



# 256K x 16 Static RAM

## Features

- Low voltage range:
  - CY62147V: 2.7V–3.6V
- Ultra-low active, standby power
- Easy memory expansion with CE and OE features
- TTL-compatible inputs and outputs
- Automatic power-down when deselected
- CMOS for optimum speed/power

## Functional Description

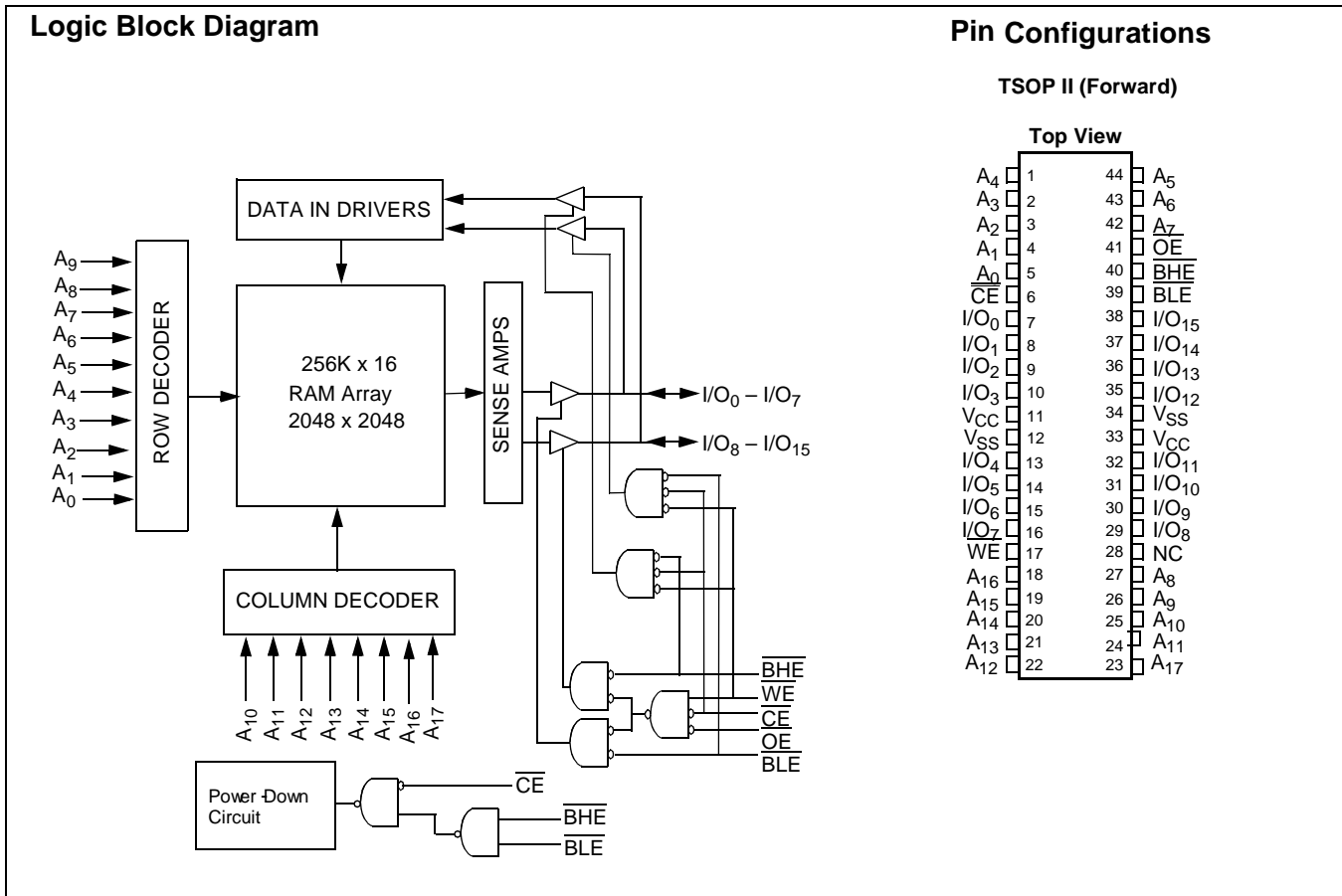
The CY62147V is a high-performance CMOS static RAM organized as 262,144 words by 16 bits. These devices feature advanced circuit design to provide ultra-low active current. This is ideal for providing More Battery Life™ (MoBL™) in portable applications such as cellular telephones. The devices also have 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 (CE HIGH) or when CE is LOW and both BLE and 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 ( $\overline{BHE}$ , BLE HIGH), or during a write operation (CE LOW, and WE LOW).

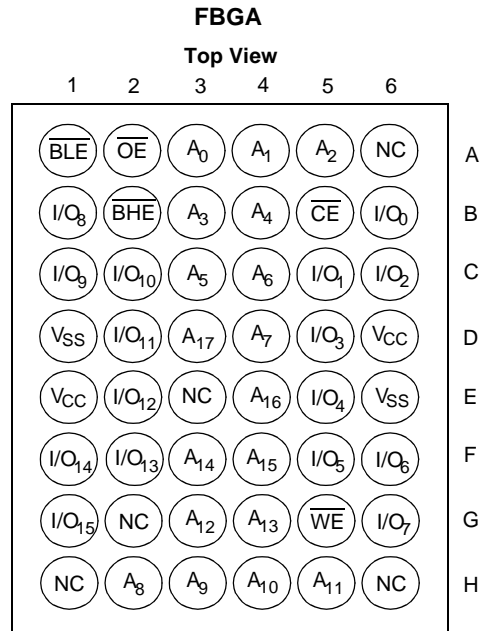
Writing to the device is accomplished by taking Chip Enable ( $\overline{CE}$ ) and Write Enable (WE) inputs LOW. If Byte Low Enable ( $\overline{BLE}$ ) is LOW, then data from I/O pins (I/O<sub>0</sub> through I/O<sub>7</sub>), is written into the location specified on the address pins (A<sub>0</sub>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

The CY62147V is available in 48-ball FBGA and standard 44-pin TSOP Type II (forward pinout) packaging.



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**Pin Configurations (continued)**

**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>[1]</sup> ..... -0.5V to V<sub>CC</sub> + 0.5V

DC Input Voltage<sup>[1]</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**

Device	Range	Ambient Temperature	V <sub>CC</sub>
CY62147V	Industrial	-40°C to +85°C	2.7V to 3.6V

**Product Portfolio**

Product	V <sub>CC</sub> Range			Power	Power Dissipation (Industrial)			
	V <sub>CC</sub> (min.)	V <sub>CC</sub> (typ.) <sup>[2]</sup>	V <sub>CC</sub> (max.)		Operating (I <sub>CC</sub> )		Standby (I <sub>SB2</sub> )	
					Typ. <sup>[2]</sup>	Maximum	Typ. <sup>[2]</sup>	Maximum
CY62147V	2.7V	3.0V	3.6V	LL	7 mA	15 mA	2 μA	20 μA

**Notes:**

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

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.

**Electrical Characteristics** Over the Operating Range

Parameter	Description	Test Conditions	CY62147V			Unit	
			Min.	Typ. <sup>[2]</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	+1	μA	
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> , Output Disabled	-1	+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
I <sub>SB1</sub>	Automatic CE Power-Down Current—CMOS Inputs	$\overline{CE} \geq V_{CC} - 0.3V$ , V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3V or V <sub>IN</sub> ≤ 0.3V, f = f <sub>MAX</sub>					
I <sub>SB2</sub>	Automatic CE Power-Down Current—CMOS Inputs	$\overline{CE} \geq V_{CC} - 0.3V$ V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3V or V <sub>IN</sub> ≤ 0.3V, f = 0	V <sub>CC</sub> = 3.6V	LL	2	20	μA

**Capacitance<sup>[3]</sup>**

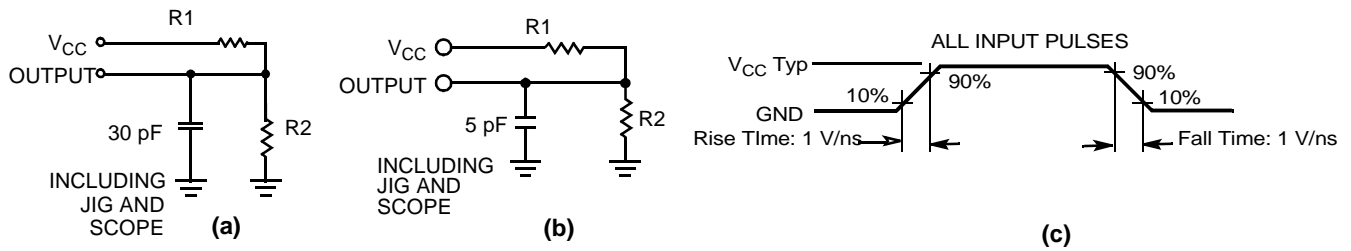
Parameter	Description	Test Conditions	Max.	Unit
C <sub>IN</sub>	Input Capacitance	T <sub>A</sub> = 25°C, f = 1 MHz, V <sub>CC</sub> = V <sub>CC</sub> (typ.)	6	pF
C <sub>OUT</sub>	Output Capacitance		8	pF

**Thermal Resistance**

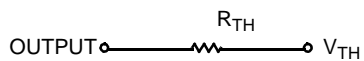
Description	Test Conditions	Symbol	BGA	TSOPII	Units
Thermal Resistance (Junction to Ambient) <sup>[3]</sup>	Still Air, soldered on a 4.25 x 1.125 inch, 4-layer printed circuit board	θ <sub>JA</sub>	55	60	°C/W
Thermal Resistance (Junction to Case) <sup>[3]</sup>		θ <sub>JC</sub>	16	22	°C/W

**Note:**

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

**AC Test Loads and Waveforms**


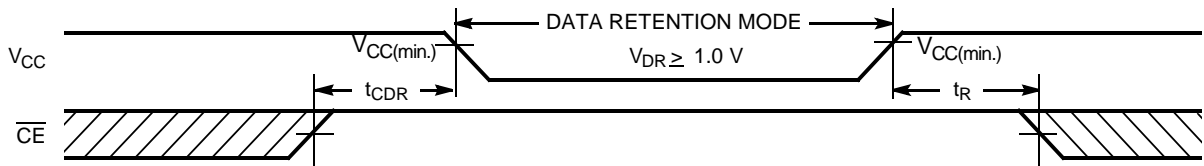
Equivalent to: THÉVENIN EQUIVALENT



Parameter	3.0V	Unit
R1	1105	$\Omega$
R2	1550	$\Omega$
R <sub>TH</sub>	645	$\Omega$
V <sub>TH</sub>	1.75	V

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

Parameter	Description	Conditions	Min.	Typ. <sup>[2]</sup>	Max.	Unit
V <sub>DR</sub>	V <sub>CC</sub> for Data Retention		1.0		3.6	V
I <sub>CCDR</sub>	Data Retention Current	V <sub>CC</sub> = 1.0V CE ≥ V <sub>CC</sub> - 0.3V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3V or V <sub>IN</sub> ≤ 0.3V No input may exceed V <sub>CC</sub> + 0.3V	LL	1	10	$\mu$ A
t <sub>CDR</sub> <sup>[3]</sup>	Chip Deselect to Data Retention Time		0			ns
t <sub>R</sub> <sup>[4]</sup>	Operation Recovery Time		70			ns

**Data Retention Waveform**

**Note:**

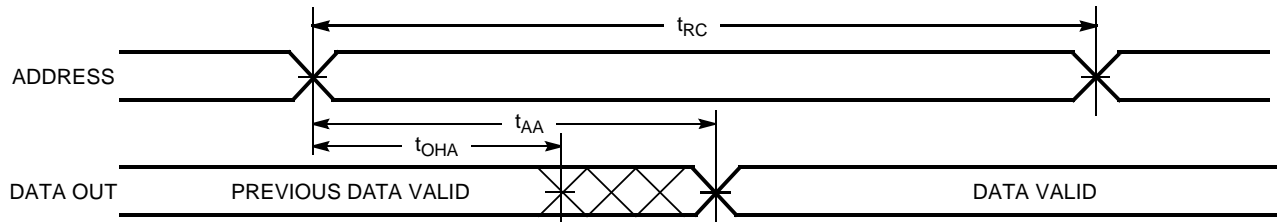
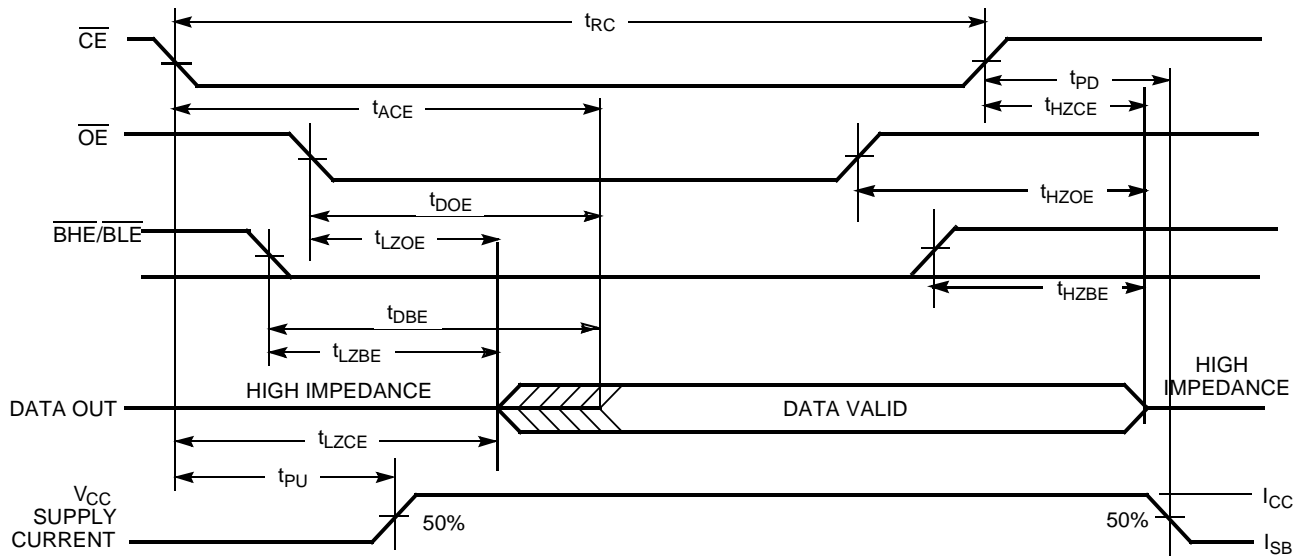
4. Full Device AC operation requires linear V<sub>CC</sub> ramp from V<sub>DR</sub> to V<sub>CC(min.)</sub> > 10  $\mu$ s or stable at V<sub>CC(min.)</sub> > 10  $\mu$ s.

**Switching Characteristics** Over the Operating Range<sup>[5]</sup>

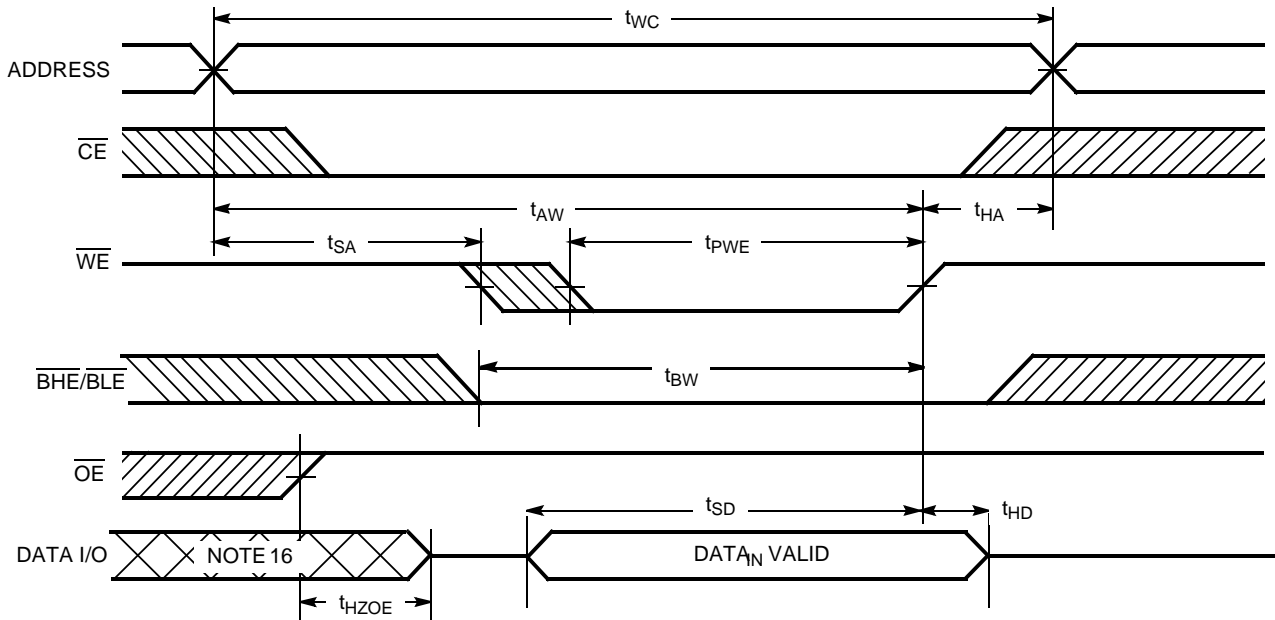
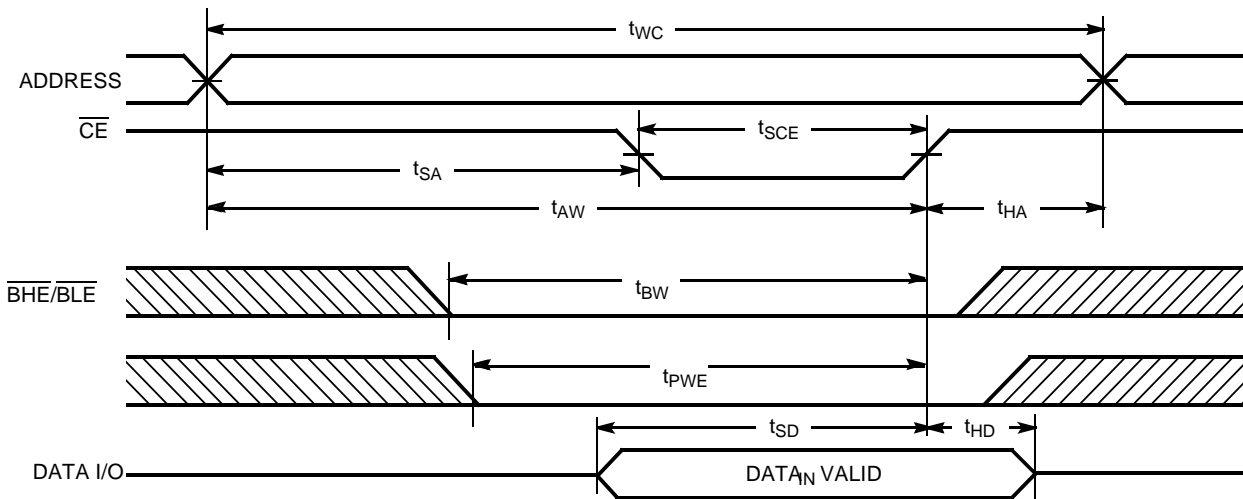
Parameter	Description	70 ns		Unit
		Min.	Max.	
<b>READ CYCLE</b>				
$t_{RC}$	Read Cycle Time	70		ns
$t_{AA}$	Address to Data Valid		70	ns
$t_{OHA}$	Data Hold from Address Change	10		ns
$t_{ACE}$	$\overline{CE}$ LOW to Data Valid		70	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid		25	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low Z <sup>[6, 8]</sup>	5		ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High Z <sup>[8]</sup>		20	ns
$t_{LZCE}$	$\overline{CE}$ LOW to Low Z <sup>[6]</sup>	10		ns
$t_{HZCE}$	$\overline{CE}$ HIGH to High Z <sup>[6, 8]</sup>		20	ns
$t_{PU}$	$\overline{CE}$ LOW to Power-Up	0		ns
$t_{PD}$	$\overline{CE}$ HIGH to Power-Down		70	ns
$t_{DBE}$	$\overline{BHE} / \overline{BLE}$ LOW to Data Valid		70	ns
$t_{LZBE}^{[7]}$	$\overline{BHE} / \overline{BLE}$ LOW to Low Z	5		ns
$t_{HZBE}$	$\overline{BHE} / \overline{BLE}$ HIGH to High Z		20	ns
<b>WRITE CYCLE<sup>[9, 10]</sup></b>				
$t_{WC}$	Write Cycle Time	70		ns
$t_{SCE}$	$\overline{CE}$ 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
$t_{PWE}$	$\overline{WE}$ Pulse Width	40		ns
$t_{BW}$	$\overline{BHE} / \overline{BLE}$ Pulse Width	60		ns
$t_{SD}$	Data Set-Up to Write End	30		ns
$t_{HD}$	Data Hold from Write End	0		ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[6, 8]</sup>		25	ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[6]</sup>	10		ns

**Notes:**

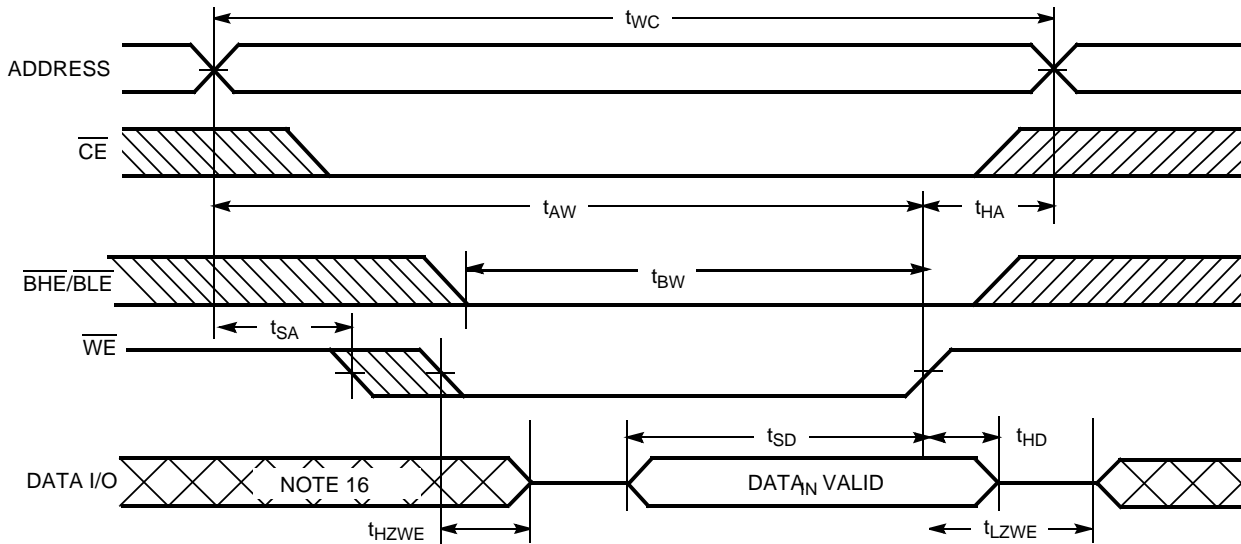
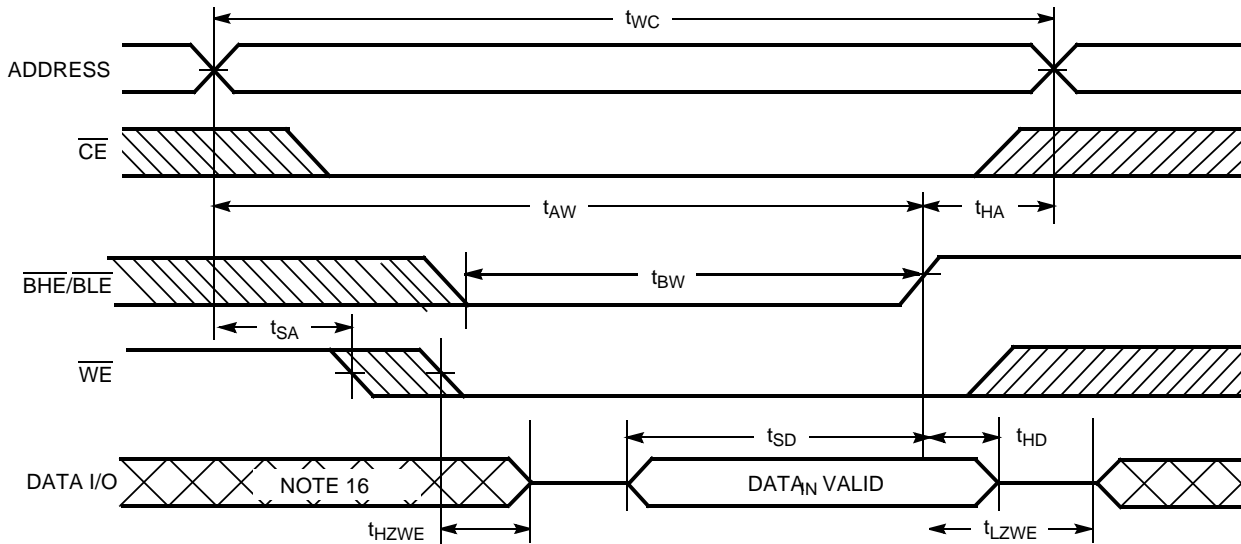
- Test conditions assume signal transition time of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to  $V_{CC(typ.)}$ , and output loading of the specified  $I_{OL}/I_{OH}$  and 30 pF load capacitance.
- At any given temperature and voltage condition,  $t_{HZCE}$  is less than  $t_{LZCE}$ ,  $t_{HZOE}$  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  $C_L = 5$  pF as in part (b) of AC Test Loads. Transition is measured  $\pm 500$  mV from steady-state voltage.
- The internal write time of the memory is defined by the overlap of  $\overline{CE}$  LOW and  $\overline{WE}$  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 ( $\overline{WE}$  controlled,  $\overline{OE}$  LOW) is the sum of  $t_{HZWE}$  and  $t_{SD}$ .

**Switching Waveforms**
**Read Cycle No. 1** <sup>[11, 12]</sup>

**Read Cycle No. 2** <sup>[12, 13]</sup>

**Notes:**

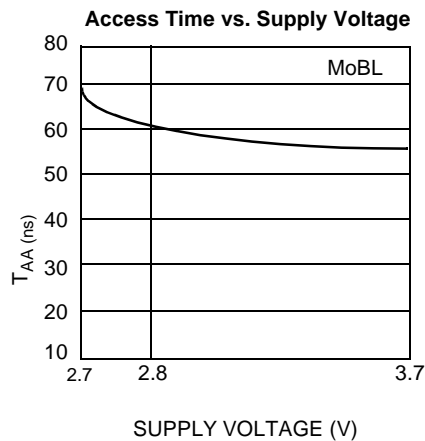
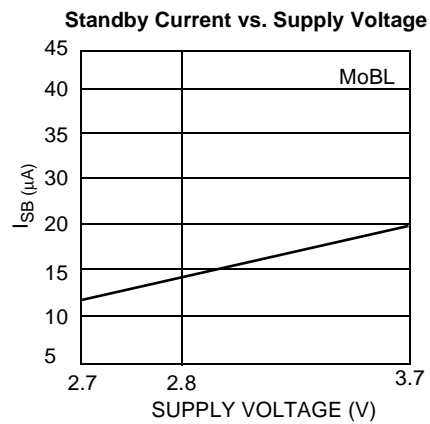
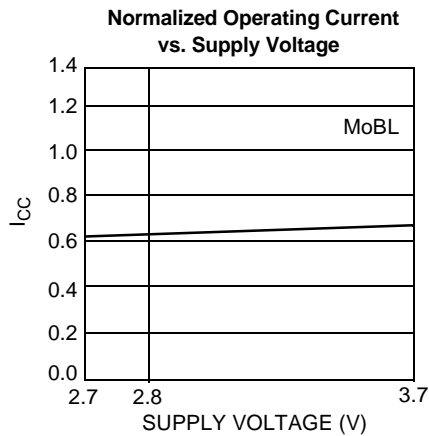
11. Device is continuously selected.  $\overline{OE}, \overline{CE} = V_{IL}$ .
12.  $\overline{WE}$  is HIGH for read cycle.
13. Address valid prior to or coincident with  $\overline{CE}$  transition LOW.

**Switching Waveforms (continued)**
**Write Cycle No. 1 (WE Controlled)** [9, 14, 15]

**Write Cycle No. 2 ( $\overline{CE}$  Controlled)** [8, 14, 15]

**Notes:**

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

**Switching Waveforms (continued)**
**Write Cycle No. 3 ( $\overline{WE}$  Controlled,  $\overline{OE}$  LOW)<sup>[10, 15]</sup>**

**Write Cycle No. 4 ( $\overline{BHE}/\overline{BLE}$  Controlled,  $\overline{OE}$  LOW)<sup>[16]</sup>**




**Typical DC and AC Characteristics**

**Truth Table**

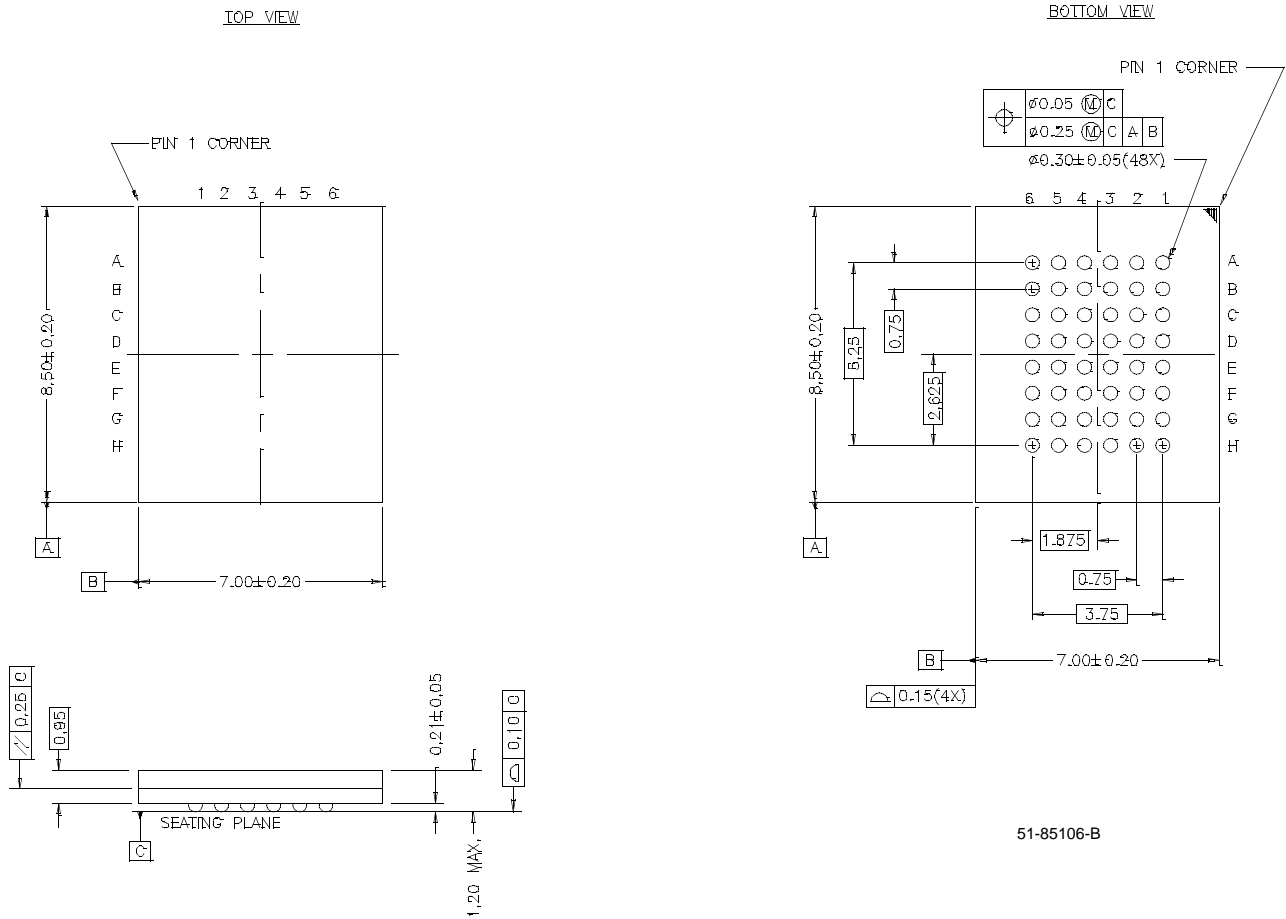
<b>CE</b>	<b>WE</b>	<b>OE</b>	<b>BHE</b>	<b>BLE</b>	<b>Inputs/Outputs</b>	<b>Mode</b>	<b>Power</b>
H	X	X	X	X	High Z	Deselect/Power-Down	Standby ( $I_{SB}$ )
L	X	X	H	H	High Z	Deselect/Power-Down	Standby ( $I_{SB}$ )
L	H	L	L	L	Data Out (I/O <sub>0</sub> –I/O <sub>15</sub> )	Read	Active ( $I_{CC}$ )
L	H	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
	CY62147VLL-70BAI	BA48B	48-Ball Fine Pitch BGA	

Package Diagrams

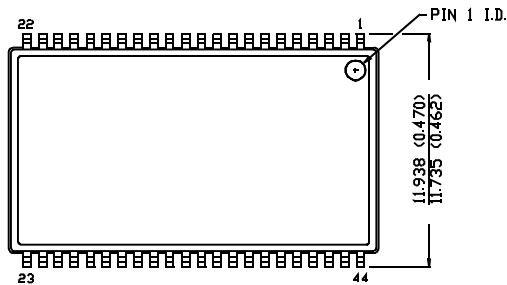
48-Ball (7.00 mm x 8.5 mm x 1.20 mm) Thin BGA BA48B



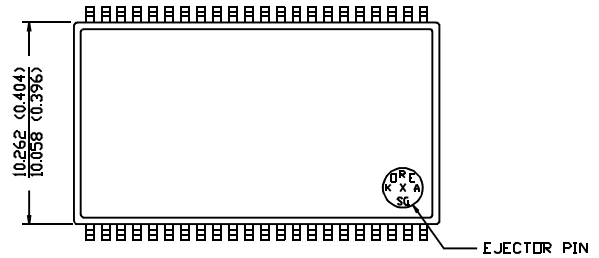
Package Diagrams (continued)

44-Pin TSOP II Z44

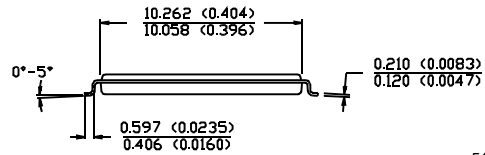
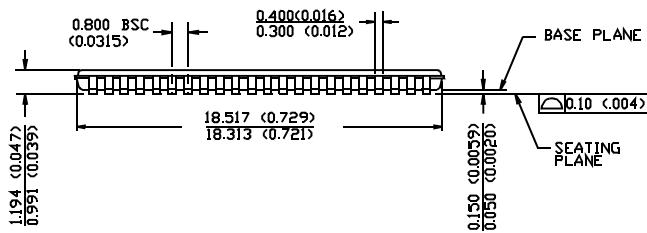
DIMENSION IN MM (INCH)  
MAX  
MIN.



TOP VIEW



BOTTOM VIEW



51-85087-A



<b>Document Title: CY62147V MoBL™ 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	Change from Spec number: 38-00757 to 38-05050