

## Features

- Very high speed: 45 ns
- Temperature ranges
  - Industrial: -40 °C to +85 °C
  - Automotive-A: -40 °C to +85 °C
  - Automotive-E: -40 °C to +125 °C
- Voltage range: 4.5 V to 5.5 V
- Pin compatible with CY62128B
- Ultra low standby power
  - Typical standby current: 1 μA
  - Maximum standby current: 4 μA (Industrial)
- Ultra low active power
  - Typical active current: 1.3 mA at f = 1 MHz
- Easy memory expansion with  $\overline{CE}_1$ ,  $CE_2$ , and  $\overline{OE}$  features
- Automatic power down when deselected
- complementary metal oxide semiconductor (CMOS) for optimum speed and power
- Offered in standard Pb-free 32-pin STSOP, 32-pin SOIC, and 32-pin thin small outline package (TSOP) Type I packages

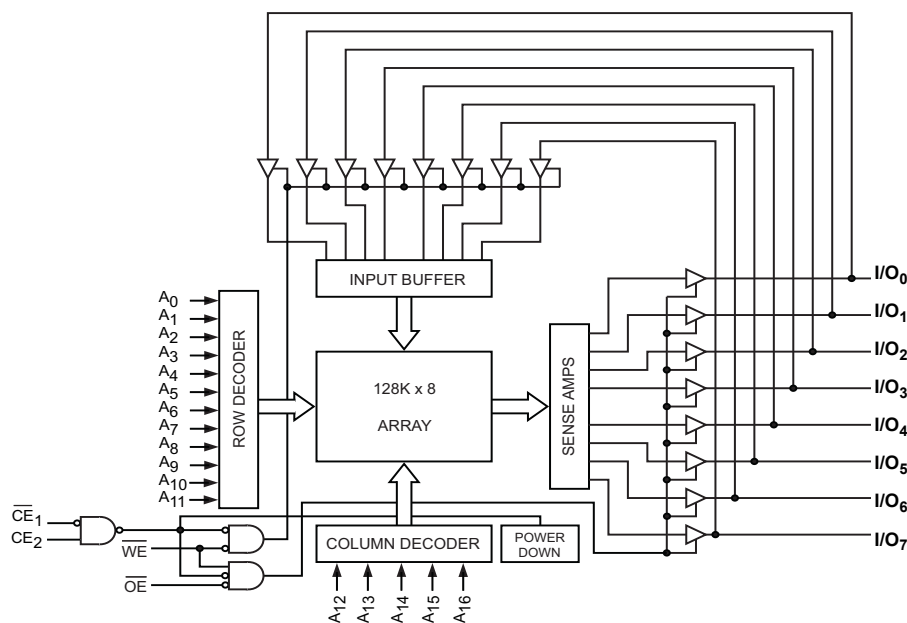
## Functional Description

The CY62128E is a high performance CMOS static RAM organized as 128K 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 such as cellular telephones. The device also has an automatic power down feature that significantly reduces power consumption when addresses are not toggling. Placing the device into standby mode reduces power consumption by more than 99 percent when deselected ( $\overline{CE}_1$  HIGH or  $CE_2$  LOW). 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 ( $\overline{CE}_1$  HIGH or  $CE_2$  LOW), the outputs are disabled ( $\overline{OE}$  HIGH), or a write operation is in progress ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH and WE LOW)

To write to the device, take Chip Enable ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH) and Write Enable (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  $A_{16}$ ).

To read from the device, take Chip Enable ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH) and Output Enable ( $\overline{OE}$ ) LOW while forcing Write Enable (WE) HIGH. Under these conditions, the contents of the memory location specified by the address pins appear on the I/O pins.

## Logic Block Diagram



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## Pin Configuration

Figure 1. 32-pin STSOP [1]

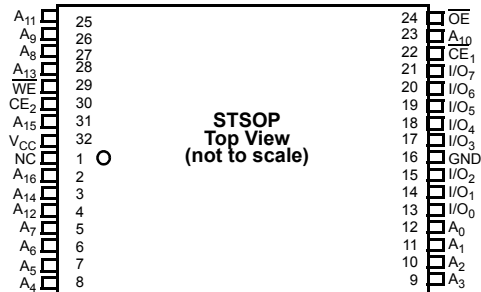


Figure 2. 32-pin TSOP I [1]

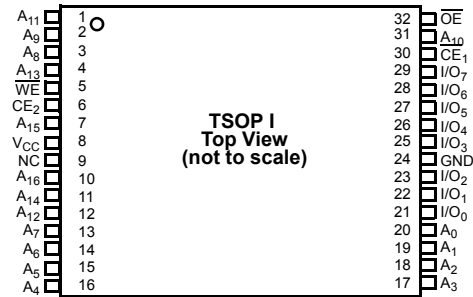
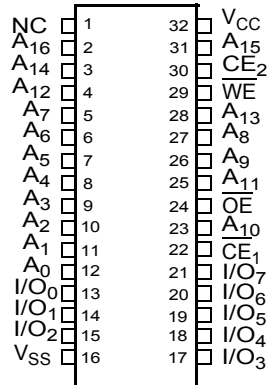


Figure 3. 32-pin SOIC [1]

Top View



**Note**

- 1. NC pins are not connected on the die.

**Product Portfolio**

Product	Range	V <sub>CC</sub> Range (V)			Speed (ns)	Power Dissipation					
						Operating I <sub>CC</sub> (mA)				Standby I <sub>SB2</sub> (µA)	
						f = 1MHz		f = f <sub>max</sub>			
Min	Typ <sup>[2]</sup>	Max		Typ <sup>[2]</sup>	Max	Typ <sup>[2]</sup>	Max	Typ <sup>[2]</sup>	Max		
CY62128ELL	Industrial / Automotive-A	4.5	5.0	5.5	45 <sup>[3]</sup>	1.3	2	11	16	1	4
CY62128ELL	Automotive-E	4.5	5.0	5.5	55	1.3	4	11	35	1	30

**Notes**

- 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.
- When used with a 100 pF capacitive load and resistive loads as shown on page 4, access times of 55 ns (t<sub>AA</sub>, t<sub>ACE</sub>) and 25 ns (t<sub>DOE</sub>) are guaranteed.

## 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 ( $V_{CC(max)}$  + 0.5 V)

DC voltage applied to outputs in High Z State <sup>[4, 5]</sup> ..... -0.5 V to 6.0 V ( $V_{CC(max)}$  + 0.5 V)

DC input voltage<sup>[4, 5]</sup> ..... -0.5 V to 6.0 V ( $V_{CC(max)}$  + 0.5 V)

Output current into outputs (LOW) ..... 20 mA

Static discharge voltage ..... > 2001V (MIL-STD-883, Method 3015)

Latch up current ..... > 200 mA

## Operating Range

Device	Range	Ambient Temperature	$V_{CC}^{[6]}$
CY62128ELL	Industrial / Automotive-A	-40 °C to +85 °C	4.5 V to 5.5 V
	Automotive-E	-40 °C to +125 °C	

## Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	45 ns (Industrial/Automotive-A)			55 ns (Automotive-E)			Unit
			Min	Typ <sup>[7]</sup>	Max	Min	Typ <sup>[7]</sup>	Max	
$V_{OH}$	Output HIGH voltage	$I_{OH} = -1$ mA	2.4	–	–	2.4	–	–	V
$V_{OL}$	Output LOW voltage	$I_{OL} = 2.1$ mA	–	–	0.4	–	–	0.4	V
$V_{IH}$	Input HIGH voltage	$V_{CC} = 4.5$ V to 5.5 V	2.2	–	$V_{CC} + 0.5$	2.2	–	$V_{CC} + 0.5$	V
$V_{IL}$	Input LOW voltage	$V_{CC} = 4.5$ V to 5.5 V	-0.5	–	0.8	-0.5	–	0.8	V
$I_{IX}$	Input leakage current	$GND \leq V_I \leq V_{CC}$	-1	–	+1	-4	–	+4	μA
$I_{OZ}$	Output leakage current	$GND \leq V_O \leq V_{CC}$ , Output Disabled	-1	–	+1	-4	–	+4	μA
$I_{CC}$	$V_{CC}$ Operating supply current	$f = f_{max} = 1/t_{RC}$	–	11	16	–	11	35	mA
		$f = 1$ MHz	–	1.3	2	–	1.3	4	
$I_{SB2}^{[8]}$	Automatic CE power-down Current—CMOS inputs	$\overline{CE}_1 \geq V_{CC} - 0.2$ V or $CE_2 \leq 0.2$ V, $V_{IN} \geq V_{CC} - 0.2$ V or $V_{IN} \leq 0.2$ V, $f = 0$ , $V_{CC} = V_{CC(max)}$	–	1	4	–	1	30	μA

### Notes

- $V_{IL(min)}$  = -2.0 V for pulse durations less than 20 ns.
- $V_{IH(max)}$  =  $V_{CC} + 0.75$  V for pulse durations less than 20 ns.
- Full device AC operation assumes a 100 μs ramp time from 0 to  $V_{CC(min)}$  and 200 μs wait time after  $V_{CC}$  stabilization.
- Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at  $V_{CC} = V_{CC(typ)}$ ,  $T_A = 25$  °C.
- Only chip enables ( $\overline{CE}_1$  and  $CE_2$ ) must be at CMOS level to meet the  $I_{SB2} / I_{CCDR}$  spec. Other inputs can be left floating.

### Capacitance

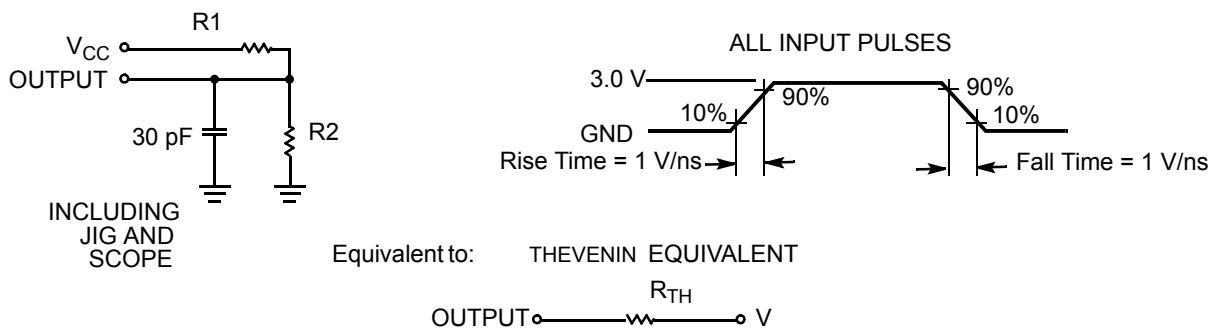
Parameter <sup>[9]</sup>	Description	Test Conditions	Max	Unit
C <sub>IN</sub>	Input capacitance	T <sub>A</sub> = 25 °C, f = 1 MHz, V <sub>CC</sub> = V <sub>CC(typ)</sub>	10	pF
C <sub>OUT</sub>	Output capacitance		10	pF

### Thermal Resistance

Parameter <sup>[9]</sup>	Description	Test Conditions	32-pin SOIC Package	32-pin STSOP Package	32-pin TSOP Package	Unit
Θ <sub>JA</sub>	Thermal resistance (Junction to ambient)	Still Air, soldered on a 3 × 4.5 inch, two-layer printed circuit board	48.67	32.56	33.01	°C/W
Θ <sub>JC</sub>	Thermal resistance (Junction to case)		25.86	3.59	3.42	°C/W

### AC Test Loads and Waveforms

Figure 4. AC Test Loads and Waveforms



Parameters	Value	Unit
R1	1800	Ω
R2	990	Ω
R <sub>TH</sub>	639	Ω
V <sub>TH</sub>	1.77	V

**Note**

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

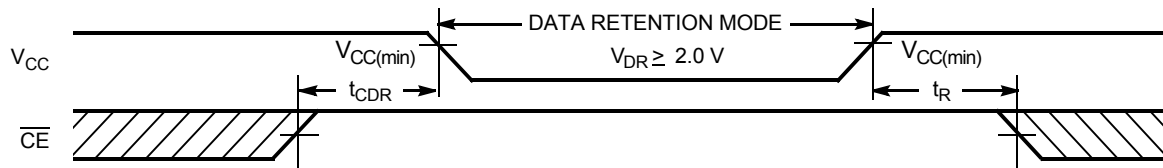
## Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions	Min	Typ <sup>[10]</sup>	Max	Unit	
$V_{DR}$	$V_{CC}$ for data retention		2	–	–	V	
$I_{CCDR}$ <sup>[11]</sup>	Data retention current	$V_{CC} = V_{DR}$ , $CE_1 \geq V_{CC} - 0.2\text{ V}$ or $CE_2 \leq 0.2\text{ V}$ , $V_{IN} \geq V_{CC} - 0.2\text{ V}$ or $V_{IN} \leq 0.2\text{ V}$	Industrial / Automotive-A	–	–	4	$\mu\text{A}$
			Automotive-E	–	–	30	$\mu\text{A}$
$t_{CDR}$ <sup>[12]</sup>	Chip deselect to data retention time		0	–	–	ns	
$t_R$ <sup>[13]</sup>	Operation recovery time		CY62128ELL-45	45	–	–	ns
			CY62128ELL-55	55	–	–	ns

## Data Retention Waveform

Figure 5. Data Retention Waveform<sup>[14]</sup>



### Notes

- Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at  $V_{CC} = V_{CC(typ)}$ ,  $T_A = 25\text{ }^\circ\text{C}$ .
- Only chip enables ( $CE_1$  and  $CE_2$ ) must be at CMOS level to meet the  $I_{SB2} / I_{CCDR}$  spec. Other inputs can be left floating.
- Tested initially and after any design or process changes that may affect these parameters.
- Full device AC operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(min)} > 100\text{ }\mu\text{s}$  or stable at  $V_{CC(min)} > 100\text{ }\mu\text{s}$ .
- $\overline{CE}$  is the logical combination of  $CE_1$  and  $CE_2$ . When  $CE_1$  is LOW and  $CE_2$  is HIGH,  $\overline{CE}$  is LOW; when  $CE_1$  is HIGH or  $CE_2$  is LOW,  $\overline{CE}$  is HIGH.

## Switching Characteristics

Over the Operating Range

Parameter <sup>[15]</sup>	Description	45 ns (Industrial / Automotive-A)		55 ns (Automotive-E)		Unit
		Min	Max	Min	Max	
<b>Read Cycle</b>						
$t_{RC}$	Read cycle time	45	–	55	–	ns
$t_{AA}$	Address to data valid	–	45	–	55	ns
$t_{OHA}$	Data hold from address change	10	–	10	–	ns
$t_{ACE}$	$\overline{CE}_1$ LOW and $CE_2$ HIGH to data valid	–	45	–	55	ns
$t_{DOE}$	$\overline{OE}$ LOW to data valid	–	22	–	25	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low Z <sup>[16]</sup>	5	–	5	–	ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High Z <sup>[16, 17]</sup>	–	18	–	20	ns
$t_{LZCE}$	$\overline{CE}_1$ LOW and $CE_2$ HIGH to Low Z <sup>[16]</sup>	10	–	10	–	ns
$t_{HZCE}$	$\overline{CE}_1$ HIGH or $CE_2$ LOW to High Z <sup>[16, 17]</sup>	–	18	–	20	ns
$t_{PU}$	$\overline{CE}_1$ LOW and $CE_2$ HIGH to power-up	0	–	0	–	ns
$t_{PD}$	$\overline{CE}_1$ HIGH or $CE_2$ LOW to power-down	–	45	–	55	ns
<b>Write Cycle<sup>[18]</sup></b>						
$t_{WC}$	Write cycle time	45	–	55	–	ns
$t_{SCE}$	$\overline{CE}_1$ LOW and $CE_2$ HIGH to write end	35	–	40	–	ns
$t_{AW}$	Address setup to write end	35	–	40	–	ns
$t_{HA}$	Address hold from write end	0	–	0	–	ns
$t_{SA}$	Address setup to write start	0	–	0	–	ns
$t_{PWE}$	$\overline{WE}$ pulse width	35	–	40	–	ns
$t_{SD}$	Data setup to write end	25	–	25	–	ns
$t_{HD}$	Data hold from write end	0	–	0	–	ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[16, 17]</sup>	–	18	–	20	ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[16]</sup>	10	–	10	–	ns

### Notes

15. Test conditions for all parameters other than tri-state parameters assume signal transition time of 3 ns (1 V/ns) or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3 V, and output loading of the specified  $I_{OL}/I_{OH}$  as shown in the [Figure 4 on page 6](#).
16. At any given 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 given device.
17.  $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  transitions are measured when the outputs enter a high impedance state.
18. The internal Write time of the memory is defined by the overlap of  $\overline{WE}$ ,  $\overline{CE} = V_{IL}$ . 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 6. Read Cycle 1 (Address Transition Controlled) [19, 20]

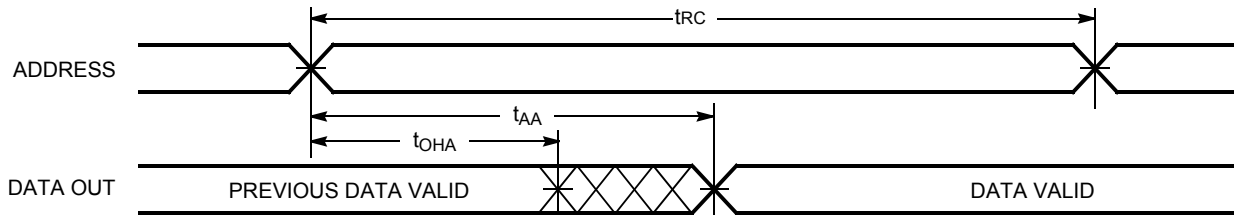


Figure 7. Read Cycle No. 2 ( $\overline{OE}$  Controlled) [20, 21, 22]

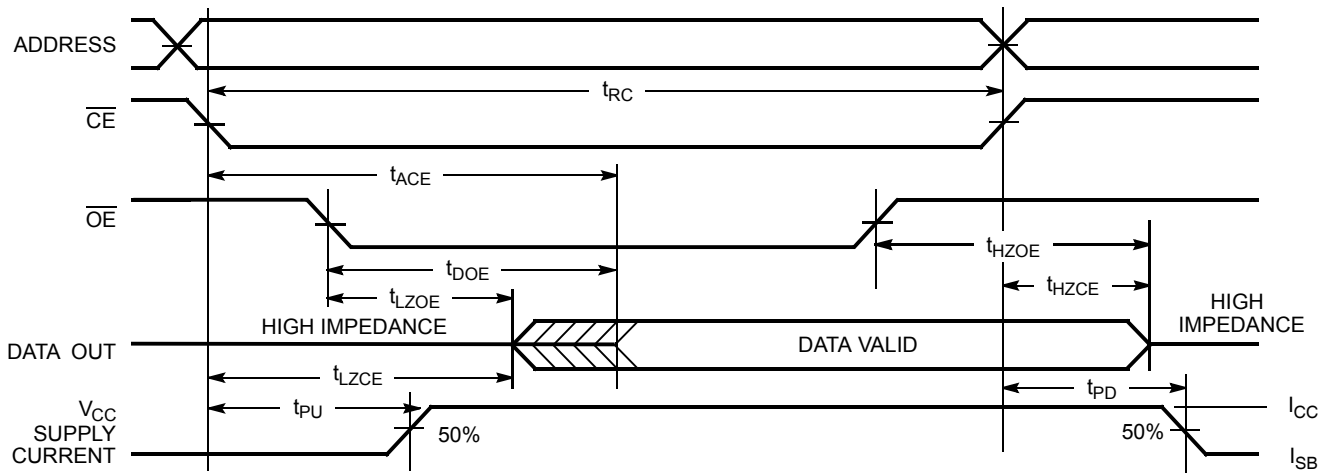
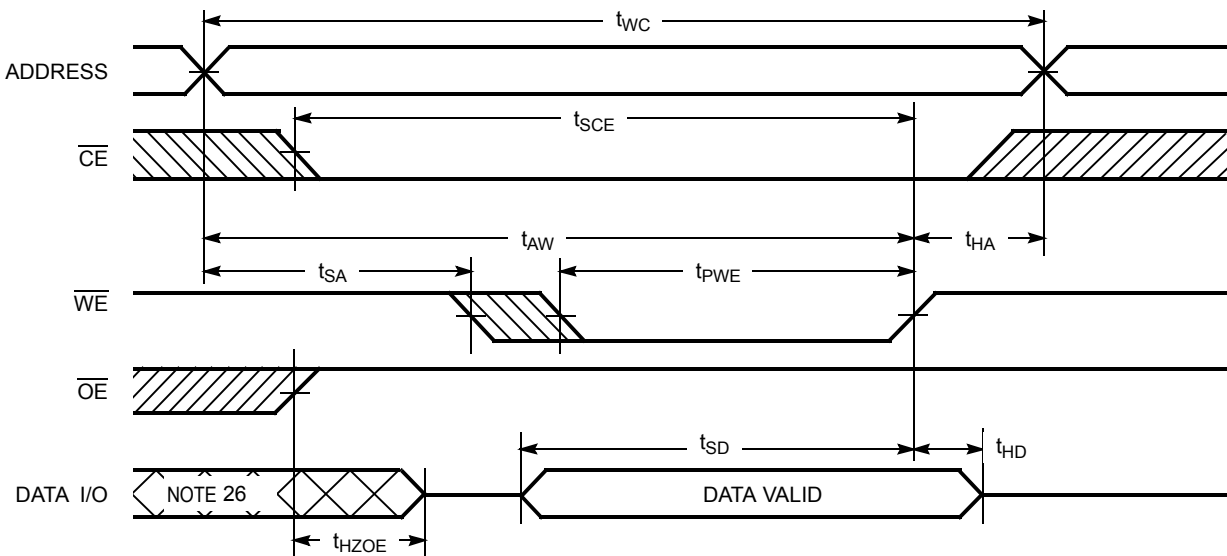


Figure 8. Write Cycle No. 1 ( $\overline{WE}$  Controlled) [22, 23, 24, 25]



### Notes

19. The device is continuously selected.  $\overline{OE}$ ,  $\overline{CE}_1 = V_{IL}$ ,  $CE_2 = V_{IH}$ .
20.  $\overline{WE}$  is HIGH for read cycle.
21. Address valid before or similar to  $\overline{CE}_1$  transition LOW and  $CE_2$  transition HIGH.
22.  $\overline{CE}$  is the logical combination of  $\overline{CE}_1$  and  $CE_2$ . When  $\overline{CE}_1$  is LOW and  $CE_2$  is HIGH,  $\overline{CE}$  is LOW; when  $\overline{CE}_1$  is HIGH or  $CE_2$  is LOW,  $\overline{CE}$  is HIGH.
23. The internal Write time of the memory is defined by the overlap of  $\overline{WE}$ ,  $\overline{CE} = V_{IL}$ . 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.
24. Data I/O is high impedance if  $\overline{OE} = V_{IH}$ .
25. If  $\overline{CE}_1$  goes HIGH or  $CE_2$  goes LOW simultaneously with  $\overline{WE}$  HIGH, the output remains in high impedance state.
26. During this period, the I/Os are in output state and input signals must not be applied.

Switching Waveforms (continued)

Figure 9. Write Cycle No. 2 ( $\overline{CE}_1$  or  $CE_2$  Controlled) [27, 28, 29, 30]

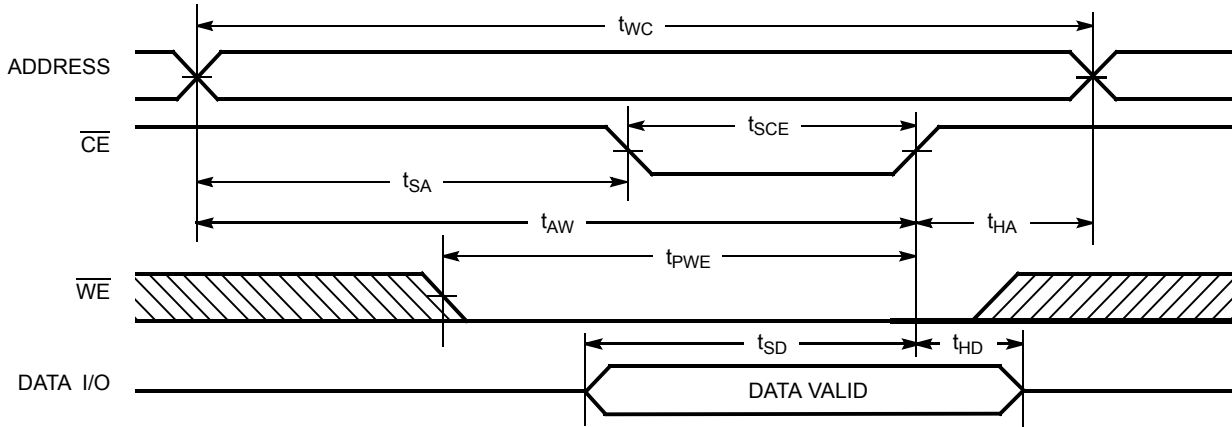
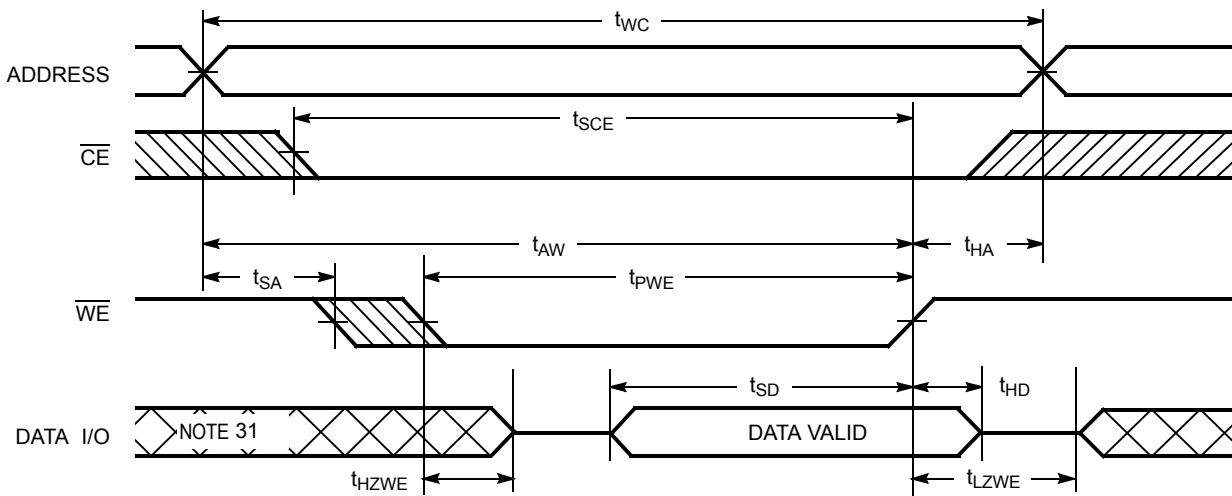


Figure 10. Write Cycle No. 3 ( $\overline{WE}$  Controlled,  $\overline{OE}$  LOW) [27, 30]



Notes

- 27.  $\overline{CE}$  is the logical combination of  $\overline{CE}_1$  and  $CE_2$ . When  $\overline{CE}_1$  is LOW and  $CE_2$  is HIGH,  $\overline{CE}$  is LOW; when  $\overline{CE}_1$  is HIGH or  $CE_2$  is LOW,  $\overline{CE}$  is HIGH.
- 28. The internal Write time of the memory is defined by the overlap of  $\overline{WE}$ ,  $\overline{CE} = V_{IL}$ . 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.
- 29. Data I/O is high impedance if  $\overline{OE} = V_{IH}$ .
- 30. If  $\overline{CE}_1$  goes HIGH or  $CE_2$  goes LOW simultaneously with  $\overline{WE}$  HIGH, the output remains in high impedance state.
- 31. During this period, the I/Os are in output state and input signals must not be applied.

**Truth Table**

$\overline{CE}_1$	$CE_2$	WE	OE	Inputs/Outputs	Mode	Power
H	X <sup>[32]</sup>	X	X	High Z	Deselect/Power down	Standby ( $I_{SB}$ )
X <sup>[32]</sup>	L	X	X	High Z	Deselect/Power down	Standby ( $I_{SB}$ )
L	H	H	L	Data Out	Read	Active ( $I_{CC}$ )
L	H	L	X	Data In	Write	Active ( $I_{CC}$ )
L	H	H	H	High Z	Selected, outputs disabled	Active ( $I_{CC}$ )

**Note**

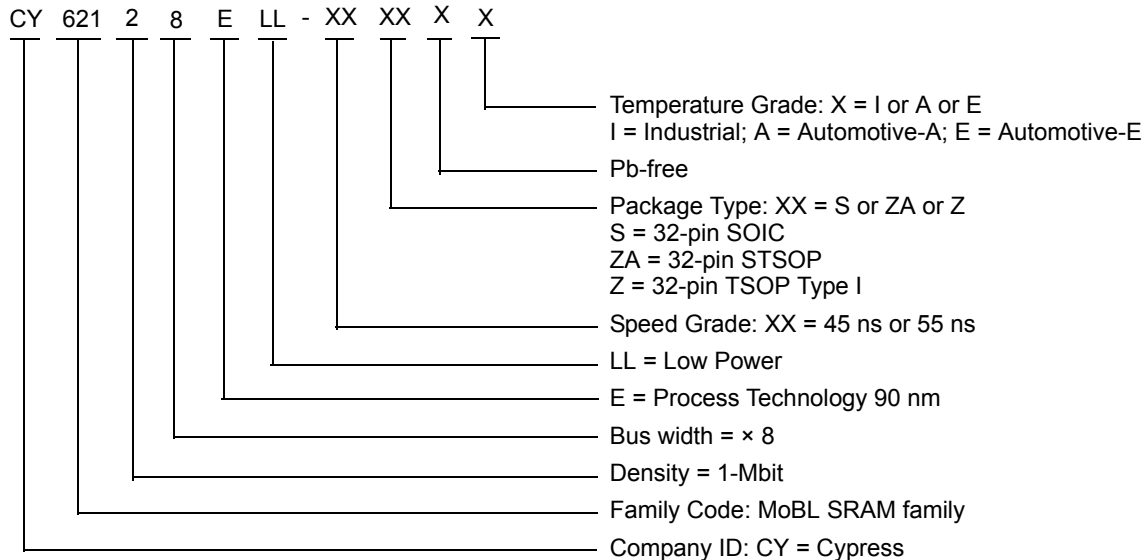
32. The 'X' (Don't care) state for the Chip enables in the truth table refer to the logic state (either HIGH or LOW). Intermediate voltage levels on these pins is not permitted.

**Ordering Information**

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
45	CY62128ELL-45SXI	51-85081	32-pin 450-Mil SOIC (Pb-free)	Industrial
	CY62128ELL-45ZAXI	51-85094	32-pin STSOP (Pb-free)	
	CY62128ELL-45ZXI	51-85056	32-pin TSOP Type I (Pb-free)	
	CY62128ELL-45SXA	51-85081	32-pin 450-Mil SOIC (Pb-free)	Automotive-A
	CY62128ELL-45ZXA	51-85056	32-pin TSOP Type I (Pb-free)	
55	CY62128ELL-55SXE	51-85081	32-pin 450-Mil SOIC (Pb-free)	Automotive-E
	CY62128ELL-55ZAXE	51-85094	32-pin STSOP (Pb-free)	

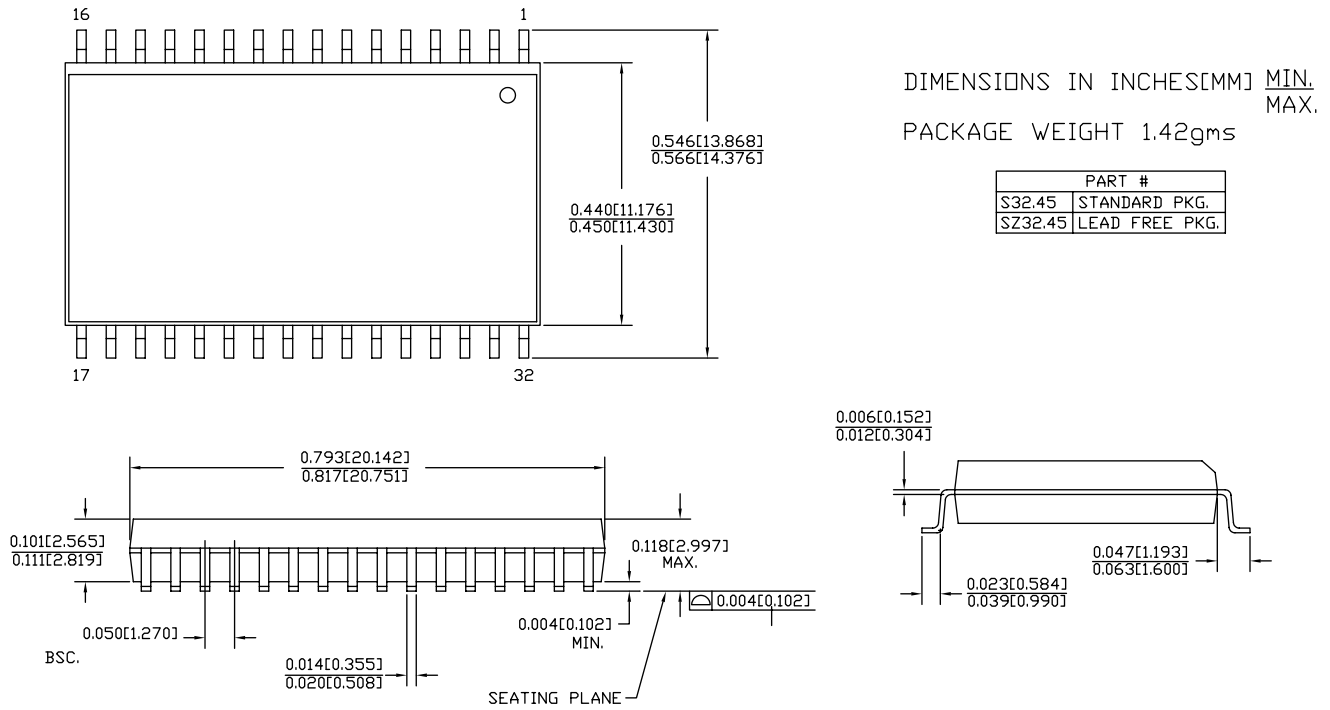
Contact your local Cypress sales representative for availability of these parts.

**Ordering Code Definitions**



Package Diagrams

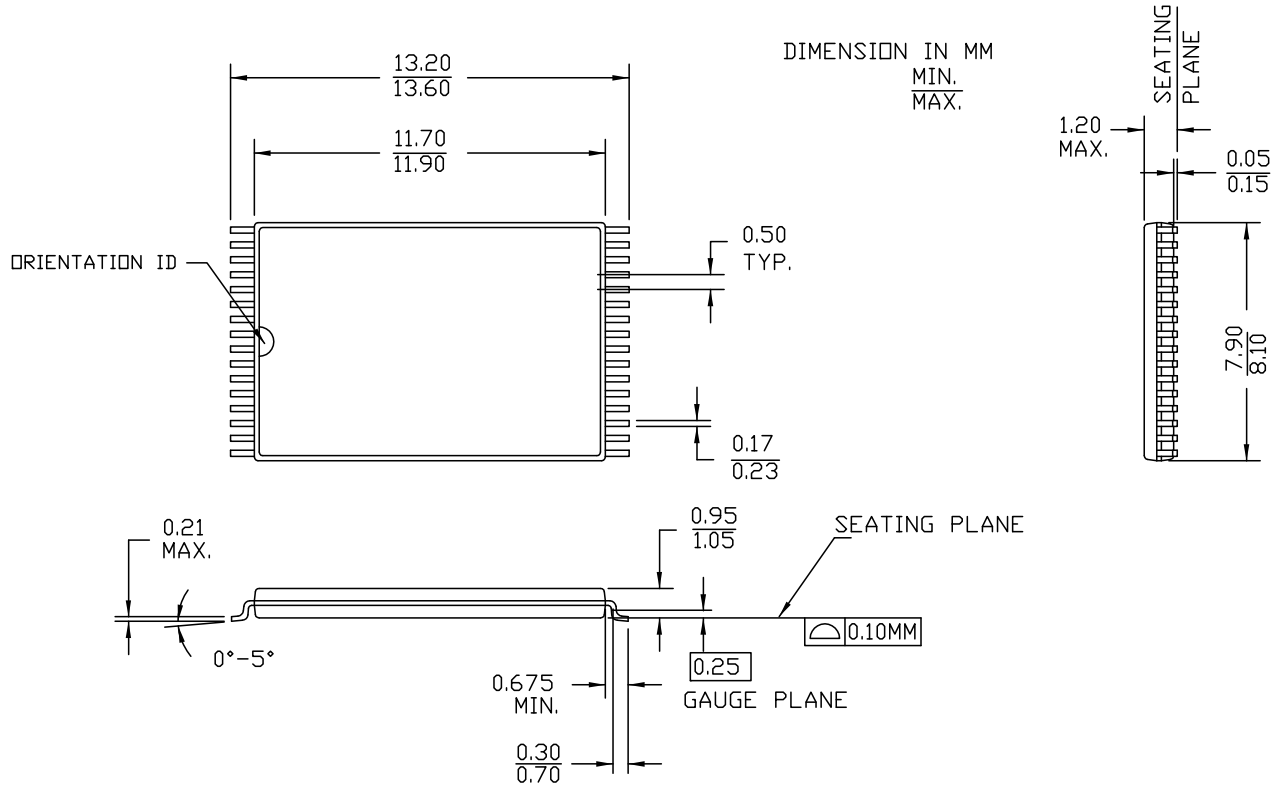
Figure 11. 32-pin Molded SOIC (450 Mil) S32.45/SZ32.45, 51-85081



51-85081 °C

Package Diagrams (continued)

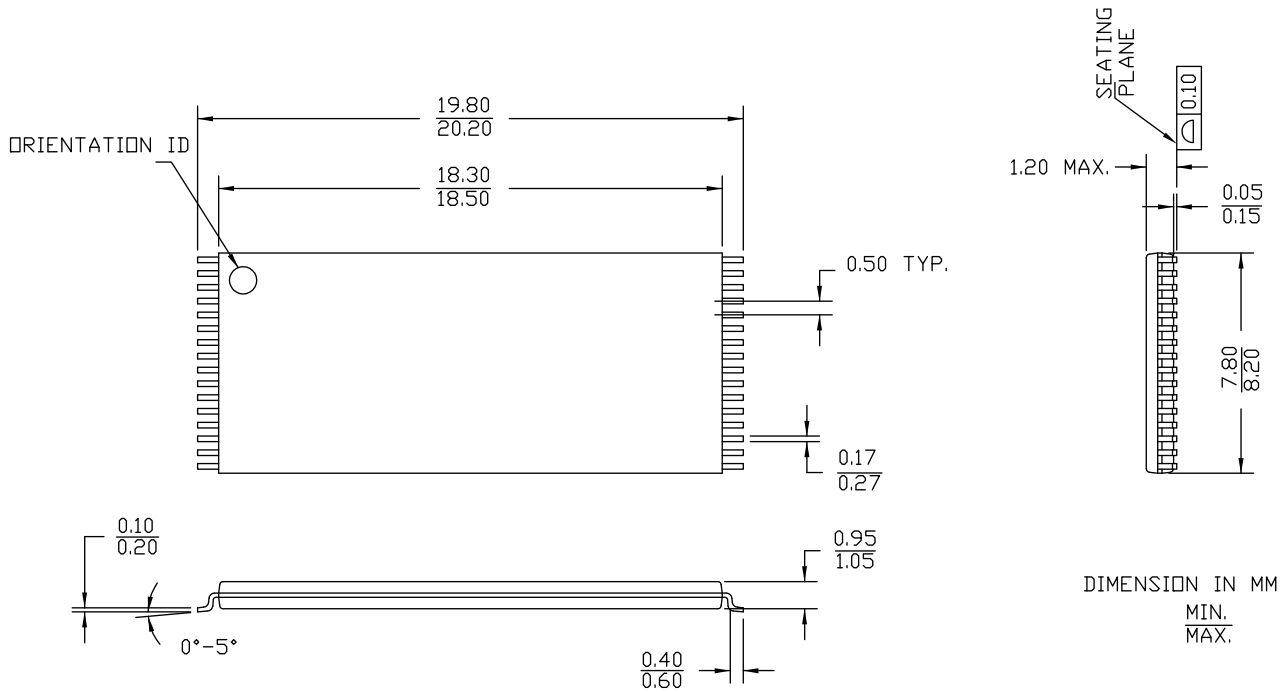
Figure 12. 32-pin Small TSOP (8 × 13.4 × 1.2 mm) ZA32, 51-85094



51-85094 \*F

Package Diagrams (continued)

Figure 13. 32-pin TSOP I (8 × 20 × 1.0 mm) Z32, 51-85056



51-85056 \*F

Acronyms

Acronym	Description
CE	chip enable
CMOS	complementary metal oxide semiconductor
I/O	input/output
OE	output enable
SRAM	static random access memory
SOIC	small outline integrated circuit
STSOP	small thin small outline package
TSOP	thin small outline package
WE	write enable

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	Mega Hertz
μA	micro Amperes
μs	micro seconds
mA	milli Amperes
mm	milli meter
ns	nano seconds
Ω	ohms
%	percent
pF	pico Farad
V	Volts
W	Watts

**Document History Page**

Document Title: CY62128E MoBL®, 1-Mbit (128 K × 8) Static RAM				
Document Number: 38-05485				
Rev.	ECN No.	Submission Date	Orig. of Change	Description of Change
**	203120	See ECN	AJU	New data sheet
*A	299472	See ECN	SYT	Converted from Advance Information to Preliminary Changed $t_{OHA}$ from 6 ns to 10 ns for both 35 ns and 45 ns, respectively Changed $t_{DOE}$ from 15 ns to 18 ns for 35 ns speed bin Changed $t_{HZOE}$ , $t_{HZWE}$ from 12 and 15 ns to 15 and 18 ns for the 35 and 45 ns speed bins, respectively Changed $t_{HZCE}$ from 12 and 15 ns to 18 and 22 ns for the 35 and 45 ns speed bins, respectively Changed $t_{SCE}$ from 25 and 40 ns to 30 and 35 ns for the 35 and 45 ns speed bins, respectively Changed $t_{SD}$ from 15 and 20 ns to 18 and 22 ns for the 35 and 45 ns speed bins, respectively Added Pb-free package information Added footnote #9 Changed operating range for SOIC package from Commercial to Industrial Modified signal transition time from 5 ns to 3 ns in footnote #11 Changed max of $I_{SB1}$ , $I_{SB2}$ and $I_{CCDR}$ from 1.0 $\mu A$ to 1.5 $\mu A$
*B	461631	See ECN	NXR	Converted from Preliminary to Final Included Automotive Range and 55 ns speed bin Removed 35 ns speed bin Removed "L" version of CY62128E Removed Reverse TSOP I package from Product offering Changed $I_{CC(Typ)}$ from 8 mA to 11 mA and $I_{CC(max)}$ from 12 mA to 16 mA for $f = f_{max}$ Changed $I_{CC(max)}$ from 1.5 mA to 2.0 mA for $f = 1$ MHz Removed $I_{SB1}$ DC Specs from Electrical characteristics table Changed $I_{SB2(max)}$ from 1.5 $\mu A$ to 4 $\mu A$ Changed $I_{SB2(Typ)}$ from 0.5 $\mu A$ to 1 $\mu A$ Changed $I_{CCDR(max)}$ from 1.5 $\mu A$ to 4 $\mu A$ Changed the AC Test load Capacitance value from 100 pF to 30 pF Changed $t_{LZOE}$ from 3 to 5 ns Changed $t_{LZCE}$ from 6 to 10 ns Changed $t_{HZCE}$ from 22 to 18 ns Changed $t_{PWE}$ from 30 to 35 ns Changed $t_{SD}$ from 22 to 25 ns Changed $t_{LZWE}$ from 6 to 10 ns Updated the Ordering Information Table
*C	464721	See ECN	NXR	Updated the Block Diagram on page # 1
*D	563144	See ECN	AJU	Added footnote 4 on page 2
*E	1024520	See ECN	VKN	Added Automotive-A information Converted Automotive-E specs to final Added footnote #9 related to $I_{SB2}$ and $I_{CCDR}$ Updated Ordering Information table
*F	2548575	08/05/08	NXR	Corrected typo error in Ordering Information table
*G	2934396	06/03/10	VKN	Added footnote #22 related to chip enable Updated package diagrams Updated template
*H	3113780	12/17/2010	PRAS	Updated Logic Block Diagram. Added Ordering Code Definitions.

**Document History Page** (continued)

Document Title: CY62128E MoBL®, 1-Mbit (128 K × 8) Static RAM Document Number: 38-05485				
Rev.	ECN No.	Submission Date	Orig. of Change	Description of Change
*I	3223635	04/12/2011	RAME	Updated as per new template Removed V30 value from Ordering Code Definition. Added Acronyms and Units of Measure table Updated Package diagram 51-85056 from *E to *F and 51-85094 *E to *F
*J	3292276	06/24/2011	RAME	Updated <a href="#">Data Retention Characteristics</a> (Changed the conditions and minimum value of $t_R$ parameter). Updated in new template.

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