

**Features**

- Very High Speed
  - 55 ns
- Wide Voltage Range
  - 2.2V to 3.7V
- Ultra Low Standby Power
  - Typical Standby Current: 8 μA
  - Maximum Standby Current: 48 μA
- Ultra Low Active Power
  - Typical Active Current: 4.0 mA at f = 1 MHz
- Easy Memory Expansion with  $\overline{CE}_1$ ,  $CE_2$ , and  $\overline{OE}$  Features
- Automatic Power Down when Deselected
- CMOS for Optimum Speed and Power
- Available in Pb-Free 48-Ball FBGA Package

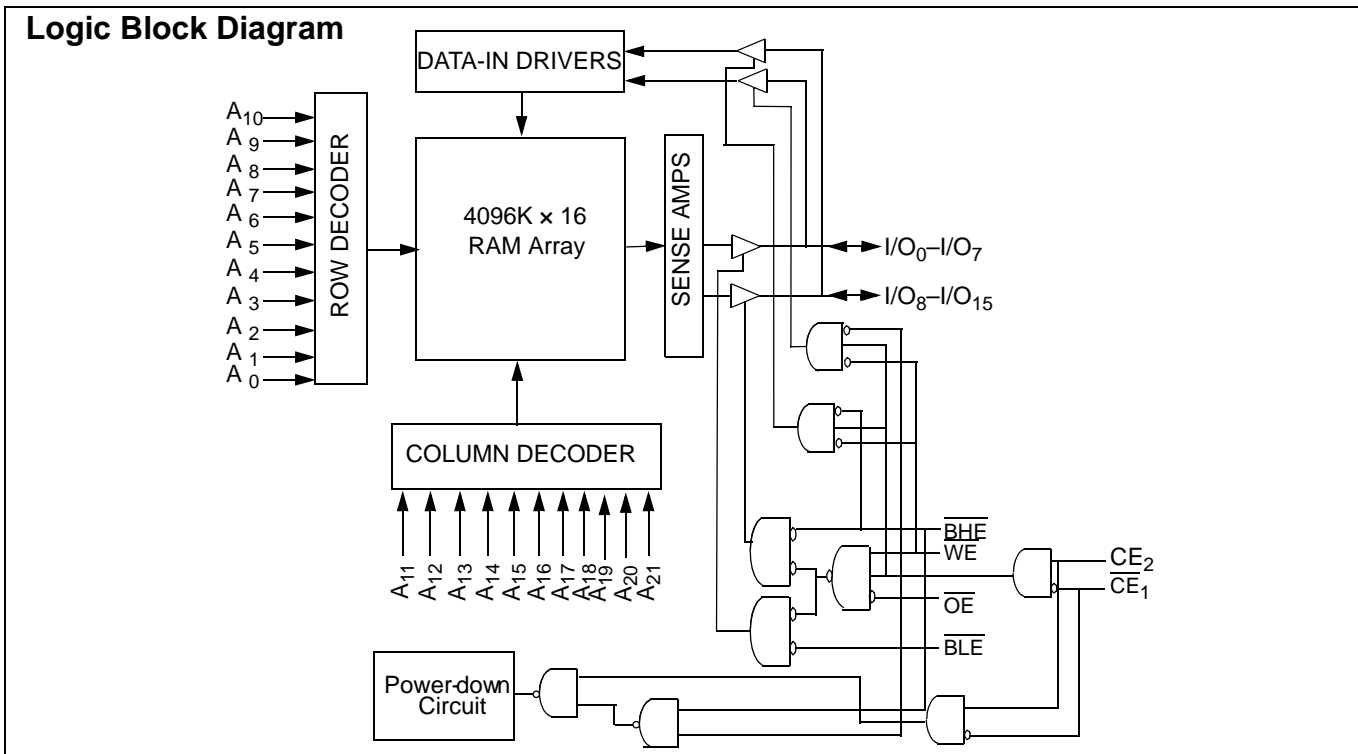
**Functional Description**

The CY62187EV30 is a high performance CMOS static RAM organized as 4M words by 16 bits<sup>[1]</sup>. This device features advanced circuit design to provide ultra low active current. It 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 by 99 percent when addresses are not toggling. The device can also be put into standby mode when deselected ( $\overline{CE}_1$  HIGH or  $CE_2$  LOW or both  $\overline{BHE}$  and  $\overline{BLE}$  are HIGH). The input and output pins ( $IO_0$  through  $IO_{15}$ ) are placed in a high impedance state when: deselected ( $\overline{CE}_1$  HIGH or  $CE_2$  LOW), outputs are disabled ( $\overline{OE}$  HIGH), both  $\overline{Byte}$  High Enable and  $\overline{Byte}$  Low Enable are disabled ( $\overline{BHE}$ ,  $\overline{BLE}$  HIGH), or during a write operation ( $\overline{CE}_1$  LOW,  $CE_2$  HIGH and  $\overline{WE}$  LOW).

To write to the device, take  $\overline{Chip}$  Enables ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH) and Write Enable ( $\overline{WE}$ ) input LOW. If  $\overline{Byte}$  Low Enable ( $\overline{BLE}$ ) is LOW, then data from I/O pins ( $IO_0$  through  $IO_7$ ), is written into the location specified on the address pins ( $A_0$  through  $A_{21}$ ). If  $\overline{Byte}$  High Enable ( $\overline{BHE}$ ) is LOW, then data from I/O pins ( $IO_8$  through  $IO_{15}$ ) is written into the location specified on the address pins ( $A_0$  through  $A_{21}$ ).

To read from the device, take  $\overline{Chip}$  Enables ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH) and Output Enable ( $\overline{OE}$ ) LOW while forcing the Write Enable ( $\overline{WE}$ ) HIGH. If  $\overline{Byte}$  Low Enable ( $\overline{BLE}$ ) is LOW, then data from the memory location specified by the address pins appear on  $IO_0$  to  $IO_7$ . If  $\overline{Byte}$  High Enable ( $\overline{BHE}$ ) is LOW, then data from memory appears on  $IO_8$  to  $IO_{15}$ . See the [Truth Table](#) on page 9 for a complete description of read and write modes.

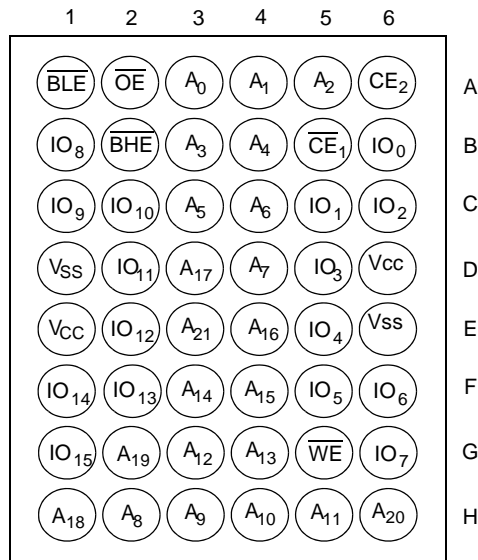


**Note**

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

## Pin Configuration

Figure 1. 48-Ball VFBGA



## Product Portfolio

Product	V <sub>CC</sub> Range (V)			Speed (ns)	Power Dissipation					
					Operating I <sub>CC</sub> (mA)				Standby I <sub>SB2</sub> (μA)	
					f = 1 MHz		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		
CY62187EV30LL	2.2	3.0	3.7	55	4.0	6	45	55	8	48
				70	4.0	6	35	45	8	48

**Note**

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 impair the useful life of the device. These 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.....	-0.3V to $V_{CC(max)}$ + 0.3V
DC Voltage Applied to Outputs in High Z State <sup>[3, 4]</sup> .....	-0.3V to $V_{CC(max)}$ + 0.3V

DC Input Voltage <sup>[3, 4]</sup> .....	-0.3V to $V_{CC(max)}$ + 0.3V
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	$V_{CC}$ <sup>[5]</sup>
CY62187EV30LL	Industrial	-40°C to +85°C	2.2V to 3.7V

## Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	55 ns			70 ns			Unit		
			Min	Typ <sup>[2]</sup>	Max	Min	Typ <sup>[2]</sup>	Max			
V <sub>OH</sub>	Output HIGH Voltage	$2.2V \leq V_{CC} \leq 2.7V$	$I_{OH} = -0.1 \text{ mA}$		2.0			2.0		V	
		$2.7V \leq V_{CC} \leq 3.7V$	$I_{OH} = -1.0 \text{ mA}$		2.4			2.4		V	
V <sub>OL</sub>	Output LOW Voltage	$2.2V \leq V_{CC} \leq 2.7V$	$I_{OL} = 0.1 \text{ mA}$							0.4	V
		$2.7V \leq V_{CC} \leq 3.7V$	$I_{OL} = 2.1 \text{ mA}$							0.4	V
V <sub>IH</sub>	Input HIGH Voltage	$2.2V \leq V_{CC} \leq 2.7V$		1.8		$V_{CC} + 0.3V$	1.8		$V_{CC} + 0.3V$	V	
		$2.7V \leq V_{CC} \leq 3.7V$		2.2		$V_{CC} + 0.3V$	2.2		$V_{CC} + 0.3V$	V	
V <sub>IL</sub>	Input LOW Voltage	$2.2V \leq V_{CC} \leq 2.7V$		-0.3		0.6	-0.3		0.6	V	
		$2.7V \leq V_{CC} \leq 3.7V$		-0.3		0.7	-0.3		0.7	V	
I <sub>IX</sub>	Input Leakage Current	$GND \leq V_I \leq V_{CC}$		-1		+1	-1		+1	μA	
I <sub>OZ</sub>	Output Leakage Current	$GND \leq V_O \leq V_{CC}$ , Output Disabled		-1		+1	-1		+1	μA	
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	$f = f_{Max} = 1/t_{RC}$	$V_{CC} = V_{CC(max)}$ $I_{OUT} = 0 \text{ mA}$ CMOS levels		45	55		35	45	mA	
		$f = 1 \text{ MHz}$			4.0	6		4.0	6	mA	
I <sub>SB2</sub> <sup>[6]</sup>	Automatic CE Power-Down Current—CMOS Inputs	$CE_1 \geq V_{CC} - 0.2V$ or $CE_2 \leq 0.2V$ , $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$ , $f = 0$ , $V_{CC} = 3.7V$			8	48		8	48	μA	

## Capacitance

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

Parameter	Description	Test Conditions	Max	Unit
C <sub>IN</sub>	Input Capacitance	$T_A = 25^\circ\text{C}$ , $f = 1 \text{ MHz}$ , $V_{CC} = V_{CC(typ)}$	25	pF
C <sub>OUT</sub>	Output Capacitance		35	pF

### Notes

- $V_{IL(min)}$  = -2.0V for pulse durations less than 20 ns.
- $V_{IH(max)}$  =  $V_{CC} + 0.75V$  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.
- Only chip enables ( $CE_1$  and  $CE_2$ ) need to be tied to CMOS levels to meet the  $I_{SB2} / I_{CCDR}$  spec. Other inputs can be left floating.

## Thermal Resistance

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

Parameter	Description	Test Conditions	FBGA	Unit
$\Theta_{JA}$	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 x 4.5 inch, 2-layer printed circuit board	59.06	$^{\circ}\text{C/W}$
$\Theta_{JC}$	Thermal Resistance (Junction to Case)		14.08	$^{\circ}\text{C/W}$

Figure 2. AC Test Loads and Waveforms

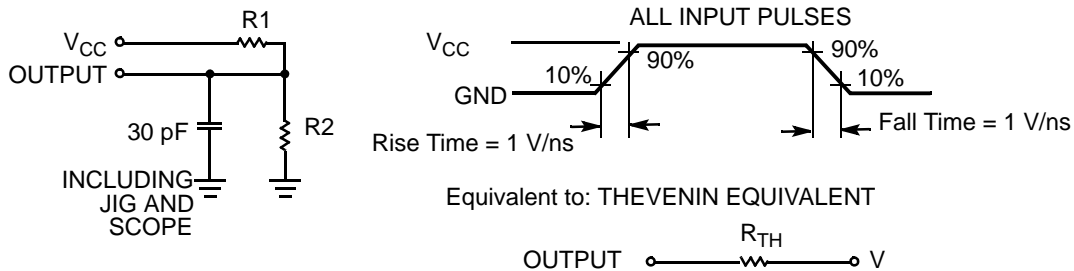


Table 1. AC Test Loads

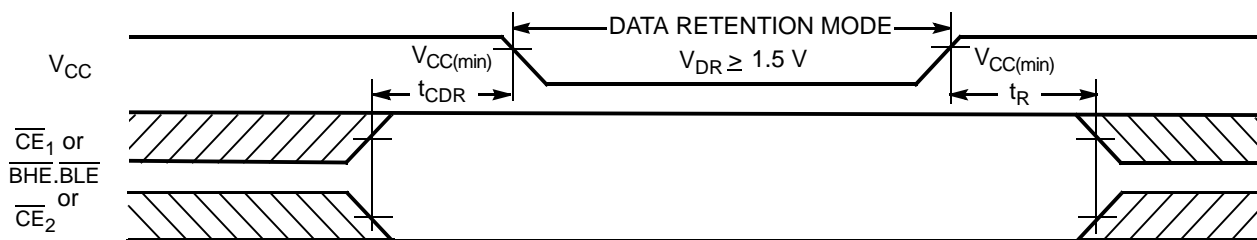
Parameter	2.2V to 3.7V	Unit
R1	1103	$\Omega$
R2	1554	$\Omega$
$R_{TH}$	645	$\Omega$
$V_{TH}$	$2.2\text{V} < V_{CC} \leq 3\text{V}$	$V_{CC}/2$
	$3\text{V} < V_{CC} \leq 3.7\text{V}$	1.5

## Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions	Min	Typ <sup>[2]</sup>	Max	Unit
$V_{DR}$	$V_{CC}$ for Data Retention		1.5			V
$I_{CCDR}$ <sup>[6]</sup>	Data Retention Current	$V_{CC} = 1.5\text{V}$ , $\overline{CE}_1 \geq V_{CC} - 0.2\text{V}$ , $CE_2 \leq 0.2\text{V}$ , $V_{IN} \geq V_{CC} - 0.2\text{V}$ or $V_{IN} \leq 0.2\text{V}$			48	$\mu\text{A}$
$t_{CDR}$ <sup>[7]</sup>	Chip Deselect to Data Retention Time		0			ns
$t_R$ <sup>[8]</sup>	Operation Recovery Time		$t_{RC}$			ns

Figure 3. Data Retention Waveform<sup>[9]</sup>



### Notes

7. Tested initially and after any design or process changes that may affect these parameters.
8. Full device operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(\text{min})} \geq 100 \mu\text{s}$  or stable at  $V_{CC(\text{min})} \geq 100 \mu\text{s}$ .
9.  $\overline{BHE.BLE}$  is the AND of both  $\overline{BHE}$  and  $\overline{BLE}$ . Chip is deselected by either disabling the chip enable signals or by disabling both  $\overline{BHE}$  and  $\overline{BLE}$ .

## Switching Characteristics

Over the Operating Range <sup>[10]</sup>

Parameter	Description	55 ns		70 ns		Unit
		Min	Max	Min	Max	
<b>Read Cycle</b>						
t <sub>RC</sub>	Read Cycle Time	55		70		ns
t <sub>AA</sub>	Address to Data Valid		55		70	ns
t <sub>OHA</sub>	Data Hold from Address Change	6		6		ns
t <sub>ACE</sub>	CE <sub>1</sub> LOW and CE <sub>2</sub> HIGH to Data Valid		55		70	ns
t <sub>DOE</sub>	OE LOW to Data Valid		25		35	ns
t <sub>LZOE</sub>	OE LOW to Low Z <sup>[11]</sup>	5		5		ns
t <sub>HZOE</sub>	OE HIGH to High Z <sup>[11, 12]</sup>		20		25	ns
t <sub>LZCE</sub>	CE <sub>1</sub> LOW and CE <sub>2</sub> HIGH to Low Z <sup>[11]</sup>	10		10		ns
t <sub>HZCE</sub>	CE <sub>1</sub> HIGH and CE <sub>2</sub> LOW to High Z <sup>[11, 12]</sup>		20		25	ns
t <sub>PU</sub>	CE <sub>1</sub> LOW and CE <sub>2</sub> HIGH to Power Up	0		0		ns
t <sub>PD</sub>	CE <sub>1</sub> HIGH and CE <sub>2</sub> LOW to Power Down		55		70	ns
t <sub>DBE</sub>	BLE/BHE LOW to Data Valid		55		70	ns
t <sub>LZBE</sub>	BLE/BHE LOW to Low Z <sup>[11]</sup>	10		10		ns
t <sub>HZBE</sub>	BLE/BHE HIGH to HIGH Z <sup>[11, 12]</sup>		20		25	ns
<b>Write Cycle<sup>[13]</sup></b>						
t <sub>WC</sub>	Write Cycle Time	55		70		ns
t <sub>SCE</sub>	CE <sub>1</sub> LOW and CE <sub>2</sub> HIGH to Write End	45		60		ns
t <sub>AW</sub>	Address Setup to Write End	45		60		ns
t <sub>HA</sub>	Address Hold from Write End	0		0		ns
t <sub>SA</sub>	Address Setup to Write Start	0		0		ns
t <sub>PWE</sub>	WE Pulse Width	40		50		ns
t <sub>BW</sub>	BLE/BHE LOW to Write End	45		60		ns
t <sub>SD</sub>	Data Setup to Write End	25		35		ns
t <sub>HD</sub>	Data Hold from Write End	0		0		ns
t <sub>HZWE</sub>	WE LOW to High-Z <sup>[11, 12]</sup>		20		25	ns
t <sub>LZWE</sub>	WE HIGH to Low-Z <sup>[11]</sup>	10		10		ns

### Notes

10. Test conditions for all parameters other than tri-state parameters assume signal transition time of 1V/ns, timing reference levels of V<sub>TH</sub>, input pulse levels of 0 to V<sub>CC(typ)</sub>, and output loading of the specified I<sub>OL</sub>/I<sub>OH</sub> as shown in [AC Test Loads](#) on page 4.
11. At any given temperature and voltage condition, t<sub>HZCE</sub> is less than t<sub>LZCE</sub>, t<sub>HZBE</sub> is less than t<sub>LZBE</sub>, t<sub>HZOE</sub> is less than t<sub>LZOE</sub>, and t<sub>HZWE</sub> is less than t<sub>LZWE</sub> for any given device.
12. t<sub>HZOE</sub>, t<sub>HZCE</sub>, t<sub>HZBE</sub>, and t<sub>HZWE</sub> transitions are measured when the outputs enter a high impedance state.
13. The internal Write time of the memory is defined by the overlap of WE, CE<sub>1</sub> = V<sub>IL</sub>, BHE and/or BLE = V<sub>IL</sub>, and CE<sub>2</sub> = V<sub>IH</sub>. 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 1 (Address Transition Controlled)<sup>[14, 15]</sup>

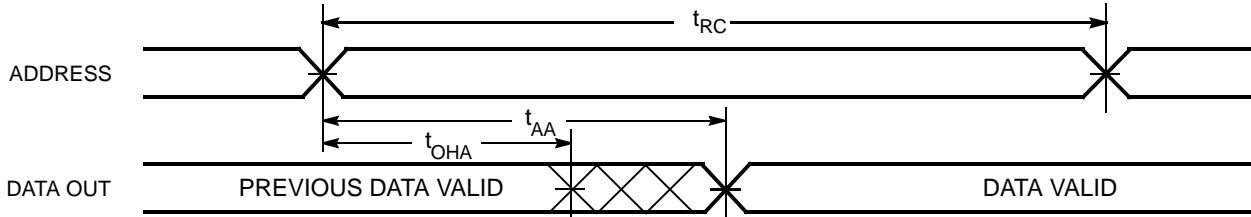
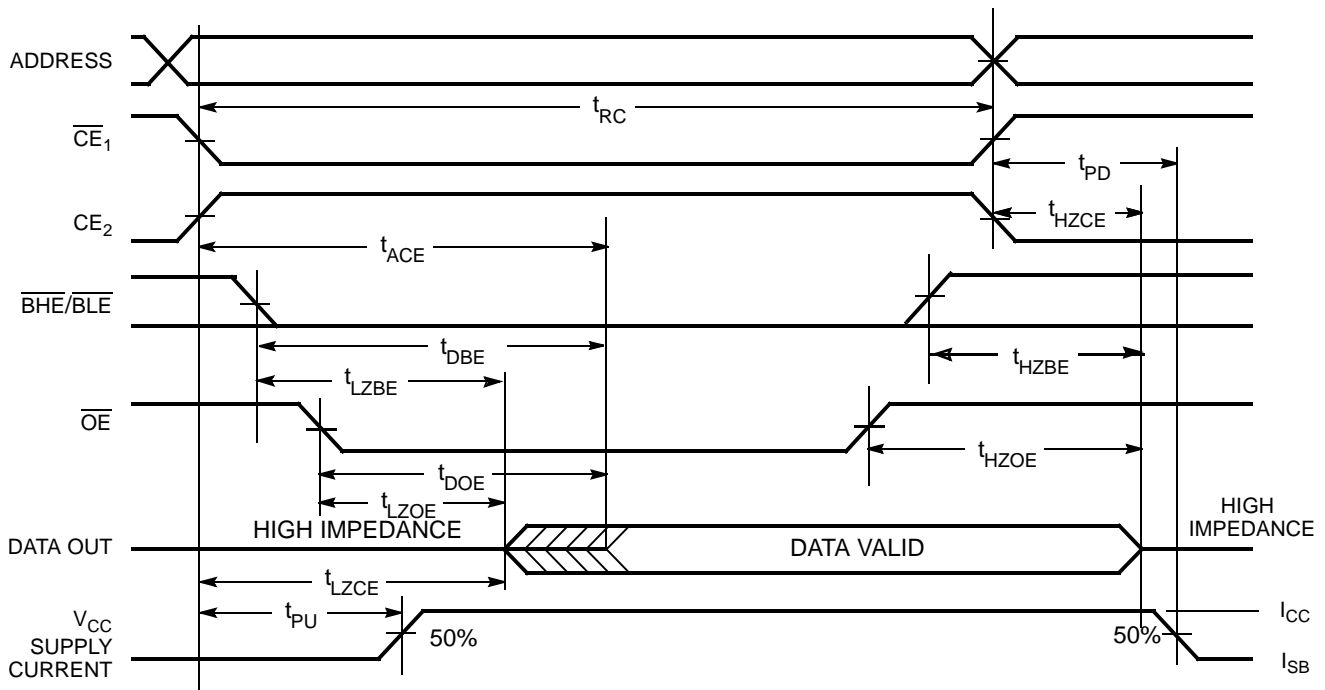


Figure 5. Read Cycle 2 ( $\overline{OE}$  Controlled)<sup>[15, 16]</sup>



**Notes**

- 14. The device is continuously selected.  $\overline{OE}$ ,  $\overline{CE}_1 = V_{IL}$ ,  $\overline{BHE}$  and/or  $\overline{BLE} = V_{IL}$ , and  $CE_2 = V_{IH}$ .
- 15.  $\overline{WE}$  is HIGH for read cycle.
- 16. Address valid prior to or coincident with  $\overline{CE}_1$ ,  $\overline{BHE}$ ,  $\overline{BLE}$  transition LOW and  $CE_2$  transition HIGH.

Switching Waveforms (continued)

Figure 6. Write Cycle 1 ( $\overline{WE}$  Controlled) [13, 17, 18, 19]

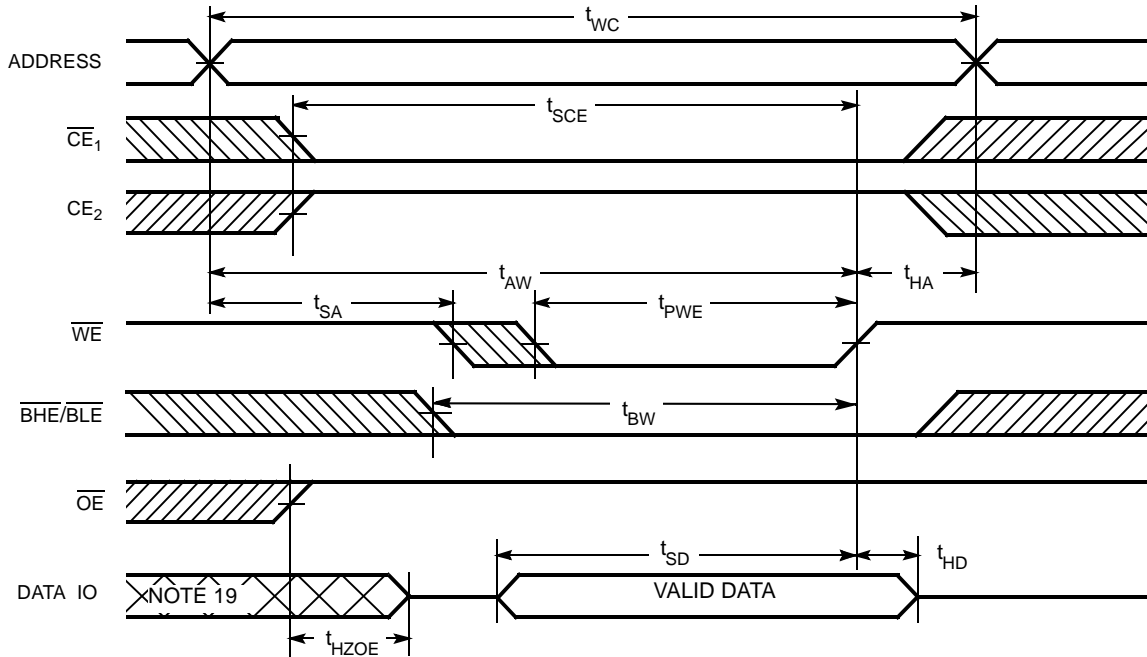
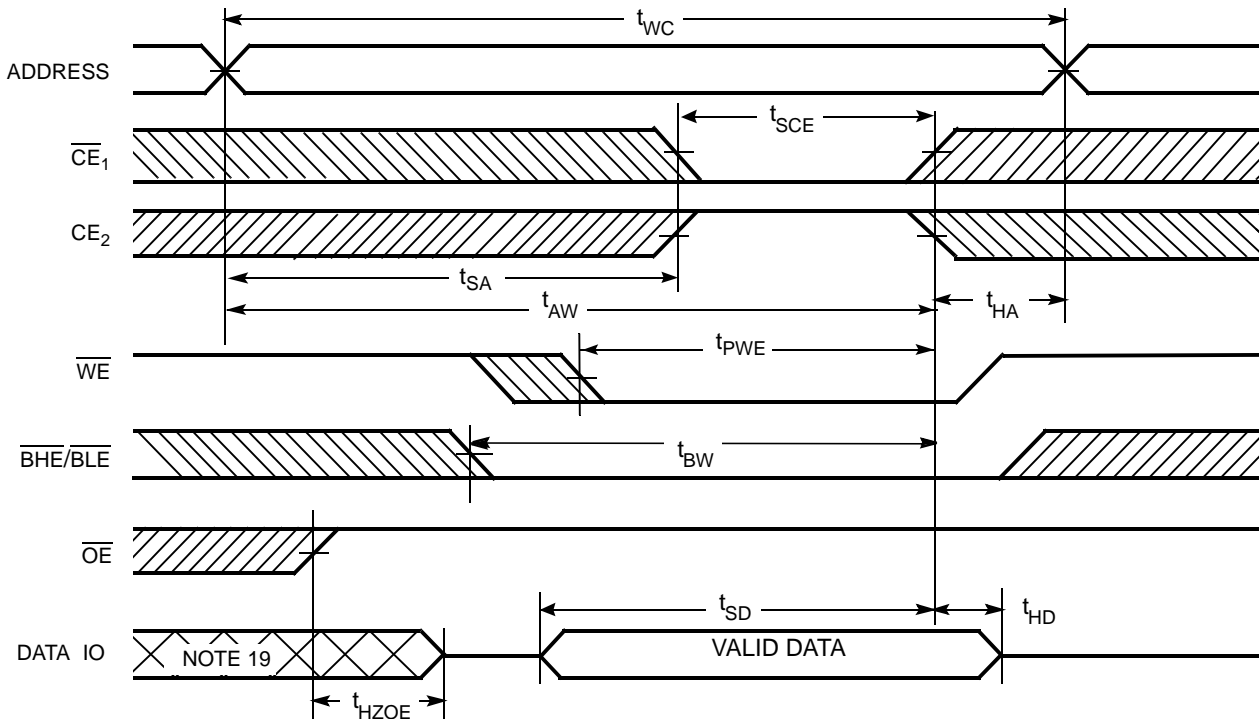


Figure 7. Write Cycle 2 ( $\overline{CE_1}$  or  $CE_2$  Controlled) [13, 17, 18, 19]



Notes

- 17. Data I/O is high impedance if  $\overline{OE} = V_{IH}$ .
- 18. If  $\overline{CE_1}$  goes HIGH and  $CE_2$  goes LOW simultaneously with  $\overline{WE} = V_{IH}$ , the output remains in a high impedance state.
- 19. During this period the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

Figure 8. Write Cycle 3 ( $\overline{WE}$  Controlled,  $\overline{OE}$  LOW)<sup>[18, 19]</sup>

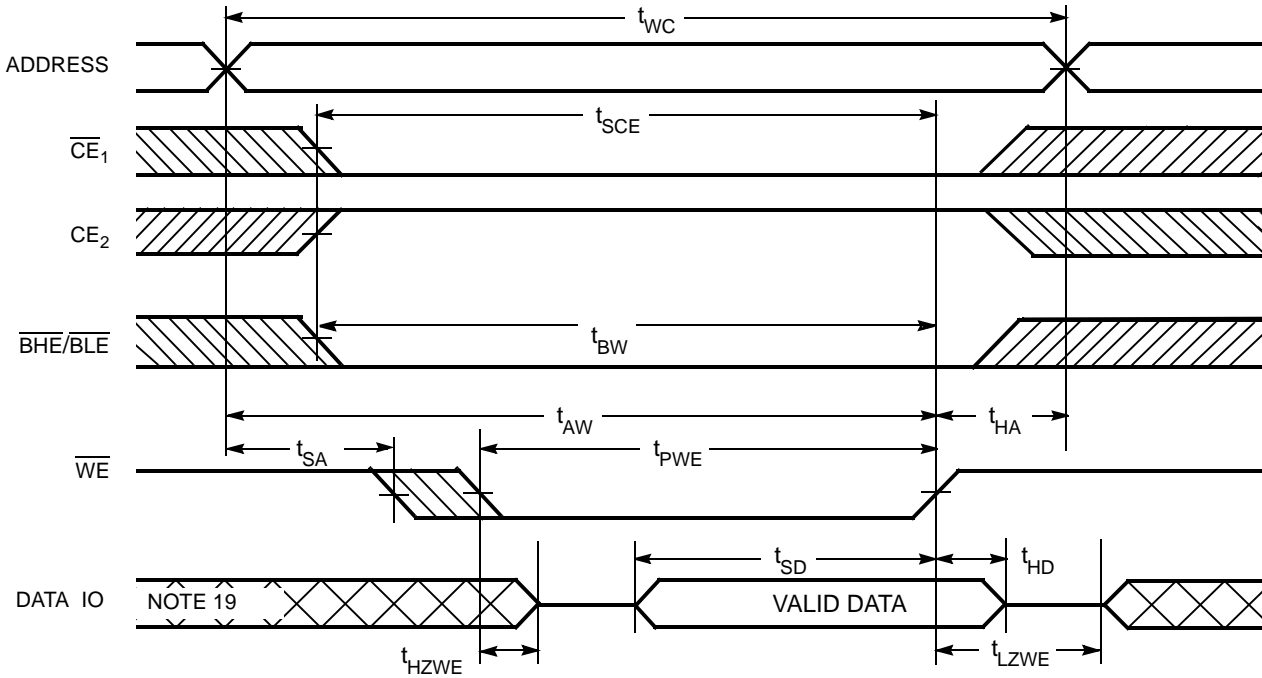
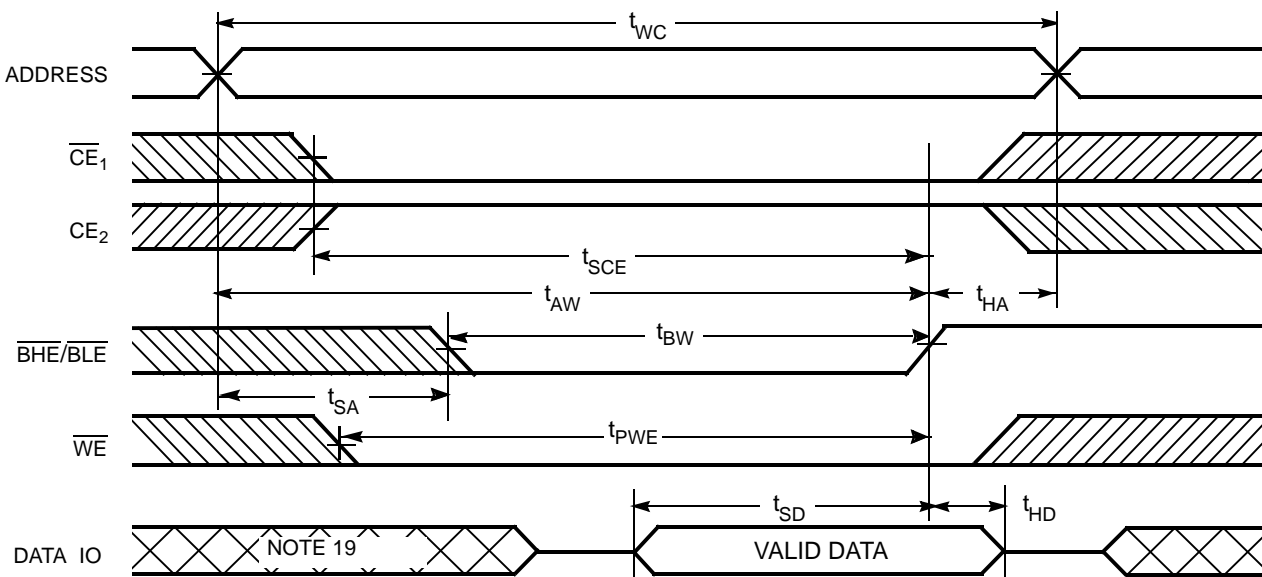


Figure 9. Write Cycle 4 ( $\overline{BHE}/\overline{BLE}$  Controlled,  $\overline{OE}$  LOW)<sup>[18, 19]</sup>





**Truth Table**

$\overline{CE}_1$	$\overline{CE}_2$	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Inputs Outputs	Mode	Power
H	X <sup>[20]</sup>	X	X	X	X	High Z	Deselect/Power Down	Standby (I <sub>SB</sub> )
X <sup>[20]</sup>	L	X	X	X	X	High Z	Deselect/Power Down	Standby (I <sub>SB</sub> )
X <sup>[20]</sup>	X <sup>[20]</sup>	X	X	H	H	High Z	Deselect/Power Down	Standby (I <sub>SB</sub> )
L	H	H	L	L	L	Data Out (IO <sub>0</sub> -IO <sub>15</sub> )	Read	Active (I <sub>CC</sub> )
L	H	H	L	H	L	High Z (IO <sub>8</sub> -IO <sub>15</sub> ); Data Out (IO <sub>0</sub> -IO <sub>7</sub> )	Read	Active (I <sub>CC</sub> )
L	H	H	L	L	H	Data Out (IO <sub>8</sub> -IO <sub>15</sub> ); High Z (IO <sub>0</sub> -IO <sub>7</sub> )	Read	Active (I <sub>CC</sub> )
L	H	L	X	L	L	Data In (IO <sub>0</sub> -IO <sub>15</sub> )	Write	Active (I <sub>CC</sub> )
L	H	L	X	H	L	High Z (IO <sub>8</sub> -IO <sub>15</sub> ); Data In (IO <sub>0</sub> -IO <sub>7</sub> )	Write	Active (I <sub>CC</sub> )
L	H	L	X	L	H	Data In (IO <sub>8</sub> -IO <sub>15</sub> ); High Z (IO <sub>0</sub> -IO <sub>7</sub> )	Write	Active (I <sub>CC</sub> )
L	H	H	H	L	H	High Z	Output Disabled	Active (I <sub>CC</sub> )
L	H	H	H	H	L	High Z	Output Disabled	Active (I <sub>CC</sub> )
L	H	H	H	L	L	High Z	Output Disabled	Active (I <sub>CC</sub> )

**Ordering Information**

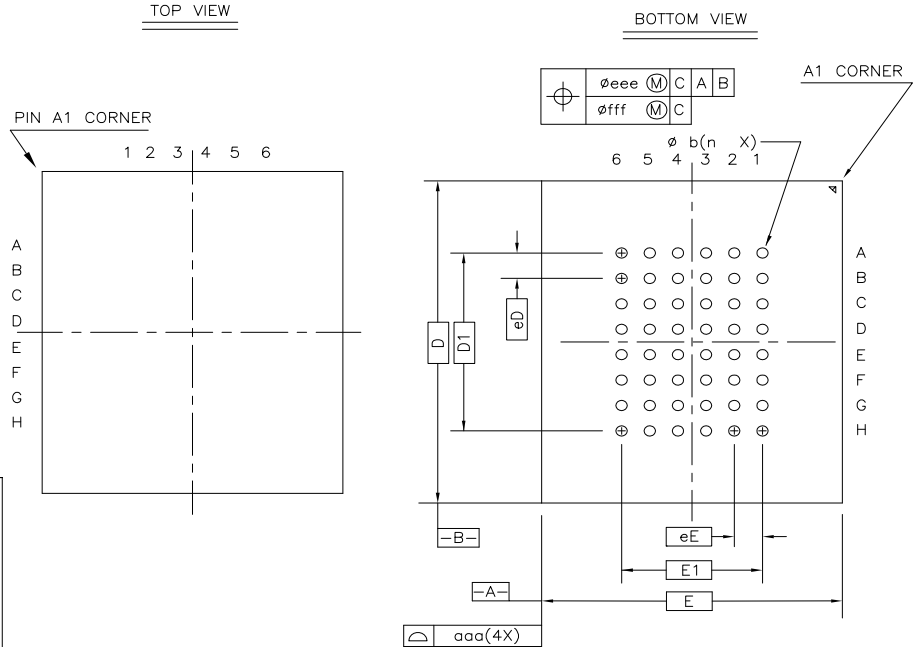
Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
55	CY62187EV30LL-55BAXI	001-50044	48-Ball Fine Pitch Ball Grid Array (8 x 9.5 x 1.4 mm) Pb-Free	Industrial
70	CY62187EV30LL-70BAXI	001-50044	48-Ball Fine Pitch Ball Grid Array (8 x 9.5 x 1.4 mm) Pb-Free	Industrial

**Note**

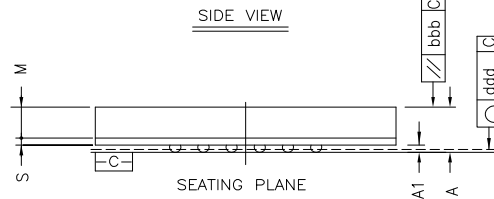
20. The 'X' (Don't care) state for the chip enables in the truth table refer to the logic state (either HIGH or LOW). Intermediate voltage levels on these pins is not permitted.

Package Diagrams

Figure 10. 48-Ball FBGA (8 x 9.5 x 1.4 mm) (001-50044)



	Symbol	Common Dimensions
Package :		FBGA
Body Size :	X	E 8.00
	Y	D 9.50
Ball Pitch :	X	eE 0.75
	Y	eD 0.75
Total Thickness :	A	1.45 +/- 0.05
Mold Thickness :	M	0.910 Ref.
Substrate Thickness :	S	0.21 Ref.
Ball Diameter :		0.30
Stand Off :	A1	0.16-0.26
Ball Width :	b	0.27-0.37
Package Edge Tolerance :	aaa	0.150
Mold Flatness :	bbb	0.200
Coplanarity:	ddd	0.080
Ball Offset (Package) :	eee	0.150
Ball Offset (Ball) :	fff	0.080
Ball Count :	n	48
Edge Ball Center to Center :	X	E1 3.750
	Y	D1 5.250



- NOTES :
1. JEDEC REFERENCE MO-205
  2. PACKAGE WEIGHT : 0.2409g
  3. DIMENSIONS IN MILLIMETERS

001-50044 - \*A

Document History Page

Document Title: CY62187EV30 MoBL <sup>®</sup> 64 Mbit (4M x 16) Static RAM				
Document Number: 001-48998				
Rev.	ECN No.	Orig. of Change	Submission Date	Description of Change
**	2595932	VKN/PYRS	10/24/08	New Data Sheet
*A	2644442	VKN/PYRS	01/23/09	Updated the Package diagram on page 10
*B	2672650	VKN/PYRS	03/12/09	<p>Extended the <math>V_{CC}</math> range to 3.7V</p> <p>Added 55 ns speed bin and it's related information</p> <p>Changed <math>I_{CC(typ)}</math> from 2.5 mA to 3.5 mA at <math>f = 1</math> MHz</p> <p>Changed <math>I_{CC(max)}</math> from 4 mA to 6 mA at <math>f = 1</math> MHz</p> <p>For 70 ns speed, changed <math>I_{CC(typ)}</math> form 33 mA to 28 mA at <math>f = f_{MAX}</math></p> <p>For 70 ns speed, changed <math>I_{CC(max)}</math> from 40 mA to 45 mA at <math>f = f_{MAX}</math></p> <p>For 70 ns speed, changed <math>t_{PWE}</math> from 45 to 50 ns, <math>t_{SD}</math> from 30 to 35 ns</p> <p>Modified footnote #6</p> <p>Changed 48-Ball FBGA package dimensions from 8 x 9.5 x 1.6 mm to 8 x 9.5 x 1.4 mm and updated package diagram on page 10</p>
*C	2737164	VKN/AESA	07/13/09	<p>Converted from preliminary to final</p> <p>Changed <math>I_{CC(typ)}</math> from 3.5 mA to 4 mA at <math>f = 1</math> MHz</p> <p>Changed <math>I_{CC(typ)}</math> from 35 mA to 45 mA and from 28 mA to 35 mA for the speeds 50 ns and 70 ns respectively at <math>f = f_{max}</math></p> <p>Included <math>V_{CC}</math> range in the test condition of the "Electrical Characteristics" table for the specs <math>V_{OH}</math>, <math>V_{OL}</math>, <math>V_{IH}</math>, <math>V_{IL}</math></p> <p>Changed <math>V_{IL(max)}</math> from 0.8V to 0.7V for <math>V_{CC} = 2.7V</math> to 3.7V</p> <p>Changed <math>C_{IN}</math> spec from 20 pF to 25 pF and <math>C_{OUT}</math> spec from 20 pF to 35 pF</p> <p>Included thermal specs for 48-FBGA</p> <p>Included <math>V_{CC}</math> range for <math>V_{TH}</math> spec in the AC test load table</p> <p>Changed <math>t_{LZBE}</math> spec from 5 ns to 10 ns</p> <p>Added footnote #20 related to chip enable</p>

## Sales, Solutions, and Legal Information

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