CY62158CV25/30/33
MoBL™

1024K x 8 MoBL Static RAM

Features

- **High Speed**
  - **55 ns and 70 ns availability**
- **Voltage range:**
  - **CY62158CV25: 2.2V–2.7V**
  - **CY62158CV30: 2.7V–3.3V**
  - **CY62158CV33: 3.0V–3.6V**
- **Ultra low active power**
  - **Typical active current: 1.5 mA @ f = 1 MHz**
  - **Typical active current: 5.5 mA @ f = f_{max}(70 ns speed)**
- **Low standby power**
- **Easy memory expansion with $\overline{CE}_1$, CE_2 and $\overline{OE}$ features**
- **Automatic power-down when deselected**
- **CMOS for optimum speed/power**

Functional Description

The CY62158CV25/30/33 are high-performance CMOS static RAMs organized as 1024K words by 8 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 by 80% when addresses are not toggling. The device can be put into standby mode reducing power consumption by more than 99% when deselected ($\overline{CE}_1$ HIGH or CE_2 LOW).

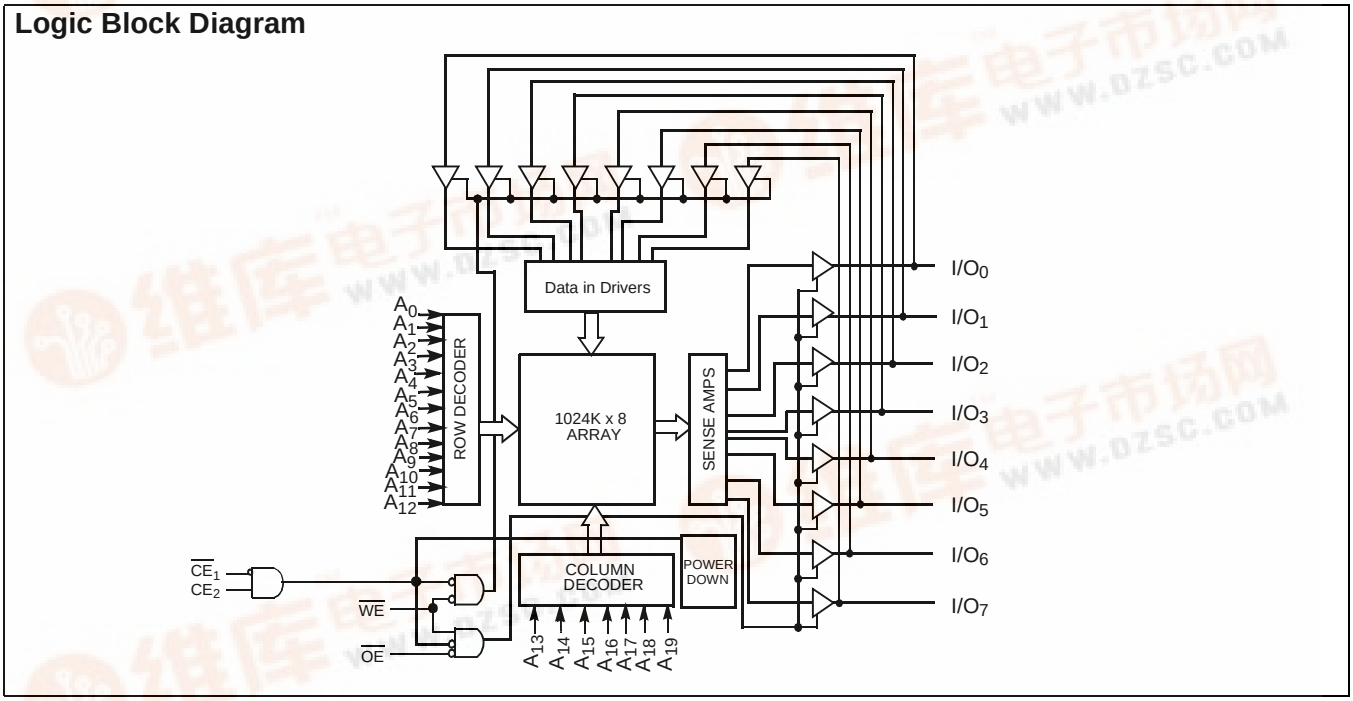
Writing to the device is accomplished by taking Chip Enable 1 ($\overline{CE}_1$) and Write Enable ($\overline{WE}$) inputs LOW and Chip Enable 2 (CE_2) HIGH. Data on the eight I/O pins (I/O_0 through I/O_7) is then written into the location specified on the address pins (A_0 through A_{19}).

Reading from the device is accomplished by taking Chip Enable 1 ($\overline{CE}_1$) and Output Enable ($\overline{OE}$) LOW and Chip Enable 2 (CE_2) HIGH while forcing Write Enable ($\overline{WE}$) HIGH. Under these conditions, the contents of the memory location specified by the address pins will appear on the I/O pins.

The eight input/output pins (I/O_0 through I/O_7) are placed in a high-impedance state when the device is deselected ($\overline{CE}_1$ LOW and CE_2 HIGH), the outputs are disabled ($\overline{OE}$ HIGH), or during a write operation ($\overline{CE}_1$ LOW and CE_2 HIGH and $\overline{WE}$ LOW).

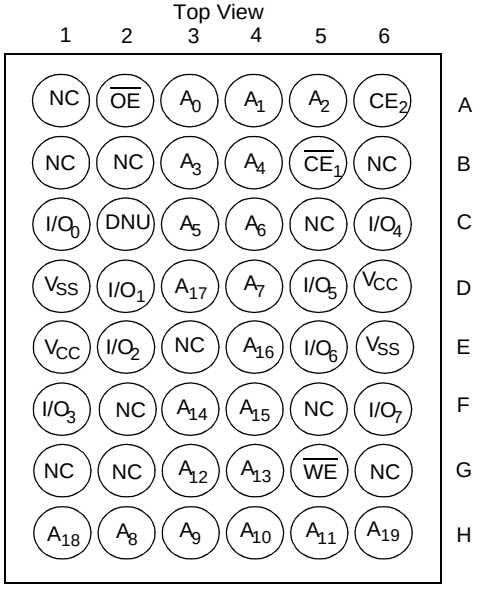
The CY62158CV25/30/33 are available in a 48-ball FBGA package.

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 V_{ccmax} + 0.5V

DC Voltage Applied to Outputs in High Z State[3]..... –0.5V to V_{CC} + 0.5V

DC Input Voltage[3].....–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

Product	Range	Ambient Temperature	V_{CC}
CY62158CV25	Industrial	–40°C to +85°C	2.2V to 2.7V
CY62158CV30			2.7V to 3.3V
CY62158CV33			3.0V to 3.6V

Product Portfolio

Product	V_{CC} Range			Speed	Power Dissipation (Industrial)					
					Operating (I_{CC})				Standby (I_{SB2})	
					f = 1 MHz		f = f_{max}			
	Min.	Typ.[4]	Max.		Typ.[4]	Max.	Typ.[4]	Max.	Typ.[4]	Max.
CY62158CV25	2.2V	2.5V	2.7V	55 ns	1.5 mA	3 mA	7 mA	15 mA	6 µA	25 µA
				70 ns	1.5 mA	3 mA	5.5 mA	12 mA		
CY62158CV30	2.7V	3.0V	3.3V	55 ns	1.5 mA	3 mA	7 mA	15 mA	8 µA	25 µA
				70 ns	1.5 mA	3 mA	5.5 mA	12 mA		
CY62158CV33	3.0V	3.3V	3.6V	55 ns	1.5 mA	3 mA	7 mA	15 mA	10 µA	30 µA
				70 ns	1.5 mA	3 mA	5.5 mA	12 mA		

Notes:
1. NC pins are not connected to the die.
2. C2 (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		CY62158CV25-55 Min.	CY62158CV25-55 Typ.[4]	CY62158CV25-55 Max.	CY62158CV25-70 Min.	CY62158CV25-70 Typ.[4]	CY62158CV25-70 Max.	Unit
V_{OH}	Output HIGH Voltage	I_{OH} = –0.1 mA	V_{CC} = 2.2V	2.0			2.0			V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA	V_{CC} = 2.2V			0.4			0.4	V
V_{IH}	Input HIGH Voltage			1.8		V_{CC}+ 0.3V	1.8		V_{CC}+ 0.3V	V
V_{IL}	Input LOW Voltage			–0.3		0.6	–0.3		0.6	V
I_{IX}	Input Leakage 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} = 2.7V, I_{OUT} = 0 mA CMOS Levels		7	15		5.5	12	mA
		f = 1 MHz			1.5	3		1.5	3	
I_{SB1}	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 = f_{max} (Address and Data Only), f = 0 (OE, WE)			6	25		6	25	µA
I_{SB2}	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} = 2.7V								

Parameter	Description	Test Conditions		CY62158CV30-55 Min.	CY62158CV30-55 Typ.[4]	CY62158CV30-55 Max.	CY62158CV30-70 Min.	CY62158CV30-70 Typ.[4]	CY62158CV30-70 Max.	Unit
V_{OH}	Output HIGH Voltage	I_{OH} = –1.0 mA	V_{CC} = 2.7V	2.4			2.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 2.1 mA	V_{CC} = 2.7V			0.4			0.4	V
V_{IH}	Input HIGH Voltage			2.2		V_{CC}+ 0.3V	2.2		V_{CC}+ 0.3V	V
V_{IL}	Input LOW Voltage			–0.3		0.8	–0.3		0.8	V
I_{IX}	Input Leakage 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} = 3.3V, I_{OUT} = 0 mA CMOS Levels		7	15		5.5	12	mA
		f = 1 MHz			1.5	3		1.5	3	
I_{SB1}	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 = f_{max} (Address and Data Only), f = 0 (OE, WE)			8	25		8	25	µA
I_{SB2}	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} = 3.3V								

Electrical Characteristics Over the Operating Range (continued)

Parameter	Description	Test Conditions		CY62158CV33-55			CY62158CV33-70			Unit
				Min.	Typ.[4]	Max.	Min.	Typ.[4]	Max.	
V_{OH}	Output HIGH Voltage	I_{OH} = –1.0 mA	V_{CC} = 3.0V	2.4			2.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 2.1 mA	V_{CC} = 3.0V			0.4			0.4	V
V_{IH}	Input HIGH Voltage			2.2		V_{CC}+ 0.3V	2.2		V_{CC}+ 0.3V	V
V_{IL}	Input LOW Voltage			–0.3		0.8	–0.3		0.8	V
I_{IX}	Input Leakage 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} = 3.6V I_{OUT} = 0 mA CMOS Levels		7	15		5.5	12	mA
		f = 1 MHz			1.5	2		1.5	2	
I_{SB1}	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 = f_{max} (Address and Data Only), f=0 ($\overline{OE}$, $\overline{WE}$)			10	30		10	30	µA
I_{SB2}	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} = 3.6V								

Capacitance[5]

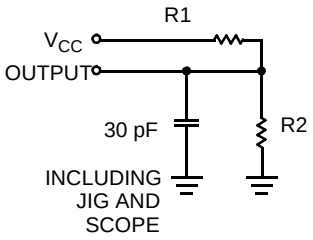
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = $V_{CC(typ.)}$	6	pF
C_{OUT}	Output Capacitance		8	pF

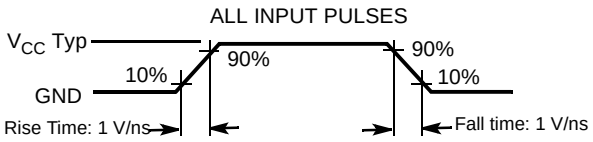
Thermal Resistance

Description	Test Conditions	Symbol	BGA	Unit
Thermal Resistance[5] (Junction to Ambient)	Still Air, soldered on a 3 x 4.5 inch, two-layer printed circuit board	Θ_{JA}	55	°C/W
Thermal Resistance[5] (Junction to Case)		Θ_{JC}	16	°C/W

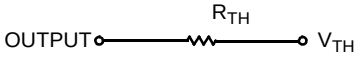
Note:
5. Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms





Equivalent to: THÉVENIN EQUIVALENT

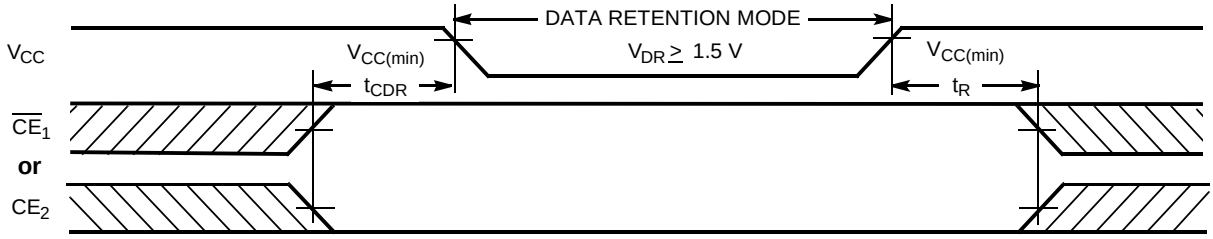


Parameters	2.5V	3.0V	3.3V	Unit
R1	16.6	1.105	1.216	K Ohms
R2	15.4	1.550	1.374	K Ohms
R_{TH}	8.0	0.645	0.645	K Ohms
V_{TH}	1.20	1.75	1.75	Volts

Data Retention Characteristics (Over the Operating Range)

Parameter	Description	Conditions	Min.	Typ.[4]	Max.	Unit
V_{DR}	V_{CC} for Data Retention		1.5		V_{ccmax}	V
I_{CCDR}	Data Retention Current	$\overline{V_{CC}}$ = 1.5V $\overline{CE_1} \geq V_{CC} - 0.2V$ or $CE_2 \leq 0.2V$ $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$		4	20	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 AC 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]

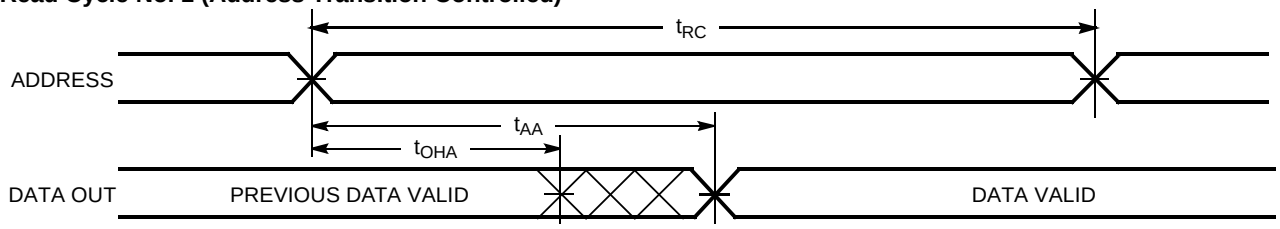
Parameter	Description	55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	
READ CYCLE						
t_{RC}	Read Cycle Time	55		70		ns
t_{AA}	Address to Data Valid		55		70	ns
t_{OHA}	Data Hold from Address Change	10		10		ns
t_{ACE}	$\overline{CE_1}$ LOW and CE_2 HIGH to Data Valid		55		70	ns
t_{DOE}	$\overline{OE}$ LOW 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}	$\overline{CE_1}$ LOW and CE_2 HIGH to Low Z[8]	10		10		ns
t_{HZCE}	$\overline{CE_1}$ HIGH or CE_2 LOW to High Z[8, 9]		20		25	ns
t_{PU}	$\overline{CE_1}$ LOW and CE_2 HIGH to Power-Up	0		0		ns
t_{PD}	$\overline{CE_1}$ HIGH or CE_2 LOW to Power-Down		55		70	ns
WRITE CYCLE[10]						
t_{WC}	Write Cycle Time	55		70		ns
t_{SCE}	$\overline{CE_1}$ LOW and CE_2 HIGH to Write End	45		60		ns
t_{AW}	Address Set-Up to Write End	45		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	45		50		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]		20		25	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[8]	5		5		ns

Notes:

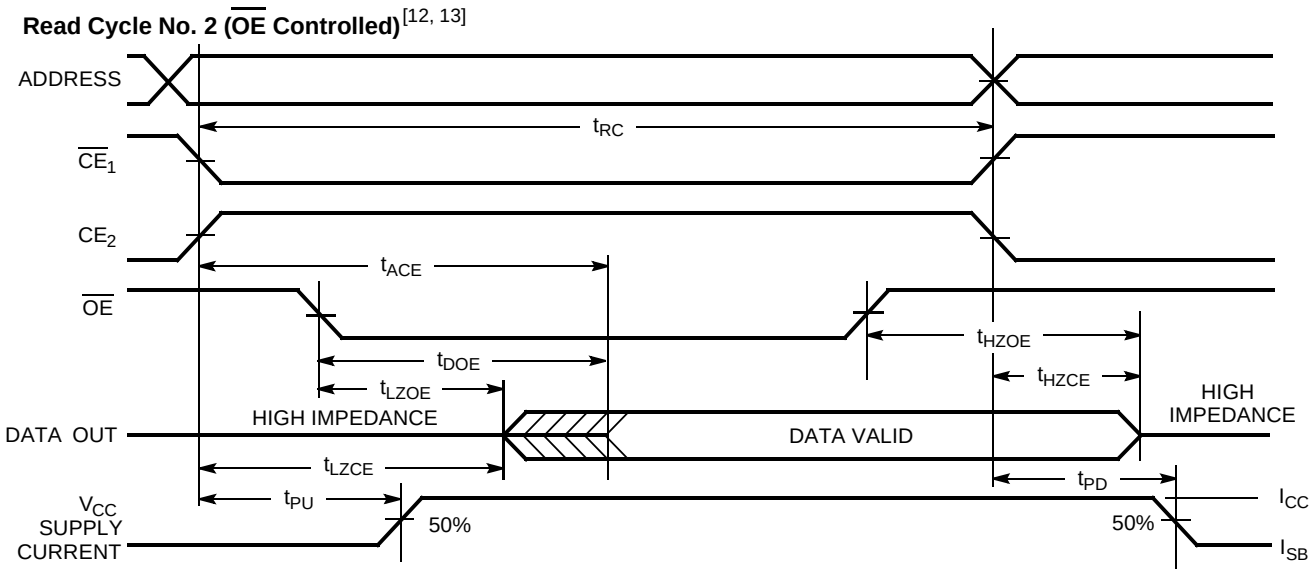
7. Test conditions assume signal transition time of 5 ns or less, timing reference levels of $V_{CC(typ.)}/2$, input pulse levels of 0 to $V_{CC(typ.)}$, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
8. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZOE} is less than t_{LZOE}, and t_{HZWE} is less than t_{LZWE} for any given device.
9. t_{HZOE}, t_{HZCE}, 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 $\overline{WE}$, $\overline{CE_1}$ = 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 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]

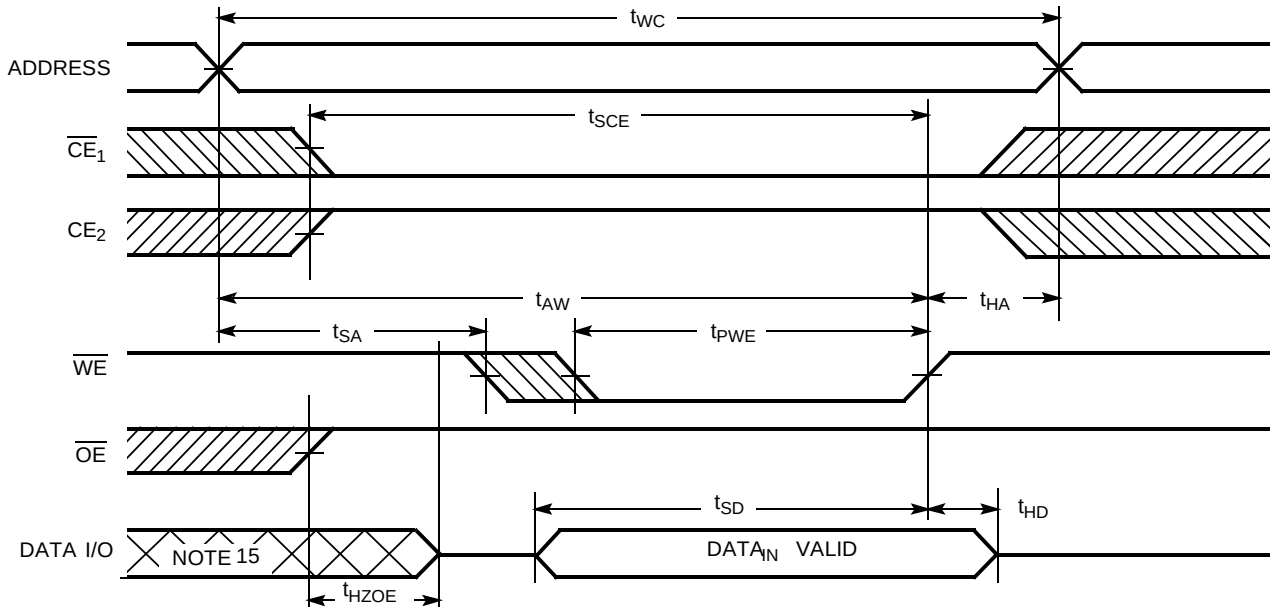


Notes:

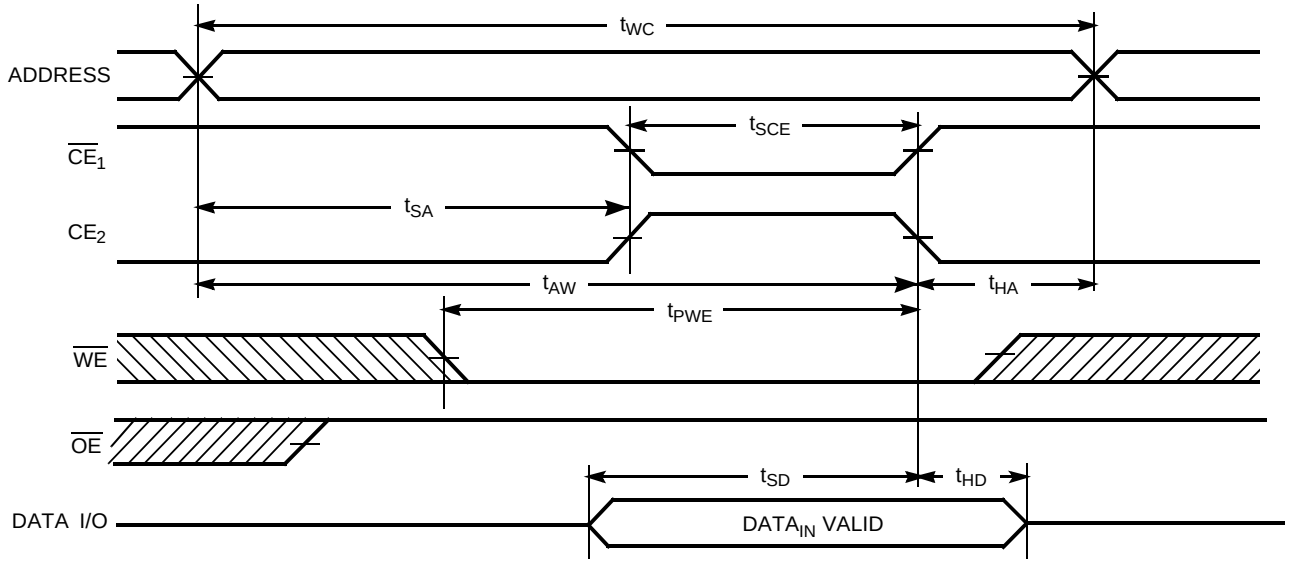
11. Device is continuously selected. $\overline{OE}$, $\overline{CE}_1$ = V_{IL}, CE_2=V_{IH}.
12. $\overline{WE}$ is HIGH for read cycle.
13. Address valid prior to or coincident with $\overline{CE}_1$ transition LOW and CE_2 transition HIGH.

Switching Waveforms

Write Cycle No. 1($\overline{WE}$ Controlled) [10, 14, 16]



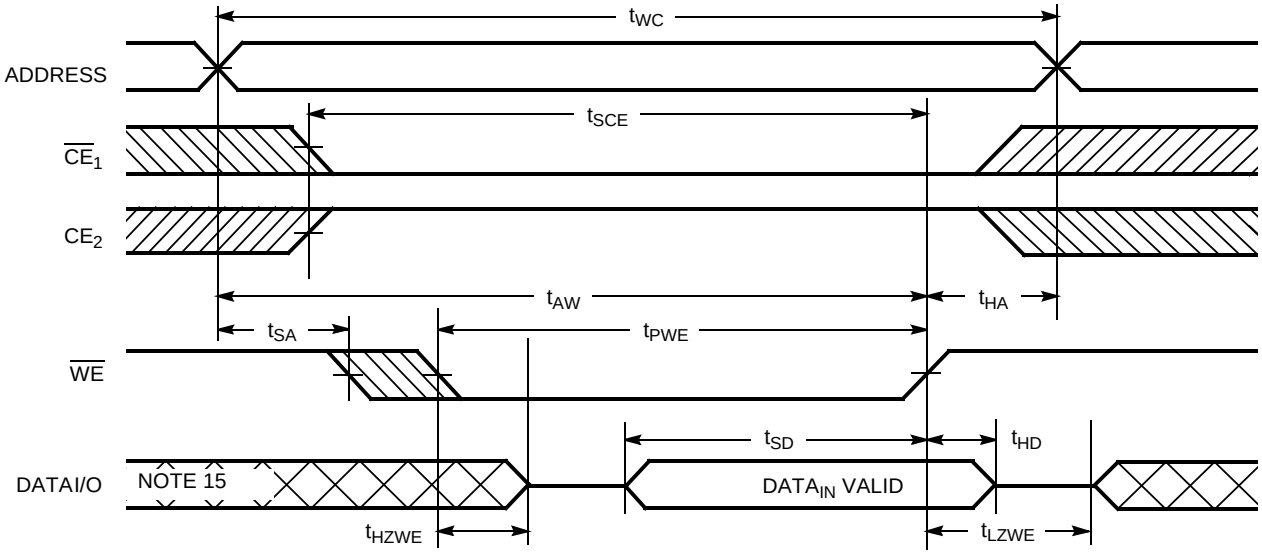
Write Cycle No. 2($\overline{CE_1}$ or CE_2 Controlled) [10, 14, 16]



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

Switching Waveforms

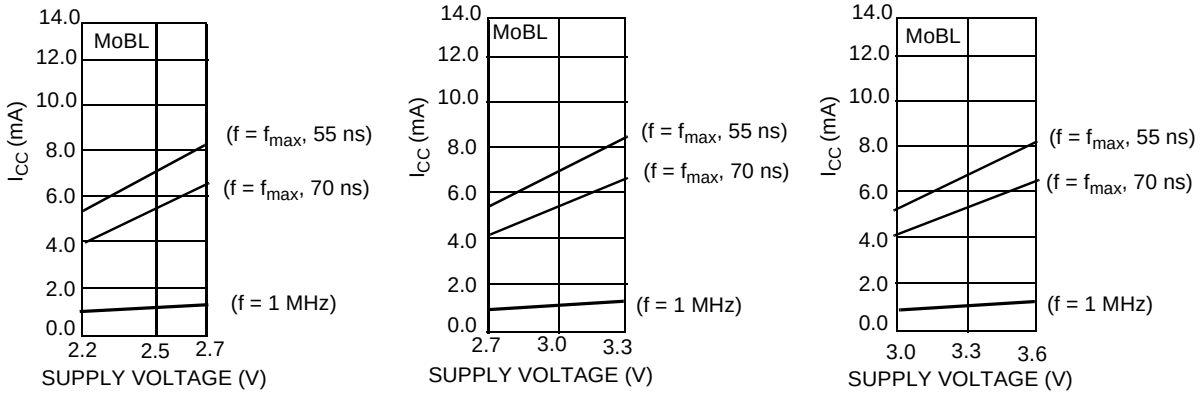
Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) [16]



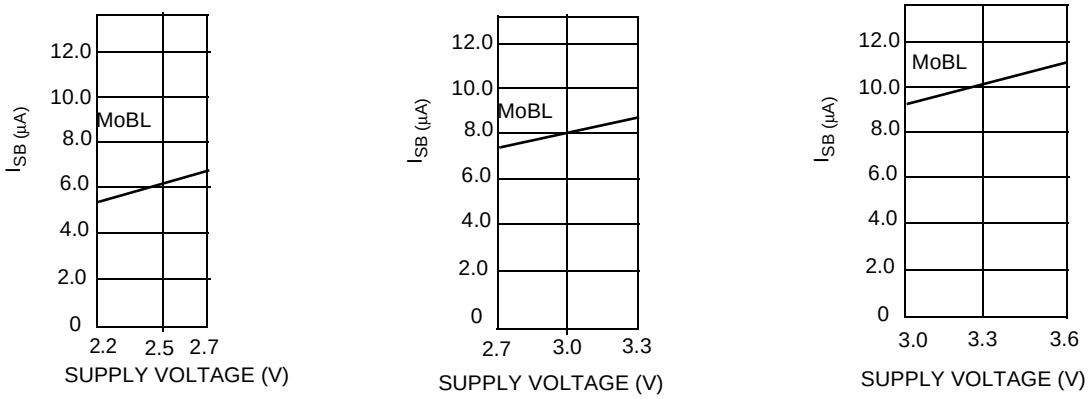
Typical DC and AC Characteristics

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

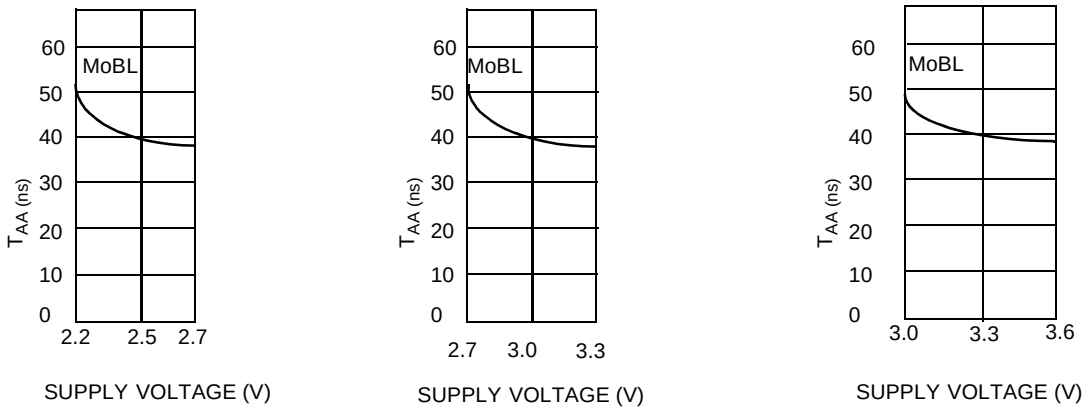
Operating Current vs. Supply Voltage



Standby Current vs. Supply Voltage



Access Time vs. Supply Voltage



Truth Table

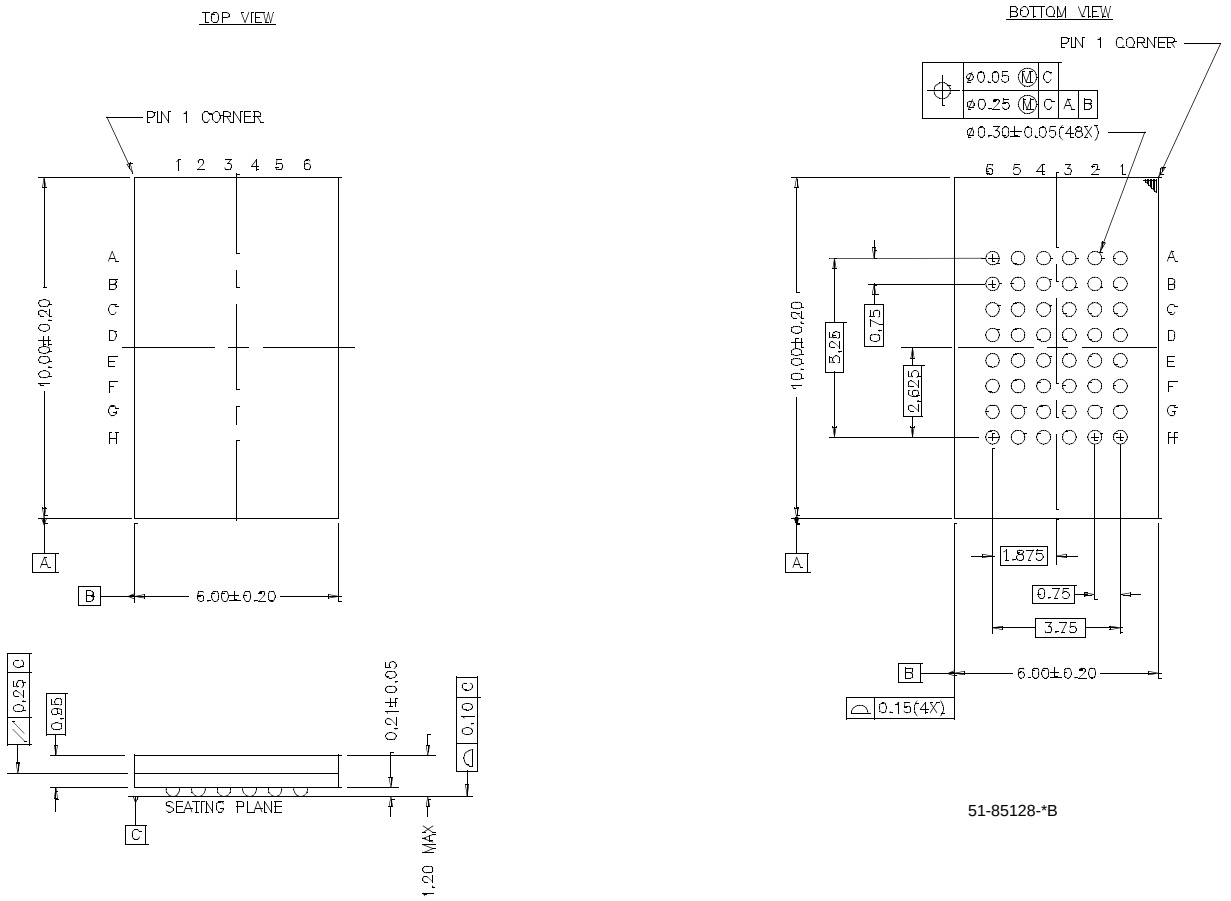
$\overline{CE_1}$	CE_2	$\overline{WE}$	$\overline{OE}$	Inputs/Outputs	Mode	Power
H	X	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
X	L	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
L	H	H	L	Data Out (I/O_0-I/O_7)	Read	Active (I_{CC})
L	H	H	H	High Z	Output Disabled	Active (Icc)
L	H	L	X	Data in (I/O_0-I/O_7)	Write	Active (Icc)

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
70	CY62158CV25LL-70BAI	BA48F	48-Ball Fine Pitch BGA	Industrial
	CY62158CV30LL-70BAI			
	CY62158CV33LL-70BAI			
55	CY62158CV30LL-55BAI			
	CY62158CV33LL-55BAI			

Package Diagrams

48-Ball (6 mm x 10 mm x 1.2 mm) FBGA BA48F



Document Title: CY62158CV25/30/33 MoBL™, 1024K x 8 MoBL Static RAM Document Number: 38-05019				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	106361	05/22/01	MGN	New Data Sheet - Advance Information
*A	107773	07/16/01	MGN	Add 55 ns Bin to Advance Information
*B	111945	01/31/02	GAV	Advance to Final
*C	114219	05/01/02	GUG/ MGN	Improved Typical and Max Icc Values