8-Mbit (512K x 16) Static RAM

Features

- Very high speed: 55 ns
- Wide voltage range: 1.65V–2.25V
- Pin Compatible with CY62157DV18 and CY62157DV20
- Ultra low standby power
  - Typical Standby current: 2 µA
  - Maximum Standby current: 8 µA
- Ultra low active power
  - Typical active current: 1.8 mA @ 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 VFBGA package

Functional Description [1]

The CY62157EV18 is a high performance CMOS static RAM organized as 512K words by 16 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. 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 Byte High Enable and Byte Low Enable are disabled ($\overline{BHE}$, $\overline{BLE}$ HIGH) or
- Write operation is active ($\overline{CE}_1$ LOW, CE_2 HIGH and $\overline{WE}$ LOW).

Write to the device by taking Chip Enables ($\overline{CE}_1$ LOW and CE_2 HIGH) and Write Enable ($\overline{WE}$) input LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from IO pins (IO_0 through IO_7), is written into the location specified on the address pins (A_0 through A_{18}). If Byte High Enable ($\overline{BHE}$) is LOW, then data from IO pins (IO_8 through IO_{15}) is written into the location specified on the address pins (A_0 through A_{18}).

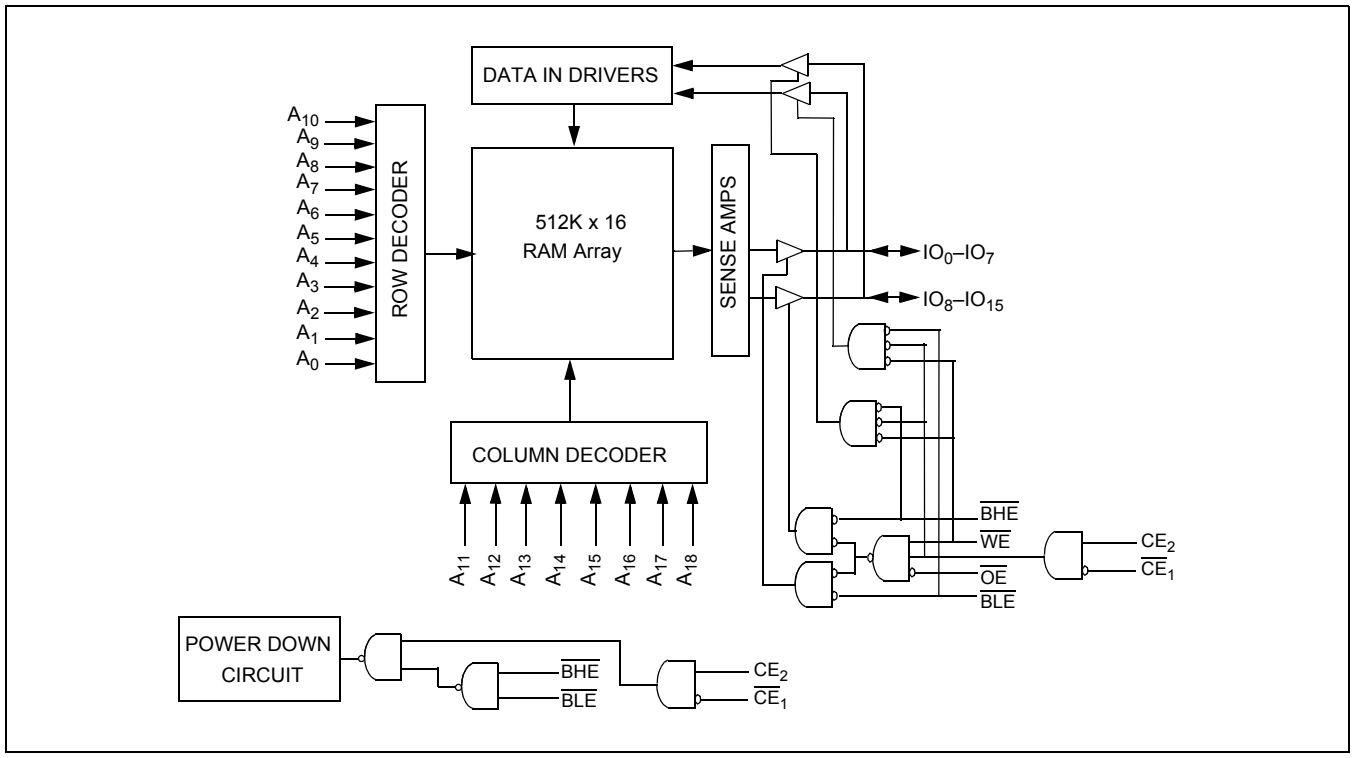
Read from the device by taking Chip Enables ($\overline{CE}_1$ LOW and CE_2 HIGH) and Output Enable ($\overline{OE}$) LOW while forcing the Write Enable ($\overline{WE}$) HIGH. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from the memory location specified by the address pins appear on IO_0 to IO_7. If 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.

Product Portfolio

Product	V_{CC} Range (V)			Speed (ns)	Power Dissipation					
					Operating I_{CC}, (mA)				Standby, I_{SB2} (µA)	
					f = 1MHz		f = f_{max}			
	Min	Typ [2]	Max		Typ [2]	Max	Typ [2]	Max	Typ [2]	Max
CY62157EV18	1.65	1.8	2.25	55	1.8	3	18	25	2	8

Notes
1. For best practice recommendations, refer to the Cypress application note "*System Design Guidelines*" located at http://www.cypress.com.
2. Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at $V_{CC} = V_{CC(typ)}$, $T_A = 25°C$.

Logic Block Diagram



Pin Configuration [3]

48-ball VFBGA
Top View

	1	2	3	4	5	6
A	$\overline{BLE}$	$\overline{OE}$	A_0	A_1	A_2	CE_2
B	IO_8	$\overline{BHE}$	A_3	A_4	$\overline{CE_1}$	IO_0
C	IO_9	IO_{10}	A_5	A_6	IO_1	IO_2
D	V_{SS}	IO_{11}	A_{17}	A_7	IO_3	V_{CC}
E	V_{CC}	IO_{12}	NC	A_{16}	IO_4	V_{SS}
F	IO_{14}	IO_{13}	A_{14}	A_{15}	IO_5	IO_6
G	IO_{15}	NC	A_{12}	A_{13}	$\overline{WE}$	IO_7
H	A_{18}	A_8	A_9	A_{10}	A_{11}	NC

Note
3. NC pins are not connected on the die.

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 ..... –0.2V to 2.45V (V_{CCmax} + 0.2V)

DC Voltage Applied to Outputs in High-Z State [4, 5] ..... –0.2V to 2.45V (V_{CCmax} + 0.2V)

DC Input Voltage [4, 5] ..... –0.2V to 2.45V (V_{CCmax} + 0.2V)

Output Current into Outputs (LOW) ..... 20 mA

Static Discharge Voltage ..... > 2001V (in accordance with MIL-STD-883, Method 3015)

Latch-up Current ..... > 200 mA

Operating Range

Device	Range	Ambient Temperature	V_{CC} [6]
CY62157EV18LL	Industrial	–40°C to +85°C	1.65V to 2.25V

Electrical Characteristics (Over the Operating Range)

Parameter	Description	Test Conditions		55 ns			Unit
				Min	Typ [2]	Max	
V_{OH}	Output HIGH Voltage	I_{OH} = –0.1 mA	V_{CC} = 1.65V	1.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA	V_{CC} = 1.65V			0.2	V
V_{IH}	Input HIGH Voltage	V_{CC} = 1.65V to 2.25V		1.4		V_{CC} + 0.2V	V
V_{IL}	Input LOW Voltage	V_{CC} = 1.65V to 2.25V		–0.2		0.4	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}		–1		+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled		–1		+1	µA
I_{CC}	V_{CC} Operating Supply Current	f = f_{max} = $1/t_{RC}$	V_{CC} = $V_{CC(max)}$ I_{OUT} = 0 mA CMOS levels		18	25	mA
		f = 1 MHz			1.8	3	mA
I_{SB1}	Automatic CEPower Down Current–CMOS Inputs	$\overline{CE}_1$ ≥ V_{CC}–0.2V or CE_2 ≤ 0.2V V_{IN} ≥ V_{CC} – 0.2V, V_{IN} ≤ 0.2V) f = f_{max} (Address and Data Only), f = 0 ($\overline{OE}$, $\overline{WE}$, $\overline{BHE}$ and $\overline{BLE}$), V_{CC} = $V_{CC(max)}$.			2	8	µA
I_{SB2} [7]	Automatic CE Power Down Current–CMOS Inputs	$\overline{CE}_1$ ≥ V_{CC} – 0.2V or CE_2 ≤ 0.2V, V_{IN} ≥ V_{CC} – 0.2V or V_{IN} ≤ 0.2V, f = 0, V_{CC} = $V_{CC(max)}$.			2	8	µA

Capacitance [8]

Parameter	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

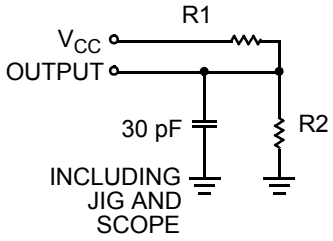
Notes

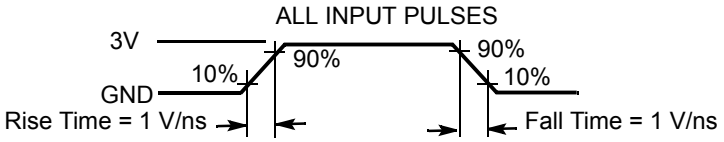
4. $V_{IL(min)}$ = –2.0V for pulse durations less than 20 ns.
5. $V_{IH(max)}$ = V_{CC} + 0.5V for pulse durations less than 20 ns.
6. Full Device AC operation assumes a 100 µs ramp time from 0 to V_{CC} (min) and 200 µs wait time after V_{CC} stabilization.
7. Only chip enable ($\overline{CE}$) and byte enables ($\overline{BHE}$ and $\overline{BLE}$) need to be tied to CMOS levels to meet the I_{SB2} spec. Other inputs can be left floating.
8. Tested initially and after any design or process changes that may affect these parameters.

Thermal Resistance [8]

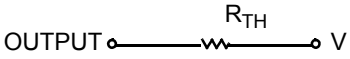
Parameter	Description	Test Conditions	BGA	Unit
Θ_{JA}	Thermal Resistance (Junction to Ambient)	Still air, soldered on a 3 × 4.5 inch, two-layer printed circuit board	72	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		8.86	°C/W

AC Test Loads and Waveforms





Equivalent to: THEVENIN EQUIVALENT

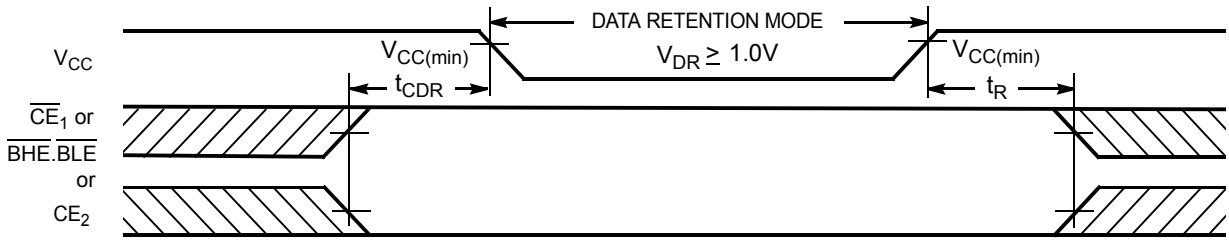


Parameters	Value	Unit
R1	13500	Ω
R2	10800	Ω
R_{TH}	6000	Ω
V_{TH}	0.80	V

Data Retention Characteristics (Over the Operating Range)

Parameter	Description	Conditions	Min	Typ [2]	Max	Unit
V_{DR}	V_{CC} for Data Retention		1.0			V
I_{CCDR}	Data Retention Current	V_{CC}= V_{DR}, $\overline{CE}_1 \geq V_{CC} - 0.2V$, $CE_2 \leq 0.2V$, $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$		1	3	µA
t_{CDR} [8]	Chip Deselect to Data Retention Time		0			ns
t_R [9]	Operation Recovery Time		t_{RC}			ns

Data Retention Waveform [10]



Notes

9. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min)} \geq 100$ µs or stable at $V_{CC(min)} \geq 100$ µs.
10. $\overline{BHE}.\overline{BLE}$ is the AND of both $\overline{BHE}$ and $\overline{BLE}$. Deselect the chip by either disabling chip enable signals or by disabling both $\overline{BHE}$ and $\overline{BLE}$.

Switching Characteristics (Over the Operating Range) [11, 12]

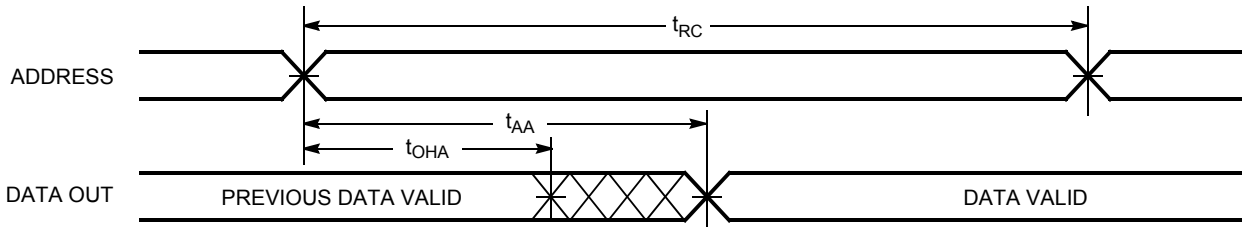
Parameter	Description	55 ns		Unit
		Min	Max	
Read Cycle				
t_{RC}	Read Cycle Time	55		ns
t_{AA}	Address to Data Valid		55	ns
t_{OHA}	Data Hold from Address Change	10		ns
t_{ACE}	$\overline{CE}_1$ LOW and CE_2 HIGH to Data Valid		55	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		25	ns
t_{LZOE}	$\overline{OE}$ LOW to Low-Z [13]	5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High-Z [13, 14]		18	ns
t_{LZCE}	$\overline{CE}_1$ LOW and CE_2 HIGH to Low-Z [13]	10		ns
t_{HZCE}	$\overline{CE}_1$ HIGH and CE_2 LOW to High-Z [13, 14]		18	ns
t_{PU}	$\overline{CE}_1$ LOW and CE_2 HIGH to Power Up	0		ns
t_{PD}	$\overline{CE}_1$ HIGH and CE_2 LOW to Power Down		55	ns
t_{DBE}	$\overline{BLE}/\overline{BHE}$ LOW to Data Valid		55	ns
t_{LZBE} [15]	$\overline{BLE}/\overline{BHE}$ LOW to Low-Z [13]	10		ns
t_{HZBE}	$\overline{BLE}/\overline{BHE}$ HIGH to High-Z [13, 14]		18	ns
Write Cycle [16]				
t_{WC}	Write Cycle Time	45		ns
t_{SCE}	$\overline{CE}_1$ LOW and CE_2 HIGH to Write End	35		ns
t_{AW}	Address Setup to Write End	35		ns
t_{HA}	Address Hold from Write End	0		ns
t_{SA}	Address Setup to Write Start	0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	35		ns
t_{BW}	$\overline{BLE}/\overline{BHE}$ LOW to Write End	35		ns
t_{SD}	Data Setup to Write End	25		ns
t_{HD}	Data Hold from Write End	0		ns
t_{HZWE}	$\overline{WE}$ LOW to High-Z [13, 14]		18	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z [13]	10		ns

Notes

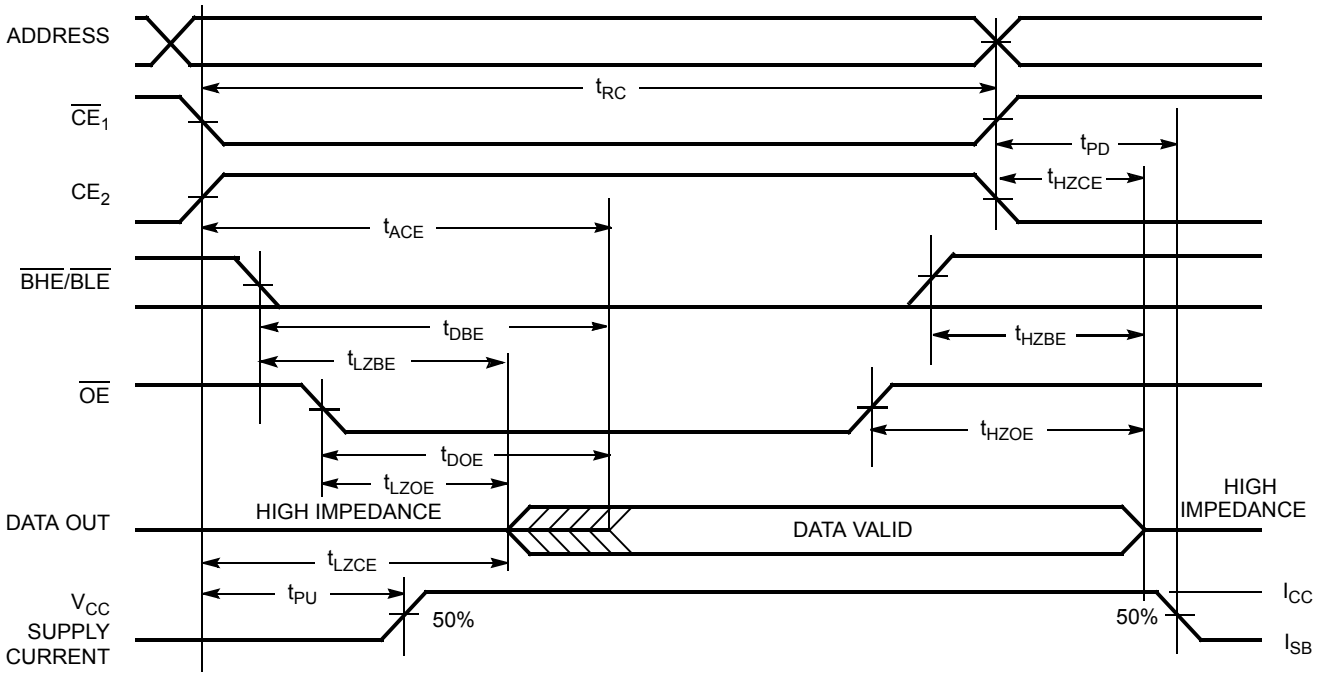
11. Test conditions for all parameters other than tri-state parameters assume signal transition time of 1V/ns or less, timing reference levels of $V_{CC(typ)}/2$, input pulse levels of 0 to $V_{CC(typ)}$, and output loading of the specified I_{OL}/I_{OH} as shown in the "AC Test Loads and Waveforms" on page 4.
12. AC timing parameters are subject to byte enable signals ($\overline{BHE}$ or $\overline{BLE}$) not switching when chip is disabled. Please see application note AN13842 for further clarification.
13. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZBE} is less than t_{LZBE}, t_{HZOE} is less than t_{LZOE}, and t_{HZWE} is less than t_{LZWE} for any given device.
14. t_{HZOE}, t_{HZCE}, t_{HZBE}, and t_{HZWE} transitions are measured when the output enters a high impedance state.
15. If both byte enables are toggled together, this value is 10 ns.
16. The internal write time of the memory is defined by the overlap of $\overline{WE}$, $\overline{CE}$ = V_{IL}, $\overline{BHE}$ and/or $\overline{BLE}$ = V_{IL}, and CE_2 = V_{IH}. 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

Read Cycle 1 (Address Transition Controlled) [17, 18]



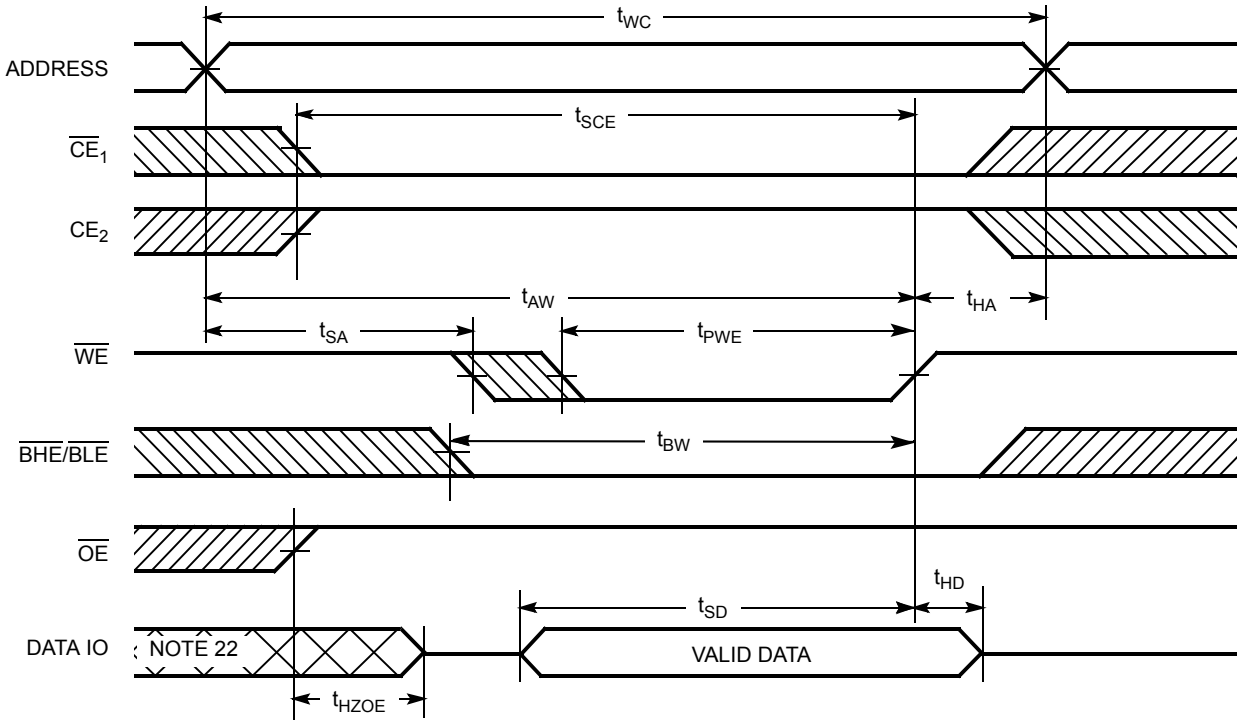
Read Cycle 2 ($\overline{OE}$ Controlled) [18, 19]



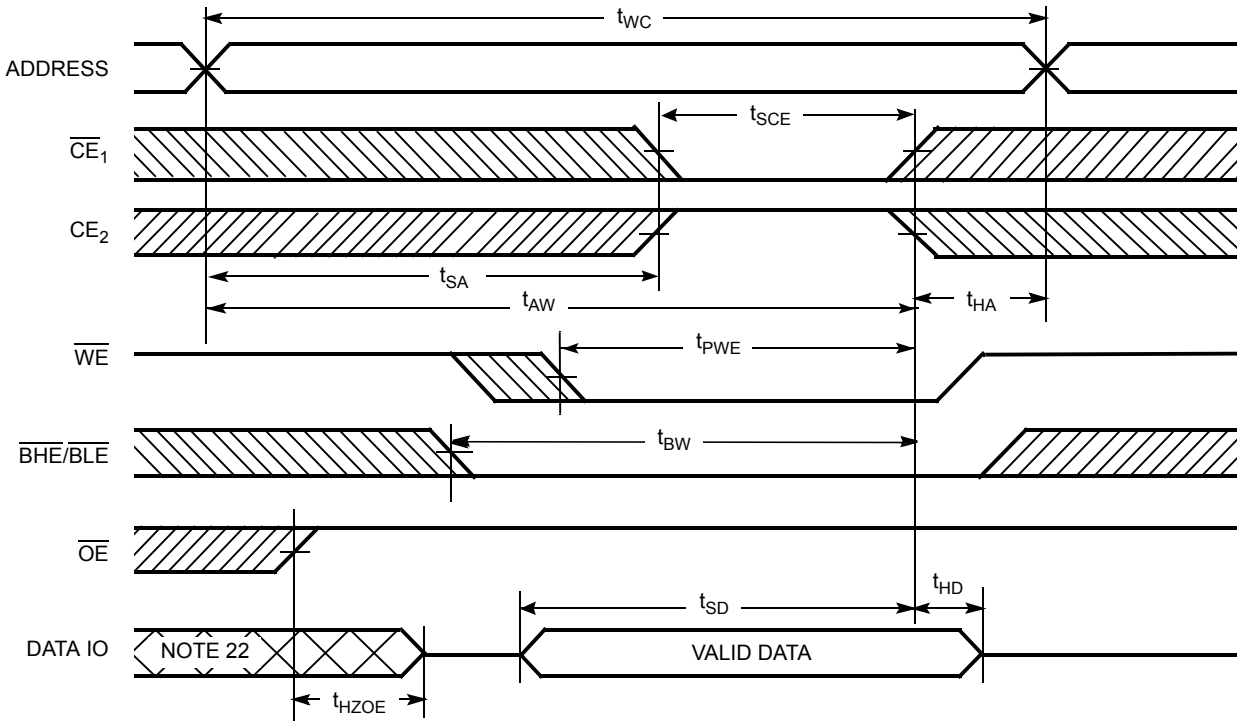
Notes:
17. The device is continuously selected. $\overline{OE}$, $\overline{CE_1} = V_{IL}$, $\overline{BHE}$ and/or $\overline{BLE} = V_{IL}$, and $CE_2 = V_{IH}$.
18. $\overline{WE}$ is HIGH for read cycle.
19. Address valid before or similar to $\overline{CE_1}$, $\overline{BHE}$, $\overline{BLE}$ transition LOW and CE_2 transition HIGH.

Switching Waveforms (continued)

Write Cycle 1 ($\overline{WE}$ Controlled) [16, 20, 21]



Write Cycle 2 ($\overline{CE}_1$ or CE_2 Controlled) [16, 20, 21]

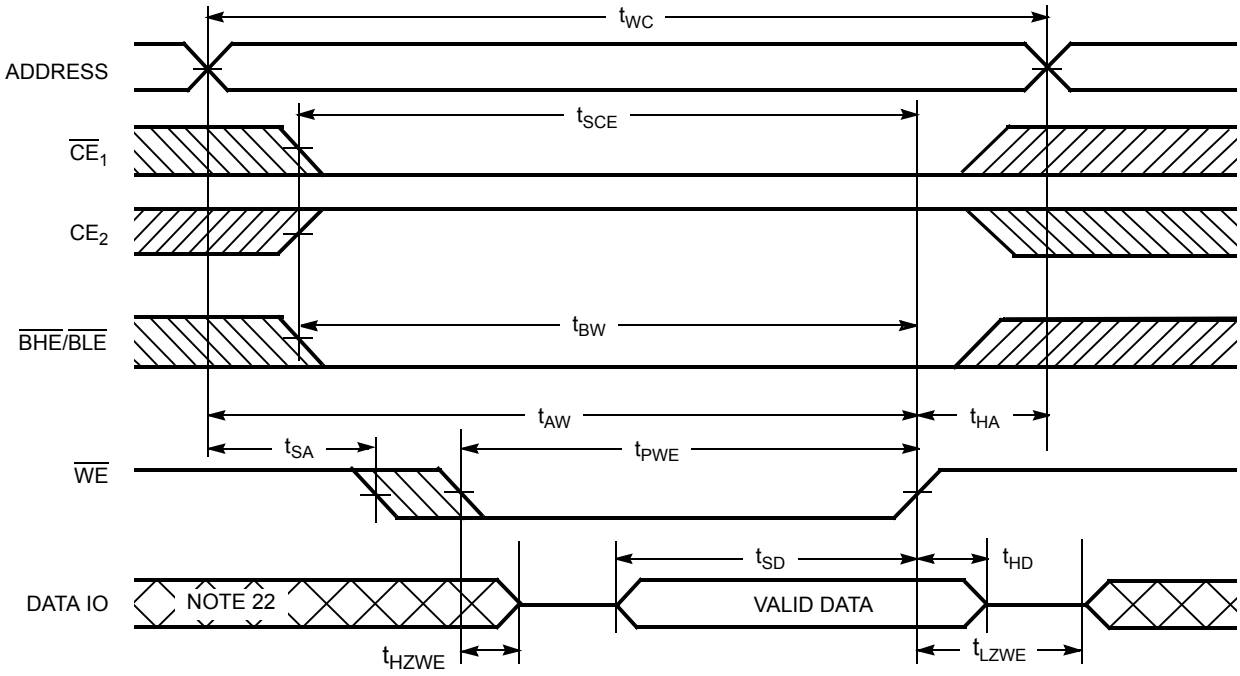


Notes:

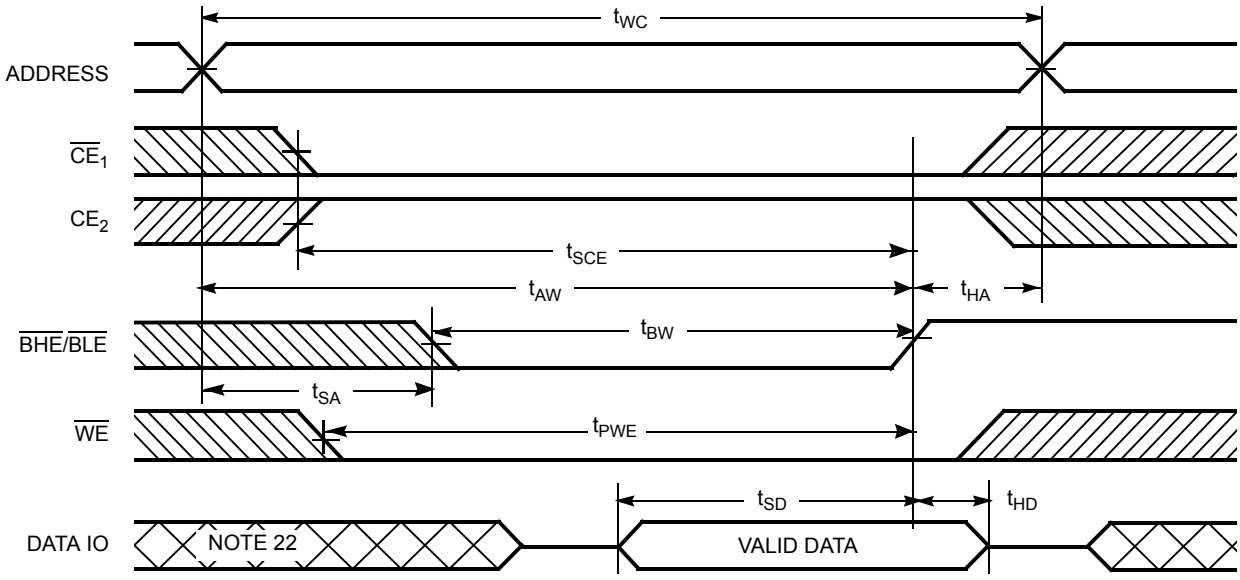
20. Data IO is high impedance if $\overline{OE} = V_{IH}$.
21. If $\overline{CE}_1$ goes HIGH and CE_2 goes LOW simultaneously with $\overline{WE} = V_{IH}$, the output remains in a high impedance state.
22. During this period, the IOs are in output state and input signals must not be applied.

Switching Waveforms (continued)

Write Cycle 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) [21]



Write Cycle 4 ($\overline{BHE}/\overline{BLE}$ Controlled, $\overline{OE}$ LOW) [21]



Truth Table

$\overline{CE_1}$	CE_2	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Inputs/Outputs	Mode	Power
H	X	X	X	X	X	High-Z	Deselect/Power Down	Standby (I_{SB})
X	L	X	X	X	X	High-Z	Deselect/Power Down	Standby (I_{SB})
X	X	X	X	H	H	High-Z	Deselect/Power Down	Standby (I_{SB})
L	H	H	L	L	L	Data Out (IO_0–IO_{15})	Read	Active (I_{CC})
L	H	H	L	H	L	Data Out (IO_0–IO_7); High-Z (IO_8–IO_{15})	Read	Active (I_{CC})
L	H	H	L	L	H	High-Z (IO_0–IO_7); Data Out (IO_8–IO_{15})	Read	Active (I_{CC})
L	H	H	H	L	H	High-Z	Output Disabled	Active (I_{CC})
L	H	H	H	H	L	High-Z	Output Disabled	Active (I_{CC})
L	H	H	H	L	L	High-Z	Output Disabled	Active (I_{CC})
L	H	L	X	L	L	Data In (IO_0–IO_{15})	Write	Active (I_{CC})
L	H	L	X	H	L	Data In (IO_0–IO_7); High-Z (IO_8–IO_{15})	Write	Active (I_{CC})
L	H	L	X	L	H	High-Z (IO_0–IO_7); Data In (IO_8–IO_{15})	Write	Active (I_{CC})

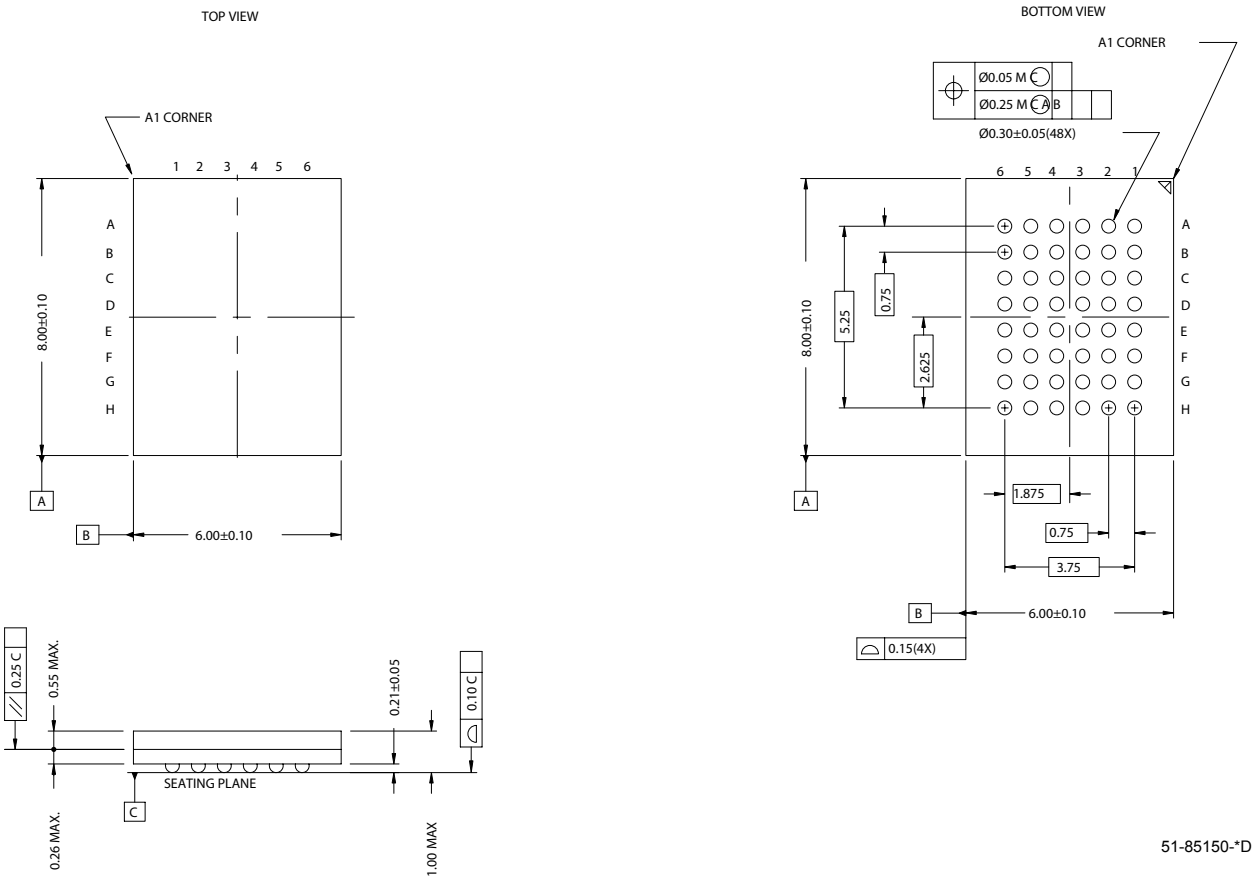
Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
55	CY62157EV18LL-55BVXI	51-85150	48-ball Very Fine Pitch Ball Grid Array (Pb-free)	Industrial

Contact your local Cypress sales representative for availability of these parts

Package Diagrams

Figure 1. 48-ball VFBGA (6 x 8 x 1 mm), 51-85150



Document History

Document Title: CY62157EV18 MoBL® 8-Mbit (512K x 16) Static RAM Document Number:38-05490				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	202862	See ECN	AJU	New Data Sheet
*A	291272	See ECN	SYT	Converted from Advance Information to Preliminary Changed V_{CC} Max from 2.20 to 2.25 V Changed V_{CC} stabilization time in footnote #7 from 100 μs to 200 μs Changed I_{CCDR} from 4 to 4.5 μA Changed t_{OHA} from 6 ns to 10 ns for both 35 ns and 45 ns Speed Bins Changed t_{DOE} from 15 and 22 ns to 18 and 22 ns for the 35 and 45 ns Speed Bins respectively Changed t_{HZOE}, t_{HZBE} and 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}, $t_{AW,}$ and t_{BW} 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
*B	444306	See ECN	NXR	Converted from Preliminary to Final Removed 35 ns speed bin Removed “L” bin Changed ball E3 from DNU to NC Removed redundant footnote on DNU Modified Maximum Ratings spec for Supply Voltage and DC Input Voltage from 2.4V to 2.45V Changed the I_{CC} Typ value from 16 mA to 18 mA and I_{CC} Max value from 28 mA to 25 mA for test condition f = fax = $1/t_{RC}$ Changed the I_{CC} Max value from 2.3 mA to 3 mA for test condition f = 1MHz Changed the I_{SB1} and I_{SB2} Max value from 4.5 μA to 8 μA and Typ value from 0.9 μA to 2 μA respectively Updated Thermal Resistance table Changed Test Load Capacitance from 50 pF to 30 pF Added Typ value for I_{CCDR} Changed the I_{CCDR} Max value from 4.5 μA to 3 μA Corrected t_R in Data Retention Characteristics from 100 μs to t_{RC} ns Changed t_{LZOE} from 3 to 5 Changed t_{LZCE} from 6 to 10 Changed t_{HZCE} from 22 to 18 Changed t_{LZBE} from 6 to 5 Changed t_{PWE} from 30 to 35 Changed t_{SD} from 22 to 25 Changed t_{LZWE} from 6 to 10 Added footnote #13 Updated the ordering Information and replaced the Package Name column with Package Diagram
*C	571786	See ECN	VKN	Replaced 45ns speed bin with 55ns

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REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
*D	908120	See ECN	VKN	Added footnote #7 related to I_{SB2} Added footnote #12 related AC timing parameters