

4-Mbit (512 K × 8) Static RAM

Features

- Very high speed: 45 ns
- Voltage range: 4.5 V to 5.5 V
- Pin compatible with CY62148B
- Ultra low standby power
 - Typical standby current: 1 µA
 - Maximum standby current: 7 µA (Industrial)
- Ultra low active power
 - Typical active current: 2.0 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 thin small outline package (TSOP) II and 32-pin small-outline integrated circuit (SOIC)^[1] packages

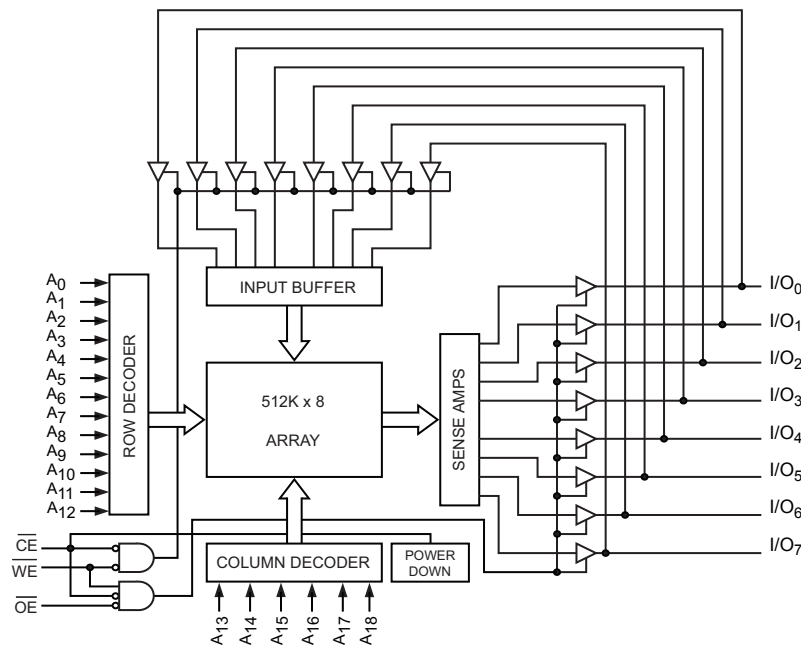
Functional Description

The CY62148E 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®) 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% when deselected (\overline{CE} HIGH). The eight input and output pins (I/O₀ through I/O₇) are placed in a high impedance state when the device is deselected (\overline{CE} HIGH), Outputs are disabled (\overline{OE} HIGH), or during an active 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/O₀ through I/O₇) is then written into the location specified on the address pins (A₀ through A₁₈).

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.

Logic Block Diagram



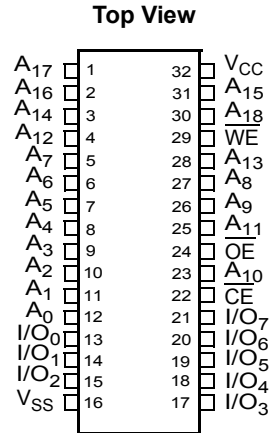
Note

1. SOIC package is available only in 55 ns speed bin.

Contents

Pin Configuration	3	Ordering Code Definitions	10
Product Portfolio	3	Package Diagrams	11
Maximum Ratings	4	Acronyms	13
Operating Range	4	Document Conventions	13
Capacitance	4	Units of Measure	13
Thermal Resistance	5	Document History Page	14
Data Retention Characteristics	6	Sales, Solutions, and Legal Information	16
Switching Characteristics	7	Worldwide Sales and Design Support	16
Switching Waveforms	8	Products	16
Truth Table	9	PSoC Solutions	16
Ordering Information	10		

Pin Configuration

Figure 1. 32-pin SOIC/TSOP II Pinout


Product Portfolio

Product		Range	V _{CC} Range (V)			Speed (ns)	Power Dissipation					
			Min	Typ ^[2]	Max		Operating I _{CC} (mA)				Standby I _{SB2} (μA)	
						f = 1 MHz		f = f _{max}				
						Typ ^[2]	Max	Typ ^[2]	Max	Typ ^[2]	Max	
CY62148ELL	TSOP II	Industrial	4.5	5.0	5.5	45	2	2.5	15	20	1	7
CY62148ELL	SOIC	Industrial / Automotive-A	4.5	5.0	5.5	55	2	2.5	15	20	1	7

Note

2. 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.

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 ($V_{CCmax} + 0.5$ V)

DC voltage applied to outputs in high Z state ^[3, 4] -0.5 V to 6.0 V ($V_{CCmax} + 0.5$ V)

DC input voltage ^[3, 4] -0.5 V to 6.0 V ($V_{CCmax} + 0.5$ V)

Output current into outputs (LOW) 20 mA

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

Latch-up current > 200 mA

Operating Range

Device	Range	Ambient Temperature	V_{CC} ^[5]
CY62148E	Industrial / Automotive-A	-40 °C to +85 °C	4.5 V to 5.5 V

Electrical Characteristics

Over the operating range

Parameter	Description	Test Conditions	45 ns			55 ns ^[6]			Unit	
			Min	Typ ^[7]	Max	Min	Typ ^[7]	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	For TSOPII package	-0.5	-	0.8	-	-	-	V
			For SOIC package	-	-	-	-0.5	-	0.6 ^[8]	
I_{IX}	Input leakage current	$GND \leq V_I \leq V_{CC}$	-1	-	+1	-1	-	+1	µA	
I_{OZ}	Output leakage current	$GND \leq V_O \leq V_{CC}$, output disabled	-1	-	+1	-1	-	+1	µA	
I_{CC}	V_{CC} operating supply current	$f = f_{max} = 1/t_{RC}$	-	15	20	-	15	20	mA	
		$f = 1$ MHz	-	2	2.5	-	2	2.5		
I_{SB2} ^[9]	Automatic CE power-down current — CMOS inputs	$\overline{CE} \geq V_{CC} - 0.2$ V, $V_{IN} \geq V_{CC} - 0.2$ V or $V_{IN} \leq 0.2$ V, $f = 0$, $V_{CC} = V_{CC(max)}$	-	1	7	-	1	7	µA	

Capacitance

Parameter ^[10]	Description	Test Conditions	Max	Unit
C_{IN}	Input capacitance	$T_A = 25$ °C, $f = 1$ MHz, $V_{CC} = V_{CC(Typ)}$	10	pF
C_{OUT}	Output capacitance		10	pF

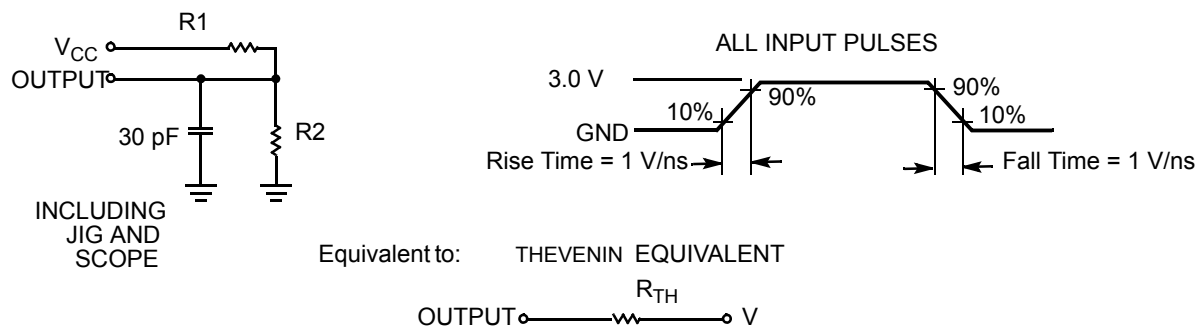
Notes

- $V_{IL(min)}$ = -2.0 V for pulse durations less than 20 ns for $I \leq 30$ mA.
- $V_{IH(max)}$ = $V_{CC} + 0.75$ V for pulse durations less than 20 ns.
- Full device AC operation assumes a minimum of 100 µs ramp time from 0 to $V_{CC(min)}$ and 200 µs wait time after V_{CC} stabilization.
- SOIC package is available only in 55 ns speed bin.
- Typical values are included for reference and are not guaranteed or tested. Typical values are measured at $V_{CC} = V_{CC(typ)}$, $T_A = 25$ °C.
- Under DC conditions the device meets a V_{IL} of 0.8 V. However, in dynamic conditions Input LOW Voltage applied to the device must not be higher than 0.6 V. This is applicable to SOIC package only. Refer to AN13470 for details.
- Chip enable (CE) must be HIGH 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.

Thermal Resistance

Parameter ^[11]	Description	Test Conditions	32-pin SOIC Package	32-pin TSOP II Package	Unit
Θ_{JA}	Thermal resistance (junction to ambient)	Still air, soldered on a 3 × 4.5 inch, two-layer printed circuit board	75	77	°C/W
Θ_{JC}	Thermal resistance (junction to case)		10	13	°C/W

Figure 2. AC Test Loads and Waveforms



Parameter ^[11]	5.0 V	Unit
R1	1800	Ω
R2	990	Ω
R_{TH}	639	Ω
V_{TH}	1.77	V

Note

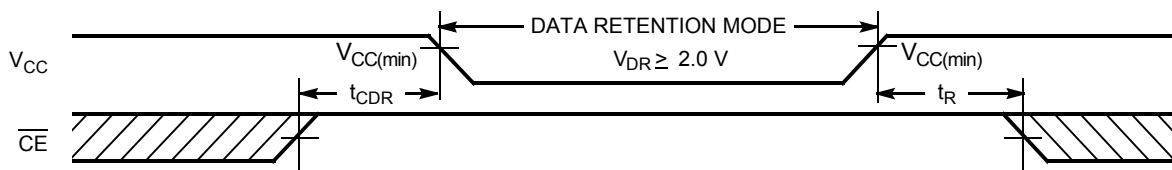
11. Tested initially and after any design or process changes that may affect these parameters.

Data Retention Characteristics

Over the operating range

Parameter	Description	Conditions	Min	Typ ^[12]	Max	Unit
V _{DR}	V _{CC} for data retention		2	–	–	V
I _{CCDR} ^[13]	Data retention current	V _{CC} = V _{DR} , $\overline{CE} \geq V_{CC} - 0.2\text{ V}$, V _{IN} ≥ V _{CC} – 0.2 V or V _{IN} ≤ 0.2 V	–	1	7	μA
t _{CDR}	Chip deselect to data retention time		0	–	–	ns
t _R ^[14]	Operation recovery time	TSOP II	45	–	–	ns
		SOIC	55	–	–	ns

Figure 3. Data Retention Waveform



Notes

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

Switching Characteristics

Over the operating range

Parameter ^[15]	Description	45 ns		55 ns ^[16]		Unit
		Min	Max	Min	Max	
Read Cycle						
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} LOW 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 ^[17]	5	–	5	–	ns
t _{HZOE}	\overline{OE} HIGH to high Z ^[17, 18]	–	18	–	20	ns
t _{LZCE}	\overline{CE} LOW to low Z ^[17]	10	–	10	–	ns
t _{HZCE}	\overline{CE} HIGH to high Z ^[17, 18]	–	18	–	20	ns
t _{PU}	\overline{CE} LOW to power-up	0	–	0	–	ns
t _{PD}	\overline{CE} HIGH to power-down	–	45	–	55	ns
Write Cycle^[19]						
t _{WC}	Write cycle time	45	–	55	–	ns
t _{SCE}	\overline{CE} LOW 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 ^[17, 18]	–	18	–	20	ns
t _{LZWE}	\overline{WE} HIGH to low Z ^[17]	10	–	10	–	ns

Notes

15. Test conditions for all parameters other than tri-state parameters assume signal transition time of 3 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 [AC Test Loads and Waveforms on page 5](#).
16. SOIC package is available only in 55 ns speed bin.
17. 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.
18. t_{HZOE}, t_{HZCE}, and t_{HZWE} transitions are measured when the outputs enter a high impedance state.
19. 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 should be referenced to the edge of the signal that terminates the write.

Switching Waveforms

Figure 4. Read Cycle No. 1 (Address Transition Controlled) [20, 21]

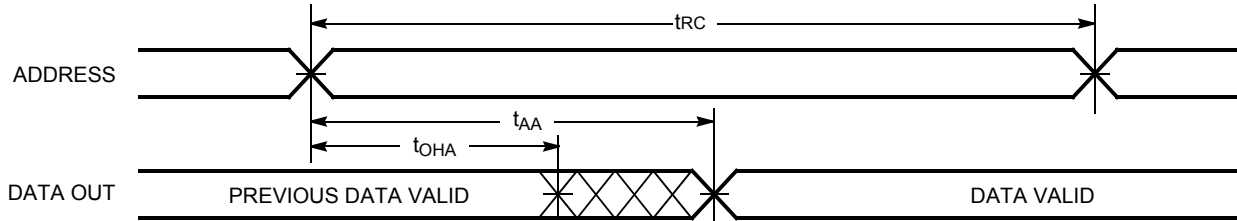


Figure 5. Read Cycle No. 2 ($\overline{\text{OE}}$ Controlled) [21, 22]

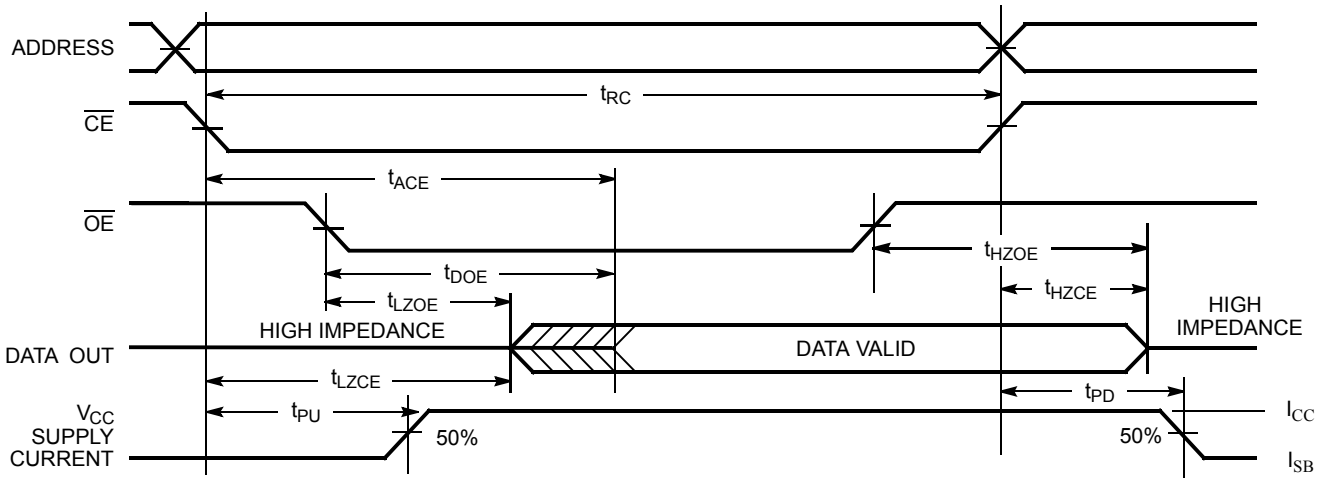
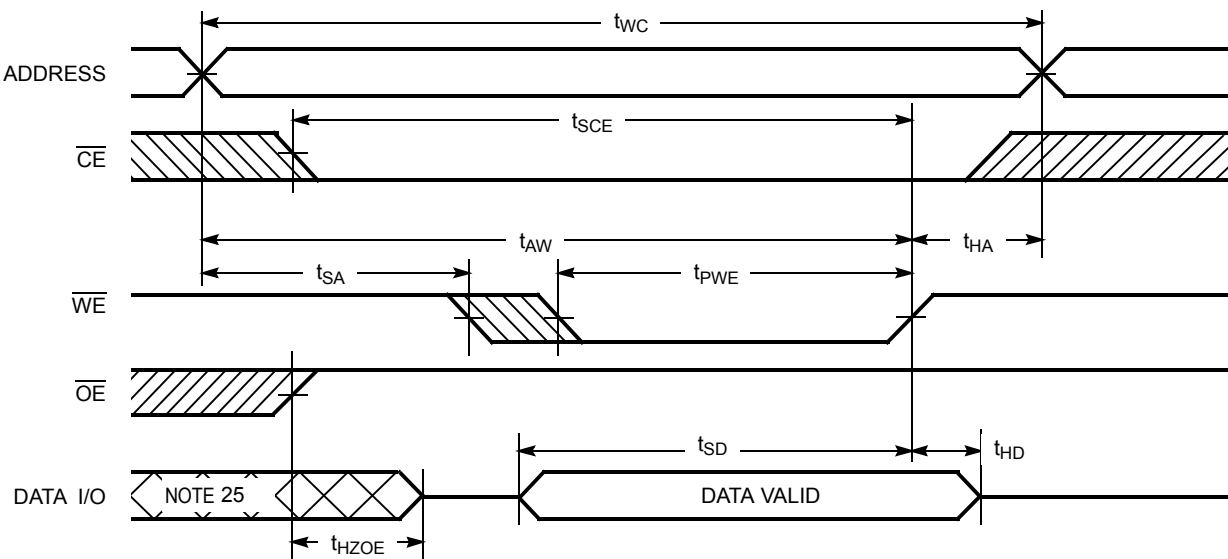


Figure 6. Write Cycle No. 1 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ HIGH During Write) [23, 24]



Notes

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

Figure 7. Write Cycle No. 2 ($\overline{\text{CE}}$ Controlled) [26, 27]

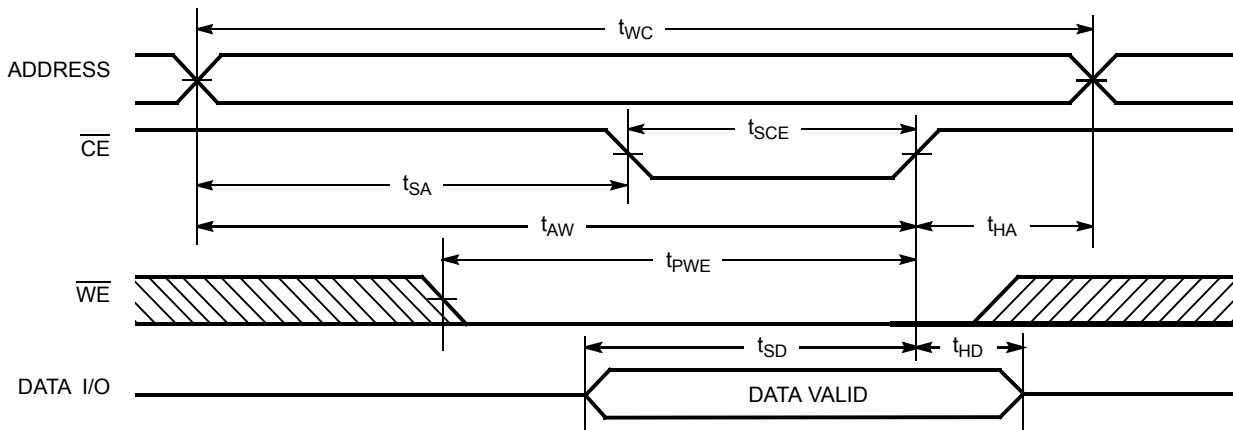
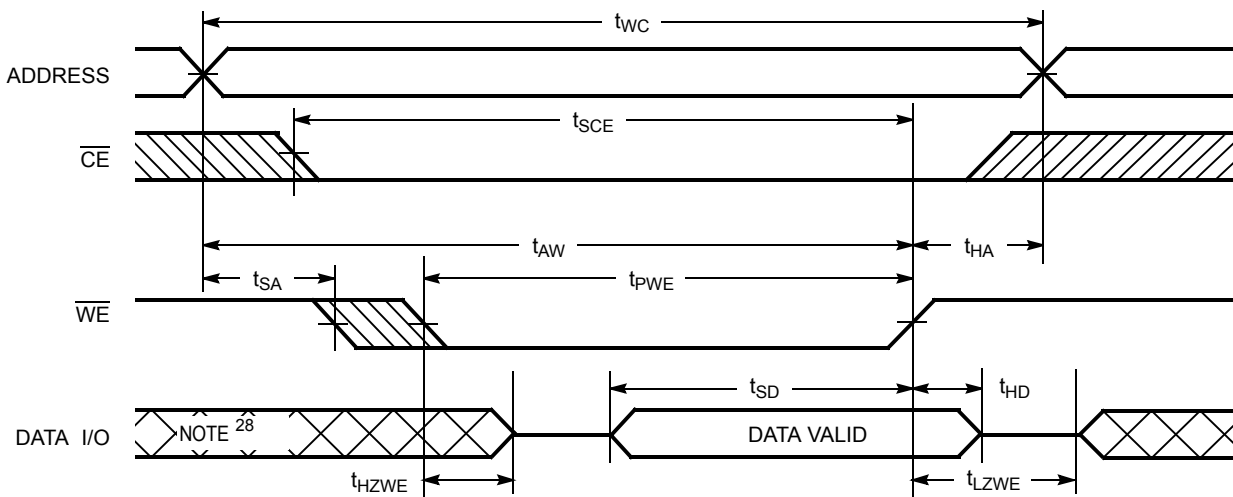


Figure 8. Write Cycle No. 3 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ LOW) [27]



Truth Table

$\overline{\text{CE}}$	$\overline{\text{WE}}$	$\overline{\text{OE}}$	I/O	Mode	Power
H ^[29]	X	X	High Z	Deselect/power-down	Standby (I_{SB})
L	H	L	Data out	Read	Active (I_{CC})
L	L	X	Data in	Write	Active (I_{CC})
L	H	H	High Z	Selected, outputs disabled	Active (I_{CC})

Notes

- 26. Data I/O is high impedance if $\overline{\text{OE}} = V_{\text{IH}}$.
- 27. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\overline{\text{WE}}$ HIGH, the output remains in high impedance state.
- 28. During this period, the I/Os are in output state and input signals must not be applied.
- 29. Chip enable ($\overline{\text{CE}}$) must be HIGH at CMOS level to meet the $I_{\text{SB2}} / I_{\text{CCDR}}$ spec. Other inputs can be left floating.

Ordering Information

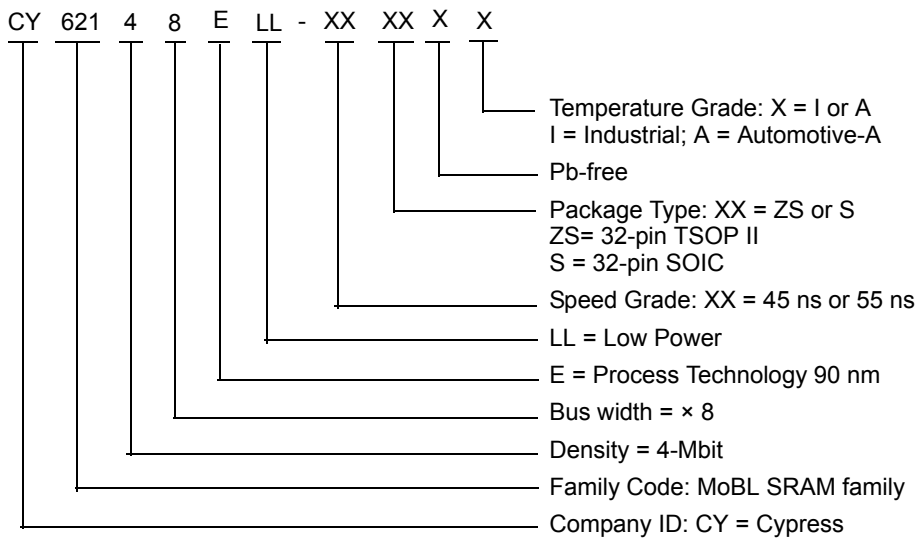
Table 1 lists the CY62148E MoBL® key package features and ordering codes. The table contains only the parts that are currently available. If you do not see what you are looking for, contact your local sales representative. For more information, visit the Cypress website at www.cypress.com and refer to the product summary page at <http://www.cypress.com/products>.

Table 1. Key features and Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
45	CY62148ELL-45ZSXI	51-85095	32-pin TSOP II (Pb-free)	Industrial
	CY62148ELL-45ZSXA	51-85095	32-pin TSOP II (Pb-free)	Automotive-A
55	CY62148ELL-55SXI	51-85081	32-pin SOIC (Pb-free)	Industrial
	CY62148ELL-55SXA	51-85081	32-pin SOIC (Pb-free)	Automotive-A

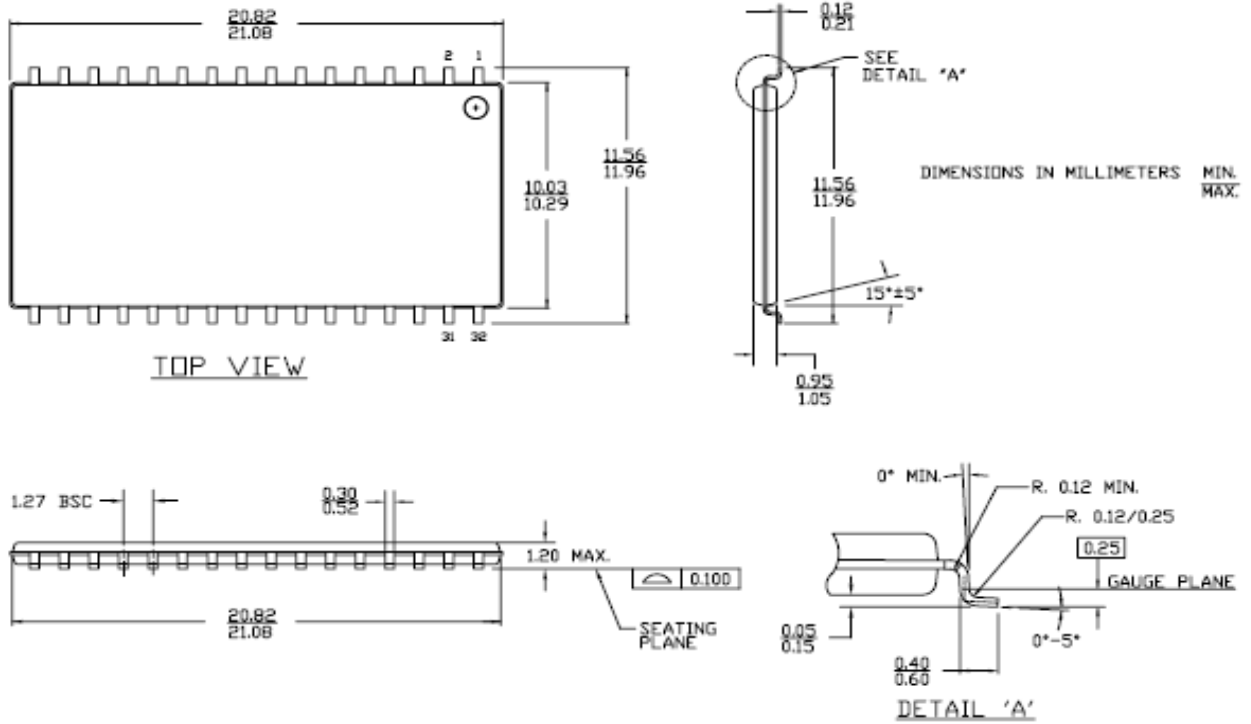
Contact your local Cypress sales representative for availability of these parts.

Ordering Code Definitions



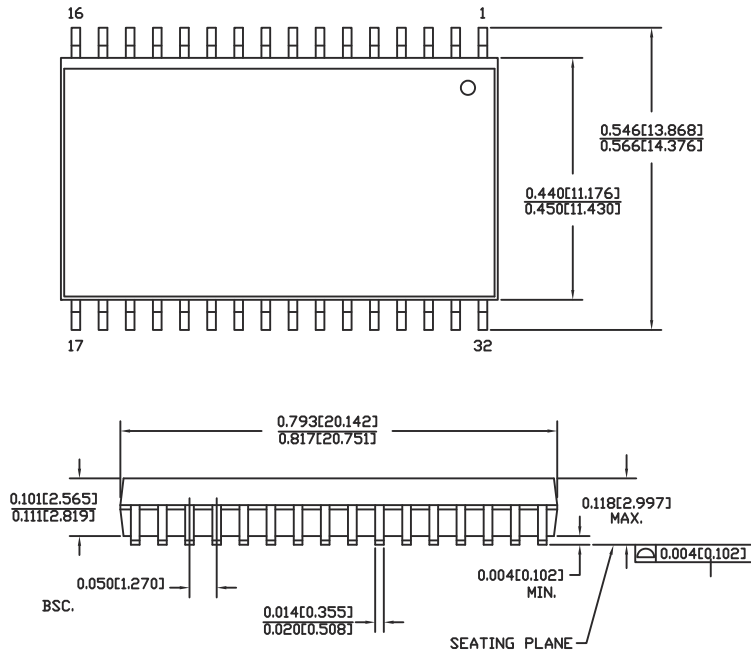
Package Diagrams

Figure 9. 32-pin TSOP II, 51-85095



51-85095 *B

Figure 10. 32-pin (450-Mil) Molded SOIC, 51-85081



DIMENSIONS IN INCHES[MM] MIN. MAX.
 PACKAGE WEIGHT 1.42gms

PART #	
S32.45	STANDARD PKG.
SZ32.45	LEAD FREE PKG.

51-85081-°C

Acronyms

Acronym	Description
CMOS	complementary metal oxide semiconductor
I/O	input/output
OE	output enable
MoBL	more battery life
SOIC	small-outline integrated circuit
SRAM	static random access memory
TSOP	thin small outline package
WE	write enable

Document Conventions

Units of Measure

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

Document History Page

Document Title: CY62148E MoBL [®] , 4-Mbit (512 K × 8) Static RAM Document Number: 38-05442				
Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	201580	AJU	01/08/04	New datasheet
*A	249276	SYT	See ECN	Changed from Advance Information to Preliminary Moved Product Portfolio to Page 2 Added RTSOP II and Removed FBGA Package Changed V _{CC} stabilization time in footnote #7 from 100 μs to 200 μs Changed I _{CCDR} from 2.0 μA to 2.5 μA Changed typo in Data Retention Characteristics(t _R) from 100 μs to t _{RC} ns Changed t _{OHA} from 6 ns to 10 ns for both 35 ns and 45 ns Speed Bin Changed t _{HZOE} , t _{HZWE} from 12 to 15 ns for 35 ns Speed Bin and 15 to 18 ns for 45 ns Speed Bin Changed t _{SCE} from 25 to 30 ns for 35 ns Speed Bin and 40 to 35 ns for 45 ns Speed Bin Changed t _{HZCE} from 12 to 18 ns for 35 ns Speed Bin and 15 to 22 ns for 45 ns Speed Bin Changed t _{SD} from 15 to 18 ns for 35 ns Speed Bin and 20 to 22 ns for 45 ns Speed Bin Changed t _{DOE} from 15 to 18 ns for 35 ns Speed Bin Corrected typo in Package Name Changed Ordering Information to include Pb-free Packages
*B	414820	ZSD	See ECN	Changed from Preliminary to Final Changed the address of Cypress Semiconductor Corporation on Page #1 from "3901 North First Street" to "198 Champion Court" Removed 35ns Speed Bin Removed "L" version of CY62148E Changed I _{CC} (Typ) value from 1.5 mA to 2 mA at f=1 MHz Changed I _{CC} (Max) value from 2 mA to 2.5 mA at f=1 MHz Changed I _{CC} (Typ) value from 12 mA to 15 mA at f=f _{max} Removed I _{SB1} spec from the Electrical characteristics table Changed I _{SB2} Typ values from 0.7 μA to 1 μA and Max values from 2.5 μA to 7 μA Modified footnote #4 to include current limit Removed redundant footnote on DNU pins Changed the AC testload capacitance from 100 pF to 30 pF on page #4 Changed test load parameters R1, R2, R _{TH} and V _{TH} from 1838 Ω, 994 Ω, 645 Ω and 1.75 V to 1800 Ω, 990 Ω, 639 Ω and 1.77 V Changed I _{CCDR} from 2.5 μA to 7 μA Added I _{CCDR} typical value Changed t _{LZOE} from 3 ns to 5 ns Changed t _{LZCE} and t _{LZWE} from 6 ns to 10 ns Changed t _{HZCE} from 22 ns to 18 ns Changed t _{PWE} from 30 ns to 35 ns Changed t _{SD} from 22 ns to 25 ns Updated the ordering information table and replaced Package Name column with Package Diagram
*C	464503	NXR	See ECN	Included Automotive Range in product offering Updated the Ordering Information
*D	485639	VKN	See ECN	Corrected the operating range to 4.5 V - 5.5 V on page# 3
*E	833080	VKN	See ECN	Added footnote #8 Added V _{IL} spec for SOIC package.

Document History Page (continued)

Document Title: CY62148E MoBL [®] , 4-Mbit (512 K × 8) Static RAM Document Number: 38-05442				
Revision	ECN	Orig. of Change	Submission Date	Description of Change
*F	890962	VKN	See ECN	Added Automotive-A part and its related information Removed Automotive-E part and its related information Added footnote #2 related to SOIC package Added footnote #9 related to I _{SB2} Added AC values for 55 ns Industrial-SOIC range Updated Ordering Information table
*G	2947039	VKN	06/10/2010	Added "CY62148ELL-45ZSXA" part in Ordering information. Added footnote related to chip enable in Truth Table Updated Package Diagrams Added Contents , PSoC Solutions , and Sales, Solutions, and Legal Information .
*H	3006318	AJU	08/23/10	Template update. Updated table of contents. Added acronyms, units of measure and ordering code definitions. Added reference to note 12 to parameter I _{CCDR} on page 5.
*I	3235744	RAME	04/20/2011	Updated Functional Description (Removed the line "For best practice recommendations, refer to the Cypress application note AN1064, SRAM System Guidelines"). Updated Package Diagrams .
*J	3302815	RAME	07/14/2011	Updated as per latest template and updated table of contents.

Sales, Solutions, and Legal Information

Worldwide Sales and Design Support

Cypress maintains a worldwide network of offices, solution centers, manufacturer's representatives, and distributors. To find the office closest to you, visit us at [Cypress Locations](#).

Products

Automotive	cypress.com/go/automotive
Clocks & Buffers	cypress.com/go/clocks
Interface	cypress.com/go/interface
Lighting & Power Control	cypress.com/go/powerpsoc cypress.com/go/plc
Memory	cypress.com/go/memory
Optical & Image Sensing	cypress.com/go/image
PSoC	cypress.com/go/psoc
Touch Sensing	cypress.com/go/touch
USB Controllers	cypress.com/go/USB
Wireless/RF	cypress.com/go/wireless

PSoC Solutions

[psoc.cypress.com/solutions](#)
PSoC 1 | PSoC 3 | PSoC 5

© Cypress Semiconductor Corporation, 2004-2011. The information contained herein is subject to change without notice. Cypress Semiconductor Corporation assumes no responsibility for the use of any circuitry other than circuitry embodied in a Cypress product. Nor does it convey or imply any license under patent or other rights. Cypress products are not warranted nor intended to be used for medical, life support, life saving, critical control or safety applications, unless pursuant to an express written agreement with Cypress. Furthermore, Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress products in life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Any Source Code (software and/or firmware) is owned by Cypress Semiconductor Corporation (Cypress) and is protected by and subject to worldwide patent protection (United States and foreign), United States copyright laws and international treaty provisions. Cypress hereby grants to licensee a personal, non-exclusive, non-transferable license to copy, use, modify, create derivative works of, and compile the Cypress Source Code and derivative works for the sole purpose of creating custom software and or firmware in support of licensee product to be used only in conjunction with a Cypress integrated circuit as specified in the applicable agreement. Any reproduction, modification, translation, compilation, or representation of this Source Code except as specified above is prohibited without the express written permission of Cypress.

Disclaimer: CYPRESS MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Cypress reserves the right to make changes without further notice to the materials described herein. Cypress does not assume any liability arising out of the application or use of any product or circuit described herein. Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress' product in a life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Use may be limited by and subject to the applicable Cypress software license agreement.