

## Features

- Higher speed up to 55 ns
- Wide voltage range: 2.2 V to 3.6 V and 4.5 V to 5.5 V
- Ultra low standby power
  - Typical standby current: 1  $\mu$ A
  - Maximum standby current: 7  $\mu$ A
- Ultra low active power
  - Typical active current: 2 mA at  $f = 1$  MHz
- Easy memory expansion with  $\overline{CE}$  and  $\overline{OE}$  features
- Automatic power-down when deselected
- Complementary metal oxide semiconductor (CMOS) for optimum speed and power
- Available in Pb-free 32-pin shrunk thin small outline package (STSOP) package

## Functional Description

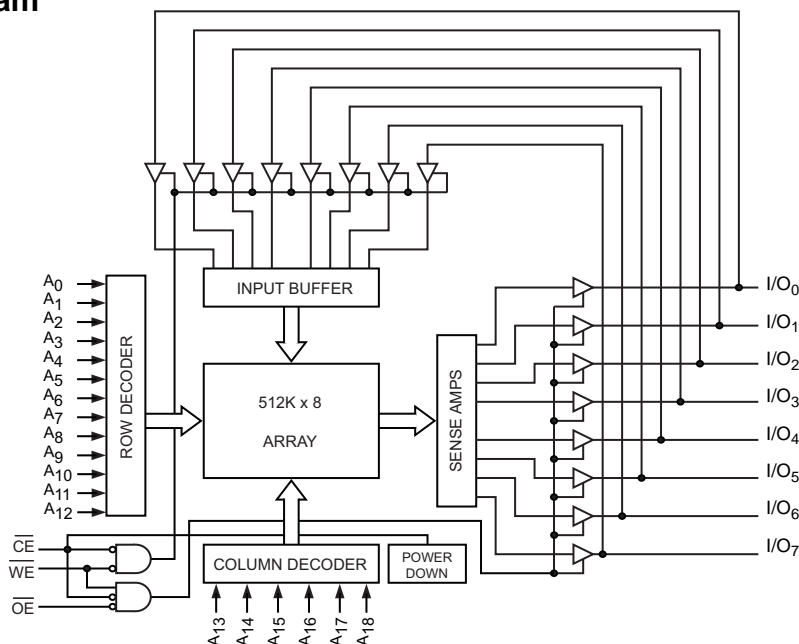
The CY62148ESL is a high performance CMOS static RAM organized as 512 K words by 8-bits. This device features advanced circuit design to provide ultra low active current. This is ideal for providing More Battery Life™ (MoBL<sup>®</sup>) in portable applications. The device also has an automatic power-down feature that significantly reduces power consumption. Placing the device in standby mode reduces power consumption by more than 99 percent when deselected ( $\overline{CE}$  HIGH). The eight input and output pins ( $I/O_0$  through  $I/O_7$ ) are placed in a high impedance state when the device is deselected ( $\overline{CE}$  HIGH), the outputs are disabled ( $\overline{OE}$  HIGH), or during a write operation ( $\overline{CE}$  LOW and  $\overline{WE}$  LOW).

To write to the device, take Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs LOW. Data on the eight I/O pins ( $I/O_0$  through  $I/O_7$ ) is then written into the location specified on the address pins ( $A_0$  through  $A_{18}$ ).

To read from the device, take Chip Enable ( $\overline{CE}$ ) and Output Enable ( $\overline{OE}$ ) LOW while forcing Write Enable ( $\overline{WE}$ ) HIGH. Under these conditions, the contents of the memory location specified by the address pins appear on the I/O pins.

The CY62148ESL device is suitable for interfacing with processors that have TTL I/P levels. It is not suitable for processors that require CMOS I/P levels. Please see [Electrical Characteristics on page 4](#) for more details and suggested alternatives.

## Logic Block Diagram

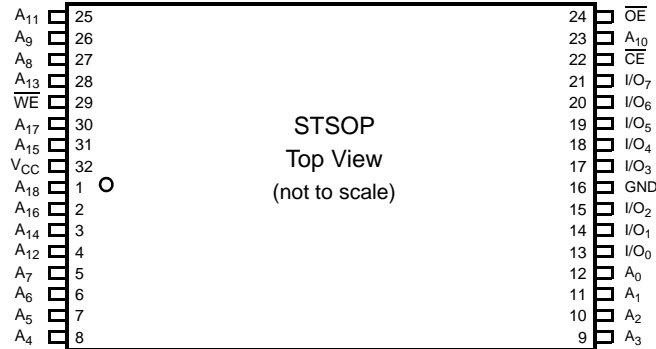


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## Pin Configuration

Figure 1. 32-pin STSOP (Top View) pinout



## Product Portfolio

Product	Range	V <sub>CC</sub> Range (V) <sup>[1]</sup>	Speed (ns)	Power Dissipation					
				Operating I <sub>CC</sub> (mA)				Standby, I <sub>SB2</sub> (μA)	
				f = 1 MHz		f = f <sub>max</sub>			
				Typ <sup>[2]</sup>	Max	Typ <sup>[2]</sup>	Max	Typ <sup>[2]</sup>	Max
CY62148ESL	Industrial / Automotive-A	2.2 V to 3.6 V and 4.5 V to 5.5 V	55	2	2.5	15	20	1	7

### Notes

1. Data sheet specifications are not guaranteed for V<sub>CC</sub> in the range of 3.6 V to 4.5 V.
2. Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at V<sub>CC</sub> = V<sub>CC(typ)</sub>, T<sub>A</sub> = 25 °C.

## Maximum Ratings

Exceeding maximum ratings may shorten the useful life of the device. User guidelines are not tested.

Storage temperature .....	-65 °C to +150 °C
Ambient temperature with power applied ...	55 °C to +125 °C
Supply voltage to ground potential .....	-0.5 V to 6.0 V
DC voltage applied to outputs in high Z state <sup>[3, 4]</sup> .....	-0.5 V to 6.0 V
DC input voltage <sup>[3, 4]</sup> .....	-0.5 V to 6.0 V

Output current into outputs (low) .....	20 mA
Static discharge voltage (MIL-STD-883, Method 3015) .....	> 2001 V
Latch-up current .....	> 200 mA

## Operating Range

Device	Range	Ambient Temperature	V <sub>CC</sub> <sup>[5]</sup>
CY62148ESL	Industrial / Automotive-A	-40 °C to +85 °C	2.2 V to 3.6 V, and 4.5 V to 5.5 V

## Electrical Characteristics

Over the operating range

Parameter	Description	Test Conditions	55 ns (Industrial/Automotive-A)			Unit
			Min	Typ <sup>[6]</sup>	Max	
V <sub>OH</sub>	Output HIGH voltage	2.2 ≤ V <sub>CC</sub> ≤ 2.7   I <sub>OH</sub> = -0.1 mA	2.0	-	-	V
		2.7 ≤ V <sub>CC</sub> ≤ 3.6   I <sub>OH</sub> = -1.0 mA	2.4	-	-	
		4.5 ≤ V <sub>CC</sub> ≤ 5.5   I <sub>OH</sub> = -1.0 mA	2.4	-	-	
		4.5 ≤ V <sub>CC</sub> ≤ 5.5   I <sub>OH</sub> = -0.1 mA	-	-	3.4 <sup>[7]</sup>	
V <sub>OL</sub>	Output LOW voltage	2.2 ≤ V <sub>CC</sub> ≤ 2.7   I <sub>OL</sub> = 0.1 mA	-	-	0.4	V
		2.7 ≤ V <sub>CC</sub> ≤ 3.6   I <sub>OL</sub> = 2.1 mA	-	-	0.4	
		4.5 ≤ V <sub>CC</sub> ≤ 5.5   I <sub>OL</sub> = 2.1 mA	-	-	0.4	
V <sub>IH</sub>	Input HIGH voltage	2.2 ≤ V <sub>CC</sub> ≤ 2.7	1.8	-	V <sub>CC</sub> + 0.3	V
		2.7 ≤ V <sub>CC</sub> ≤ 3.6	2.2	-	V <sub>CC</sub> + 0.3	
		4.5 ≤ V <sub>CC</sub> ≤ 5.5	2.2	-	V <sub>CC</sub> + 0.5	
V <sub>IL</sub> <sup>[8]</sup>	Input LOW voltage	2.2 ≤ V <sub>CC</sub> ≤ 2.7	-0.3	-	0.4	V
		2.7 ≤ V <sub>CC</sub> ≤ 3.6	-0.3	-	0.6	
		4.5 ≤ V <sub>CC</sub> ≤ 5.5	-0.5	-	0.6	
I <sub>IX</sub>	Input leakage current	GND ≤ V <sub>IN</sub> ≤ V <sub>CC</sub>	-1	-	+1	μA
I <sub>OZ</sub>	Output leakage current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> , output disabled	-1	-	+1	μA
I <sub>CC</sub>	V <sub>CC</sub> operating supply current	f = f <sub>max</sub> = 1/t <sub>RC</sub>   V <sub>CC</sub> = V <sub>CCmax</sub>	-	15	20	mA
		f = 1 MHz   I <sub>OUT</sub> = 0 mA, CMOS levels	-	2	2.5	
I <sub>SB1</sub> <sup>[9]</sup>	Automatic CE power-down current – CMOS inputs	CE ≥ V <sub>CC</sub> - 0.2 V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2 V or V <sub>IN</sub> ≤ 0.2 V, f = f <sub>max</sub> (address and data only), f = 0 (OE and WE), V <sub>CC</sub> = V <sub>CC(max)</sub>	-	1	7	μA
		-	-	-	-	
I <sub>SB2</sub> <sup>[9]</sup>	Automatic CE power-down current – CMOS inputs	CE ≥ V <sub>CC</sub> - 0.2 V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2 V or V <sub>IN</sub> ≤ 0.2 V, f = 0, V <sub>CC</sub> = V <sub>CC(max)</sub>	-	1	7	μA
		-	-	-	-	

### Notes

- V<sub>IL(min)</sub> = -2.0 V for pulse durations less than 20 ns.
- V<sub>IH(max)</sub> = V<sub>CC</sub> + 0.75 V for pulse durations less than 20 ns.
- Full device AC operation assumes a minimum of 100 μs ramp time from 0 to V<sub>CC(min)</sub> and 200 μs wait time after V<sub>CC</sub> stabilization.
- Typical values are included for reference and are not guaranteed or tested. Typical values are measured at V<sub>CC</sub> = V<sub>CC(typ)</sub>, T<sub>A</sub> = 25 °C.
- Please note that the maximum V<sub>OH</sub> limit does not exceed minimum CMOS V<sub>IH</sub> of 3.5V. If you are interfacing this SRAM with 5V legacy processors that require a minimum V<sub>IH</sub> of 3.5V, please refer to Application Note AN6081 for technical details and options you may consider
- Under DC conditions the device meets a V<sub>IL</sub> of 0.8 V (for V<sub>CC</sub> range of 2.7 V to 3.6 V and 4.5 V to 5.5 V) and 0.6 V (for V<sub>CC</sub> range of 2.2 V to 2.7 V). However, in dynamic conditions Input LOW voltage applied to the device must not be higher than 0.6 V and 0.4 V for the above ranges.
- Chip enable (CE) must be HIGH at CMOS level to meet the I<sub>SB1</sub> / I<sub>SB2</sub> / I<sub>CCDR</sub> spec. Other inputs can be left floating.

### Capacitance

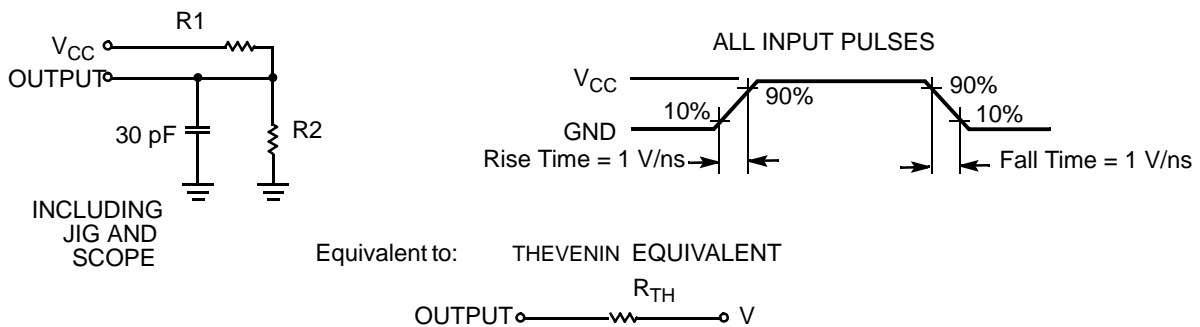
Parameter <sup>[10]</sup>	Description	Test Conditions	Max	Unit
C <sub>IN</sub>	Input capacitance	T <sub>A</sub> = 25 °C, f = 1 MHz, V <sub>CC</sub> = V <sub>CC(Typ)</sub>	10	pF
C <sub>OUT</sub>	Output capacitance		10	pF

### Thermal Resistance

Parameter <sup>[10]</sup>	Description	Test Conditions	32-pin STSOP	Unit
Θ <sub>JA</sub>	Thermal resistance (junction to ambient)	Still air, soldered on a 3 × 4.5 inch, two-layer printed circuit board	49.02	°C/W
Θ <sub>JC</sub>	Thermal resistance (junction to case)		14.07	°C/W

### AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms



Parameter	2.5 V	3.0 V	5.0 V	Unit
R1	16667	1103	1800	Ω
R2	15385	1554	990	Ω
R <sub>TH</sub>	8000	645	639	Ω
V <sub>TH</sub>	1.20	1.75	1.77	V

**Note**

10. Tested initially and after any design or process changes that may affect these parameters.

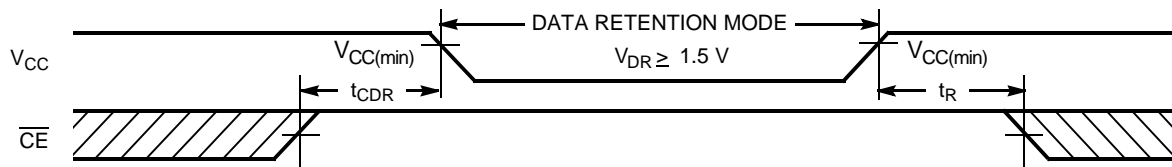
## Data Retention Characteristics

Over the operating range

Parameter	Description	Conditions	Min	Typ <sup>[11]</sup>	Max	Unit
$V_{DR}$	$V_{CC}$ for data retention		1.5	–	–	V
$I_{CCDR}$ <sup>[12]</sup>	Data retention current	$CE \geq V_{CC} - 0.2\text{ V}$ , $V_{IN} \geq V_{CC} - 0.2\text{ V}$ or $V_{IN} \leq 0.2\text{ V}$ , $V_{CC} = 1.5\text{ V}$	–	1	7	$\mu\text{A}$
$t_{CDR}$	Chip deselect to data retention time		0	–	–	ns
$t_R$ <sup>[13]</sup>	Operation recovery time		55	–	–	ns

## Data Retention Waveform

Figure 3. Data Retention Waveform



### Notes

11. Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at  $V_{CC} = V_{CC(typ)}$ ,  $T_A = 25\text{ }^\circ\text{C}$ .
12. Chip enable ( $\overline{CE}$ ) must be HIGH at CMOS level to meet the  $I_{SB1}$  /  $I_{SB2}$  /  $I_{CCDR}$  spec. Other inputs can be left floating.
13. Full device operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(min)} \geq 100\text{ }\mu\text{s}$  or stable at  $V_{CC(min)} \geq 100\text{ }\mu\text{s}$ .

## Switching Characteristics

Over the operating range

Parameter <sup>[14, 15]</sup>	Description	55 ns (Industrial / Automotive-A)		Unit
		Min	Max	
<b>Read Cycle</b>				
$t_{RC}$	Read cycle time	55	–	ns
$t_{AA}$	Address to data valid	–	55	ns
$t_{OHA}$	Data hold from address change	10	–	ns
$t_{ACE}$	CE LOW to data valid	–	55	ns
$t_{DOE}$	OE LOW to data valid	–	25	ns
$t_{LZOE}$	OE LOW to low Z <sup>[16]</sup>	5	–	ns
$t_{HZOE}$	OE HIGH to high Z <sup>[16, 17]</sup>	–	20	ns
$t_{LZCE}$	CE LOW to low Z <sup>[16]</sup>	10	–	ns
$t_{HZCE}$	CE HIGH to high Z <sup>[16, 17]</sup>	–	20	ns
$t_{PU}$	CE LOW to power-up	0	–	ns
$t_{PD}$	CE HIGH to power-up	–	55	ns
<b>Write Cycle <sup>[18]</sup></b>				
$t_{WC}$	Write cycle time	55	–	ns
$t_{SCE}$	CE LOW to write end	40	–	ns
$t_{AW}$	Address setup to write end	40	–	ns
$t_{HA}$	Address hold from write end	0	–	ns
$t_{SA}$	Address setup to write start	0	–	ns
$t_{PWE}$	WE pulse width	40	–	ns
$t_{SD}$	Data setup to write end	25	–	ns
$t_{HD}$	Data hold from write end	0	–	ns
$t_{HZWE}$	WE LOW to high Z <sup>[16, 17]</sup>	–	20	ns
$t_{LZWE}$	WE HIGH to low Z <sup>[16]</sup>	10	–	ns

### Notes

14. In an earlier revision of this device, under a specific application condition, READ and WRITE operations were limited to switching of the chip enable signal as described in the Application Note [AN66311](#). However, the issue has been fixed and in production now, and hence, this Application Notes is no longer applicable. It is available for download on our website as it contains information on the date code of the parts, beyond which the fix has been in production.
15. Test conditions for all parameters other than tri-state parameters assume signal transition time of 3 ns or less (1 V/ns), timing reference levels of  $V_{CC(typ)}/2$ , input pulse levels of 0 to  $V_{CC(typ)}$ , and output loading of the specified  $I_{OL}/I_{OH}$  as shown in [Figure 2 on page 5](#).
16. At any temperature and voltage condition,  $t_{HZCE}$  is less than  $t_{LZCE}$ ,  $t_{HZOE}$  is less than  $t_{LZOE}$ , and  $t_{HZWE}$  is less than  $t_{LZWE}$  for any device.
17.  $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  transitions are measured when the output enter a high impedance state.
18. The internal write time of the memory is defined by the overlap of WE, CE =  $V_{IL}$ . All signals must be ACTIVE to initiate a write and any of these signals can terminate a write by going INACTIVE. The data input setup and hold timing must be referenced to the edge of the signal that terminates the write.

## Switching Waveforms

Figure 4. Read Cycle No. 1 (Address Transition Controlled) [19, 20]

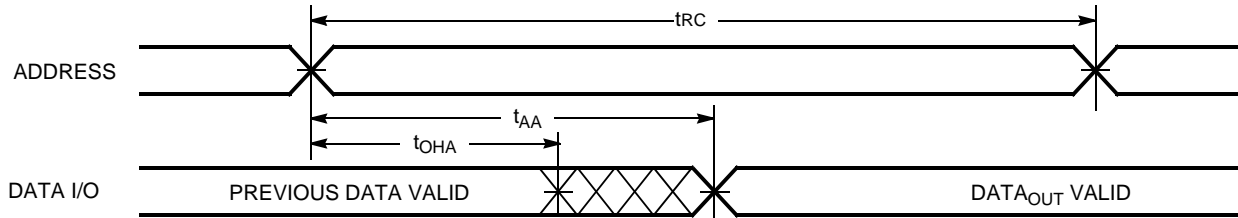
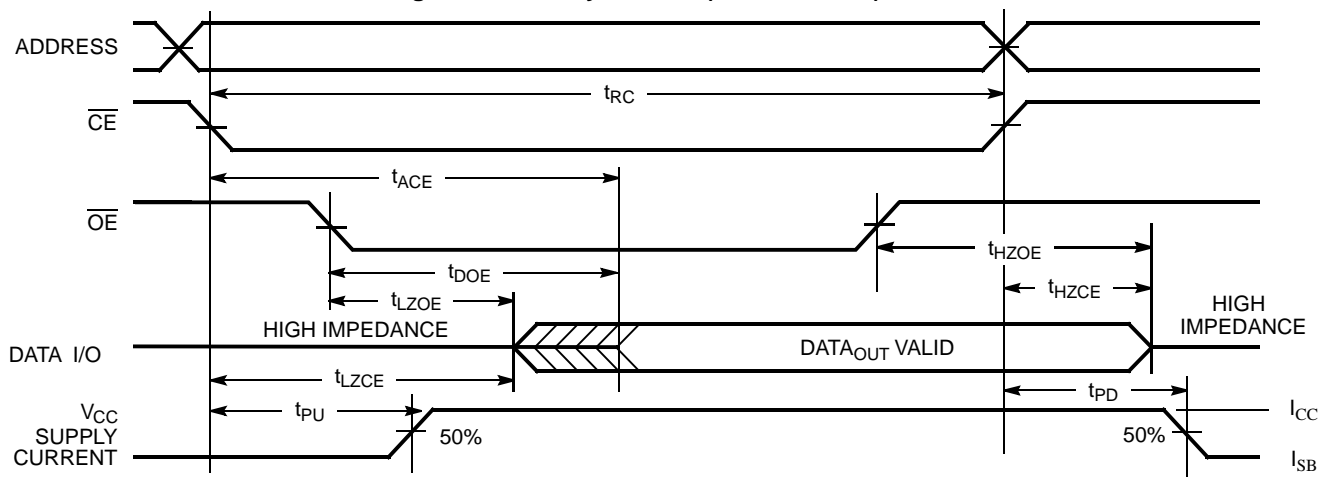


Figure 5. Read Cycle No. 2 ( $\overline{OE}$  Controlled) [20, 21]



### Notes

19. Device is continuously selected.  $\overline{OE}$ ,  $\overline{CE} = V_{IL}$ .
20. WE is HIGH for read cycles.
21. Address valid before or similar to  $\overline{CE}$  transition LOW.
22. Data I/O is high impedance if  $\overline{OE} = V_{IH}$ .
23. If  $\overline{CE}$  goes HIGH simultaneously with WE HIGH, the output remains in high impedance state.
24. During this period, the I/Os are in output state. Do not apply input signals.



Switching Waveforms (continued)

Figure 6. Write Cycle No. 1 ( $\overline{\text{CE}}$  Controlled) [25, 26]

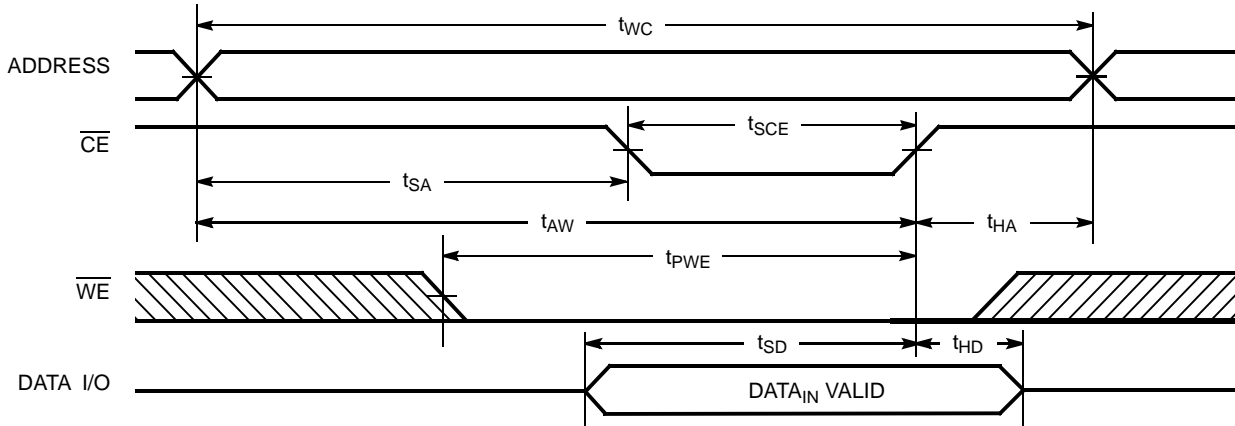
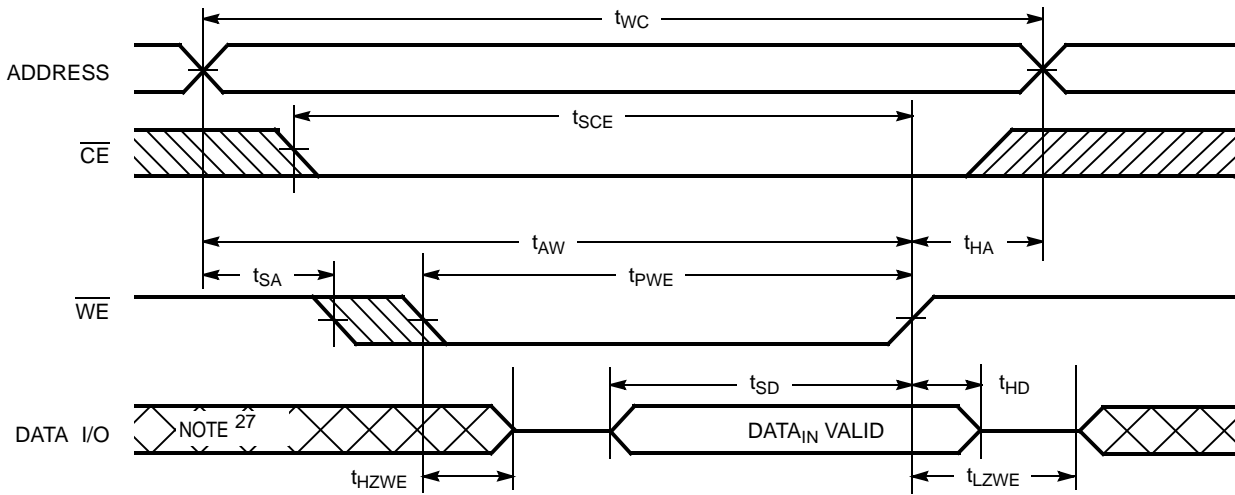


Figure 7. Write Cycle No. 2 ( $\overline{\text{WE}}$  Controlled) [26]



Notes

- 25. Data I/O is high impedance if  $\overline{\text{OE}} = V_{IH}$ .
- 26. If  $\overline{\text{CE}}$  goes HIGH simultaneously with  $\overline{\text{WE}}$  HIGH, the output remains in high impedance state.
- 27. During this period, the I/Os are in output state. Do not apply input signals.

**Truth Table**

<b>CE</b>	<b>WE</b>	<b>OE</b>	<b>I/O</b>	<b>Mode</b>	<b>Power</b>
H <sup>[28]</sup>	X	X	High Z	Deselect/power-down	Standby ( $I_{SB}$ )
L	H	L	Data out	Read	Active ( $I_{CC}$ )
L	H	H	High Z	Output disabled	Active ( $I_{CC}$ )
L	L	X	Data in	Write	Active ( $I_{CC}$ )

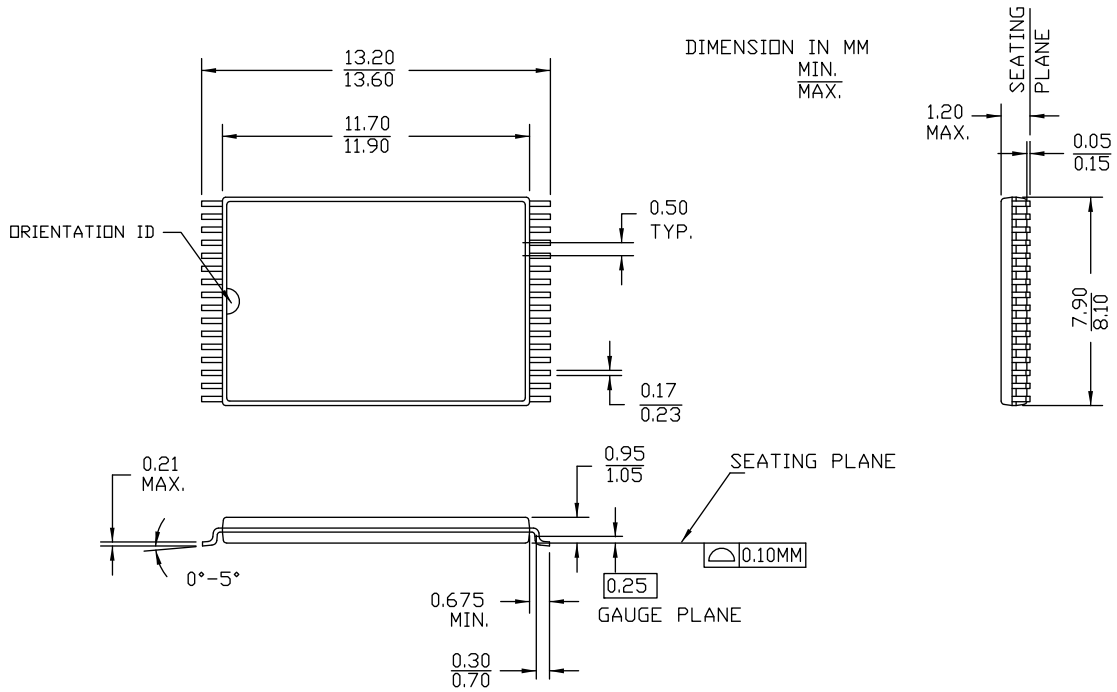
**Note**

28. Chip enable ( $\overline{CE}$ ) must be HIGH at CMOS level to meet the  $I_{SB1}$  /  $I_{SB2}$  /  $I_{CCDR}$  spec. Other inputs can be left floating.



Package Diagram

Figure 8. 32-pin STSOP (8 x 13.4 x 1.2 mm) ZA32 Package Outline, 51-85094



51-85094 \*F

### Acronyms

Acronym	Description
BHE	Byte High Enable
BLE	Byte Low Enable
CE	Chip Enable
CMOS	Complementary Metal Oxide Semiconductor
I/O	Input/Output
OE	Output Enable
SRAM	Static Random Access Memory
TSOP	Thin Small Outline Package
WE	Write Enable

### Document Conventions

#### Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	megahertz
μA	microampere
mA	milliampere
ns	nanosecond
Ω	ohm
pF	picofarad
V	volt
W	watt

Document History Page

Document Title: CY62148ESL MoBL <sup>®</sup> , 4-Mbit (512 K x 8) Static RAM				
Document Number: 001-50045				
Rev.	ECN	Orig. of Change	Submission Date	Description of Change
**	2612938	VKN / PYRS	01/21/09	New data sheet.
*A	2800124	VKN	11/06/2009	Updated <a href="#">Product Portfolio</a> (Included Automotive-A information). Updated <a href="#">Operating Range</a> (Included Automotive-A information). Updated <a href="#">Ordering Information</a> (Updated part numbers (Included Automotive-A information)).
*B	2947039	VKN	06/10/2010	Updated <a href="#">Electrical Characteristics</a> (Added Note 9 and referred the same note in I <sub>SB2</sub> parameter). Updated <a href="#">Truth Table</a> (Added Note 28 and referred the same note in $\overline{CE}$ column). Updated <a href="#">Package Diagram</a> .
*C	3006318	AJU	08/23/2010	Updated <a href="#">Electrical Characteristics</a> (Updated Note 9 and referred the same note in I <sub>SB1</sub> parameter). Updated <a href="#">Data Retention Characteristics</a> (Added Note 12 and referred the same note in I <sub>CCDR</sub> parameter). Added <a href="#">Ordering Code Definitions</a> . Added <a href="#">Acronyms and Units of Measure</a> . Updated in new template.
*D	3296704	RAME	06/29/2011	Updated <a href="#">Functional Description</a> (Removed “For best practice recommendations, refer to the Cypress application note AN1064, SRAM System Guidelines.”). Updated <a href="#">Ordering Code Definitions</a> . Updated <a href="#">Package Diagram</a> to latest revision.
*E	3515577	TAVA	02/03/2012	Updated <a href="#">Switching Waveforms</a> .
*F	3548240	TAVA	03/12/2012	Updated <a href="#">Electrical Characteristics</a> (Updated Note 8 (Removed “Refer to AN13470 for details.”)).
*G	3897076	MEMJ	02/06/2013	Updated <a href="#">Switching Waveforms</a> : Removed figure “Write Cycle No. 1 (WE Controlled, $\overline{OE}$ HIGH During Write)”. Updated title of <a href="#">Figure 7</a> .
*H	4039358	MEMJ	07/01/2013	Updated <a href="#">Functional Description</a> .  Updated <a href="#">Electrical Characteristics</a> : Added one more Test Condition “ $4.5 \leq V_{CC} \leq 5.5$ ” for V <sub>OH</sub> parameter and added maximum value corresponding to that Test Condition. Added Note 7 and referred the same note in maximum value for V <sub>OH</sub> parameter corresponding to Test Condition “ $4.5 \leq V_{CC} \leq 5.5$ ”.  Updated in new template.
*I	4099182	VINI	08/19/2013	Updated <a href="#">Switching Characteristics</a> : Added Note 14 and referred the same note in “Parameter” column.

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