CY62137FV18 MoBL®

2-Mbit (128K x 16) Static RAM

Features

- Very high speed: 55 ns
- Wide voltage range: 1.65V–2.25V
- Pin compatible with CY62137CV18
- Ultra low standby power
  - Typical standby current: 1 µA
  - Maximum standby current: 5 µA
- Ultra low active power
  - Typical active current: 1.6 mA @ f = 1 MHz
- Ultra low standby power
- Easy memory expansion with CE and OE features
- Automatic power down when deselected
- CMOS for optimum speed and power
- Byte power down feature
- Available in a Pb-free 48-Ball VFBGA package

Functional Description

The CY62137FV18 is a high performance CMOS static RAM organized as 128K 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. Placing the device into standby mode reduces power consumption by more than 99% when deselected ($\overline{CE}$ HIGH or both $\overline{BLE}$ and $\overline{BHE}$ are HIGH). The input and output pins (IO_0 through IO_{15}) are placed in a high impedance state when:

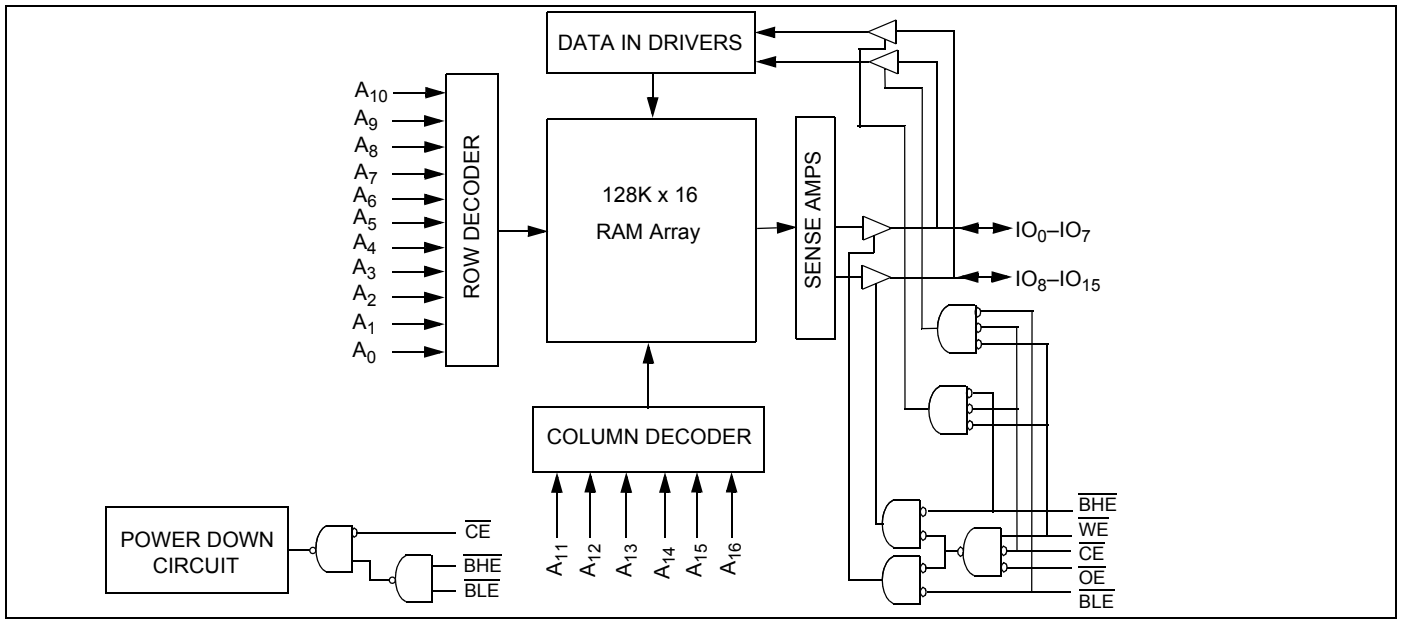
- Deselected ($\overline{CE}$ HIGH)
- Outputs are disabled ($\overline{OE}$ HIGH)
- Both the Byte High Enable and the Byte Low Enable are disabled ($\overline{BHE}$, $\overline{BLE}$ HIGH)
- Write operation is active ($\overline{CE}$ LOW and $\overline{WE}$ LOW)

To write to the device, take Chip Enable ($\overline{CE}$) and Write Enable ($\overline{WE}$) inputs 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_{16}). 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_{16}).

To read from the device, take 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 appear on IO_0 to IO_7. If Byte High Enable ($\overline{BHE}$) is LOW, then data from the memory appears on IO_8 to IO_{15}. See the "Truth Table" on page 9 for a complete description of read and write modes.

For best practice recommendations, refer to the Cypress application note AN1064, SRAM System Guidelines.

Logic Block Diagram



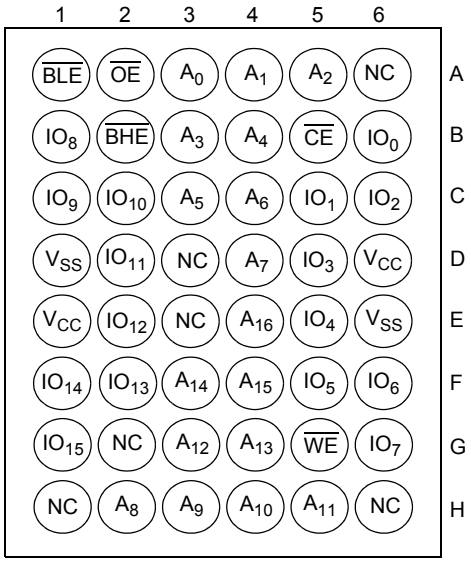
Product Portfolio

Product	V_{CC} Range (V)			Speed (ns)	Power Dissipation					
					Operating I_{CC} (mA)				Standby I_{SB2} (µA)	
					f = 1 MHz		f = f_{max}			
	Min	Typ [1]	Max		Typ [1]	Max	Typ [1]	Max	Typ [1]	Max
CY62137FV18LL	1.65	1.8	2.25	55	1.6	2.5	13	18	1	5

Pin Configuration

Figure 1. 48-Ball VFBGA Pinout [2, 3]

Top View



Notes
1. Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at $V_{CC} = V_{CC(typ)}$, $T_A = 25°C$.
2. NC pins are not connected on the die.
3. Pins D3, H1, G2, and H6 in the VBGA package are address expansion pins for 4 Mb, 8 Mb, 16 Mb, and 32 Mb, respectively.

Maximum Ratings

Exceeding maximum ratings may impair 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 .....–0.2V to + 2.45V

DC Voltage Applied to Outputs in High Z State [4, 5].....–0.2V to 2.45V

DC Input Voltage [4, 5].....–0.2V to 2.45V

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

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

Latch up Current ..... > 200 mA

Operating Range

Device	Range	Ambient Temperature	V_{CC} [6]
CY62137FV18	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 [1]	Max	
V_{OH}	Output HIGH Voltage	I_{OH} = –0.1 mA		1.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA				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} = $1/t_{RC}$	$V_{CC(max)}$ = 2.25V, I_{OUT} = 0 mA, CMOS levels		13	18	mA
		f = 1 MHz	$V_{CC(max)}$ = 2.25V		1.6	2.5	mA
I_{SB1}	Automatic CE Power Down Current–CMOS Inputs	$\overline{CE}$ ≥ V_{CC}– 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 $\overline{BLE}$)	$V_{CC(max)}$ = 2.25V		1	5	µA
I_{SB2} [7]	Automatic CE Power Down Current–CMOS Inputs	$\overline{CE}$ ≥ V_{CC}– 0.2V, V_{IN} ≥ V_{CC} – 0.2V or V_{IN} ≤ 0.2V, f = 0	$V_{CC(max)}$ = 2.25V		1	5	µA

Capacitance

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

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 minimum of 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 $\overline{BLE}$) must be tied to CMOS levels to meet the I_{SB2} / I_{CCDR} spec. Other inputs can be left floating.

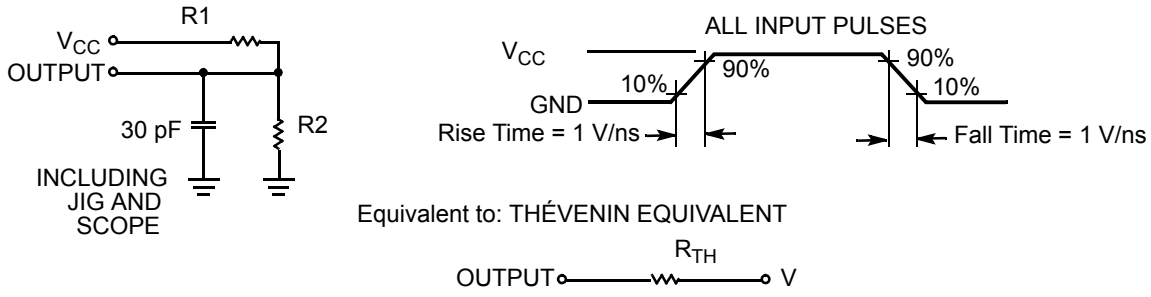
Thermal Resistance

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

Parameter	Description	Test Conditions	VFBGA	Unit
Q_{JA}	Thermal Resistance (Junction to Ambient)	Still air, soldered on a 3 × 4.5 inch, two-layer printed circuit board	75	°C/W
Q_{JC}	Thermal Resistance (Junction to Case)		10	°C/W

AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms



Parameters	1.80V	Unit
R1	13500	Ω
R2	10800	Ω
R_{TH}	6000	Ω
V_{TH}	0.80	V

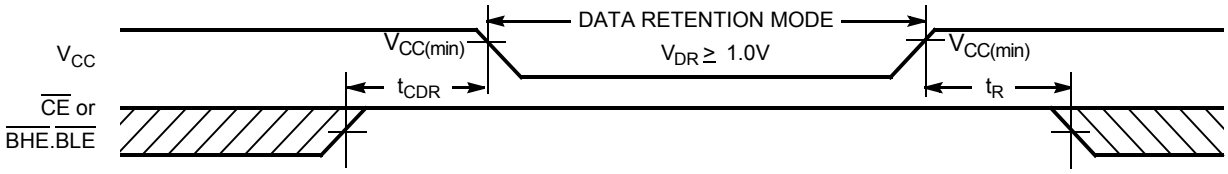
Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions	Min	Typ [1]	Max	Unit
V_{DR}	V_{CC} for Data Retention		1.0			V
I_{CCDR} [7]	Data Retention Current	V_{CC} = 1.0V, $\overline{CE} \geq V_{CC}$ - 0.2V, $V_{IN} \geq V_{CC}$ - 0.2V or $V_{IN} \leq$ 0.2V		1	4	µA
t_{CDR} [8]	Chip Deselect to Data Retention Time		0			ns
t_R [9]	Operation Recovery Time		t_{RC}			ns

Data Retention Waveform

Figure 3. Data Retention Waveform [10]



Notes

8. Tested initially and after any design or process changes that may affect these parameters.
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}	$\overline{CE}$ LOW 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}	$\overline{CE}$ LOW to Low Z [13]	10		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z [13, 14]		18	ns
t_{PU}	$\overline{CE}$ LOW to power up	0		ns
t_{PD}	$\overline{CE}$ HIGH to power down		55	ns
t_{DBE}	$\overline{BLE}$/$\overline{BHE}$ LOW to data valid		55	ns
t_{LZBE}	$\overline{BLE}$/$\overline{BHE}$ LOW to Low Z [13]	10		ns
t_{HZBE}	$\overline{BLE}$/$\overline{BHE}$ HIGH to High Z [13, 14]		18	ns
Write Cycle [15]				
t_{WC}	Write Cycle Time	45		ns
t_{SCE}	$\overline{CE}$ LOW 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 outputs enter a high impedance state.
15. 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}. 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 shows the read cycle No.1 that is address transition controlled. [16, 17]

Figure 4. Read Cycle No.1

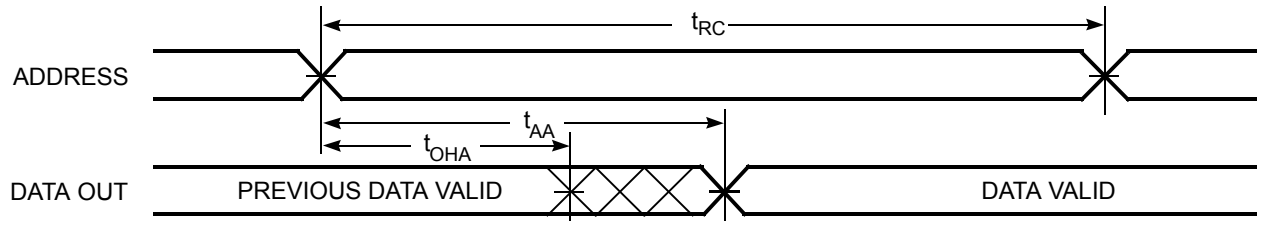
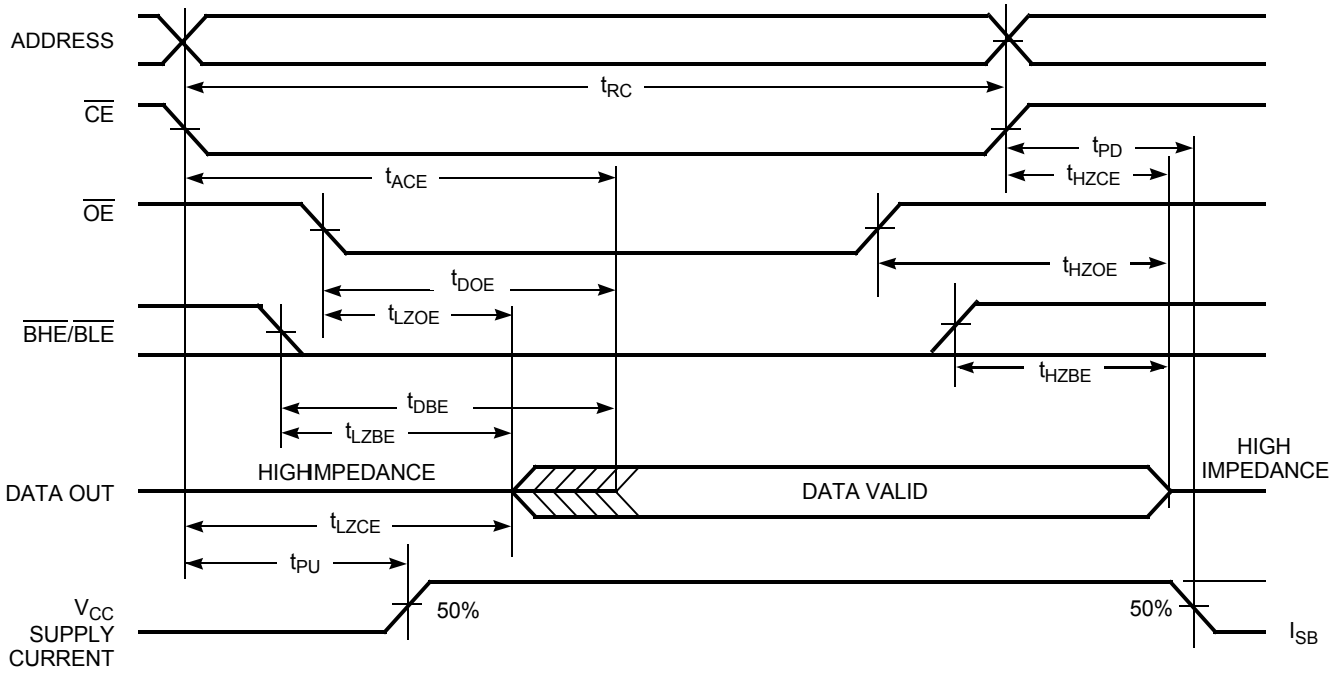


Figure 5 shows the read cycle No.1 that is $\overline{OE}$ controlled. [17, 18]

Figure 5. Read Cycle No. 2



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

Switching Waveforms (continued)

Figure 6 shows the read cycle No.1 that is $\overline{WE}$ controlled. [15, 19, 20]

Figure 6. Write Cycle No. 1

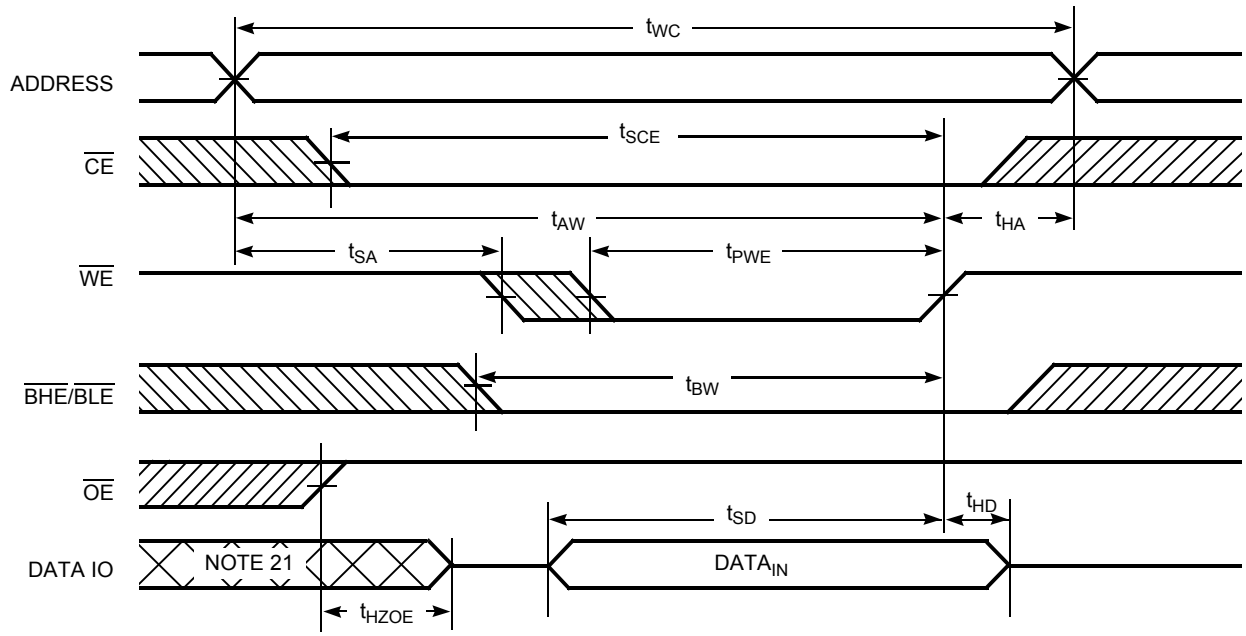
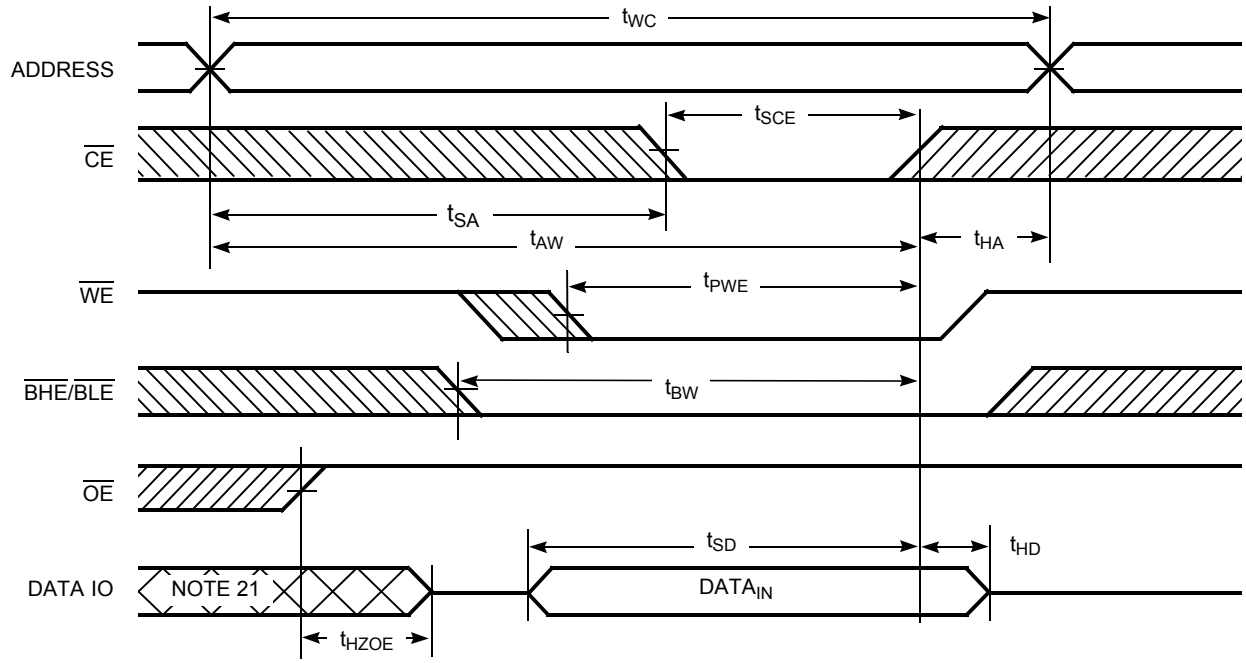


Figure 7 shows the read cycle No.1 that is $\overline{CE}$ controlled. [15, 19, 20]

Figure 7. Write Cycle No. 2



Notes
19. Data IO is high impedance if $\overline{OE}$ = V_{IH}.
20. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ = V_{IH}, the output remains in a high impedance state.
21. During this period, the IOs are in output state. Do not apply input signals.

Switching Waveforms (continued)

Figure 8 shows the read cycle No.1 that is $\overline{WE}$ controlled, $\overline{OE}$ LOW. [20]

Figure 8. Write Cycle No. 3

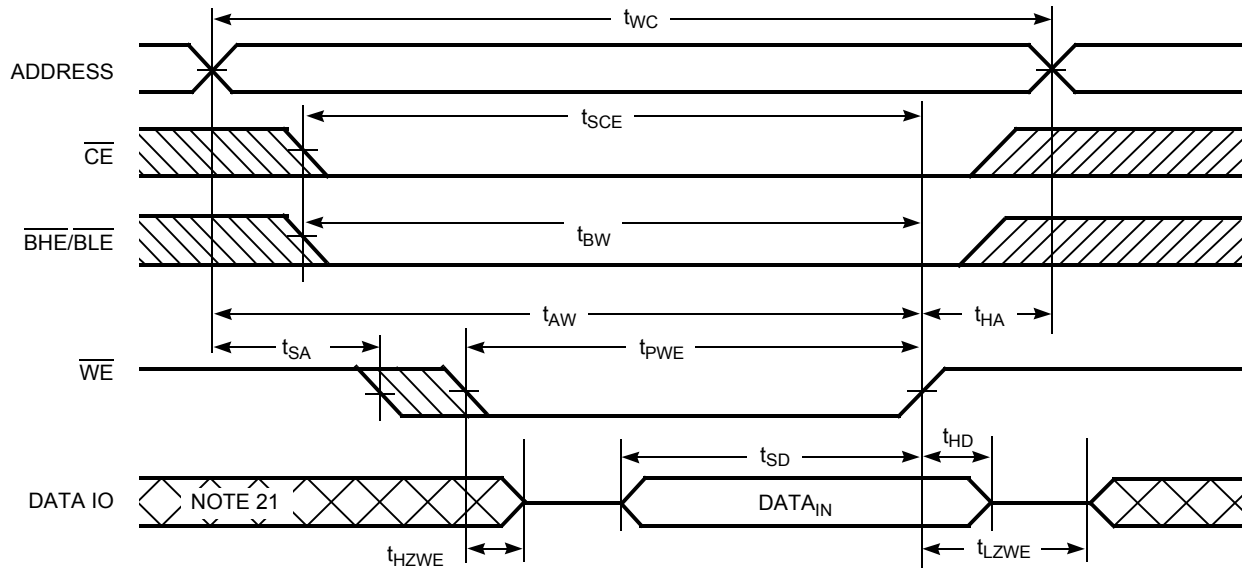
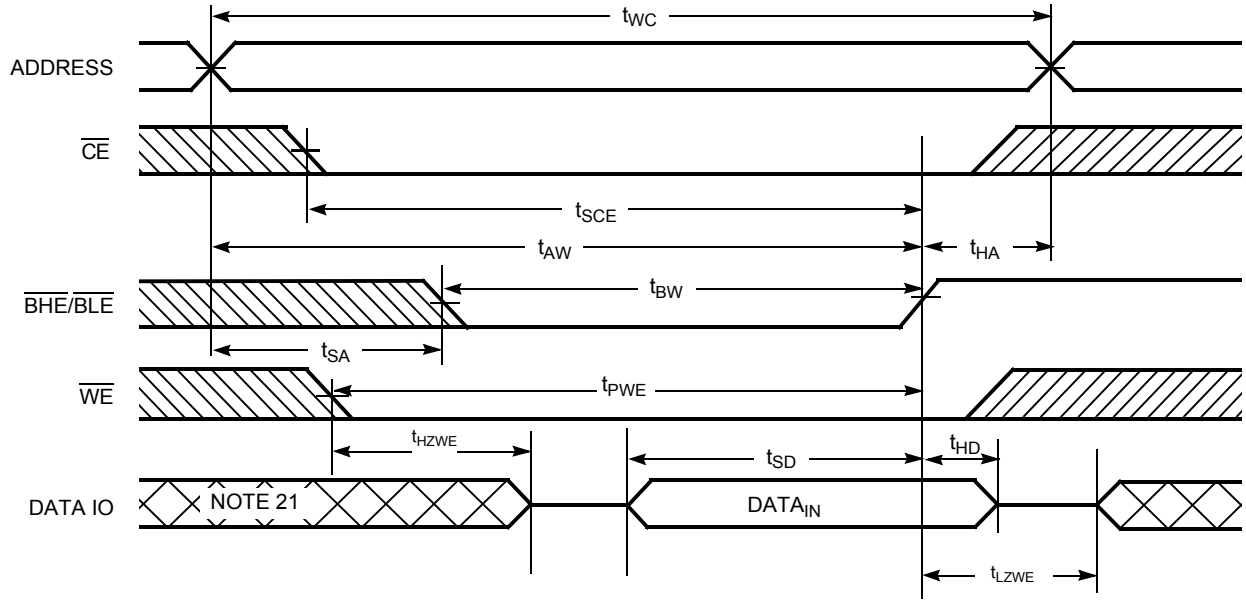


Figure 9 shows the read cycle No.1 that is $\overline{BHE}/\overline{BLE}$ controlled, $\overline{OE}$ LOW. [20]

Figure 9. Write Cycle No. 4



Truth Table

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

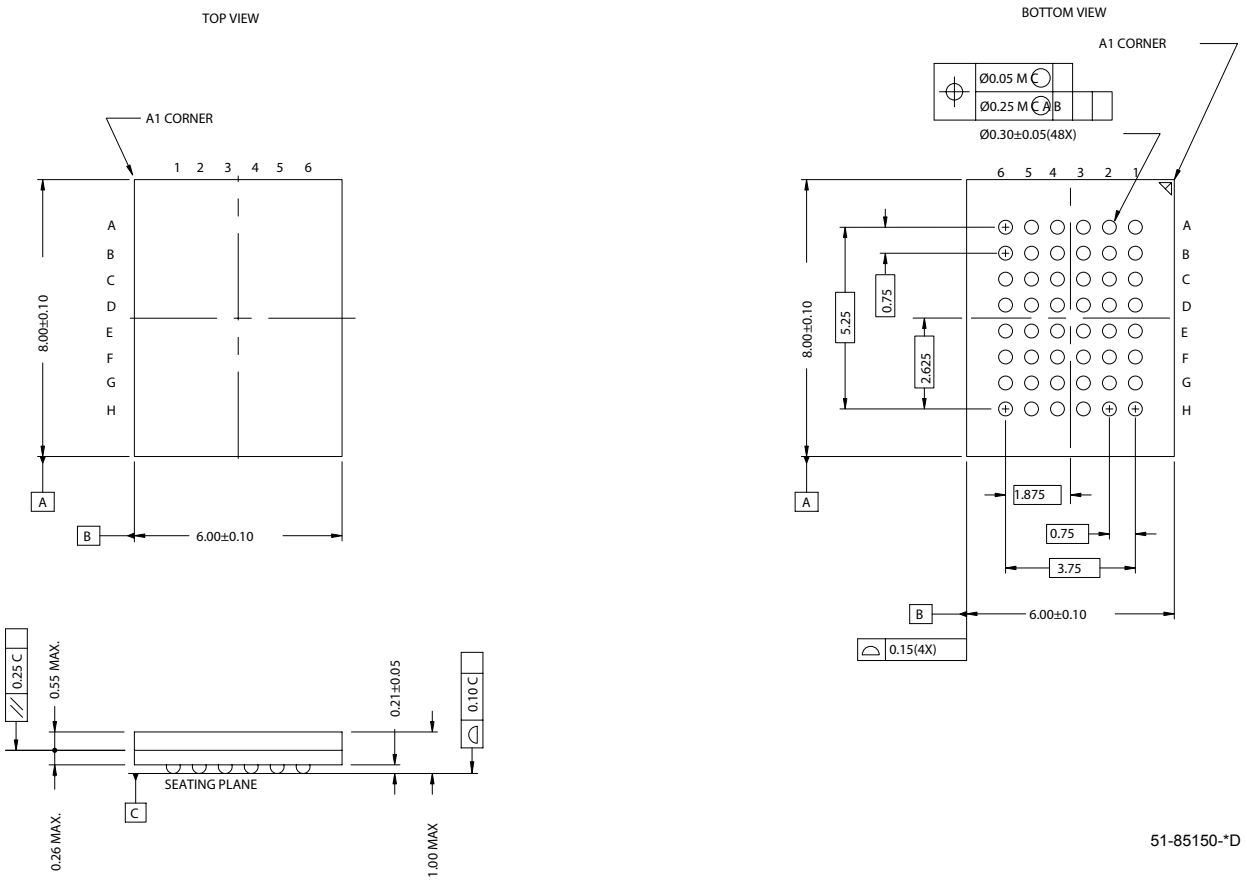
Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
55	CY62137FV18LL-55BVXI	51-85150	48-Ball VFBGA (Pb-free)	Industrial

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

Package Diagram

Figure 10. 48-Ball VFBGA (6 x 8 x 1 mm), 51-85150



Document History Page

Document Title: CY62137FV18 MoBL® 2-Mbit (128K x 16) Static RAM Document Number: 001-08030				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	463660	See ECN	NXR	New datasheet
*A	469180	See ECN	NSI	Minor change: moved to external web
*B	569125	See ECN	NXR	Converted from preliminary to final Replaced 45 ns speed bin with 55 ns speed bin Changed the $I_{CC(max)}$ value from 2.25 mA to 2.5 mA for test condition f=1 MHz Changed the $I_{SB2(typ)}$ value from 0.5 μA to 1 μA Changed the $I_{SB2(max)}$ value from 2.5 μA to 5 μA Changed the $I_{CCDR(typ)}$ value from 0.5 μA to 1 μA and $I_{CCDR(max)}$ value from 2.5 μA to 4 μA
*C	869500	See ECN	VKN	Added footnote #12 related to t_{ACE}
*D	908120	See ECN	VKN	Added footnote #8 related to I_{SB2} and I_{CCDR} Made footnote #13 applicable to AC parameters from t_{ACE} Changed t_{WC} specification from 45 ns to 55 ns Changed t_{SCE}, t_{AW}, t_{PWE}, t_{BW} specification from 35 ns to 40 ns Changed t_{HZWE} specification from 18 ns to 20 ns
*E	1274728	See ECN	VKN/AESA	Changed t_{WC} specification from 55 ns to 45 ns Changed t_{SCE}, t_{AW}, t_{PWE}, t_{BW} specification from 40 ns to 35 ns Changed t_{HZWE} specification from 20 ns to 18 ns

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