrial and Automotive temperature ranges available
- Lead-free available

### DESCRIPTION

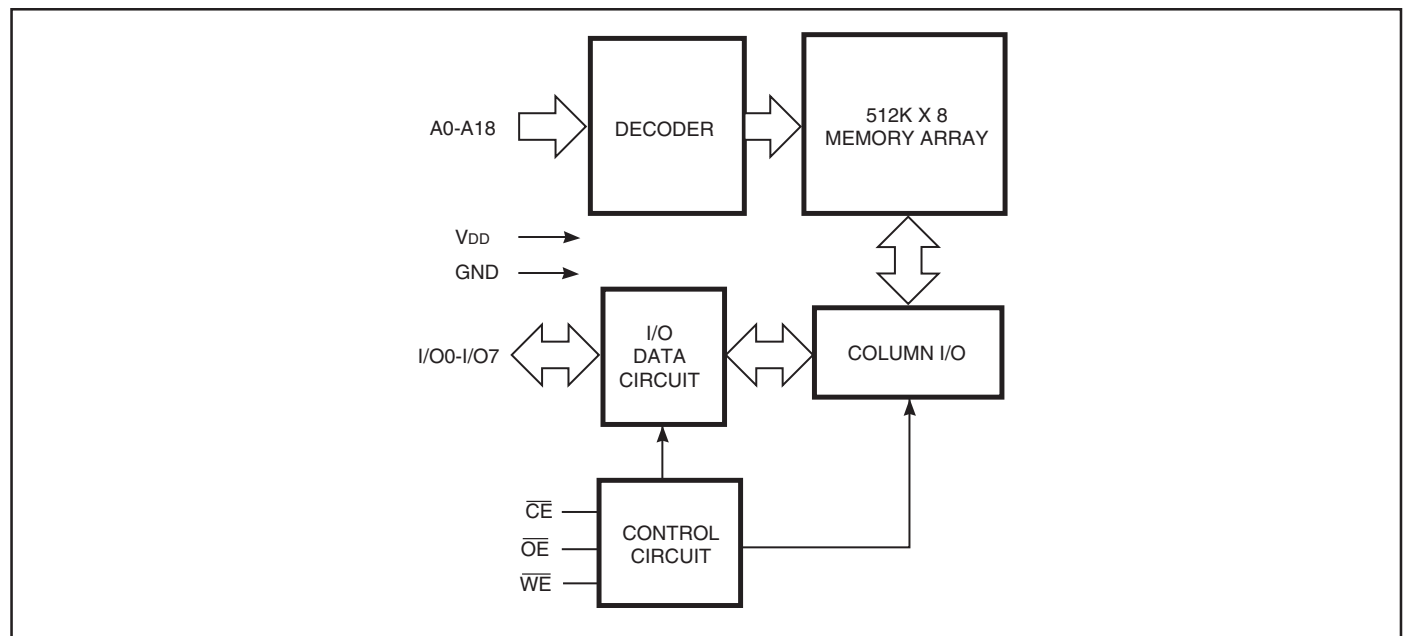
The *ISSI* IS61C5128AL/AS and IS64C5128AL/AS are high-speed, 4,194,304-bit static RAMs organized as 524,288 words by 8 bits. They are fabricated using *ISSI*'s high-performance CMOS technology. This highly reliable process coupled with innovative circuit design techniques, yields access times as fast as 12 ns with low power consumption.

When  $\overline{CE}$  is HIGH (deselected), the device assumes a standby mode at which the power dissipation can be reduced down with CMOS input levels.

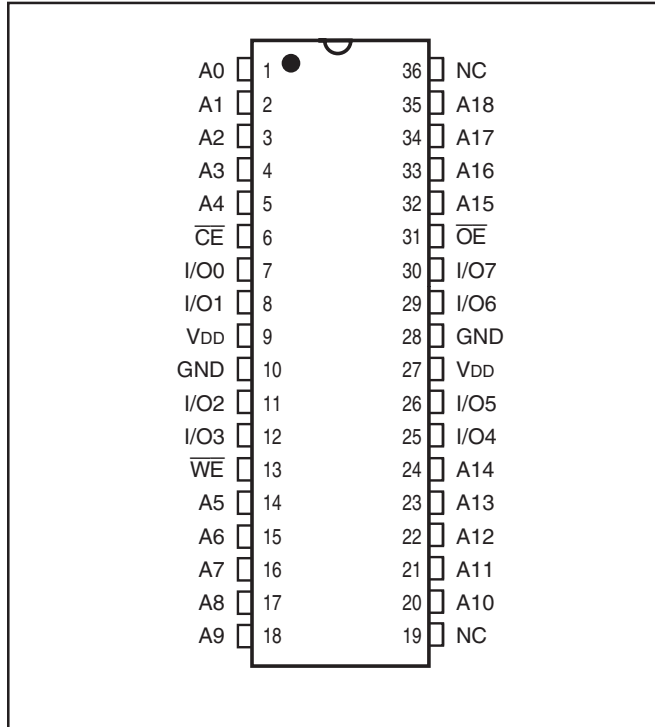
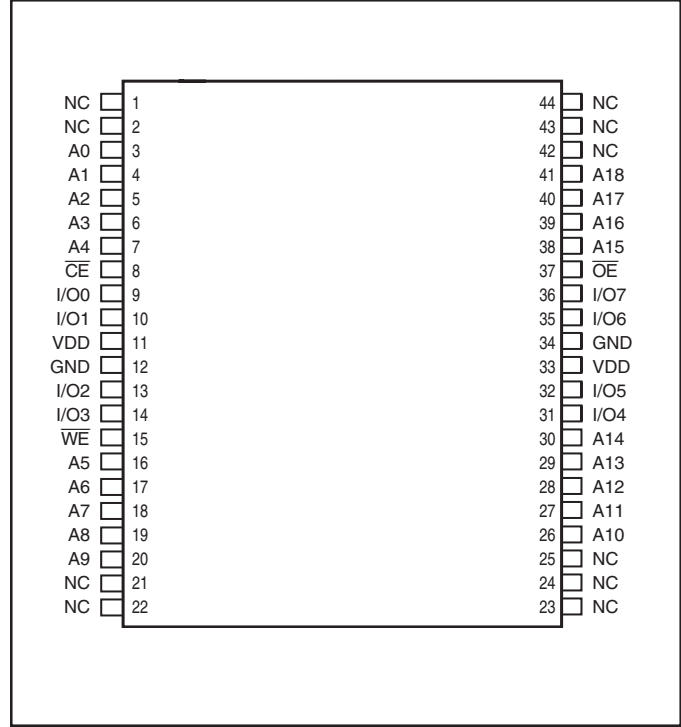
Easy memory expansion is provided by using Chip Enable and Output Enable inputs,  $\overline{CE}$  and  $\overline{OE}$ . The active LOW Write Enable ( $\overline{WE}$ ) controls both writing and reading of the memory. A data byte allows Upper Byte ( $\overline{UB}$ ) and Lower Byte ( $\overline{LB}$ ) access.

The IS61C5128AL/AS and IS64C5128AL/AS are packaged in the JEDEC standard 36-pin SOJ (400-mil), 32-pin sTSOP-I, 32-pin SOP, 44-pin TSOP-II and 32-pin TSOP-II packages

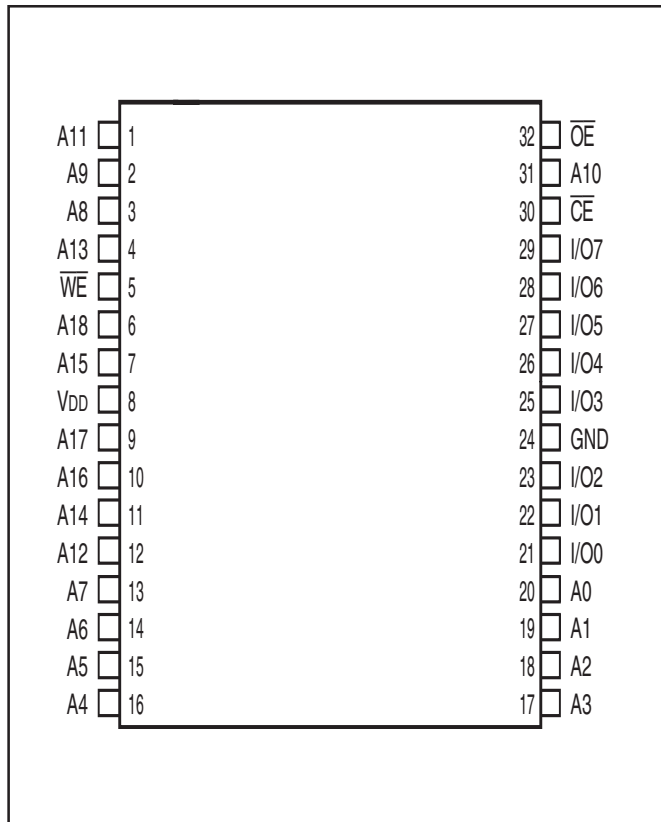
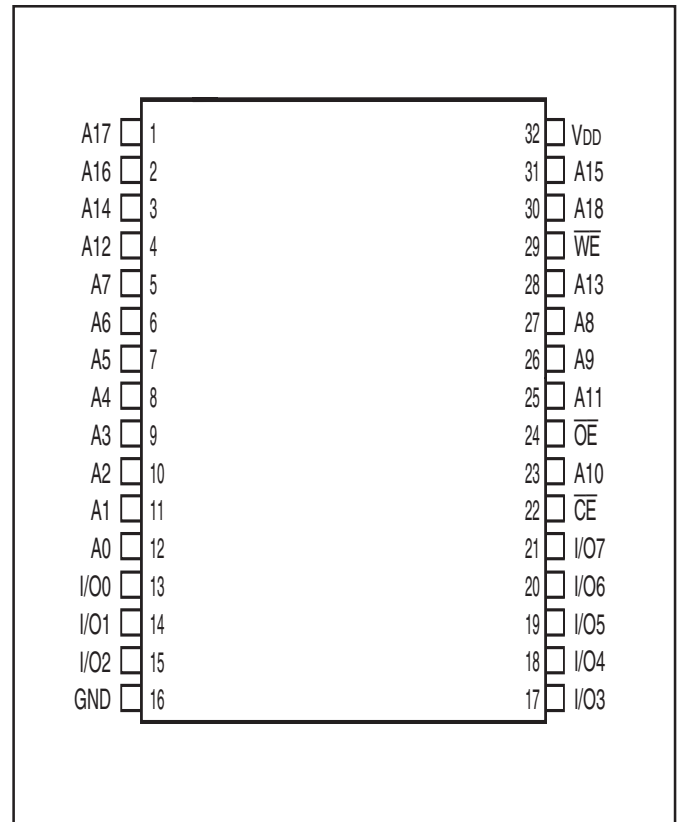
### FUNCTIONAL BLOCK DIAGRAM



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**HIGH SPEED (IS61/64C5128AL) PIN CONFIGURATION**
**36-Pin SOJ (400-mil)**

**44-Pin TSOP (Type II)**

**PIN DESCRIPTIONS**

|                 |                     |
|-----------------|---------------------|
| A0-A18          | Address Inputs      |
| $\overline{CE}$ | Chip Enable Input   |
| $\overline{OE}$ | Output Enable Input |
| $\overline{WE}$ | Write Enable Input  |
| I/O0-I/O7       | Bidirectional Ports |
| V <sub>DD</sub> | Power               |
| GND             | Ground              |
| NC              | No Connection       |

**LOW POWER (IS61/64C5128AS) PIN CONFIGURATION**
**32-pin sTSOP (TYPE I)**

**32-pin SOP  
32-pin TSOP (TYPE II)**

**PIN DESCRIPTIONS**

|                 |                     |
|-----------------|---------------------|
| A0-A18          | Address Inputs      |
| $\overline{CE}$ | Chip Enable 1 Input |
| $\overline{OE}$ | Output Enable Input |
| $\overline{WE}$ | Write Enable Input  |
| I/O0-I/O7       | Input/Output        |
| VDD             | Power               |
| GND             | Ground              |

**TRUTH TABLE**

| Mode            | $\overline{WE}$ | $\overline{OE}$ | $\overline{OE}$ | I/O0-I/O7        | I/O PIN                             |
|-----------------|-----------------|-----------------|-----------------|------------------|-------------------------------------|
|                 |                 |                 |                 |                  | V <sub>DD</sub> Current             |
| Not Selected    | X               | H               | X               | High-Z           | I <sub>SB1</sub> , I <sub>SB2</sub> |
| Output Disabled | H               | L               | H               | High-Z           | I <sub>CC1</sub> , I <sub>CC2</sub> |
| Read            | H               | L               | L               | D <sub>OUT</sub> | I <sub>CC1</sub> , I <sub>CC2</sub> |
| Write           | L               | L               | X               | D <sub>IN</sub>  | I <sub>CC1</sub> , I <sub>CC2</sub> |

**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.

**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.

**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> = -4.0 mA            | 2.4                   | —                     | V           |    |
| V <sub>OL</sub> | Output LOW Voltage               | V <sub>DD</sub> = Min., I <sub>OL</sub> = 8.0 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.<br>Ind.<br>Auto. | -1<br>-2<br>-5        | 1<br>2<br>5 | μA |
| I <sub>LO</sub> | Output Leakage                   | GND ≤ V <sub>OUT</sub> ≤ V <sub>DD</sub><br>Outputs Disabled | Com.<br>Ind.<br>Auto. | -1<br>-2<br>-5        | 1<br>2<br>5 | μA |

**Note:** 1. V<sub>IL</sub> = -3.0V for pulse width less than 10 ns.

**OPERATING RANGE: HIGH SPEED OPTION (IS61/64C5128AL)**

| <b>Range</b> | <b>Ambient Temperature</b> | <b>V<sub>DD</sub></b> | <b>Speed (ns)</b> |
|--------------|----------------------------|-----------------------|-------------------|
| Commercial   | 0°C to +70°C               | 5V ± 10%              | 10                |
| Industrial   | -40°C to +85°C             | 5V ± 10%              | 10                |
| Automotive   | -40°C to +125°C            | 5V ± 10%              | 12                |

**OPERATING RANGE: LOW POWER OPTION (IS61/64C5128AS)**

| <b>Range</b> | <b>Ambient Temperature</b> | <b>V<sub>DD</sub></b> | <b>Speed (ns)</b> |
|--------------|----------------------------|-----------------------|-------------------|
| Commercial   | 0°C to +70°C               | 5V ± 10%              | 25                |
| Industrial   | -40°C to +85°C             | 5V ± 10%              | 25                |
| Automotive   | -40°C to +125°C            | 5V ± 10%              | 25                |

**HIGH SPEED OPTION (IS61/64C5128AL)**
**POWER SUPPLY CHARACTERISTICS<sup>(1)</sup> (Over Operating Range)**

| Symbol           | Parameter  | Test Conditions   |                     | -10 ns |      | -12 ns |      | Unit |
|------------------|--|---|---------------------|--------|------|--------|------|------|
|                  |  |   |                     | Min.   | Max. | Min.   | Max. |      |
| I <sub>CC1</sub> | V <sub>DD</sub> Operating Supply Current         | V <sub>DD</sub> = V <sub>DD MAX.</sub> , $\overline{CE} = V_{IL}$<br>I <sub>OUT</sub> = 0 mA, f = 0   | Com.                | —      | 45   | —      | 45   | mA   |
|                  |  |   | Ind.                | —      | 50   | —      | 50   |      |
|                  |  |   | Auto.               | —      | 55   | —      | 55   |      |
| I <sub>CC2</sub> | V <sub>DD</sub> Dynamic Operating Supply Current | V <sub>DD</sub> = V <sub>DD MAX.</sub> , $\overline{CE} = V_{IL}$<br>I <sub>OUT</sub> = 0 mA, f = f <sub>MAX</sub>  | Com.                | —      | 50   | —      | 45   | mA   |
|                  |  |   | Ind.                | —      | 55   | —      | 50   |      |
|                  |  |   | Auto.               | —      | 70   | —      | 60   |      |
|                  |  |   | typ. <sup>(2)</sup> | 30     |      | 25     |      |      |
| I <sub>SB1</sub> | TTL Standby Current (TTL Inputs)                 | V <sub>DD</sub> = V <sub>DD MAX.</sub> ,<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>$\overline{CE} \geq V_{IH}$ , f = 0                           | Com.                | —      | 15   | —      | 15   | mA   |
|                  |  |   | Ind.                | —      | 20   | —      | 20   |      |
|                  |  |   | Auto.               | —      | 30   | —      | 30   |      |
| I <sub>SB2</sub> | CMOS Standby Current (CMOS Inputs)               | V <sub>DD</sub> = V <sub>DD MAX.</sub> ,<br>$\overline{CE} \leq V_{DD} - 0.2V$ ,<br>V <sub>IN</sub> ≥ V <sub>DD</sub> - 0.2V, or<br>V <sub>IN</sub> ≤ 0.2V, f = 0 | Com.                | —      | 8    | —      | 8    | mA   |
|                  |  |   | Ind.                | —      | 12   | —      | 12   |      |
|                  |  |   | Auto.               | —      | 20   | —      | 20   |      |
|                  |  |   | typ. <sup>(2)</sup> | 2      |      |        |      |      |

**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>DD</sub> = 5V, T<sub>A</sub> = 25% and not 100% tested.

**LOW POWER OPTION (IS61/64C5128AS)**
**POWER SUPPLY CHARACTERISTICS<sup>(1)</sup> (Over Operating Range)**

| Symbol           | Parameter  | Test Conditions  |                     | -25 ns |      | Unit |
|------------------|--|--|---------------------|--------|------|------|
|                  |  |  |                     | Min.   | Max. |      |
| I <sub>CC</sub>  | Average operating Current                        | $\overline{CE} = V_{IL}$ , V <sub>DD</sub> = Max.<br>I <sub>OUT</sub> = 0 mA, f = 0  | Com.                | —      | 10   | mA   |
|                  |  |  | Ind.                | —      | 15   |      |
|                  |  |  | Auto.               | —      | 20   |      |
| I <sub>CC1</sub> | V <sub>DD</sub> Dynamic Operating Supply Current | V <sub>DD</sub> = Max., $\overline{CE} = V_{IL}$<br>I <sub>OUT</sub> = 0 mA, f = f <sub>MAX</sub>  | Com.                | —      | 25   | mA   |
|                  |  |  | Ind.                | —      | 30   |      |
|                  |  |  | Auto.               | —      | 40   |      |
|                  |  |  | typ. <sup>(2)</sup> | 15     |      |      |
| I <sub>SB1</sub> | TTL Standby Current (TTL Inputs)                 | V <sub>DD</sub> = Max.,<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , $\overline{CE} \geq V_{IH}$ ,<br>f = 0   | Com.                | —      | 1    | mA   |
|                  |  |  | Ind.                | —      | 1.5  |      |
|                  |  |  | Auto.               | —      | 2    |      |
| I <sub>SB2</sub> | CMOS Standby Current (CMOS Inputs)               | V <sub>DD</sub> = Max.,<br>$\overline{CE} \geq V_{DD} - 0.2V$ ,<br>V <sub>IN</sub> ≥ V <sub>DD</sub> - 0.2V,<br>or V <sub>IN</sub> ≤ V <sub>SS</sub> + 0.2V, f = 0 | Com.                | —      | 0.8  | mA   |
|                  |  |  | Ind.                | —      | 0.9  |      |
|                  |  |  | Auto.               | —      | 2    |      |
|                  |  |  | typ.                | 0.2    |      |      |

**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>DD</sub> = 5V, T<sub>A</sub> = 25% and not 100% tested.

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

| Symbol           | Parameter                        | -10  |      | -12  |      | -25  |      | Unit |
|------------------|----------------------------------|------|------|------|------|------|------|------|
|                  |                                  | Min. | Max. | Min. | Max. | Min. | Max. |      |
| $t_{RC}$         | Read Cycle Time                  | 10   | —    | 12   | —    | 25   | —    | ns   |
| $t_{AA}$         | Address Access Time              | —    | 10   | —    | 12   | —    | 25   | ns   |
| $t_{OHA}$        | Output Hold Time                 | 3    | —    | 3    | —    | 3    | —    | ns   |
| $t_{ACE}$        | $\overline{CE}$ Access Time      | —    | 10   | —    | 12   | —    | 25   | ns   |
| $t_{DOE}$        | $\overline{OE}$ Access Time      | —    | 5    | —    | 6    | —    | 15   | ns   |
| $t_{HZOE}^{(2)}$ | $\overline{OE}$ to High-Z Output | 0    | 5    | 0    | 6    | 0    | 8    | ns   |
| $t_{LZOE}^{(2)}$ | $\overline{OE}$ to Low-Z Output  | 0    | —    | 0    | —    | 2    | —    | ns   |
| $t_{HZCE}^{(2)}$ | $\overline{CE}$ to High-Z Output | 0    | 5    | 0    | 6    | 0    | 8    | ns   |
| $t_{LZCE}^{(2)}$ | $\overline{CE}$ to Low-Z Output  | 2    | —    | 2    | —    | 2    | —    | 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  $\pm 500$  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

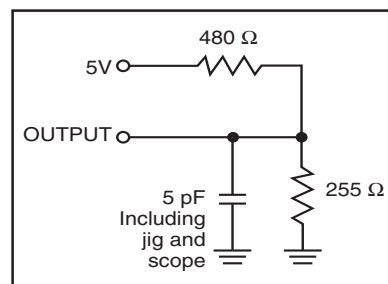
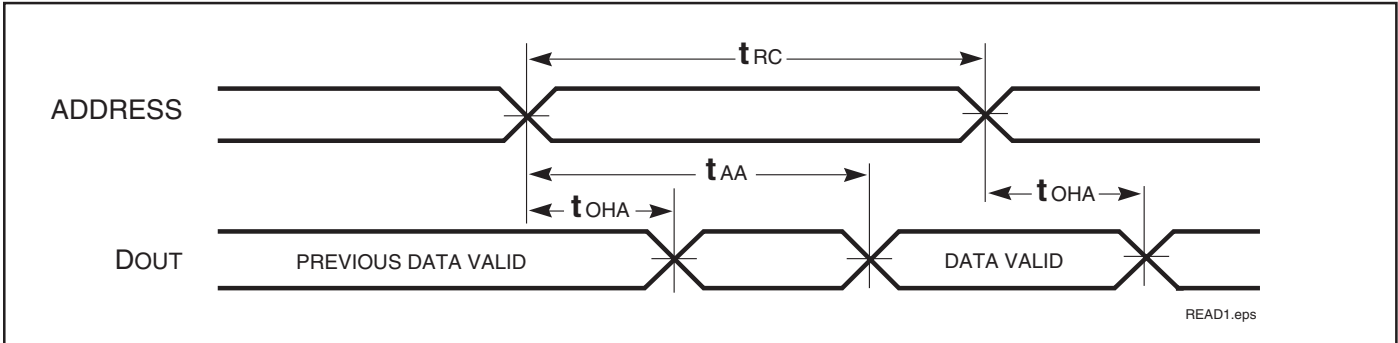
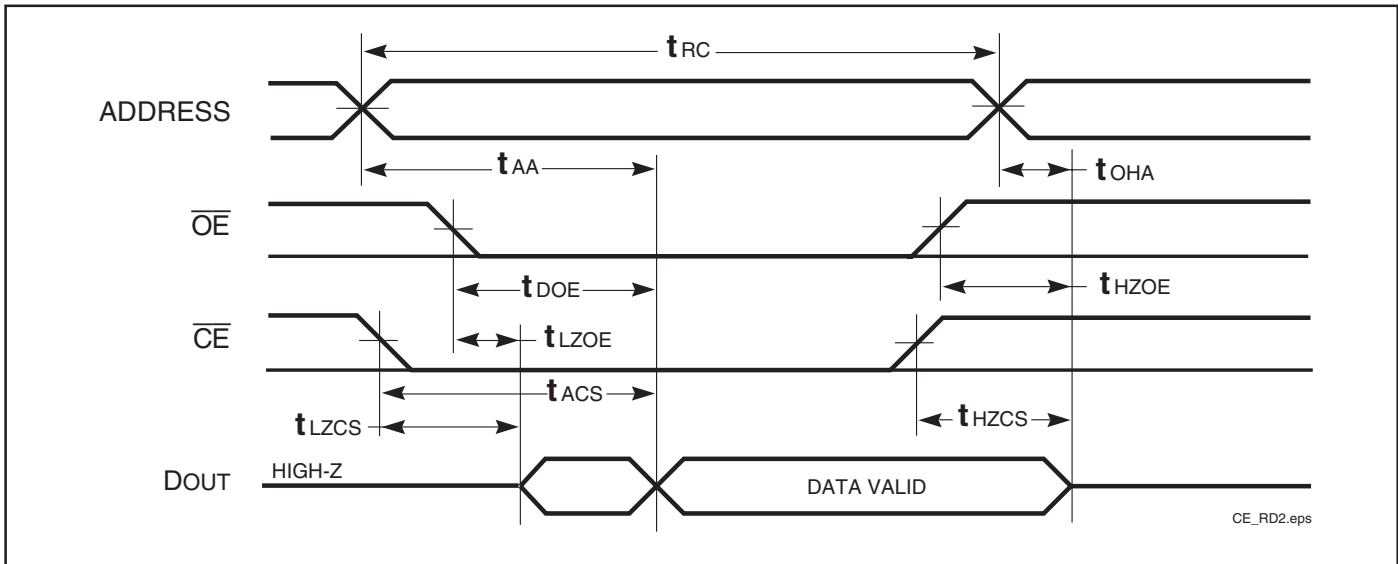


Figure 2

**AC WAVEFORMS**  
**READ CYCLE NO. 1<sup>(1,2)</sup>**



**READ CYCLE NO. 2<sup>(1,3)</sup>**



**Notes:**

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



**WRITE CYCLE SWITCHING CHARACTERISTICS<sup>(1,3)</sup> (Over Operating Range)**

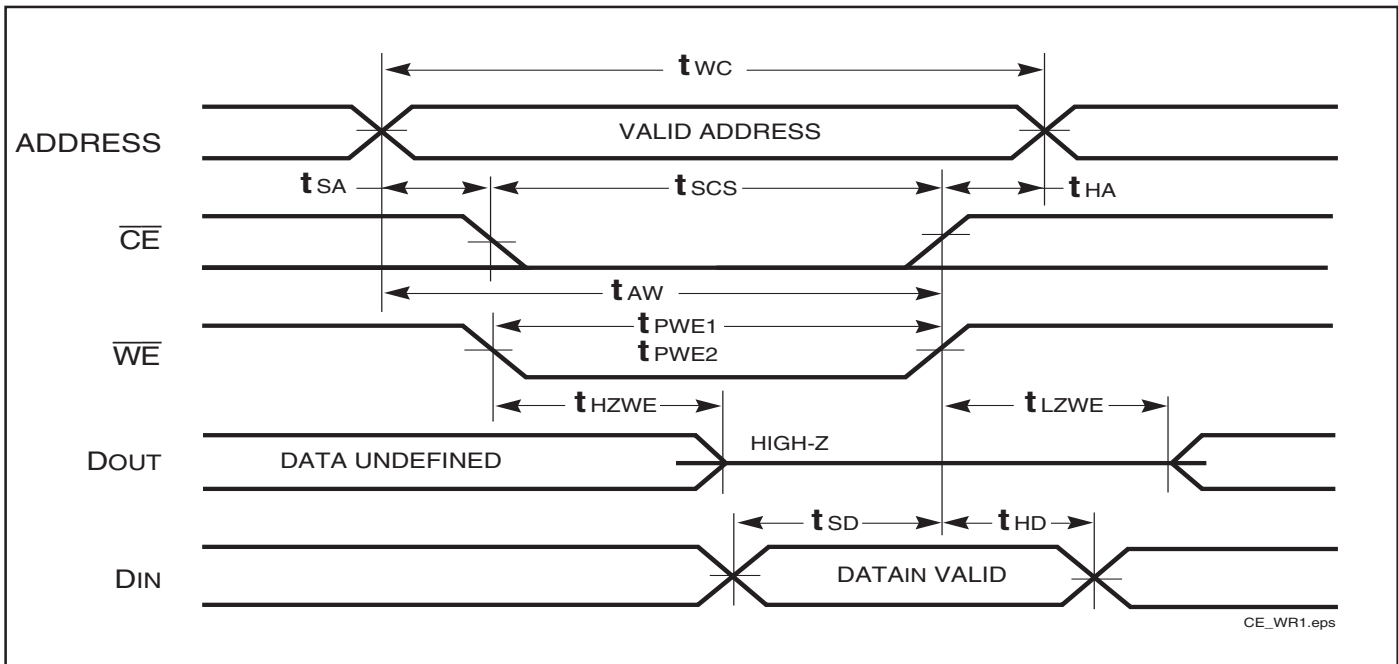
| Symbol                          | Parameter  | -10  |      | -12  |      | -25  |      | Unit |
|---------------------------------|--|------|------|------|------|------|------|------|
|                                 |  | Min. | Max. | Min. | Max. | Min. | Max. |      |
| t <sub>WC</sub>                 | Write Cycle Time                                     | 10   | —    | 12   | —    | 25   | —    | ns   |
| t <sub>SCE</sub>                | $\overline{CE}$ to Write End                         | 7    | —    | 9    | —    | 18   | —    | ns   |
| t <sub>AW</sub>                 | Address Setup Time to Write End                      | 7    | —    | 9    | —    | 18   | —    | ns   |
| t <sub>HA</sub>                 | Address Hold from Write End                          | 0    | —    | 0    | —    | 0    | —    | ns   |
| t <sub>SA</sub>                 | Address Setup Time                                   | 0    | —    | 0    | —    | 0    | —    | ns   |
| t <sub>PWE1</sub>               | $\overline{WE}$ Pulse Width ( $\overline{OE}$ =High) | 7    | —    | 9    | —    | 15   | —    | ns   |
| t <sub>PWE2</sub>               | $\overline{WE}$ Pulse Width ( $\overline{OE}$ =Low)  | 7    | —    | 9    | —    | 15   | —    | ns   |
| t <sub>SD</sub>                 | Data Setup to Write End                              | 6    | —    | 6    | —    | 15   | —    | ns   |
| t <sub>HD</sub>                 | Data Hold from Write End                             | 0    | —    | 0    | —    | 0    | —    | ns   |
| t <sub>HZWE<sup>(2)</sup></sub> | $\overline{WE}$ LOW to High-Z Output                 | —    | 6    | —    | 6    | —    | 15   | ns   |
| t <sub>LZWE<sup>(2)</sup></sub> | $\overline{WE}$ HIGH to Low-Z Output                 | 3    | —    | 3    | —    | 5    | —    | 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  $\pm 500$  mV from steady-state voltage. Not 100% tested.
3. The internal write time is defined by the overlap of  $\overline{CE}$  LOW, 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.

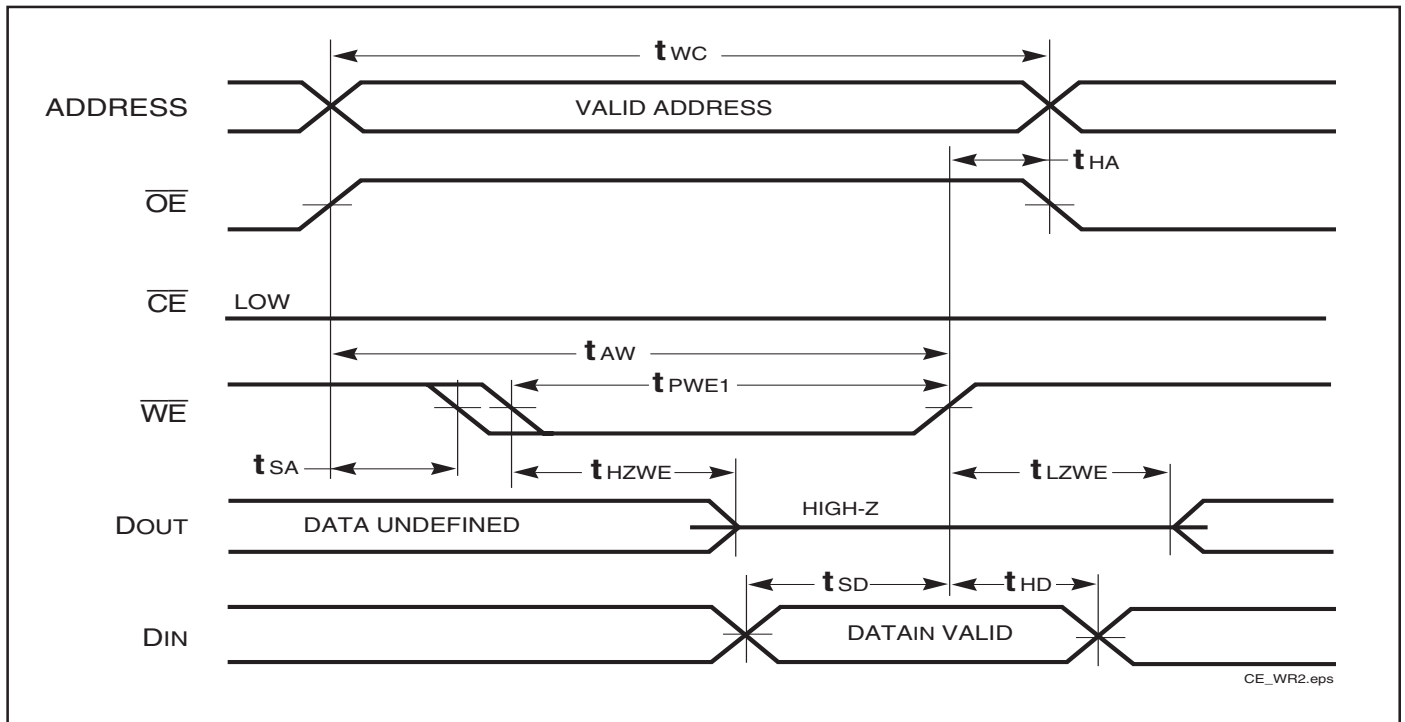
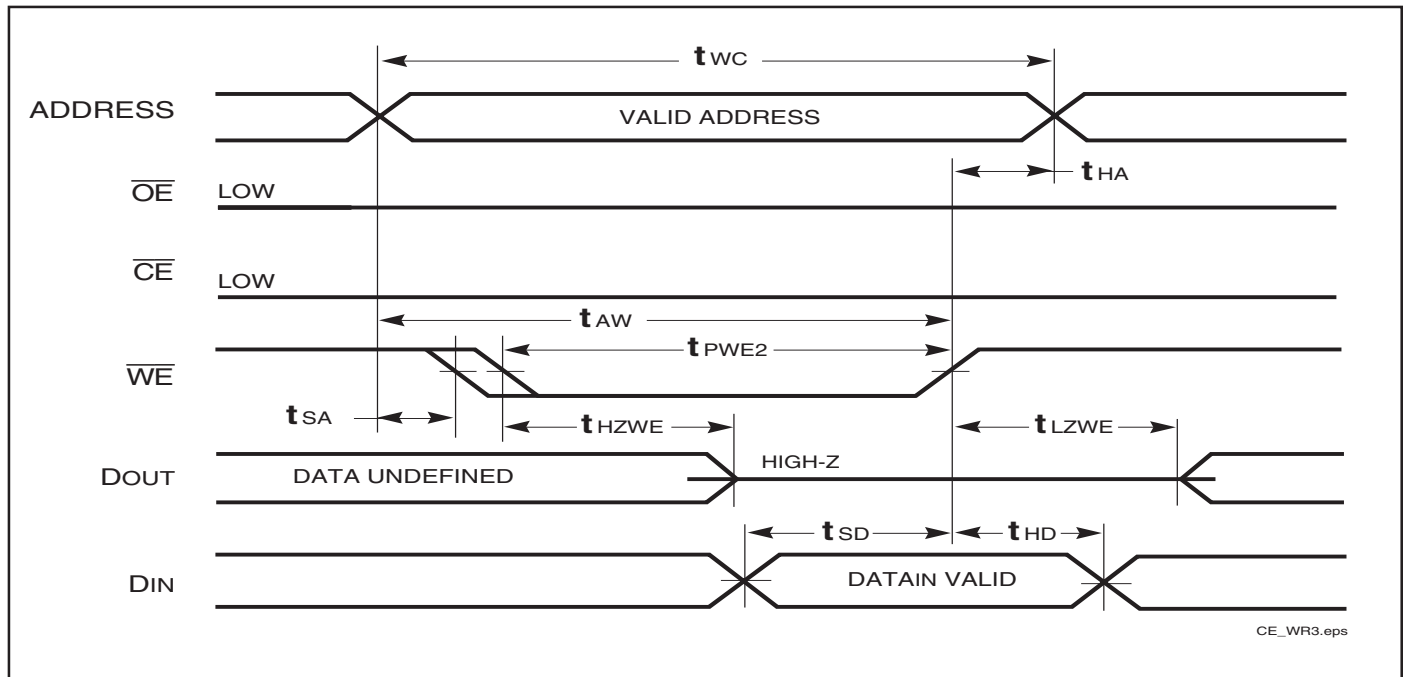
**AC WAVEFORMS**

**WRITE CYCLE NO. 1 ( $\overline{WE}$  Controlled)<sup>(1,2)</sup>**



**Notes:**

1. The internal write time is defined by the overlap of  $\overline{CE}$  LOW 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  $\overline{OE} \geq V_{IH}$ .

**WRITE CYCLE NO. 2 ( $\overline{OE}$  is HIGH During Write Cycle) <sup>(1,2)</sup>**

**WRITE CYCLE NO. 3 ( $\overline{OE}$  is LOW During Write Cycle) <sup>(1)</sup>**

**Notes:**

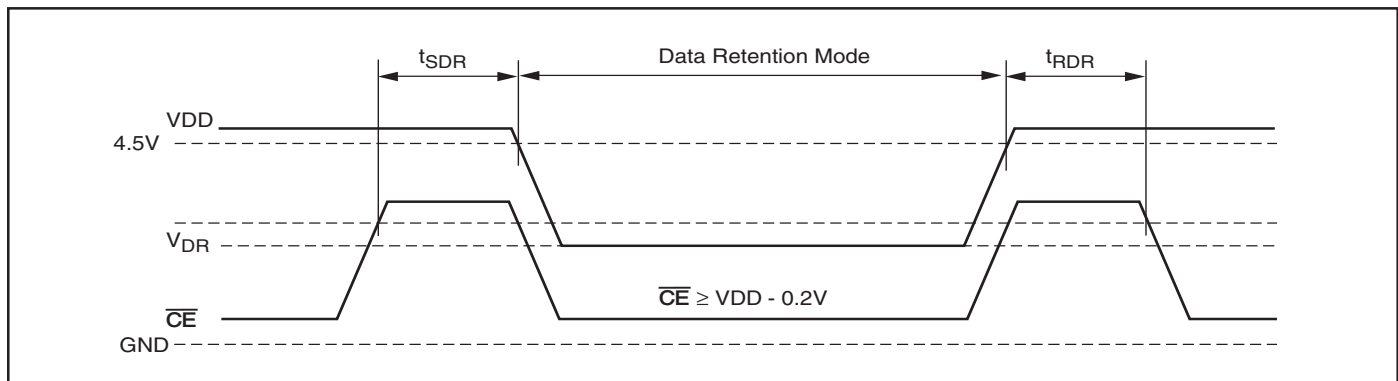
1. The internal write time is defined by the overlap of  $\overline{CE}$  LOW and  $\overline{WE}$  LOW. All signals must be in valid states to initiate a Write, but any one can go inactive to terminate the Write. The Data Input Setup and Hold timing are referenced to the rising or falling edge of the signal that terminates the Write.
2. I/O will assume the High-Z state if  $\overline{OE} \geq V_{IH}$ .

**DATA RETENTION SWITCHING CHARACTERISTICS (HIGH SPEED) (IS61/64C5128AL)**

| Symbol    | Parameter                   | Test Condition  | Min.   | Max.          | Unit |
|-----------|-----------------------------|---|--|---------------|------|
| $V_{DR}$  | $V_{DD}$ for Data Retention | See Data Retention Waveform   | 2.9  | 5.5           | V    |
| $I_{DR}$  | Data Retention Current      | $V_{DD} = 2.9V, \overline{CE} \geq V_{DD} - 0.2V$<br>$V_{IN} \geq V_{DD} - 0.2V, \text{ or } V_{IN} \leq V_{SS} + 0.2V$ | Com.<br>Ind.<br>Auto.<br>typ. <sup>(1)</sup> | 8<br>10<br>15 | mA   |
| $t_{SDR}$ | 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  $V_{DD} = 5V, T_A = 25^\circ C$  and not 100% tested.

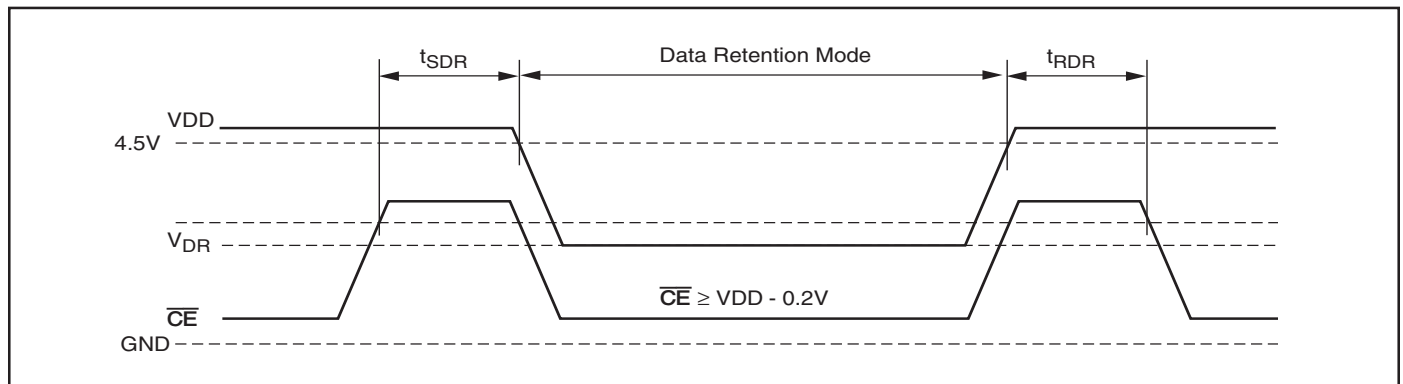
**DATA RETENTION WAVEFORM ( $\overline{CE}$  Controlled)**


**DATA RETENTION SWITCHING CHARACTERISTICS (LOW POWER) (IS61/64C5128AS)**

| Symbol    | Parameter                   | Test Condition  | Min.     | Max. | Unit |
|-----------|-----------------------------|---|----------|------|------|
| $V_{DR}$  | $V_{DD}$ for Data Retention | See Data Retention Waveform   | 2.9      | 5.5  | V    |
| $I_{DR}$  | Data Retention Current      | $V_{DD} = 2.9V, \overline{CE} \geq V_{DD} - 0.2V$<br>$V_{IN} \geq V_{DD} - 0.2V, \text{ or } V_{IN} \leq V_{SS} + 0.2V$ | —        | 0.8  | mA   |
|           |                             |   | —        | 0.9  |      |
|           |                             |   | —        | 2    |      |
| $t_{SDR}$ | 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  $V_{DD} = 5V, T_A = 25^\circ C$  and not 100% tested.

**DATA RETENTION WAVEFORM ( $\overline{CE}$  Controlled)**


**HIGH SPEED (IS61/64C5128AL)****ORDERING INFORMATION****Industrial Range: –40°C to +85°C**

| Speed (ns) | Order Part No.    | Package                        |
|------------|-------------------|--------------------------------|
| 10         | IS61C5128AL-10KI  | 400-mil Plastic SOJ            |
|            | IS61C5128AL-10KLI | 400-mil Plastic SOJ, Lead-free |
|            | IS61C5128AL-10TI  | 44-pin TSOP-II                 |
|            | IS61C5128AL-10TLI | 44-pin TSOP-II, Lead-free      |

**Automotive Range: –40°C to +125°C**

| Speed (ns) | Order Part No.     | Package                   |
|------------|--------------------|---------------------------|
| 12         | IS64C5128AL-12KA3  | 400-mil Plastic SOJ       |
|            | IS64C5128AL-12TA3  | 44-pin TSOP-II            |
|            | IS64C5128AL-12TLA3 | 44-pin TSOP-II, Lead-free |

**LOW POWER (IS61/64C5128AS)****ORDERING INFORMATION****Industrial Range: –40°C to +85°C**

| Speed (ns) | Order Part No.    | Package                        |
|------------|-------------------|--------------------------------|
| 25         | IS61C5128AS-25QI  | 450-mil Plastic SOP            |
|            | IS61C5128AS-25QLI | 450-mil Plastic SOP, Lead-free |
|            | IS61C5128AS-25HI  | 32-pin STSOP-I                 |
|            | IS61C5128AS-25HLI | 32-pin STSOP-I, Lead-free      |
|            | IS61C5128AS-25TI  | 32-pin TSOP-II                 |
|            | IS61C5128AS-25TLI | 32-pin TSOP-II, Lead-free      |

# PACKAGING INFORMATION

450-mil Plastic SOP  
 Package Code: Q (32-pin)



|           | MILLIMETERS |       | INCHES    |       |
|-----------|-------------|-------|-----------|-------|
| Symbol    | Min.        | Max.  | Min.      | Max.  |
| No. Leads | 32          |       |           |       |
| A         | —           | 3.00  | —         | 0.118 |
| A1        | 0.10        | —     | 0.004     | —     |
| B         | 0.36        | 0.51  | 0.014     | 0.020 |
| C         | 0.15        | 0.30  | 0.006     | 0.012 |
| D         | 20.14       | 20.75 | 0.793     | 0.817 |
| E         | 13.87       | 14.38 | 0.546     | 0.566 |
| E1        | 11.18       | 11.43 | 0.440     | 0.450 |
| e         | 1.27 BSC    |       | 0.050 BSC |       |
| L         | 0.58        | 0.99  | 0.023     | 0.039 |
| $\alpha$  | 0°          | 10°   | 0°        | 10°   |
| S         | —           | 0.86  | —         | 0.034 |

**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.

# 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.

| Symbol        | Millimeters |       | Inches    |       | Millimeters |       | Inches    |       | Millimeters |       | Inches    |       |
|---------------|-------------|-------|-----------|-------|-------------|-------|-----------|-------|-------------|-------|-----------|-------|
|               | 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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Rev. F  
10/29/03





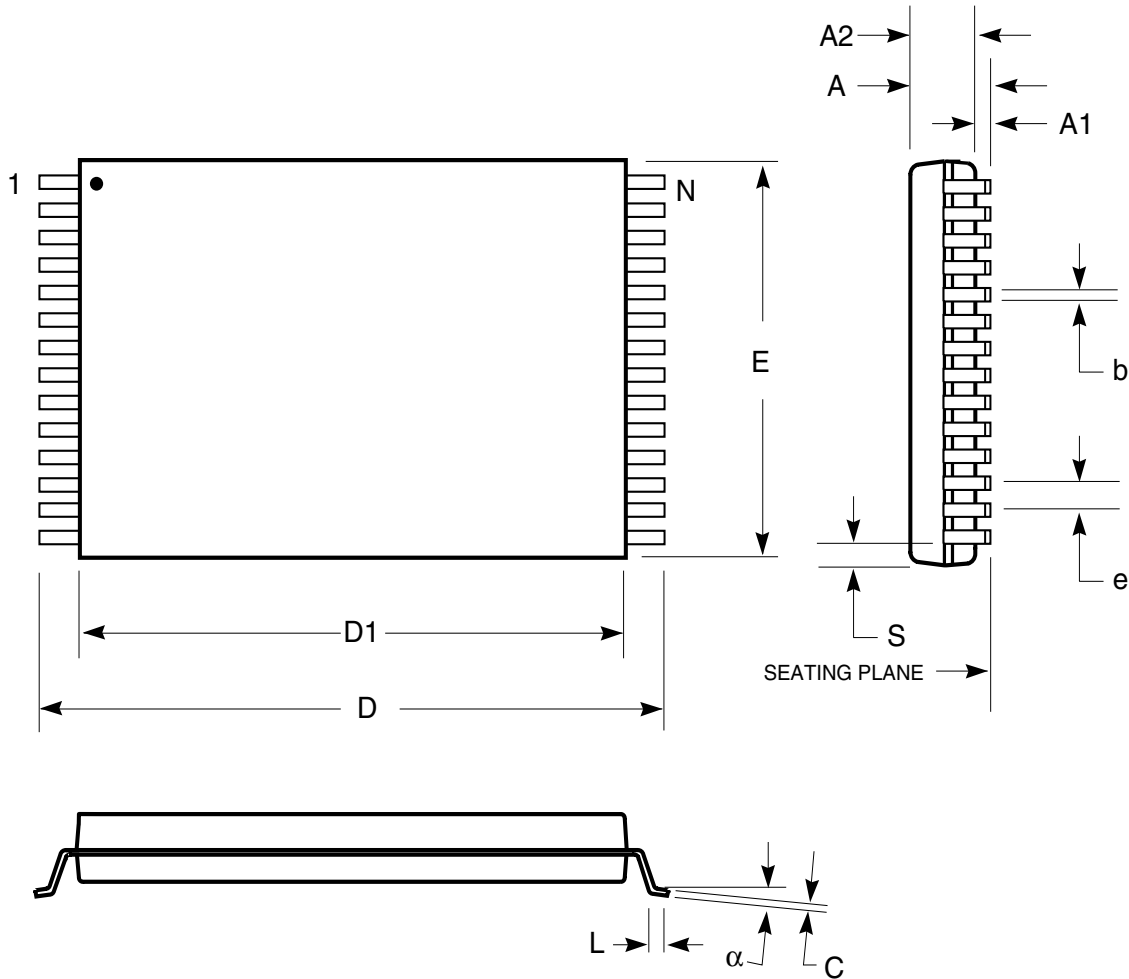
# PACKAGING INFORMATION

| Symbol        | Millimeters |       | Inches    |       | Millimeters |       | Inches    |       | Millimeters |       | Inches    |       |
|---------------|-------------|-------|-----------|-------|-------------|-------|-----------|-------|-------------|-------|-----------|-------|
|               | 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

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. |        |
| alpha                      | 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

Plastic TSOP  
 Package Code: T (Type II)



**Notes:**

1. Controlling dimension: millimeters, 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.



Plastic TSOP (T - Type II)

| Symbol        | Millimeters |       | Inches    |       | Millimeters |       | Inches    |       | Millimeters |       | Inches    |       |
|---------------|-------------|-------|-----------|-------|-------------|-------|-----------|-------|-------------|-------|-----------|-------|
|               | Min         | Max   | Min       | Max   | Min         | Max   | Min       | Max   | Min         | Max   | Min       | Max   |
| Ref. Std.     |             |       |           |       |             |       |           |       |             |       |           |       |
| No. Leads (N) | 32          |       |           |       | 44          |       |           |       | 50          |       |           |       |
| A             | —           | 1.20  | —         | 0.047 | —           | 1.20  | —         | 0.047 | —           | 1.20  | —         | 0.047 |
| A1            | 0.05        | 0.15  | 0.002     | 0.006 | 0.05        | 0.15  | 0.002     | 0.006 | 0.05        | 0.15  | 0.002     | 0.006 |
| b             | 0.30        | 0.52  | 0.012     | 0.020 | 0.30        | 0.45  | 0.012     | 0.018 | 0.30        | 0.45  | 0.012     | 0.018 |
| C             | 0.12        | 0.21  | 0.005     | 0.008 | 0.12        | 0.21  | 0.005     | 0.008 | 0.12        | 0.21  | 0.005     | 0.008 |
| D             | 20.82       | 21.08 | 0.820     | 0.830 | 18.31       | 18.52 | 0.721     | 0.729 | 20.82       | 21.08 | 0.820     | 0.830 |
| E1            | 10.03       | 10.29 | 0.391     | 0.400 | 10.03       | 10.29 | 0.395     | 0.405 | 10.03       | 10.29 | 0.395     | 0.405 |
| E             | 11.56       | 11.96 | 0.451     | 0.466 | 11.56       | 11.96 | 0.455     | 0.471 | 11.56       | 11.96 | 0.455     | 0.471 |
| e             | 1.27 BSC    |       | 0.050 BSC |       | 0.80 BSC    |       | 0.032 BSC |       | 0.80 BSC    |       | 0.031 BSC |       |
| L             | 0.40        | 0.60  | 0.016     | 0.024 | 0.41        | 0.60  | 0.016     | 0.024 | 0.40        | 0.60  | 0.016     | 0.024 |
| ZD            | 0.95 REF    |       | 0.037 REF |       | 0.81 REF    |       | 0.032 REF |       | 0.88 REF    |       | 0.035 REF |       |
| α             | 0°          | 5°    | 0°        | 5°    | 0°          | 5°    | 0°        | 5°    | 0°          | 5°    | 0°        | 5°    |

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Rev. F  
 06/18/03

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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А