



# 4M (256K x 16) Static RAM

## Features

- Wide voltage range: 2.7V–3.6V
- Ultra-low active, standby power
- Easy memory expansion with  $\overline{CE}$  and  $\overline{OE}$  features
- TTL-compatible inputs and outputs
- Automatic power-down when deselected
- CMOS for optimum speed/power
- Package available in a standard 44-pin TSOP Type II (forward pinout) package

## Functional Description<sup>[1]</sup>

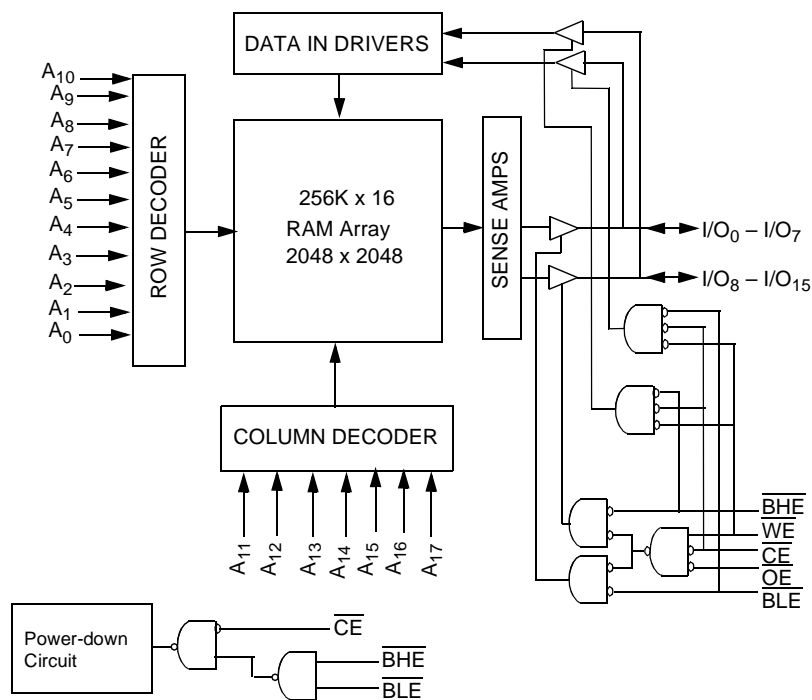
The CY62147V is a high-performance CMOS static RAM organized as 256K words by 16 bits. These devices feature advanced circuit design to provide ultra-low active current. This is ideal for providing More Battery Life™ (MoBL<sup>®</sup>) in portable applications such as cellular telephones. The devices also have an automatic power-down feature that significantly reduces power consumption by 99% when addresses are not toggling. The device can also be put into standby mode when

deselected ( $\overline{CE}$  HIGH) or when  $\overline{CE}$  is LOW and both  $\overline{BLE}$  and  $\overline{BHE}$  are HIGH. The input/output pins (I/O<sub>0</sub> through I/O<sub>15</sub>) are placed in a high-impedance state when: deselected ( $\overline{CE}$  HIGH), outputs are disabled ( $\overline{OE}$  HIGH),  $\overline{BHE}$  and  $\overline{BLE}$  are disabled ( $\overline{BHE}$ ,  $\overline{BLE}$  HIGH), or during a write operation ( $\overline{CE}$  LOW, and  $\overline{WE}$  LOW).

Writing to the device is accomplished by taking Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs LOW. If Byte Low Enable ( $\overline{BLE}$ ) is LOW, then data from I/O pins (I/O<sub>0</sub> through I/O<sub>7</sub>), is written into the location specified on the address pins (A<sub>0</sub> through A<sub>17</sub>). If Byte High Enable ( $\overline{BHE}$ ) is LOW, then data from I/O pins (I/O<sub>8</sub> through I/O<sub>15</sub>) is written into the location specified on the address pins (A<sub>0</sub> through A<sub>17</sub>).

Reading from the device is accomplished by taking Chip Enable ( $\overline{CE}$ ) and Output Enable ( $\overline{OE}$ ) LOW while forcing the Write Enable ( $\overline{WE}$ ) HIGH. If Byte Low Enable ( $\overline{BLE}$ ) is LOW, then data from the memory location specified by the address pins will appear on I/O<sub>0</sub> to I/O<sub>7</sub>. If Byte High Enable ( $\overline{BHE}$ ) is LOW, then data from memory will appear on I/O<sub>8</sub> to I/O<sub>15</sub>. See the truth table at the back of this data sheet for a complete description of read and write modes.

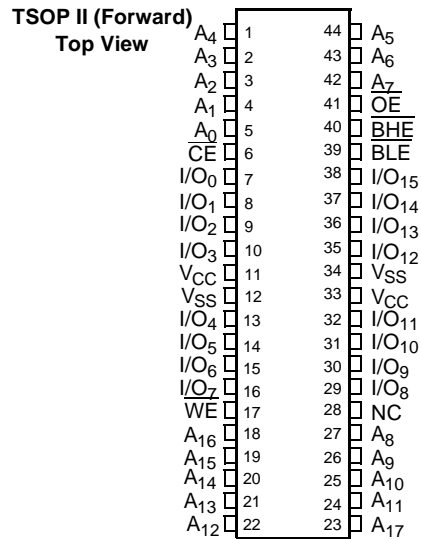
## Logic Block Diagram



**Note:**

1. For best practice recommendations, please refer to the Cypress application note "System Design Guidelines" on <http://www.cypress.com>.

## Pin Configurations



### Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature	.....-65°C to +150°C
Ambient Temperature with Power Applied	.....-55°C to +125°C
Supply Voltage to Ground Potential	.....-0.5V to +4.6V
DC Voltage Applied to Outputs in High-Z State <sup>[2]</sup>	.....-0.5V to V <sub>CC</sub> + 0.5V

DC Input Voltage <sup>[2]</sup>	.....-0.5V to V <sub>CC</sub> + 0.5V
Output Current into Outputs (LOW)	..... 20 mA
Static Discharge Voltage	..... > 2001V (per MIL-STD-883, Method 3015)
Latch-up Current	..... > 200 mA

### Operating Range

Range	Ambient Temperature	V <sub>CC</sub>
Industrial	-40°C to +85°C	2.7V to 3.6V

### Product Portfolio

Product	V <sub>CC</sub> Range (V)			Speed (ns)	Power Dissipation			
	V <sub>CC(min.)</sub>	V <sub>CC(typ.)</sub> <sup>[3]</sup>	V <sub>CC(max.)</sub>		Operating I <sub>CC</sub> (mA)		Standby I <sub>SB2</sub> (µA)	
					Typ. <sup>[3]</sup>	Maximum	Typ. <sup>[3]</sup>	Maximum
CY62147VLL	2.7	3.0	3.6	70	7	15	2	20

### Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	CY62147V-70			Unit	
			Min.	Typ. <sup>[3]</sup>	Max.		
V <sub>OH</sub>	Output HIGH Voltage	I <sub>OH</sub> = -1.0 mA	V <sub>CC</sub> = 2.7V	2.4		V	
V <sub>OL</sub>	Output LOW Voltage	I <sub>OL</sub> = 2.1 mA	V <sub>CC</sub> = 2.7V		0.4	V	
V <sub>IH</sub>	Input HIGH Voltage		V <sub>CC</sub> = 3.6V	2.2	V <sub>CC</sub> + 0.5V	V	
V <sub>IL</sub>	Input LOW Voltage		V <sub>CC</sub> = 2.7V	-0.5	0.8	V	
I <sub>IX</sub>	Input Load Current	GND ≤ V <sub>I</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	I <sub>OUT</sub> = 0 mA, f = f <sub>MAX</sub> = 1/t <sub>RC</sub> , CMOS Levels	V <sub>CC</sub> = 3.6V		7	15	mA
		I <sub>OUT</sub> = 0 mA, f = 1 MHz, CMOS Levels			1	2	mA

#### Notes:

- V<sub>IL(min.)</sub> = -2.0V for pulse durations less than 20 ns.
- 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.

**Electrical Characteristics** Over the Operating Range (continued)

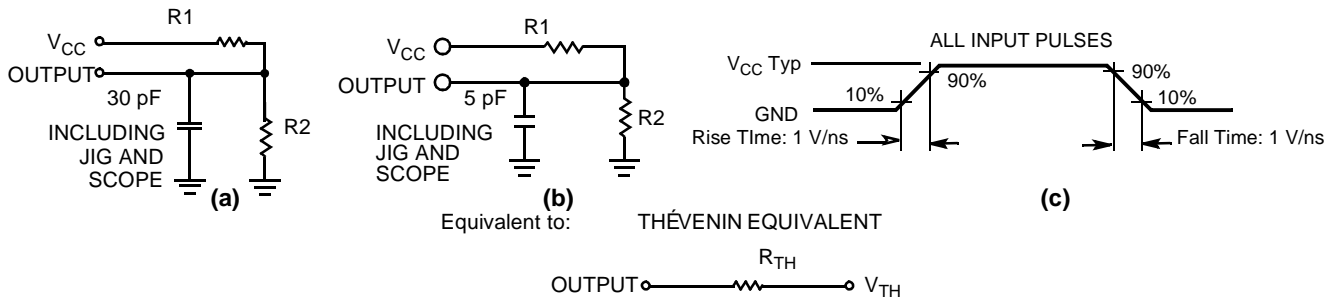
Parameter	Description	Test Conditions	CY62147V-70			Unit
			Min.	Typ. <sup>[3]</sup>	Max.	
$I_{SB1}$	Automatic CE Power-down Current—CMOS Inputs	$CE \geq V_{CC} - 0.3V, V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V, f = f_{MAX}$		2	20	$\mu A$
$I_{SB2}$	Automatic CE Power-down Current—CMOS Inputs	$CE \geq V_{CC} - 0.3V, V_{IN} \geq V_{CC} - 0.3V$ , or $V_{IN} \leq 0.3V, f = 0$	$V_{CC} = 3.6V$			

**Capacitance<sup>[4]</sup>**

Parameter	Description	Test Conditions	Max.	Unit
$C_{IN}$	Input Capacitance	$T_A = 25^\circ C, f = 1\text{ MHz}, V_{CC} = V_{CC}(typ.)$	6	pF
$C_{OUT}$	Output Capacitance		8	pF

**Thermal Resistance**

Parameter	Description	Test Conditions	BGA	TSOPII	Units
$\Theta_{JA}$	Thermal Resistance (Junction to Ambient) <sup>[4]</sup>	Still Air, soldered on a 4.25 x 1.125 inch, 4-layer printed circuit board	55	60	$^\circ C/W$
$\Theta_{JC}$	Thermal Resistance (Junction to Case) <sup>[4]</sup>		16	22	$^\circ C/W$

**AC Test Loads and Waveforms**


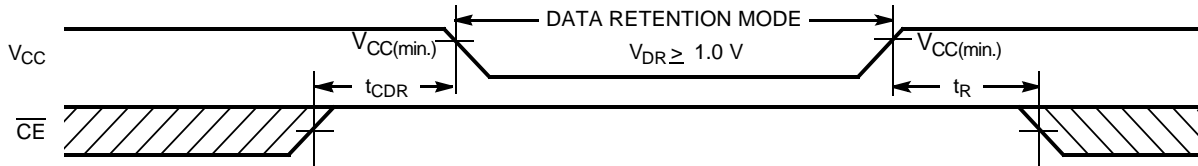
Parameter	3.0V	Unit
R1	1105	$\Omega$
R2	1550	$\Omega$
$R_{TH}$	645	$\Omega$
$V_{TH}$	1.75	V

**Data Retention Characteristics** (Over the Operating Range)

Parameter	Description	Conditions	Min.	Typ. <sup>[3]</sup>	Max.	Unit
$V_{DR}$	$V_{CC}$ for Data Retention		1.0		3.6	V
$I_{CCDR}$	Data Retention Current	$V_{CC} = 1.0V, CE \geq V_{CC} - 0.3V, V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$ ; No input may exceed $V_{CC} + 0.3V$		1	10	$\mu A$
$t_{CDR}^{[4]}$	Chip Deselect to Data Retention Time		0			ns
$t_R^{[5]}$	Operation Recovery Time		70			ns

**Note:**

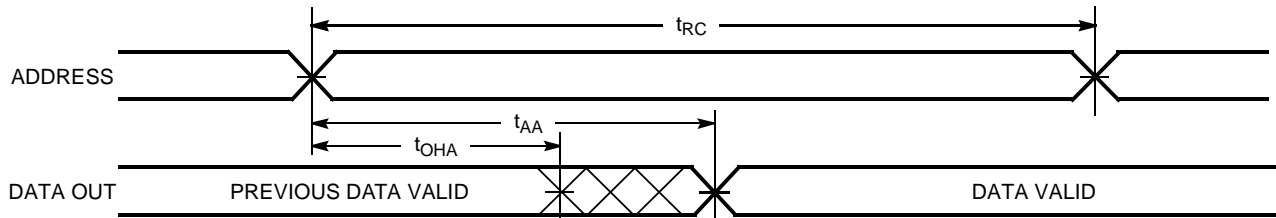
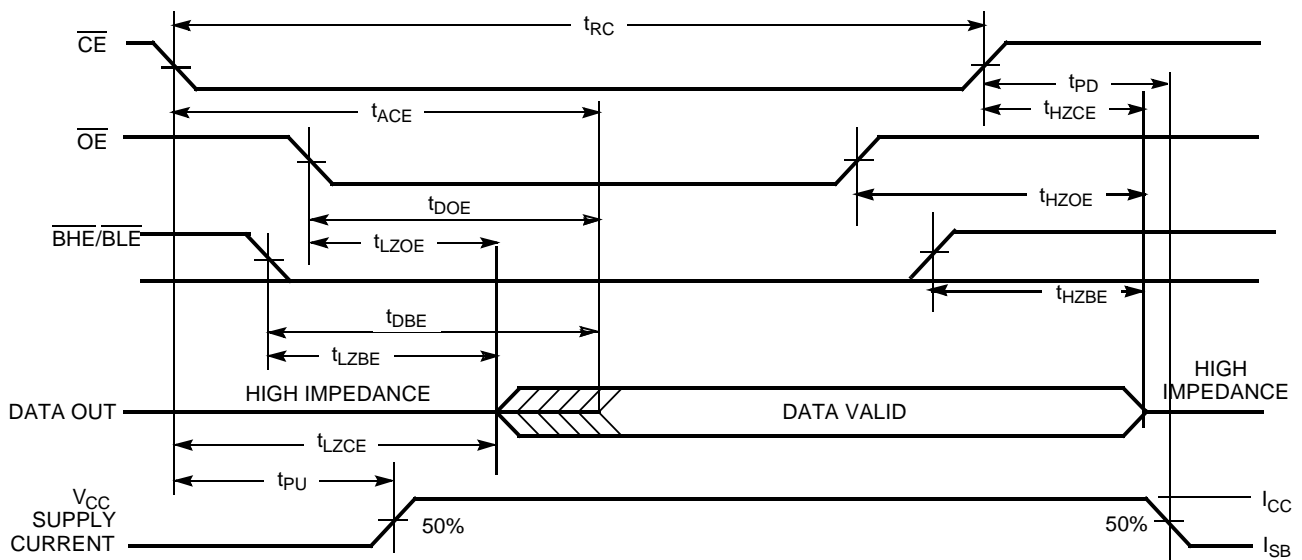
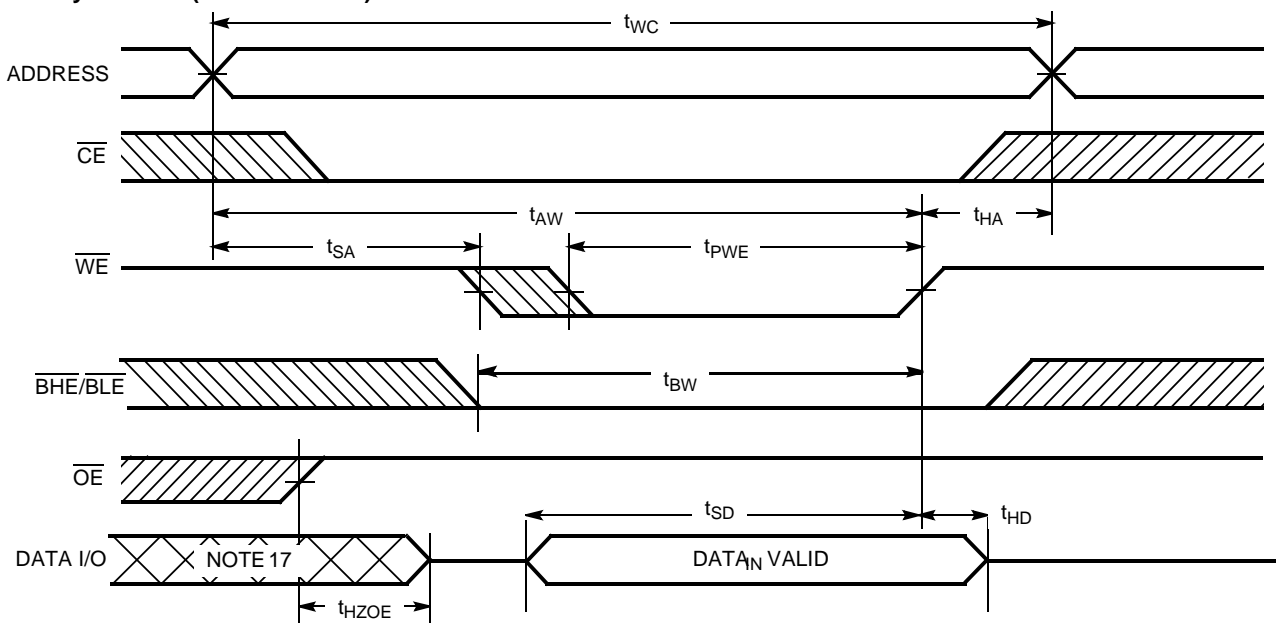
4. Tested initially and after any design or process changes that may affect these parameters.

**Data Retention Waveform**

**Switching Characteristics** Over the Operating Range<sup>[6]</sup>

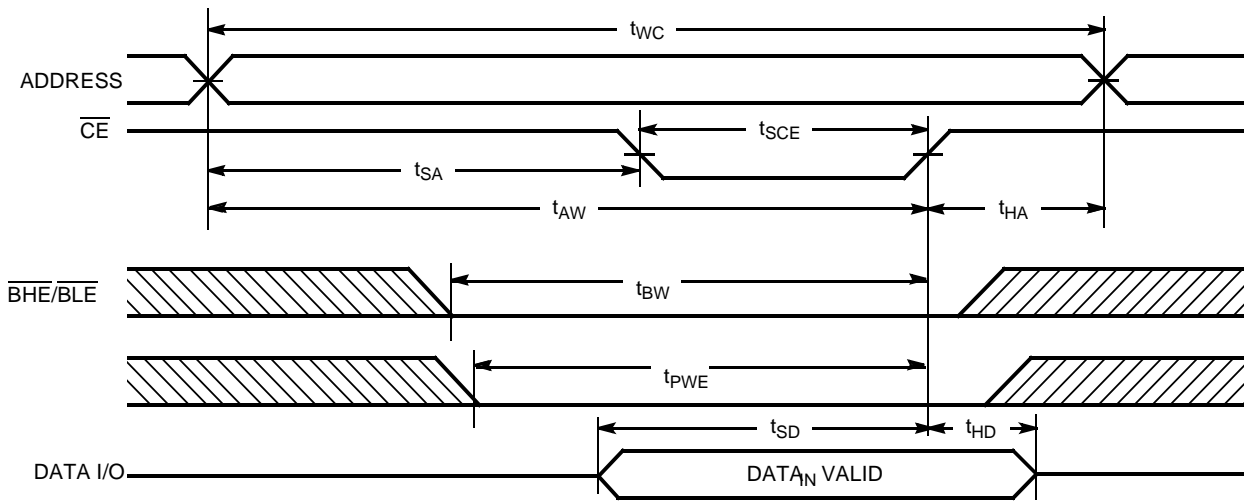
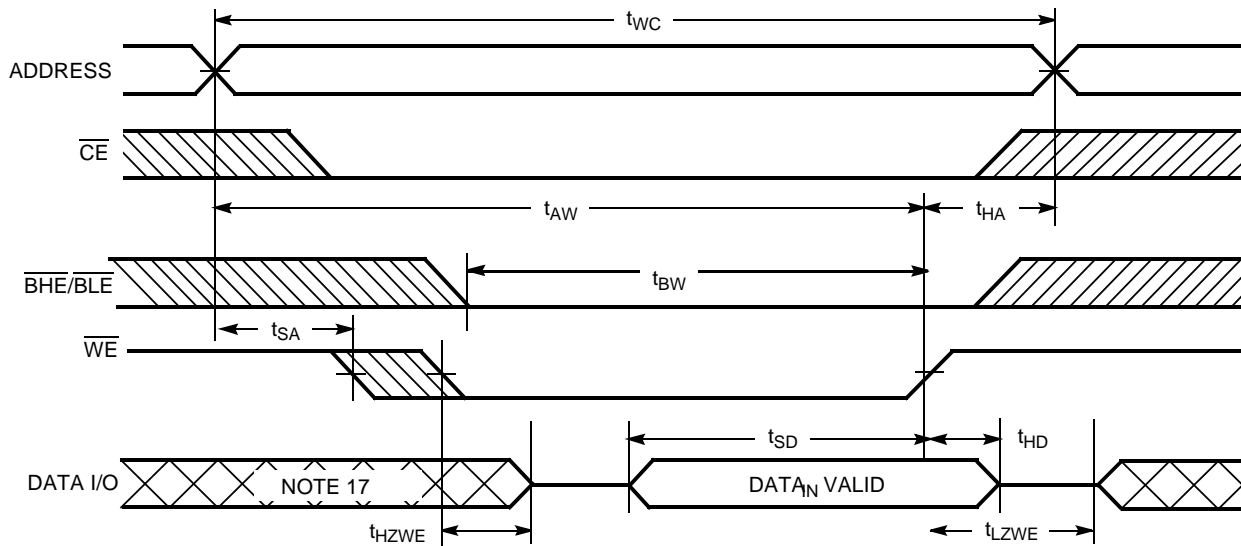
Parameter	Description	70 ns		Unit
		Min.	Max.	
<b>Read Cycle</b>				
$t_{RC}$	Read Cycle Time	70		ns
$t_{AA}$	Address to Data Valid		70	ns
$t_{OHA}$	Data Hold from Address Change	10		ns
$t_{ACE}$	CE LOW to Data Valid		70	ns
$t_{DOE}$	OE LOW to Data Valid		25	ns
$t_{LZOE}$	OE LOW to Low-Z <sup>[7, 9]</sup>	5		ns
$t_{HZOE}$	OE HIGH to High-Z <sup>[9]</sup>		20	ns
$t_{LZCE}$	CE LOW to Low-Z <sup>[7]</sup>	10		ns
$t_{HZCE}$	CE HIGH to High-Z <sup>[7, 9]</sup>		20	ns
$t_{PU}$	CE LOW to Power-up	0		ns
$t_{PD}$	CE HIGH to Power-down		70	ns
$t_{DBE}$	BHE / BLE LOW to Data Valid		70	ns
$t_{LZBE}$ <sup>[8]</sup>	BHE / BLE LOW to Low-Z	5		ns
$t_{HZBE}$	BHE / BLE HIGH to High-Z		20	ns
<b>Write Cycle</b> <sup>[10, 11]</sup>				
$t_{WC}$	Write Cycle Time	70		ns
$t_{SCE}$	CE LOW to Write End	60		ns
$t_{AW}$	Address Set-up to Write End	60		ns
$t_{HA}$	Address Hold from Write End	0		ns
$t_{SA}$	Address Set-up to Write Start	0		ns
$t_{PWE}$	WE Pulse Width	40		ns
$t_{BW}$	BHE / BLE Pulse Width	60		ns
$t_{SD}$	Data Set-up to Write End	30		ns
$t_{HD}$	Data Hold from Write End	0		ns
$t_{HZWE}$	WE LOW to High-Z <sup>[7, 9]</sup>		25	ns
$t_{LZWE}$	WE HIGH to Low-Z <sup>[7]</sup>	10		ns

**Notes:**

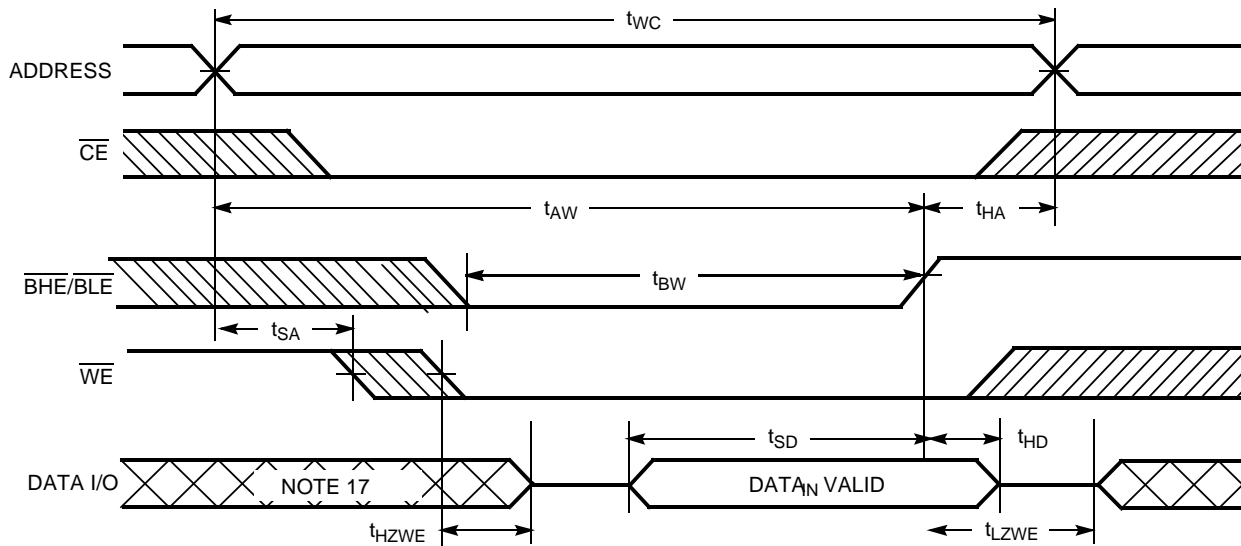
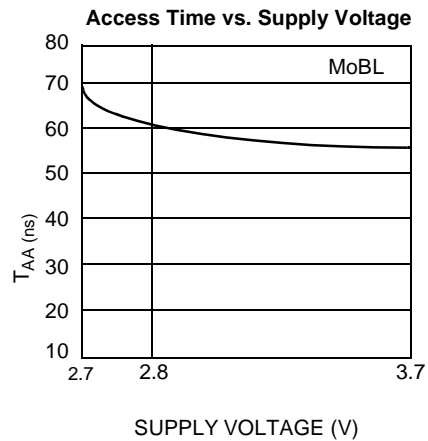
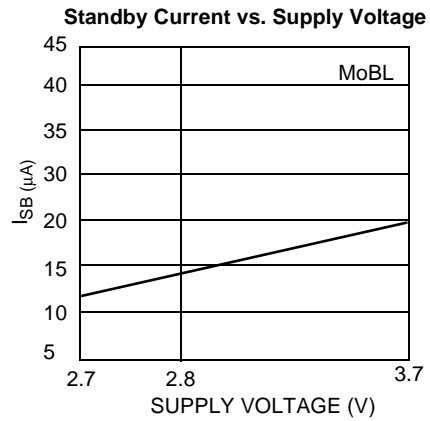
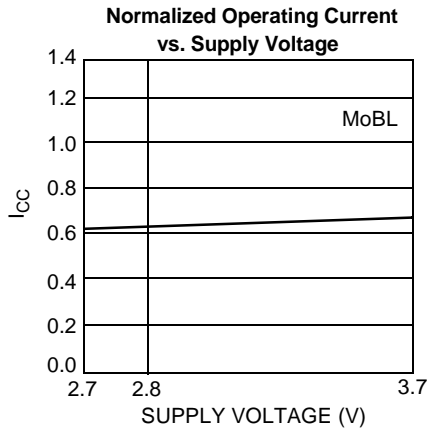
- Full Device AC operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(min.)} > 10 \mu s$  or stable at  $V_{CC(min.)} > 10 \mu s$ .
- Test conditions assume signal transition time of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to  $V_{CC(typ.)}$ , and output loading of the specified  $I_{OL}/I_{OH}$  and 30 pF load capacitance.
- 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.
- If both byte enables are toggled together this value is 10ns
- $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  are specified with  $C_L = 5 \text{ pF}$  as in part (b) of AC Test Loads. Transition is measured  $\pm 500 \text{ mV}$  from steady-state voltage.
- The internal write time of the memory is defined by the overlap of CE LOW and WE LOW. Both signals must be LOW to initiate a write and either signal can terminate a write by going HIGH. The data input set-up and hold timing should be referenced to the rising edge of the signal that terminates the write.
- The minimum write cycle time for Write Cycle #3 (WE controlled, OE LOW) is the sum of  $t_{HZWE}$  and  $t_{SD}$ .

**Switching Waveforms**
**Read Cycle No. 1** [12, 13]

**Read Cycle No. 2** [13, 14]

**Write Cycle No. 1 (WE Controlled)** [10, 15, 16]

**Notes:**

- 12. Device is continuously selected.  $\overline{OE}$ ,  $\overline{CE} = V_{IL}$ .
- 13.  $\overline{WE}$  is HIGH for read cycle.
- 14. Address valid prior to or coincident with  $\overline{CE}$  transition LOW.

**Switching Waveforms (continued)**
**Write Cycle No. 2 ( $\overline{CE}$  Controlled)<sup>[8, 15, 16]</sup>**

**Write Cycle No. 3 ( $\overline{WE}$  Controlled,  $\overline{OE}$  LOW)<sup>[11, 16]</sup>**

**Notes:**

15. Data I/O is high-impedance if  $\overline{OE} = V_{IH}$ .
16. If  $\overline{CE}$  goes HIGH simultaneously with  $\overline{WE}$  HIGH, the output remains in a high-impedance state.
17. During this period, the I/Os are in output state and input signals should not be applied.

**Switching Waveforms (continued)**
**Write Cycle No. 4 ( $\overline{\text{BHE}}/\overline{\text{BLE}}$  Controlled,  $\overline{\text{OE}}$  LOW)<sup>[17]</sup>**

**Typical DC and AC Characteristics**


**Truth Table**

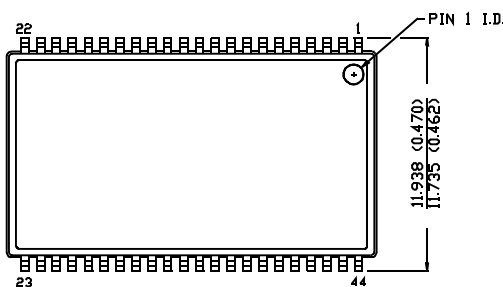
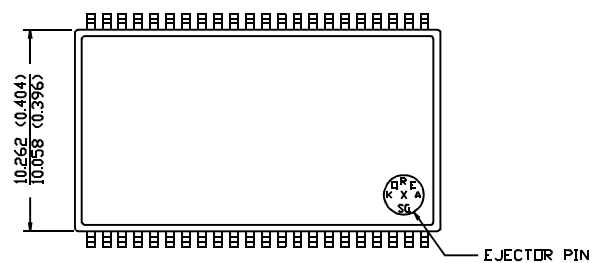
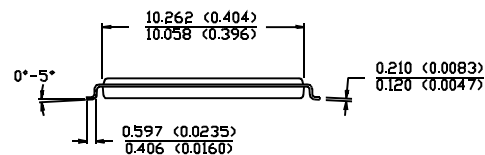
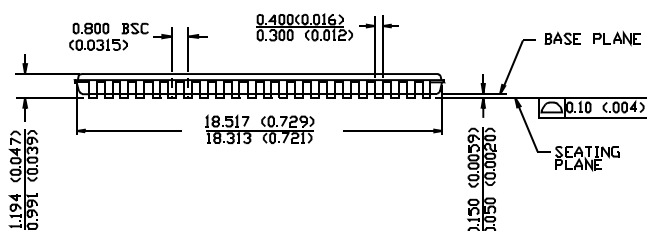
$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Inputs/Outputs	Mode	Power
H	X	X	X	X	High-Z	Deselect/Power-down	Standby ( $I_{SB}$ )
L	X	X	H	H	High-Z	Deselect/Power-down	Standby ( $I_{SB}$ )
L	H	L	L	L	Data Out (I/O <sub>0</sub> –I/O <sub>15</sub> )	Read	Active ( $I_{CC}$ )
L	H	L	H	L	Data Out (I/O <sub>0</sub> –I/O <sub>7</sub> ); I/O <sub>8</sub> –I/O <sub>15</sub> in High-Z	Read	Active ( $I_{CC}$ )
L	H	L	L	H	Data Out (I/O <sub>8</sub> –I/O <sub>15</sub> ); I/O <sub>0</sub> –I/O <sub>7</sub> in High-Z	Read	Active ( $I_{CC}$ )
L	H	H	L	L	High-Z	Deselect/Output Disabled	Active ( $I_{CC}$ )
L	H	H	H	L	High-Z	Deselect/Output Disabled	Active ( $I_{CC}$ )
L	H	H	L	H	High-Z	Deselect/Output Disabled	Active ( $I_{CC}$ )
L	L	X	L	L	Data In (I/O <sub>0</sub> –I/O <sub>15</sub> )	Write	Active ( $I_{CC}$ )
L	L	X	H	L	Data In (I/O <sub>0</sub> –I/O <sub>7</sub> ); I/O <sub>8</sub> –I/O <sub>15</sub> in High-Z	Write	Active ( $I_{CC}$ )
L	L	X	L	H	Data In (I/O <sub>8</sub> –I/O <sub>15</sub> ); I/O <sub>0</sub> –I/O <sub>7</sub> in High-Z	Write	Active ( $I_{CC}$ )

**Ordering Information**

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
70	CY62147VLL-70ZI	Z44	44-pin TSOP II	Industrial

**Package Diagram**

 DIMENSION IN MM (INCH)  
 MAX  
 MIN.

**44-Pin TSOP II Z44**

**TOP VIEW**

**BOTTOM VIEW**


51-85087-A

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<b>Document Title: CY62147V MoBL<sup>®</sup> 4M (256K x 16) Static RAM</b>				
<b>Document Number: 38-05050</b>				
<b>REV.</b>	<b>ECN NO.</b>	<b>Issue Date</b>	<b>Orig. of Change</b>	<b>Description of Change</b>
**	109958	12/16/01	SZV	Changed from Spec number: 38-00757 to 38-05050
A	116514	09/04/02	GBI	Added footnote 1. Deleted fBGA package (replacement fBGA package is available in CY62147CV30).

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