CY62146CV18 MoBL2™

256K x 16 Static RAM

Features

- **High Speed**
  - **55 ns and 70 ns availability**
- **Low voltage range:**
  - **1.65V–1.95V**
- **Pin Compatible with CY62146BV18**
- **Ultra-low active power**
  - **Typical Active Current: 0.5 mA @ f = 1 MHz**
  - **Typical Active Current: 2 mA @ f = f_{max} (70 ns speed)**
- **Low standby power**
- **Easy memory expansion with $\overline{CE}$ and $\overline{OE}$ features**
- **Automatic power-down when deselected**
- **CMOS for optimum speed/power**

Functional Description

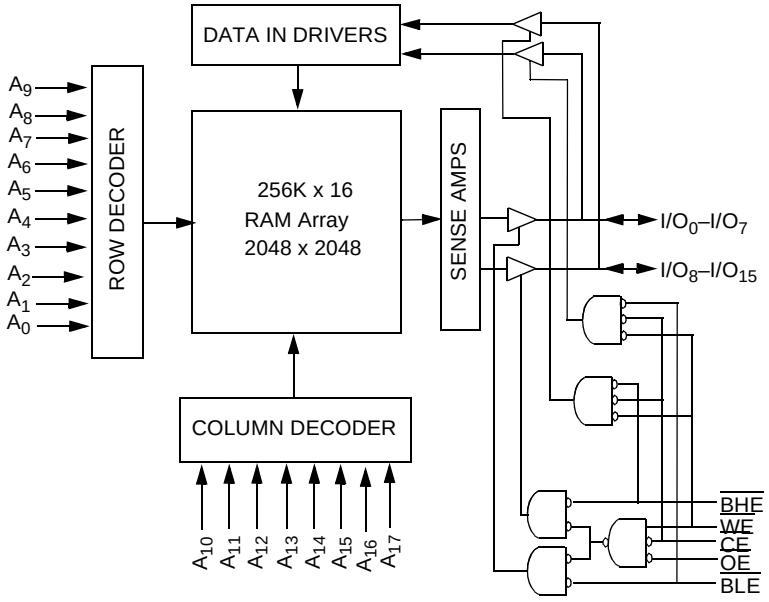
The CY62146CV18 is a high-performance CMOS static RAM organized as 256K words by 16 bits. These devices feature advanced circuit design to provide ultra-low active current. This is ideal for providing More Battery Life™ (MoBL™) in portable applications such as cellular telephones. The device also has 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). The input/output pins (I/O_0 through I/O_{15}) 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_0 through I/O_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 I/O pins (I/O_8 through I/O_{15}) is written into the location specified on the address pins (A_0 through A_{17}).

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_0 to I/O_7. If Byte High Enable ($\overline{BHE}$) is LOW, then data from memory will appear on I/O_8 to I/O_{15}. See the truth table at the back of this data sheet for a complete description of read and write modes.

The CY62146CV18 is available in a 48-Ball FBGA package.

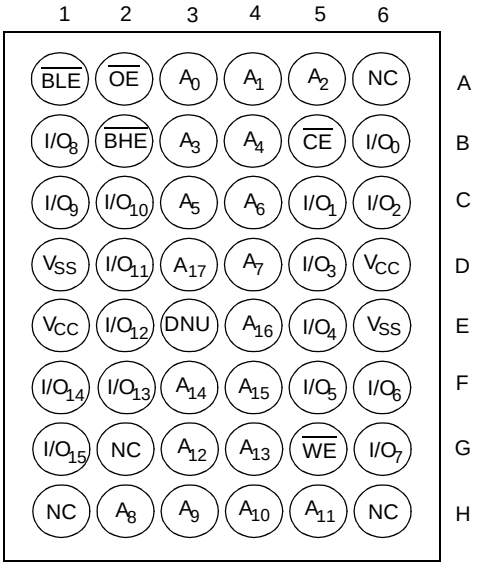
Logic Block Diagram



Pin Configurations[1, 2]

FBGA

Top View



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 +2.4V

DC Voltage Applied to Outputs in High-Z State[2] ..... –0.5V to V_{CC} + 0.5V

DC Input Voltage[2] ..... –0.5V to V_{CC} + 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_{CC}
CY62146CV18	Industrial	–40°C to +85°C	1.65V to 1.95V

Product Portfolio

Product	V_{CC} Range			Speed	Power Dissipation (Industrial)					
					Operating (I_{CC})				Standby (I_{SB2})	
					f = 1 MHz		f = f_{max}			
	$V_{CC(min.)}$	$V_{CC(typ.)}$[4]	$V_{CC(max.)}$		Typ.[4]	Max.	Typ.[4]	Max.	Typ.[4]	Max.
CY62146CV18	1.65V	1.80V	1.95V	55ns	0.5 mA	3 mA	2.5 mA	7 mA	1 μA	10 μA
				70ns	0.5 mA	3 mA	2 mA	6 mA		

Notes:
1. NC pins are not connected to the die.
2. E3 (DNU) can be left as NC or V_{SS} to ensure proper application.
3. $V_{IL(min.)}$ = –2.0V for pulse durations less than 20 ns.
4. 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.

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		CY62146CV18 MoBL2™-55			CY62146CV18 MoBL2™-70			Unit
				Min.	Typ.[4]	Max	Min.	Typ.[4]	Max.	
V_{OH}	Output HIGH Voltage	I_{OH} = –0.1 mA	V_{CC} = 1.65V	1.4			1.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA	V_{CC} = 1.65V			0.2			0.2	V
V_{IH}	Input HIGH Voltage			1.4		V_{CC} + 0.2V	1.4		V_{CC} + 0.2V	V
V_{IL}	Input LOW Voltage			–0.2		0.4	–0.2		0.4	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}		–1		+1	–1		+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled		–1		+1	–1		+1	µA
I_{CC}	V_{CC} Operating Supply Current	f = f_{MAX} = $1/t_{RC}$	V_{CC} = 1.95V, I_{OUT} = 0 mA CMOS levels		2.5	7		2	6	mA
		f = 1 MHz			0.5	3		0.5	3	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 (OE, WE, BHE, and BLE)			1	10		1	10	µA
I_{SB2}	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} = 1.95V								

Capacitance[5]

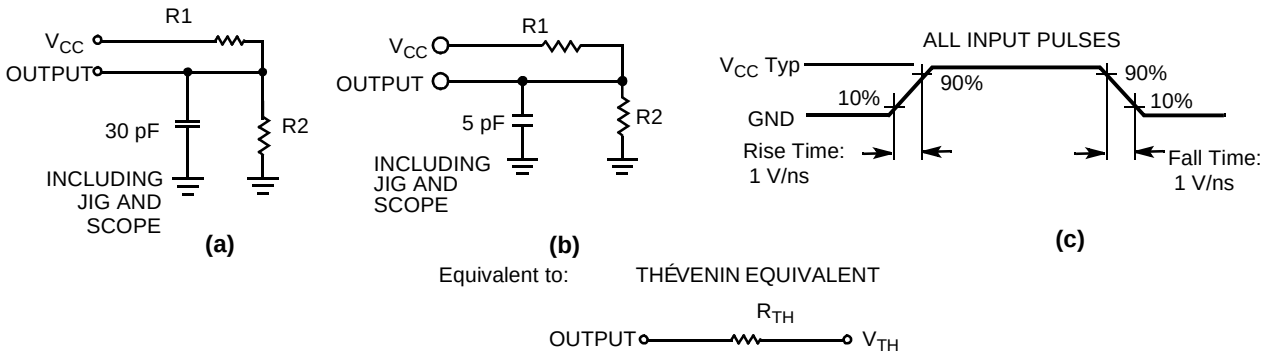
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC}= $V_{CC(typ.)}$	8	pF
C_{OUT}	Output Capacitance		10	pF

Thermal Resistance

Description	Test Conditions	Symbol	BGA	Unit
Thermal Resistance (Junction to Ambient)[5]	Still Air, soldered on a 4.25 x 1.125 inch, 4-layer printed circuit board	Θ_{JA}	55	°C/W
Thermal Resistance (Junction to Case)[5]		Θ_{JC}	16	°C/W

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

AC Test Loads and Waveforms

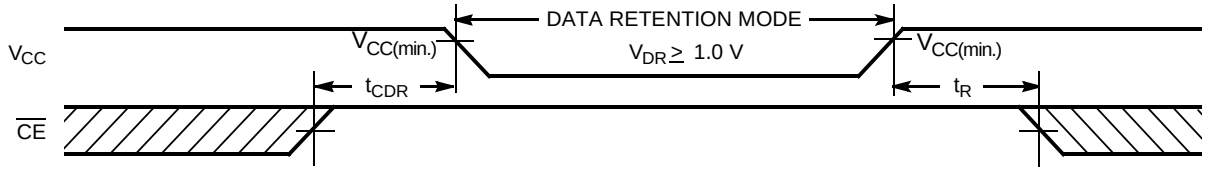


Parameters	1.8V	UNIT
R1	13500	Ohms
R2	10800	Ohms
R_{TH}	6000	Ohms
V_{TH}	0.80	Volts

Data Retention Characteristics (Over the Operating Range)

Parameter	Description	Conditions	Min.	Typ.[4]	Max.	Unit
V_{DR}	V_{CC} for Data Retention		1.0		1.95	V
I_{CCDR}	Data Retention Current	$\overline{V_{CC}}$= 1.0V $\overline{CE} \geq V_{CC} - 0.2V$, $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$		1	8	µA
t_{CDR}[5]	Chip Deselect to Data Retention Time		0			ns
t_R[6]	Operation Recovery Time		t_{RC}			ns

Data Retention Waveform



Note:

6. 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.

Switching Characteristics Over the Operating Range [7]

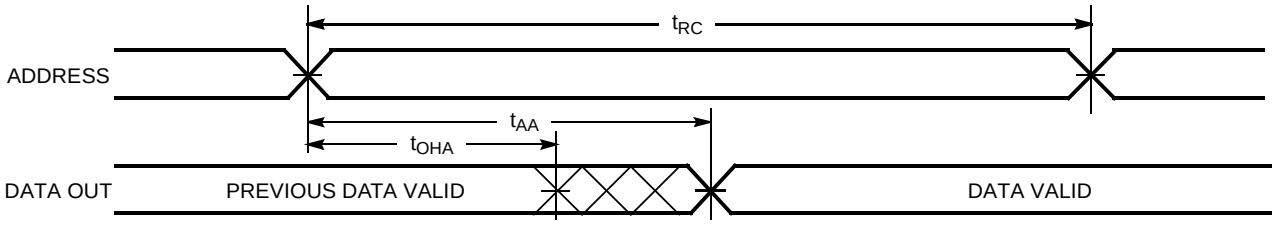
Parameter	Description	55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	
Read Cycle						
t_{RC}	Read Cycle Time	55		70		ns
t_{AA}	Address to Data Valid		55		70	ns
t_{OHA}	Data Hold from Address Change	10		10		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		55		70	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		25		35	ns
t_{LZOE}	$\overline{OE}$ LOW to Low-Z[8]	5		5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High-Z[8, 9]		20		25	ns
t_{LZCE}	$\overline{CE}$ LOW to Low-Z[8]	5		10		ns
t_{HZCE}	$\overline{CE}$ HIGH to High-Z[8, 9]		20		25	ns
t_{PU}	$\overline{CE}$ LOW to Power-up	0		0		ns
t_{PD}	$\overline{CE}$ HIGH to Power-down		55		70	ns
t_{DBE}	$\overline{BHE}$ / $\overline{BLE}$ LOW to Data Valid		30		45	ns
t_{LZBE}	$\overline{BHE}$ / $\overline{BLE}$ LOW to Low-Z[8]	5		5		ns
t_{HZBE}	$\overline{BHE}$ / $\overline{BLE}$ HIGH to High-Z[8, 9]		20		25	ns
Write Cycle[10]						
t_{WC}	Write Cycle Time	55		70		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	40		60		ns
t_{AW}	Address Set-up to Write End	40		60		ns
t_{HA}	Address Hold from Write End	0		0		ns
t_{SA}	Address Set-up to Write Start	0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	40		50		ns
t_{BW}	$\overline{BHE}$ / $\overline{BLE}$ Pulse Width	40		60		ns
t_{SD}	Data Set-up to Write End	25		30		ns
t_{HD}	Data Hold from Write End	0		0		ns
t_{HZWE}	$\overline{WE}$ LOW to High-Z[8, 9]		15		25	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[9]	5		10		ns

Notes:

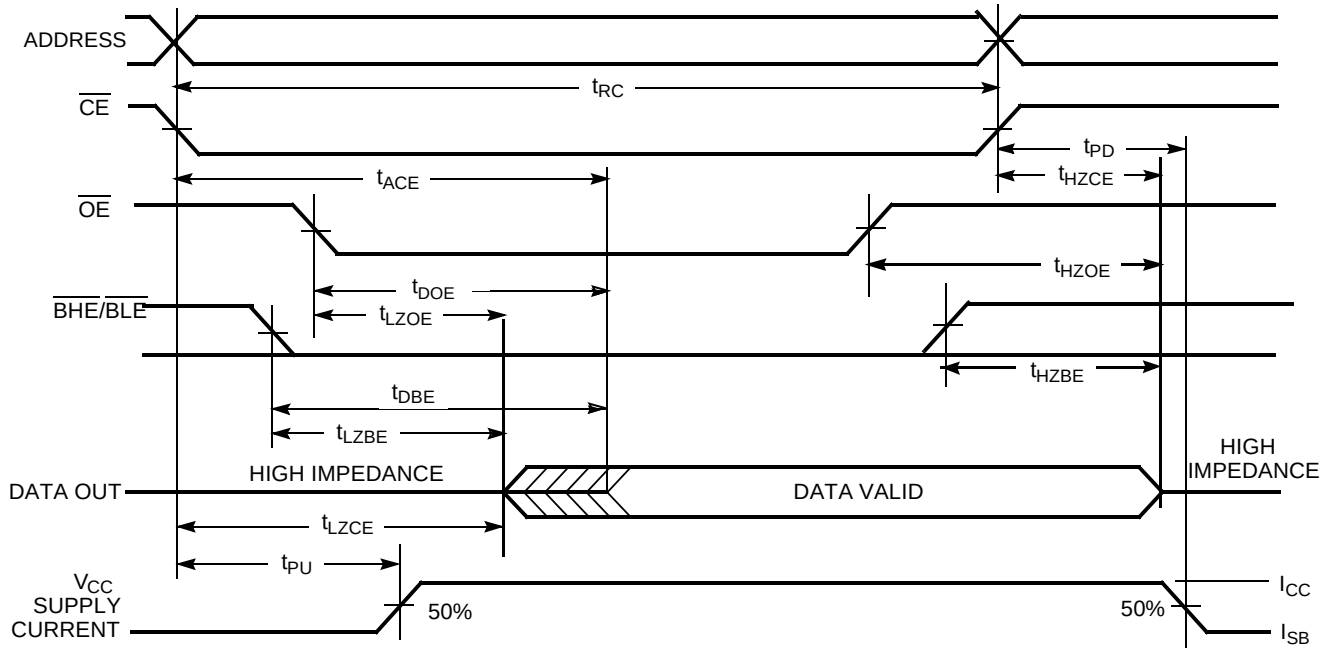
7. Test conditions assume signal transition time of 3ns or less, timing reference levels of $V_{CC(typ)}/2$, input pulse levels of 0 to $V_{CC(typ)}$, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance
8. At any given temperature and voltage condition, t_{HZCE} is less than 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.
9. t_{HZOE}, t_{HZCE}, t_{HZBE}, and t_{HZWE} transitions are measured when the outputs enter a high impedance state.
10. 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 set-up and hold timing should be referenced to the edge of the signal that terminates the write

Switching Waveforms

Read Cycle No. 1 (Address Transition Controlled)[11, 12]



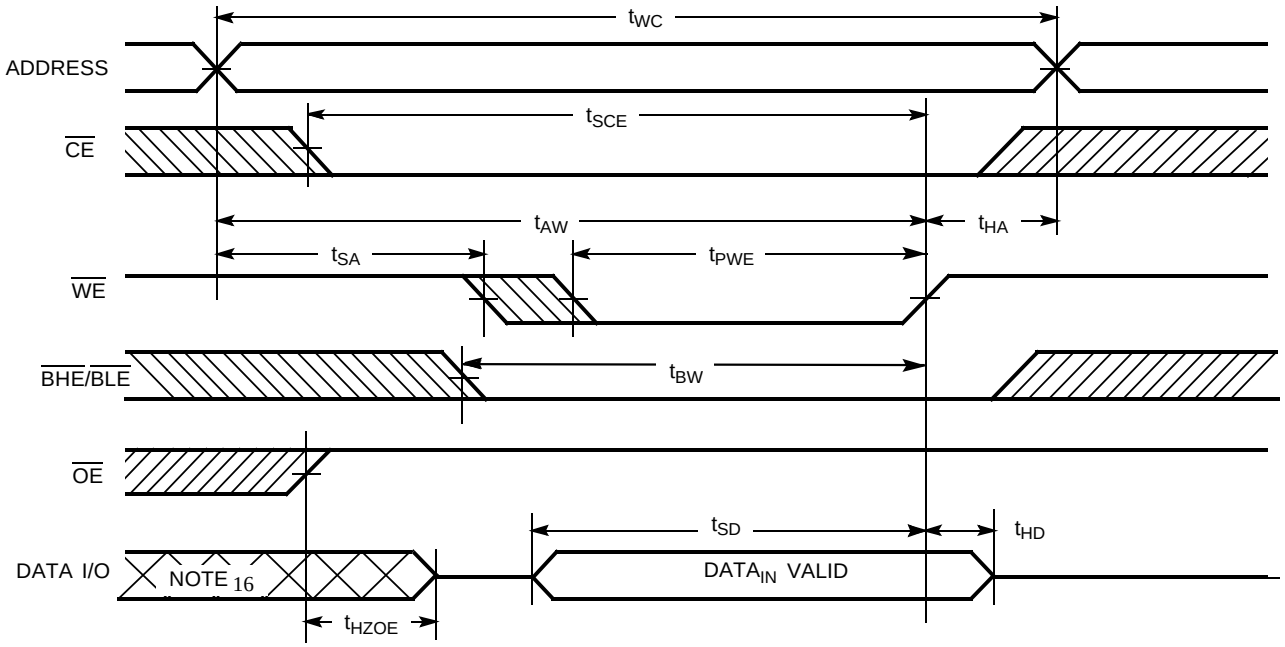
Read Cycle No. 2 ($\overline{OE}$ Controlled)[12, 13]



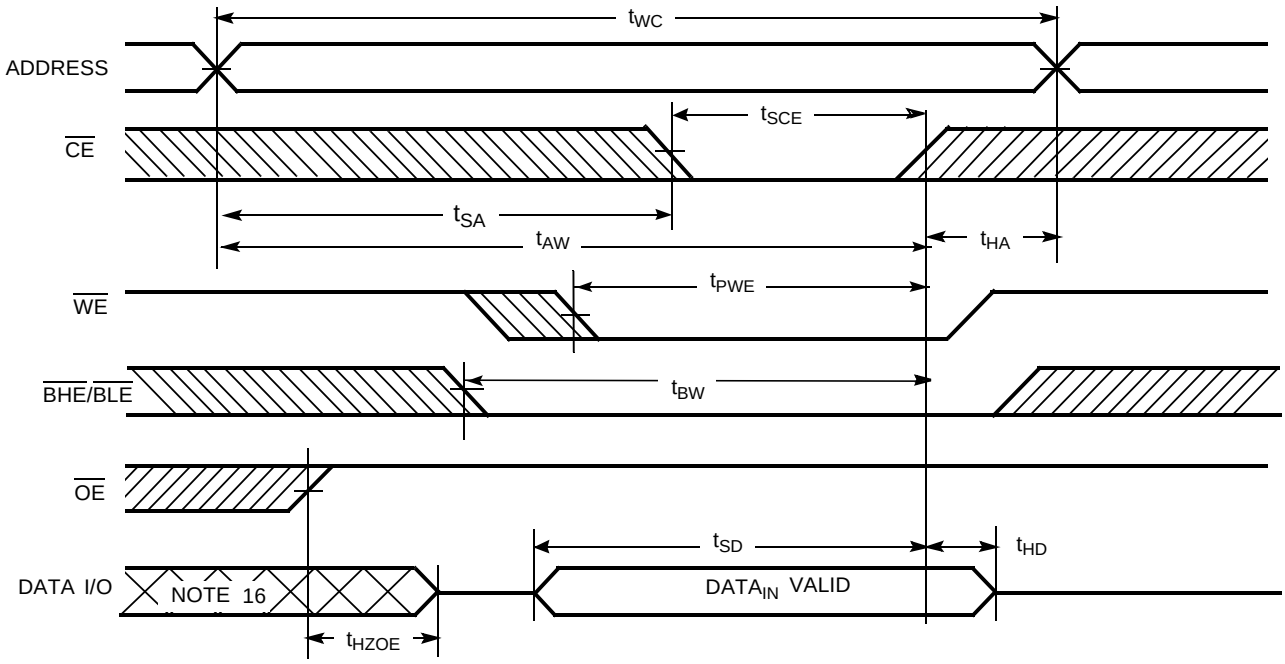
Notes:
11. Device is continuously selected. $\overline{OE}$, $\overline{CE}$ = V_{IL}, $\overline{BHE}$ and/or $\overline{BLE}$ = V_{IL}.
12. $\overline{WE}$ is HIGH for read cycle.
13. Address valid prior to or coincident with $\overline{CE}$, $\overline{BHE}$, $\overline{BLE}$, transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1($\overline{WE}$ Controlled)[10, 14, 15]



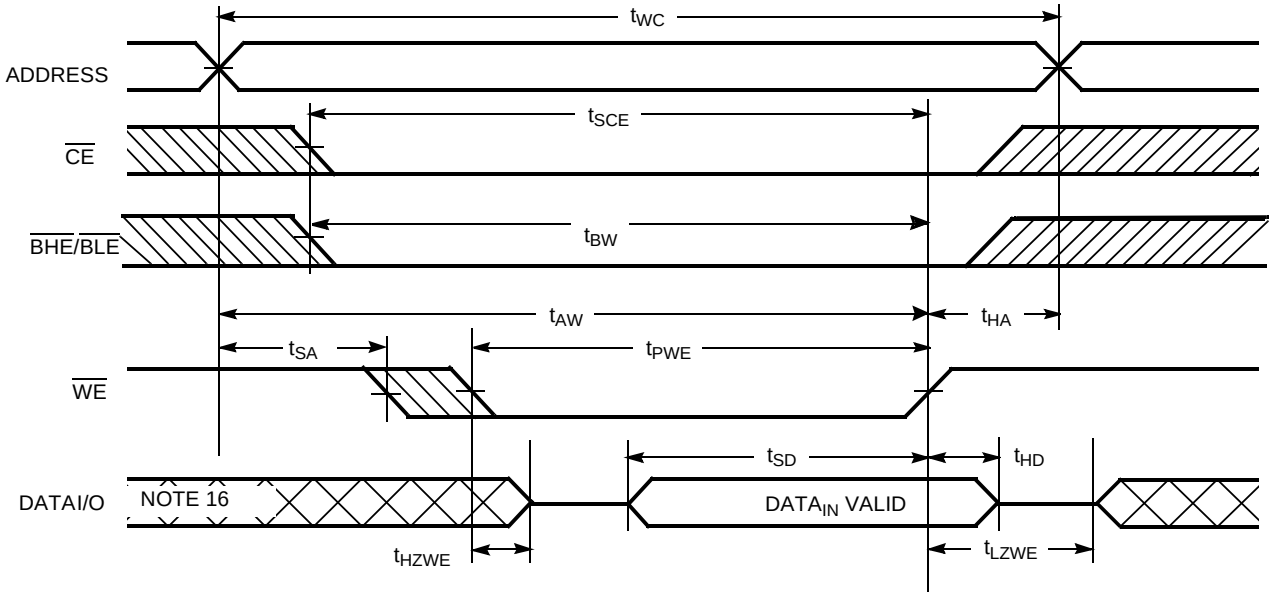
Write Cycle No. 2 ($\overline{CE}$ Controlled)[10, 14, 15]



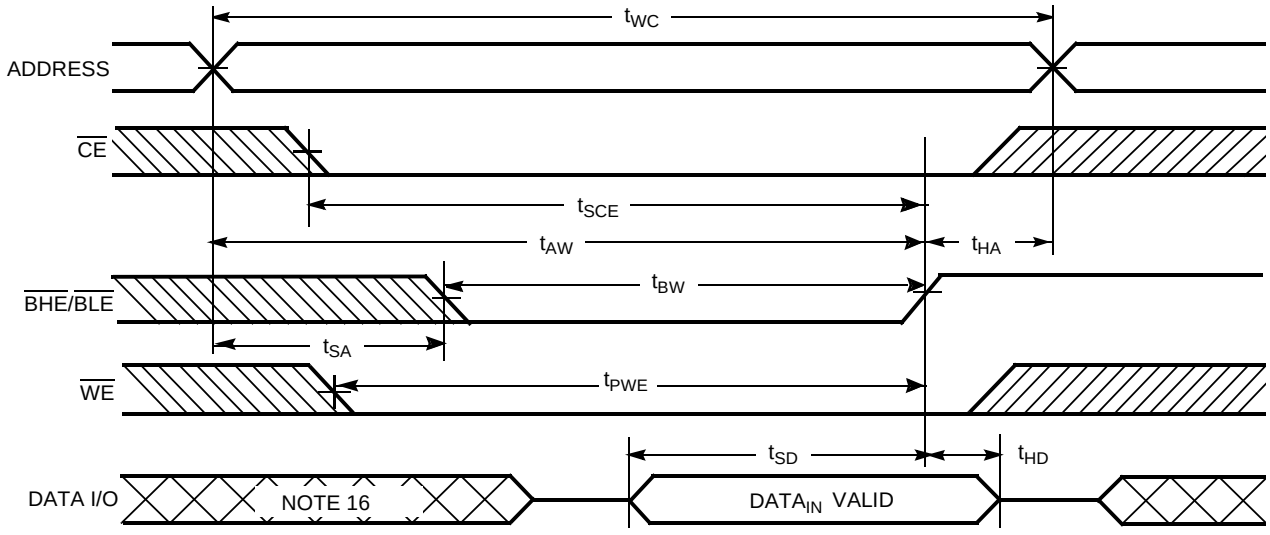
Notes:
14. Data I/O is high-impedance if $\overline{OE} = V_{IH}$.
15. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ HIGH, the output remains in a high-impedance state.
16. During this period, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW)[15]

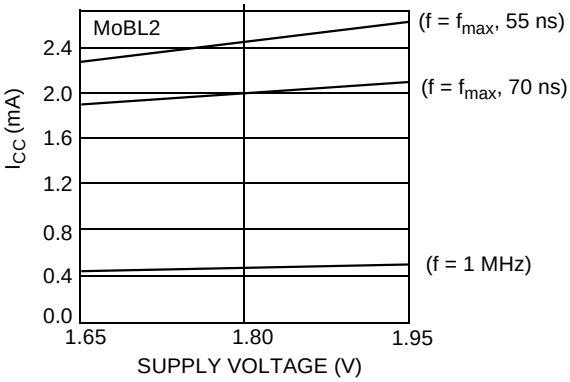


Write Cycle No. 4 ($\overline{BHE}$/$\overline{BLE}$ Controlled, $\overline{OE}$ LOW)[15]

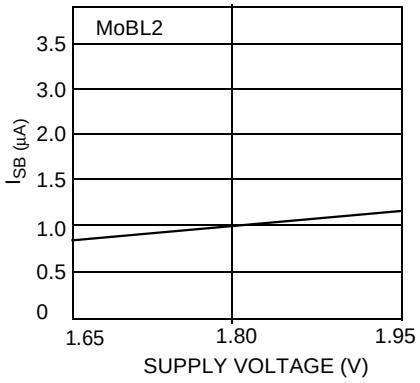


Typical DC and AC Characteristics (Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at $V_{CC} = V_{CC\ Typ}$, $T_A = 25°C$.)

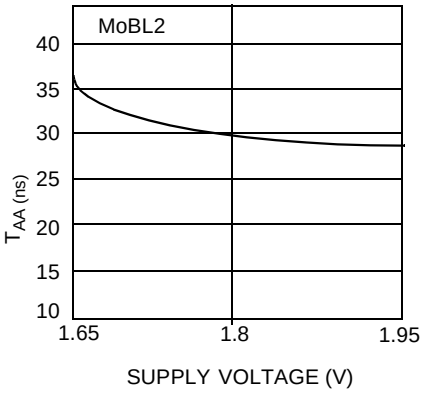
Operating Current vs. Supply Voltage



Standby Current vs. Supply Voltage



Access Time vs. Supply Voltage



Truth Table

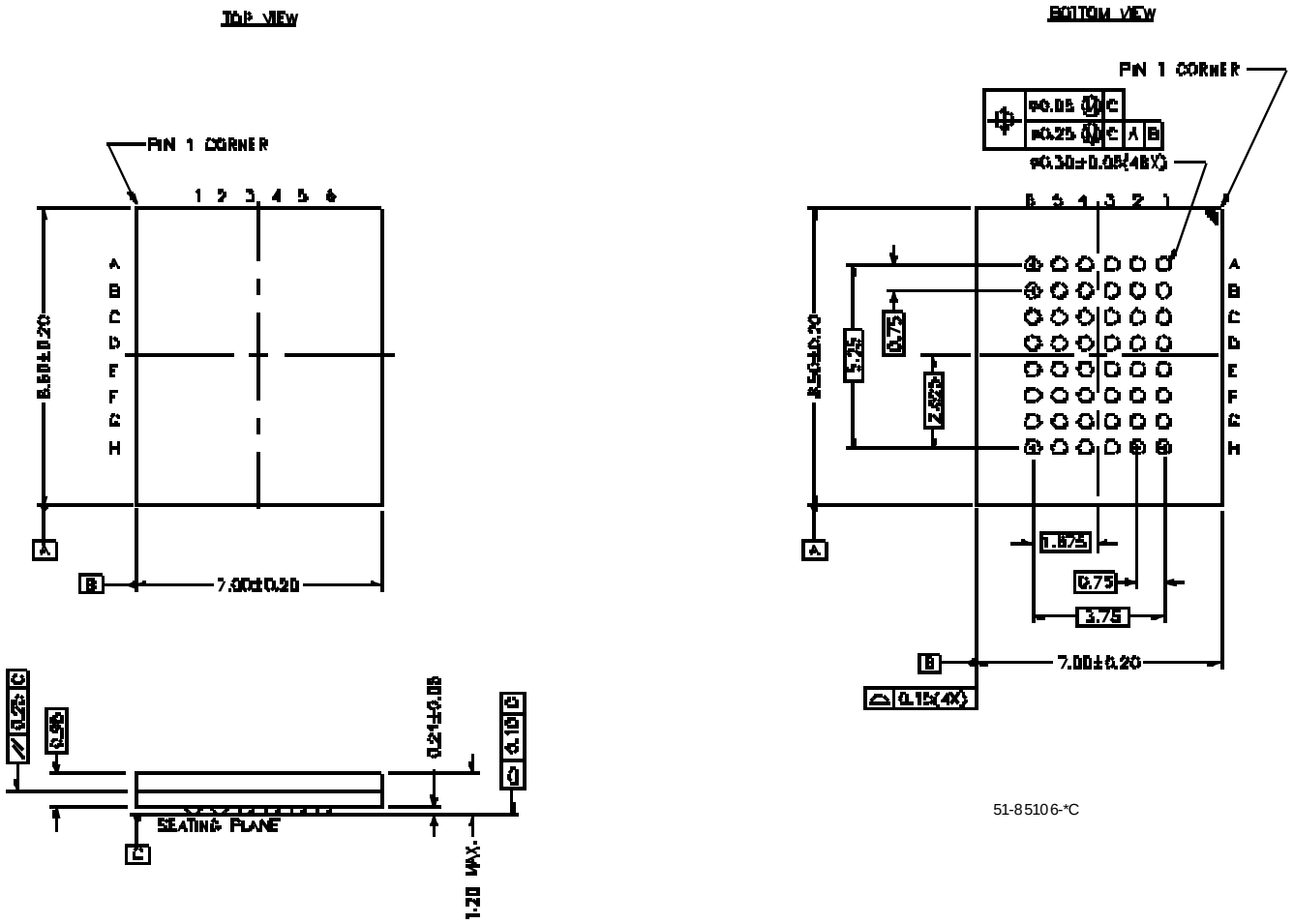
$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Inputs/Outputs	Mode	Power
H	X	X	X	X	High-Z	Deselect/Power-down	Standby (I_{SB})
L	H	L	L	L	Data Out (I/O_0–I/O_{15})	Read	Active (I_{CC})
L	H	L	H	L	Data Out (I/O_0–I/O_7); I/O_8–I/O_{15} in High-Z	Read	Active (I_{CC})
L	H	L	L	H	Data Out (I/O_8–I/O_{15}); I/O_0–I/O_7 in High-Z	Read	Active (I_{CC})
L	H	L	H	H	High-Z	Output Disabled	Active (I_{CC})
L	H	H	X	X	High-Z	Output Disabled	Active (I_{CC})
L	L	X	L	L	Data In (I/O_0–I/O_{15})	Write	Active (I_{CC})
L	L	X	H	L	Data In (I/O_0–I/O_7); I/O_8–I/O_{15} in High-Z	Write	Active (I_{CC})
L	L	X	L	H	Data In (I/O_8–I/O_{15}); I/O_0–I/O_7 in High-Z	Write	Active (I_{CC})
L	L	X	H	H	High-Z	Output Disabled	Active (I_{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
70	CY62146CV18LL-70BAI	BA48B	48-Ball Fine Pitch BGA (7 mm x 8.5 mm x 1.2 mm)	Industrial
	CY62146CV18LL-70BVI	BV48A	48-Ball Fine Pitch BGA (6 mm x 8 mm x 1 mm)	
55	CY62146CV18LL-55BAI	BA48B	48-Ball Fine Pitch BGA (7 mm x 8.5 mm x 1.2 mm)	
	CY62146CV18LL-55BVI	BV48A	48-Ball Fine Pitch BGA (6 mm x 8 mm x 1 mm)	

Package Diagrams

48-Ball (7.00 mm x 8.5 mm x 1.2 mm) Thin BGA BA48B



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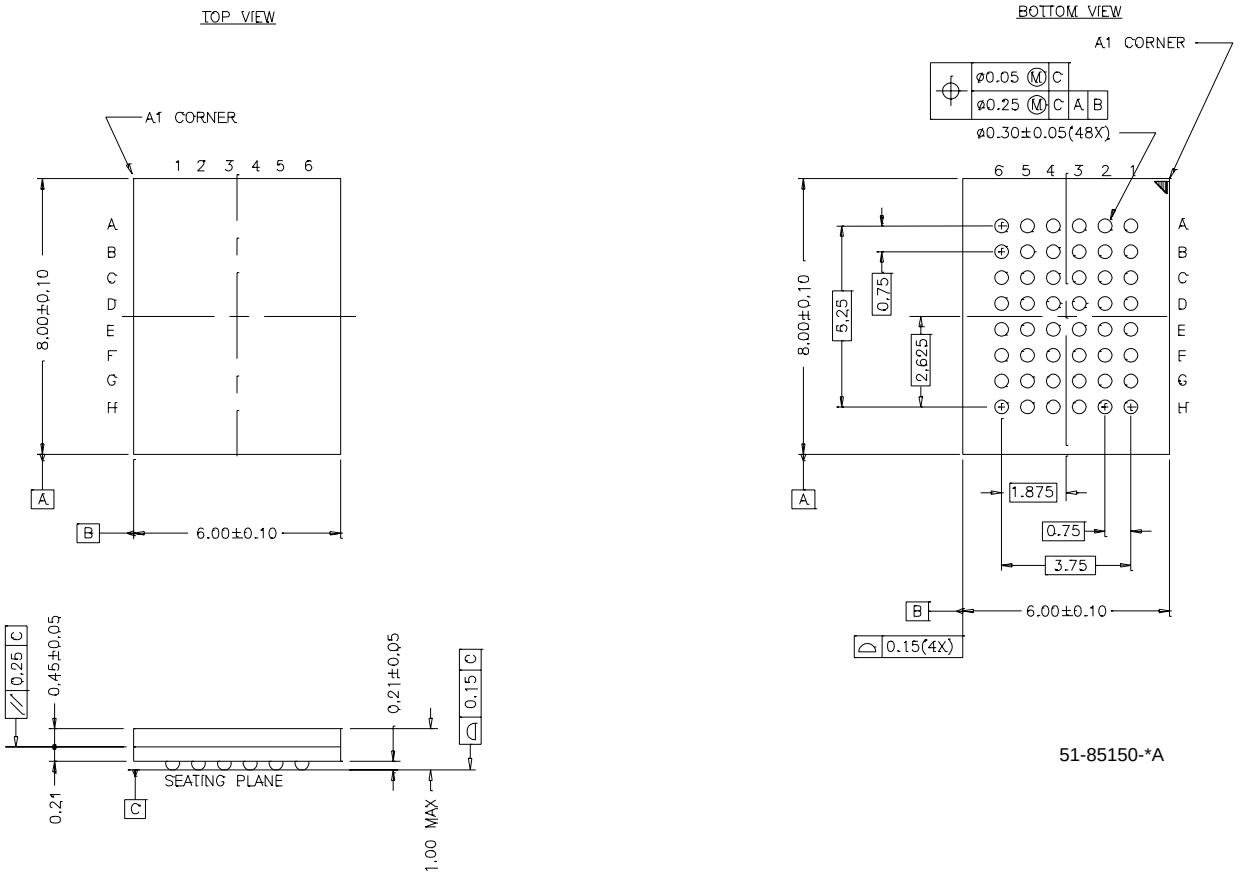
Package Diagrams (continued)

48-Lead VFBGA (6 x 8 x 1 mm) BV48A



Document Title: CY62146CV18 MoBL2™ MoBL2 256K x 16 SRAM Document Number: 38-05010				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	106039	05/08/01	HRT/MGN	Created Preliminary Data Sheet
*A	107702	06/15/01	MGN	Delete Datasheet. Not offering this device.
*B	111468	11/02/01	MGN	Reactivating datasheet. Die Rev. from R5 to R7.
*C	115863	09/03/02	DPM	From Preliminary to Final. Added BV package