



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 $\overline{CE}_1$, $\overline{CE}_2$ 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 $\overline{CE}_2$ LOW).

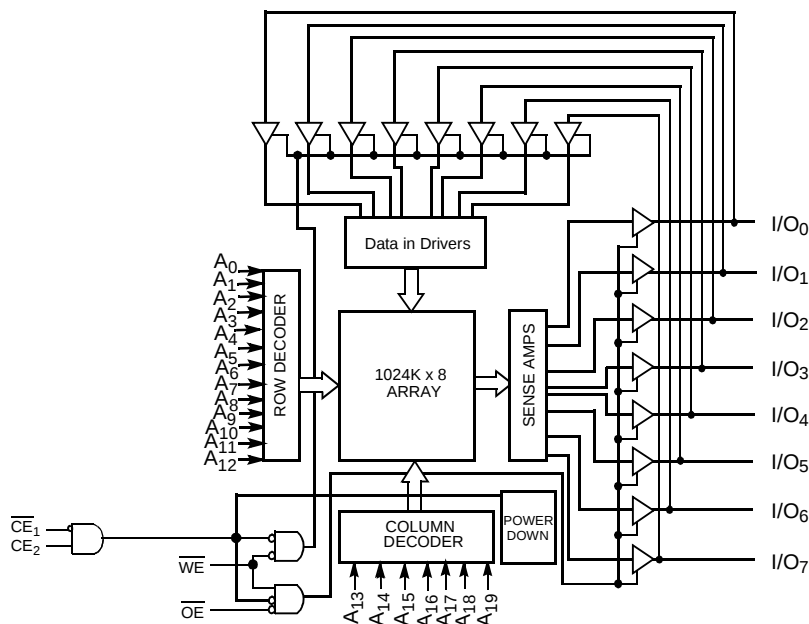
Writing to the device is accomplished by taking Chip Enable 1 ($\overline{CE}_1$) and Write Enable (WE) inputs LOW and Chip Enable 2 ($\overline{CE}_2$) HIGH. Data on the eight I/O pins (I/O₀ through I/O₇) is then written into the location specified on the address pins (A₀ through A₁₉).

Reading from the device is accomplished by taking Chip Enable 1 ($\overline{CE}_1$) and Output Enable (OE) LOW and Chip Enable 2 ($\overline{CE}_2$) HIGH while forcing Write Enable (WE) HIGH. Under these conditions, the contents of the memory location specified by the address pins will appear on the I/O pins.

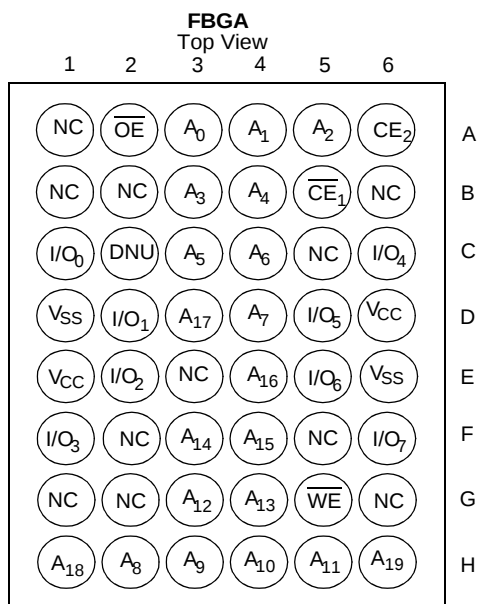
The eight input/output pins (I/O₀ through I/O₇) are placed in a high-impedance state when the device is deselected ($\overline{CE}_1$ LOW and $\overline{CE}_2$ HIGH), the outputs are disabled ($\overline{OE}$ HIGH) or during a write operation ($\overline{CE}_1$ LOW and $\overline{CE}_2$ HIGH and WE LOW).

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

Logic Block Diagram



Pin Configurations ^[1, 2]



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:

- NC pins are not connected to the die.
- C2 (DNU) can be left as NC or V_{SS} to ensure proper application.
- V_{IL(min.)} = –2.0V for pulse durations less than 20 ns.
- 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			CY62158CV25-70			Unit
				Min.	Typ. ^[4]	Max.	Min.	Typ. ^[4]	Max.	
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	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	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			CY62158CV30-70			Unit
				Min.	Typ. ^[4]	Max.	Min.	Typ. ^[4]	Max.	
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	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	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} f = 1 MHz		7 1.5	15 2		5.5 1.5	12 2	mA
		V _{CC} = 3.6V I _{OUT} = 0 mA CMOS Levels							
I _{SB1}	Automatic CE Power-Down Current — CMOS Inputs	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)		10	30		10	30	μA
I _{SB2}	Automatic CE Power-Down Current — CMOS Inputs	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

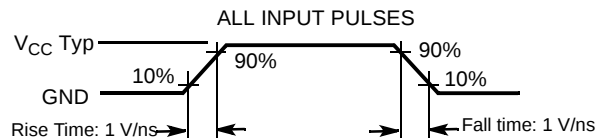
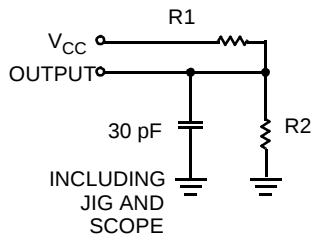
Thermal Resistance

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

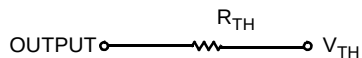
Note:

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

AC Test Loads and Waveforms



Equivalent to: THÉVENIN EQUIVALENT

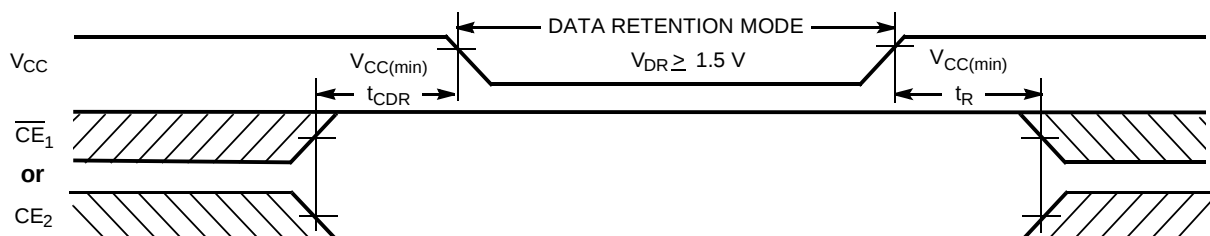


Parameters	2.5V	3.0V	3.3V	Unit
R1	16.6	1.105	1.216	K Ohms
R2	15.4	1.550	1.374	K Ohms
R _{TH}	8.0	0.645	0.645	K Ohms
V _{TH}	1.20	1.75	1.75	Volts

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	V _{CC} = 1.5V CE ₁ ≥ V _{CC} - 0.2V or CE ₂ ≤ 0.2V V _{IN} ≥ V _{CC} - 0.2V or V _{IN} ≤ 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:

- Full Device AC operation requires linear V_{CC} ramp from V_{DR} to V_{CC(min.)} ≥ 100 μs or stable at V_{CC(min.)} ≥ 100 μs.

Switching Characteristics Over the Operating Range^[7]

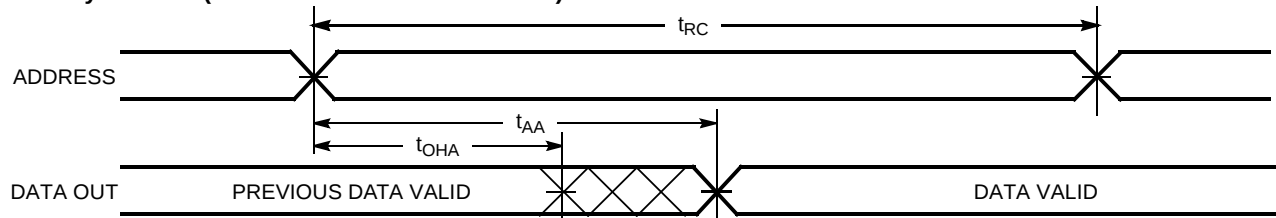
Parameter	Description	55 ns		70 ns		Unit
		Min.	Max.	Min.	Max.	
READ CYCLE						
t _{RC}	Read Cycle Time	55		70		ns
t _{AA}	Address to Data Valid		55		70	ns
t _{OHA}	Data Hold from Address Change	10		10		ns
t _{ACE}	$\overline{CE}_1$ LOW and CE ₂ HIGH to Data Valid		55		70	ns
t _{DOE}	$\overline{OE}$ 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:

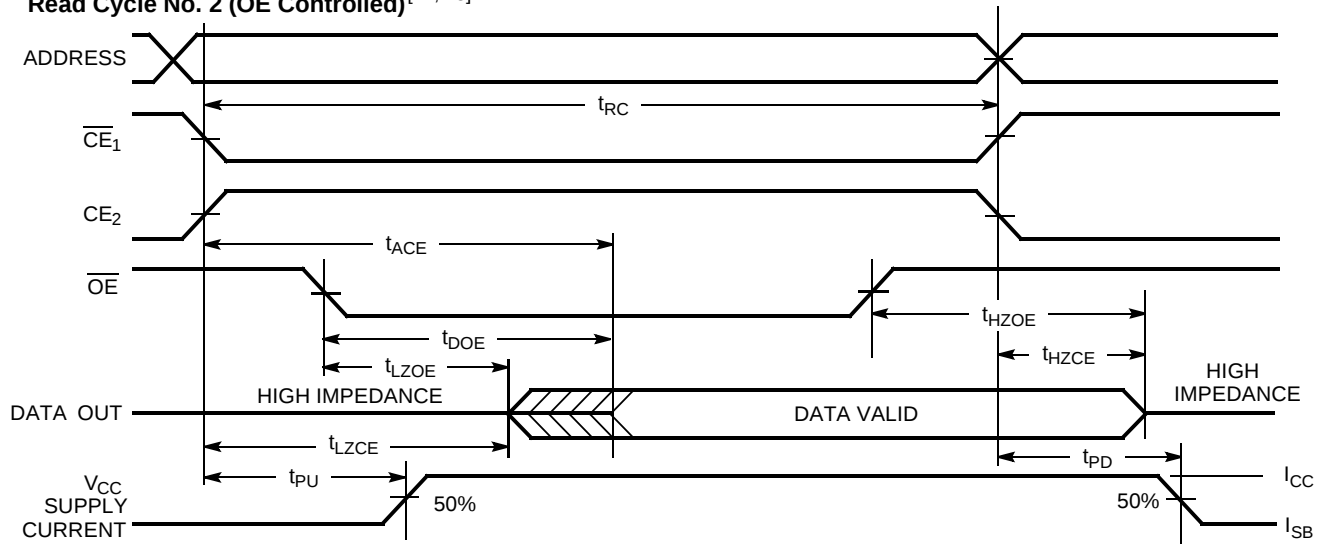
- Test conditions assume signal transition time of 5 ns or less, timing reference levels of $V_{CC(typ.)}/2$, input pulse levels of 0 to $V_{CC(typ.)}$, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE} , t_{HZOE} is less than t_{LZOE} , and t_{HZWE} is less than t_{LZWE} for any given device.
- t_{HZOE} , t_{HZCE} , and t_{HZWE} transitions are measured when the outputs enter a high impedance state.
- 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 ($\overline{\text{OE}}$ Controlled)^[12, 13]

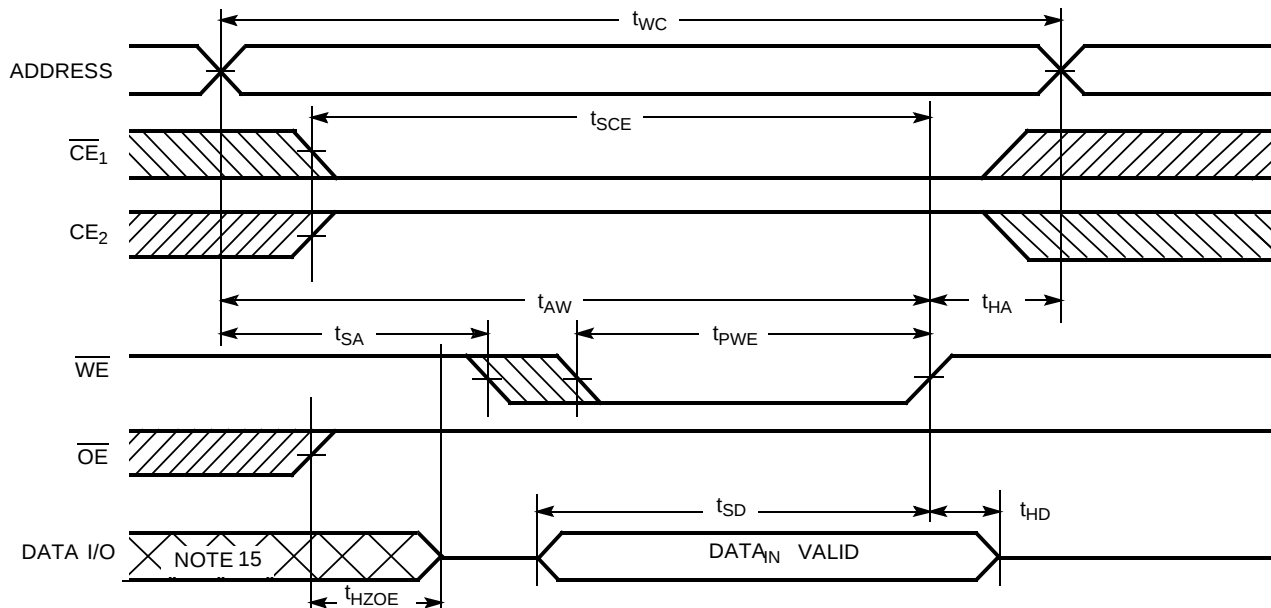


Notes:

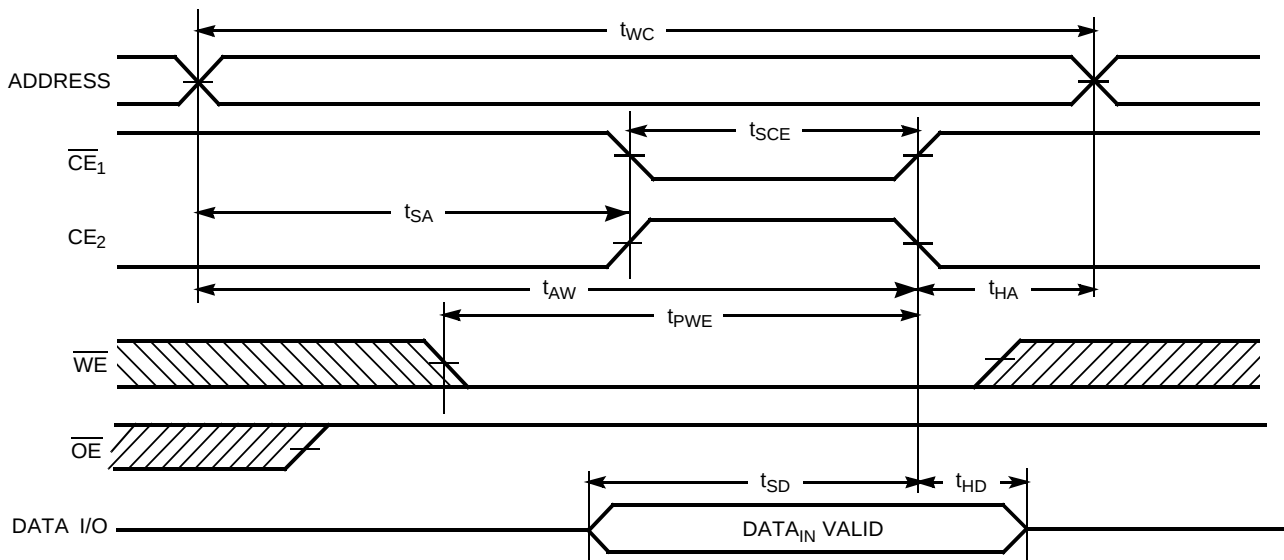
11. Device is continuously selected. $\overline{\text{OE}}$, $\overline{\text{CE}}_1 = V_{\text{IL}}$, $\text{CE}_2 = V_{\text{IH}}$.
12. WE is HIGH for read cycle.
13. Address valid prior to or coincident with $\overline{\text{CE}}_1$ transition LOW and CE_2 transition HIGH.

Switching Waveforms

Write Cycle No. 1(WE Controlled) ^[10, 14, 16]



Write Cycle No. 2(CE₁ or CE₂ Controlled) ^[10, 14, 16]

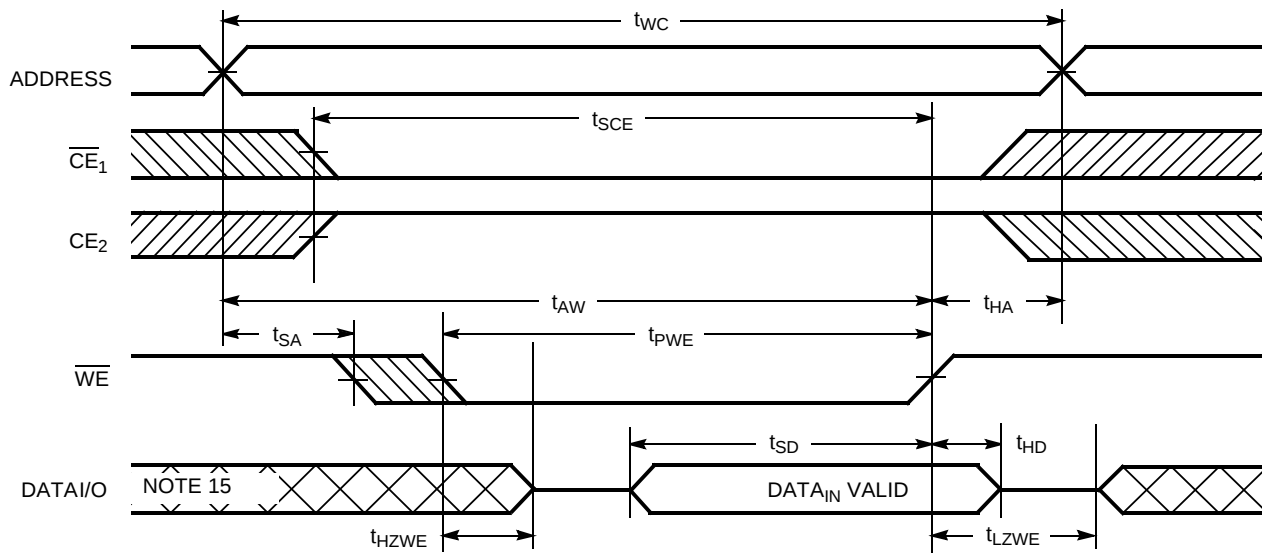


Notes:

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 CE₁ goes HIGH or CE₂ goes LOW simultaneously with WE HIGH, the output remains in high-impedance state.

Switching Waveforms

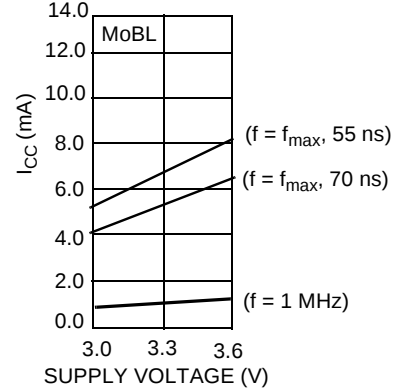
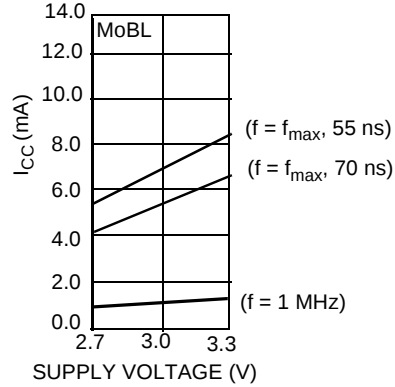
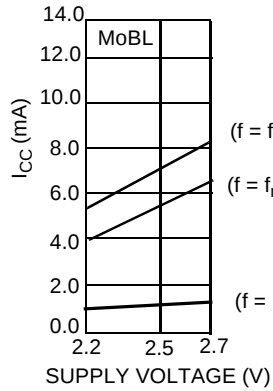
Write Cycle No. 3 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ LOW)^[16]



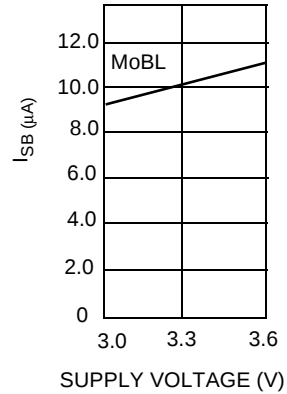
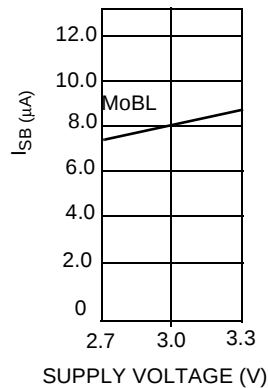
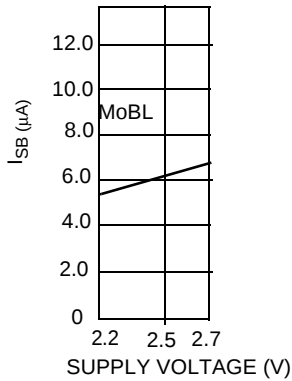
Typical DC and AC Characteristics

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

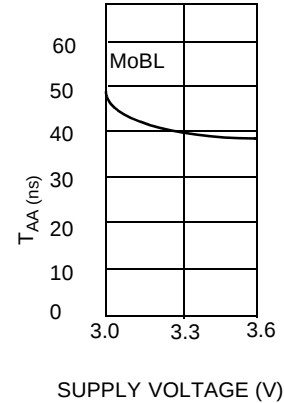
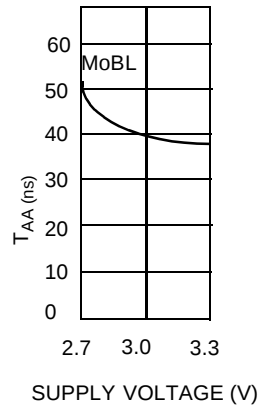
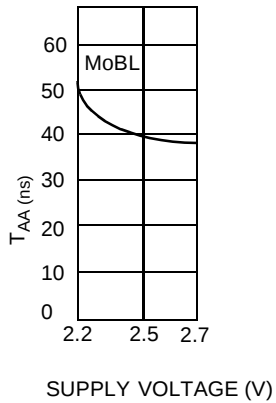
Operating Current vs. Supply Voltage



Standby Current vs. Supply Voltage



Access Time vs. Supply Voltage



Truth Table

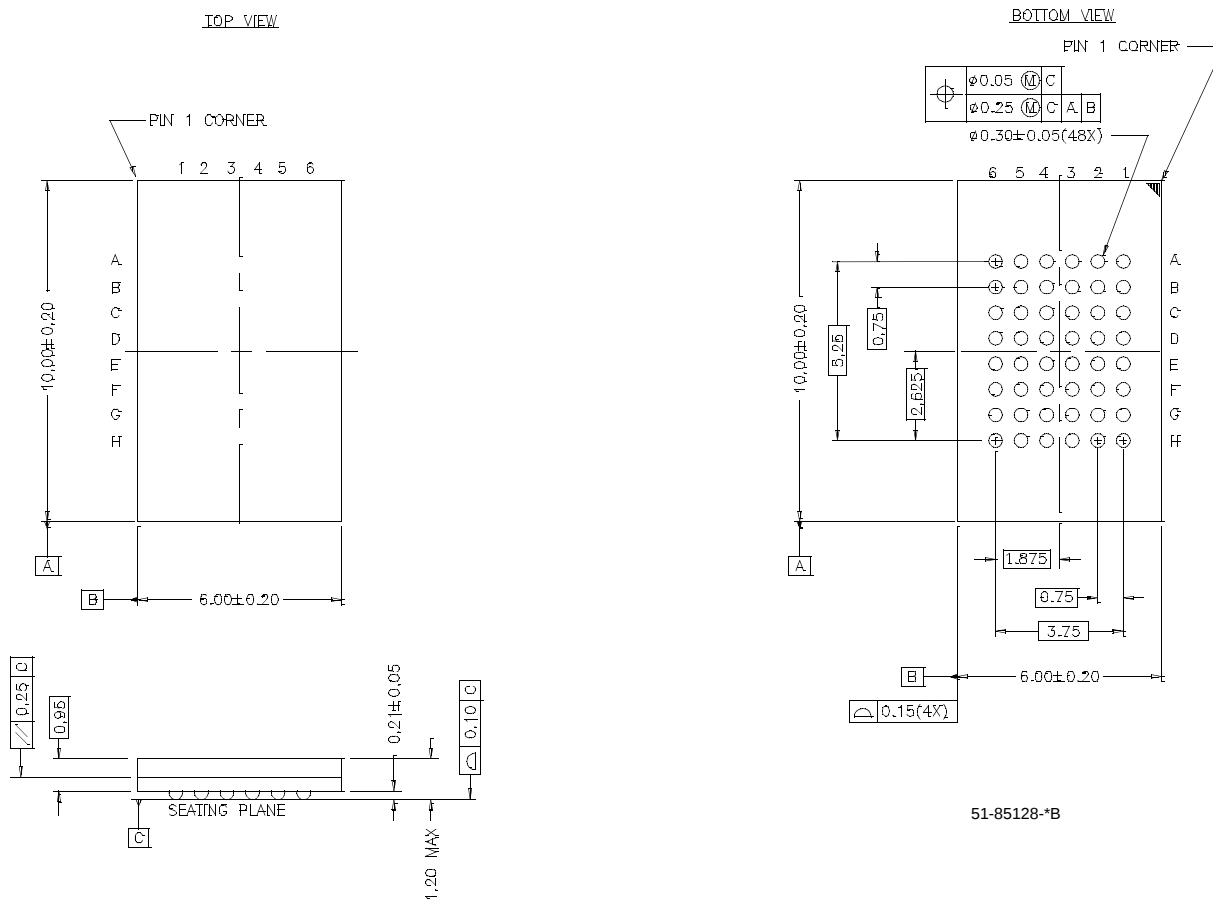
CE ₁	CE ₂	WE	OE	Inputs/Outputs	Mode	Power
H	X	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
X	L	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
L	H	H	L	Data Out (I/O_0 - I/O_7)	Read	Active (I_{CC})
L	H	H	H	High Z	Output Disabled	Active (I_{CC})
L	H	L	X	Data in (I/O_0 - I/O_7)	Write	Active (I_{CC})

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



MoBL, MoBL2 and More Battery Life are trademarks of Cypress Semiconductor Corporation. All product and company names mentioned in this document may be the trademarks of their respective holders.

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