

4M (256K x 16) Static RAM

Features

- Wide voltage range: 2.7V–3.6V
- Ultra-low active, standby power
- Easy memory expansion with $\overline{CE}$ and $\overline{OE}$ features
- TTL-compatible inputs and outputs
- Automatic power-down when deselected
- CMOS for optimum speed/power
- Package available in a standard 44-pin TSOP Type II (forward pinout) package

Functional Description^[1]

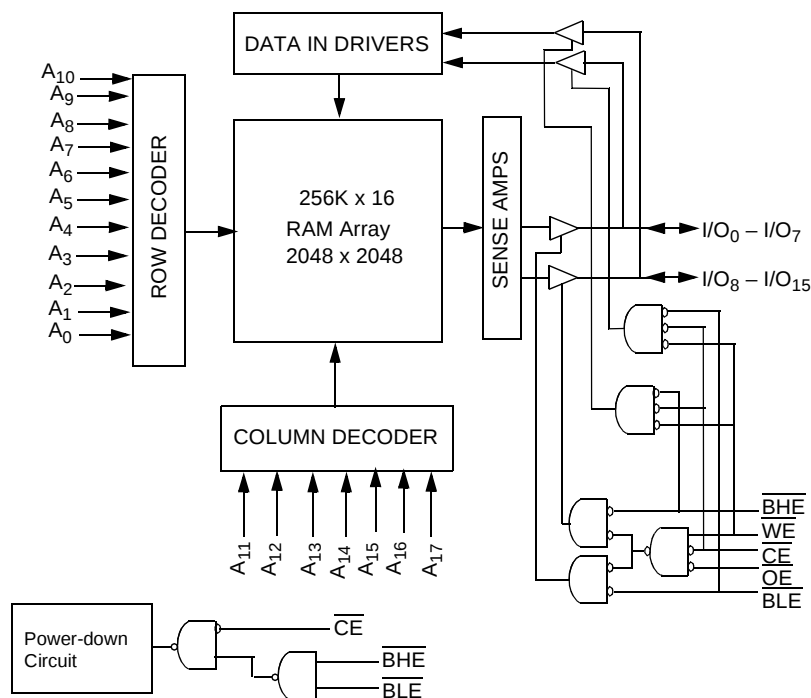
The CY62147V is a high-performance CMOS static RAM organized as 256K words by 16 bits. These devices feature advanced circuit design to provide ultra-low active current. This is ideal for providing More Battery Life™ (MoBL®) in portable applications such as cellular telephones. The devices also have 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) or when $\overline{CE}$ is LOW and both $\overline{BLE}$ and $\overline{BHE}$ are 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_{17}). 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.

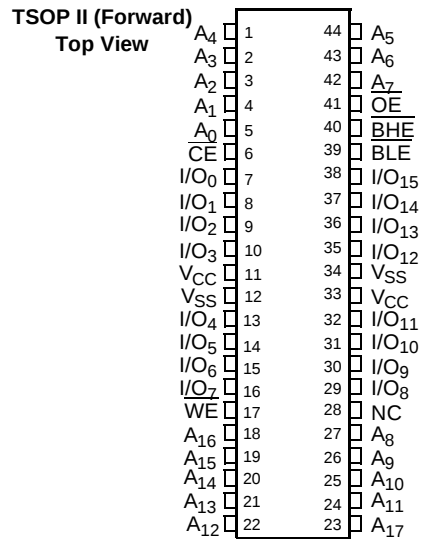
Logic Block Diagram



Note:

1. For best practice recommendations, please refer to the Cypress application note "System Design Guidelines" on <http://www.cypress.com>.

Pin Configurations



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 +4.6V

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

Range	Ambient Temperature	V _{CC}
Industrial	-40°C to +85°C	2.7V to 3.6V

Product Portfolio

Product	V _{CC} Range (V)			Speed (ns)	Power Dissipation			
					Operating I _{CC} , (mA)		Standby I _{SB2} , (μA)	
	V _{CC(min.)}	V _{CC(typ.)} ^[3]	V _{CC(max.)}		Typ. ^[3]	Maximum	Typ. ^[3]	Maximum
CY62147VLL	2.7	3.0	3.6	70	7	15	2	20

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		CY62147V-70			Unit
				Min.	Typ. ^[3]	Max.	
V _{OH}	Output HIGH Voltage	I _{OH} = -1.0 mA	V _{CC} = 2.7V	2.4			V
V _{OL}	Output LOW Voltage	I _{OL} = 2.1 mA	V _{CC} = 2.7V			0.4	V
V _{IH}	Input HIGH Voltage		V _{CC} = 3.6V	2.2		V _{CC} + 0.5V	V
V _{IL}	Input LOW Voltage		V _{CC} = 2.7V	-0.5		0.8	V
I _{IX}	Input Load Current	GND ≤ V _I ≤ V _{CC}		-1	±1	+1	μA
I _{OZ}	Output Leakage Current	GND ≤ V _O ≤ V _{CC} , Output Disabled		-1	+1	+1	μA
I _{CC}	V _{CC} Operating Supply Current	I _{OUT} = 0 mA, f = f _{MAX} = 1/t _{RC} , CMOS Levels	V _{CC} = 3.6V		7	15	mA
		I _{OUT} = 0 mA, f = 1 MHz, CMOS Levels			1	2	mA

Notes:

2. V_{IL(min.)} = -2.0V for pulse durations less than 20 ns.

3. 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 (continued)

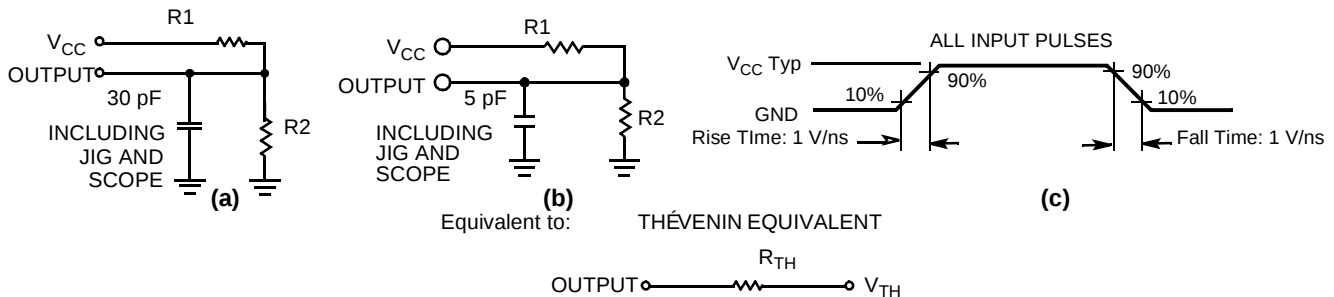
Parameter	Description	Test Conditions	CY62147V-70			Unit
			Min.	Typ. ^[3]	Max.	
I_{SB1}	Automatic CE Power-down Current—CMOS Inputs	$CE \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$, $f = f_{MAX}$		2	20	μA
I_{SB2}	Automatic CE Power-down Current—CMOS Inputs	$CE \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$, or $V_{IN} \leq 0.3V$, $f = 0$				

Capacitance^[4]

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

Thermal Resistance

Parameter	Description	Test Conditions	BGA	TSOPII	Units
θ_{JA}	Thermal Resistance (Junction to Ambient) ^[4]	Still Air, soldered on a 4.25 x 1.125 inch, 4-layer printed circuit board	55	60	$^\circ C/W$
θ_{JC}	Thermal Resistance (Junction to Case) ^[4]		16	22	$^\circ C/W$

AC Test Loads and Waveforms


Parameter	3.0V	Unit
R1	1105	Ω
R2	1550	Ω
R_{TH}	645	Ω
V_{TH}	1.75	V

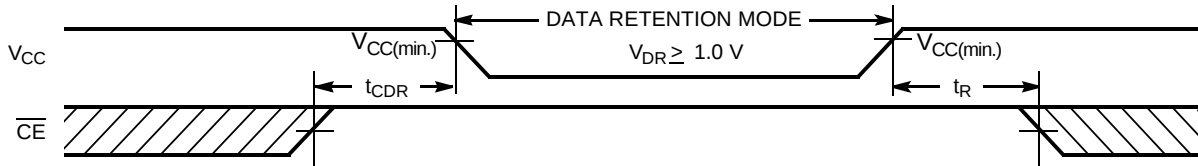
Data Retention Characteristics (Over the Operating Range)

Parameter	Description	Conditions	Min.	Typ. ^[3]	Max.	Unit
V_{DR}	V_{CC} for Data Retention		1.0		3.6	V
I_{CCDR}	Data Retention Current	$V_{CC} = 1.0V$, $CE \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$; No input may exceed $V_{CC} + 0.3V$		1	10	μA
$t_{CDR}^{[4]}$	Chip Deselect to Data Retention Time		0			ns
$t_R^{[5]}$	Operation Recovery Time		70			ns

Note:

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

Data Retention Waveform



Switching Characteristics Over the Operating Range^[6]

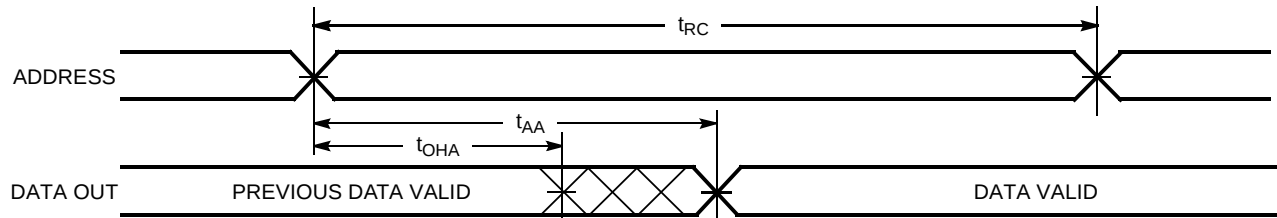
Parameter	Description	70 ns		Unit
		Min.	Max.	
Read Cycle				
t _{RC}	Read Cycle Time	70		ns
t _{AA}	Address to Data Valid		70	ns
t _{OHA}	Data Hold from Address Change	10		ns
t _{ACE}	CE LOW to Data Valid		70	ns
t _{DOE}	OE LOW to Data Valid		25	ns
t _{LZOE}	OE LOW to Low-Z ^[7, 9]	5		ns
t _{HZOE}	OE HIGH to High-Z ^[9]		20	ns
t _{LZCE}	CE LOW to Low-Z ^[7]	10		ns
t _{HZCE}	CE HIGH to High-Z ^[7, 9]		20	ns
t _{PU}	CE LOW to Power-up	0		ns
t _{PD}	CE HIGH to Power-down		70	ns
t _{DBE}	BHE / BLE LOW to Data Valid		70	ns
t _{LZBE} ^[8]	BHE / BLE LOW to Low-Z	5		ns
t _{HZBE}	BHE / BLE HIGH to High-Z		20	ns
Write Cycle ^[10, 11]				
t _{WC}	Write Cycle Time	70		ns
t _{SCE}	CE LOW to Write End	60		ns
t _{AW}	Address Set-up to Write End	60		ns
t _{HA}	Address Hold from Write End	0		ns
t _{SA}	Address Set-up to Write Start	0		ns
t _{PWE}	WE Pulse Width	40		ns
t _{BW}	BHE / BLE Pulse Width	60		ns
t _{SD}	Data Set-up to Write End	30		ns
t _{HD}	Data Hold from Write End	0		ns
t _{HZWE}	WE LOW to High-Z ^[7, 9]		25	ns
t _{LZWE}	WE HIGH to Low-Z ^[7]	10		ns

Notes:

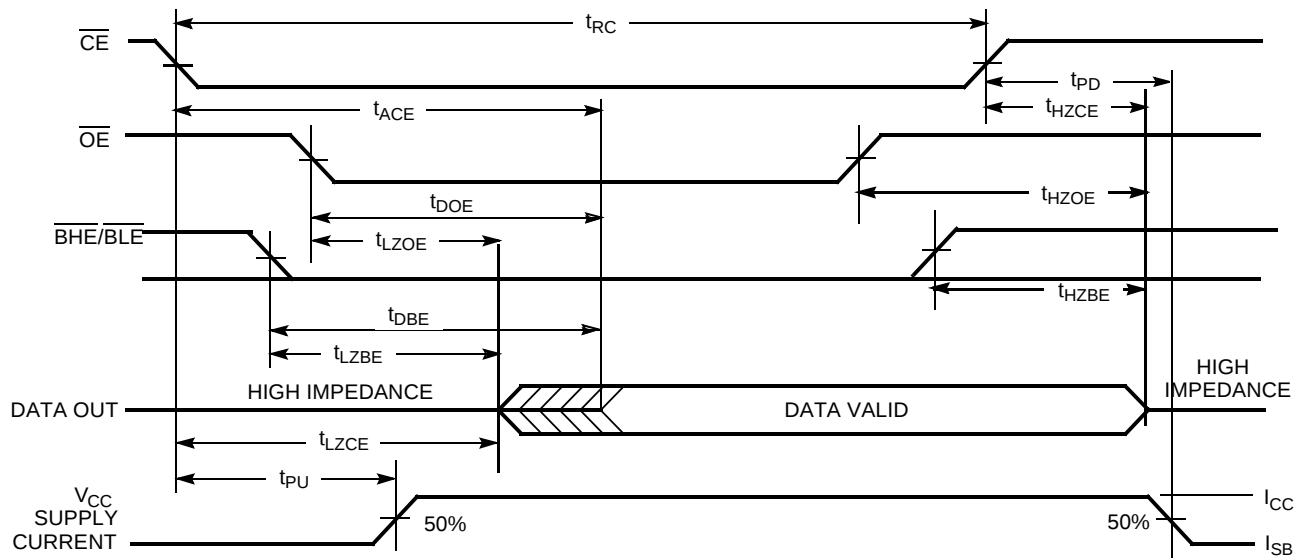
- Full Device AC operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} > 10 \mu s$ or stable at $V_{CC(min.)} > 10 \mu s$.
- Test conditions assume signal transition time of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to $V_{CC(typ.)}$, and output loading of the 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.
- If both byte enables are toggled together this value is 10ns
- t_{HZOE} , t_{HZCE} , and t_{HZWE} are specified with $C_L = 5$ pF as in part (b) of AC Test Loads. Transition is measured ± 500 mV from steady-state voltage.
- The internal write time of the memory is defined by the overlap of CE LOW and WE LOW. Both signals must be LOW to initiate a write and either signal can terminate a write by going HIGH. The data input set-up and hold timing should be referenced to the rising edge of the signal that terminates the write.
- The minimum write cycle time for Write Cycle #3 (WE controlled, OE LOW) is the sum of t_{HZWE} and t_{SD} .

Switching Waveforms

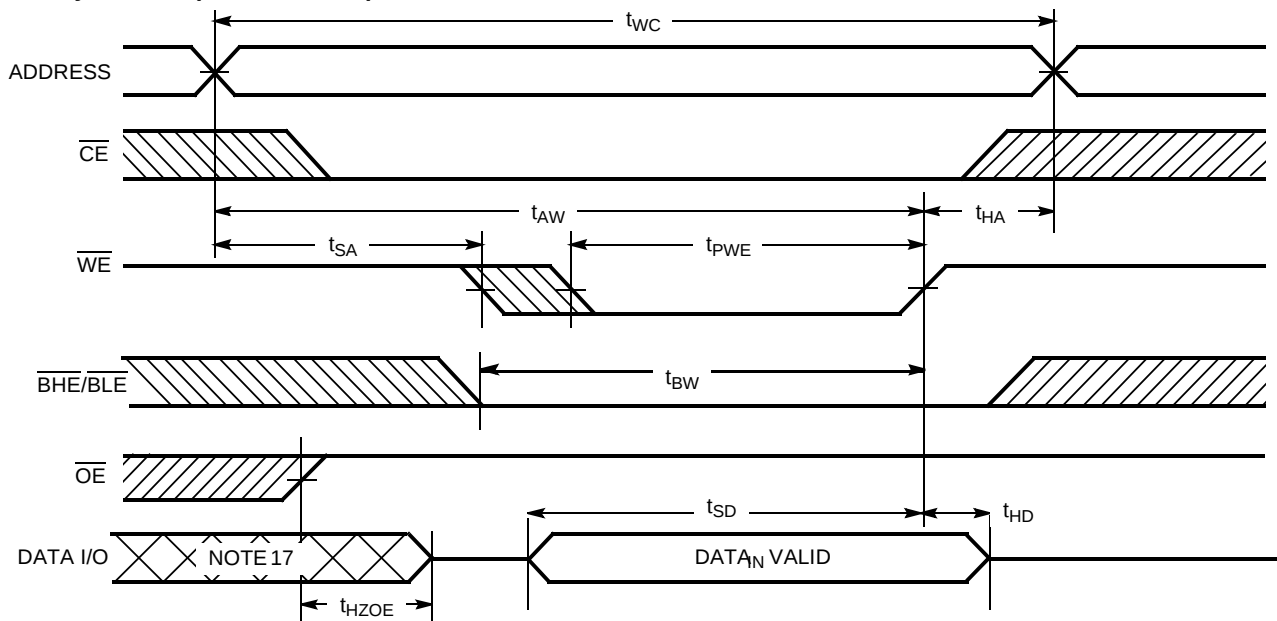
Read Cycle No. 1 [12, 13]



Read Cycle No. 2 [13, 14]

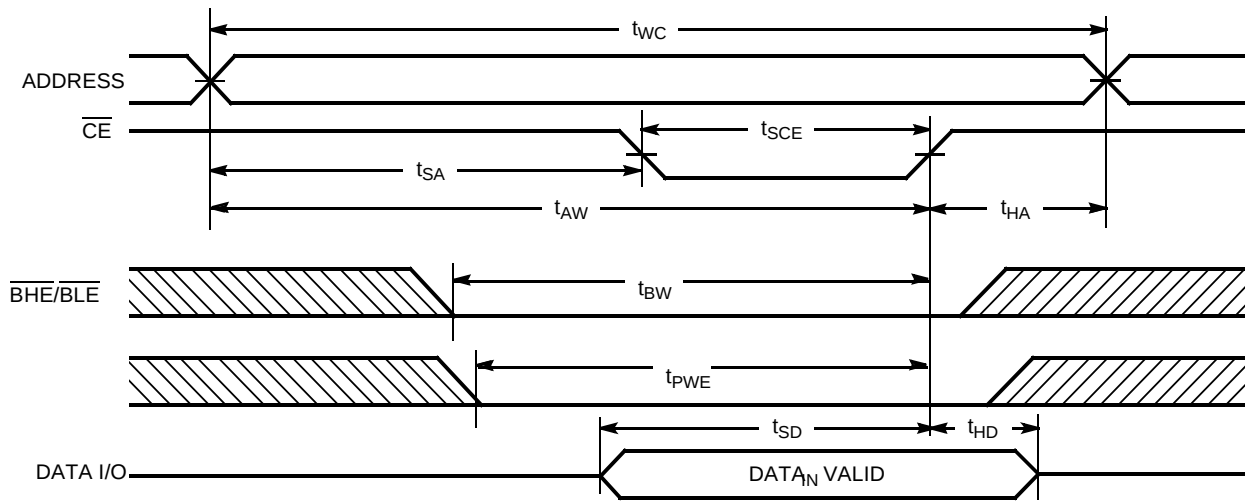
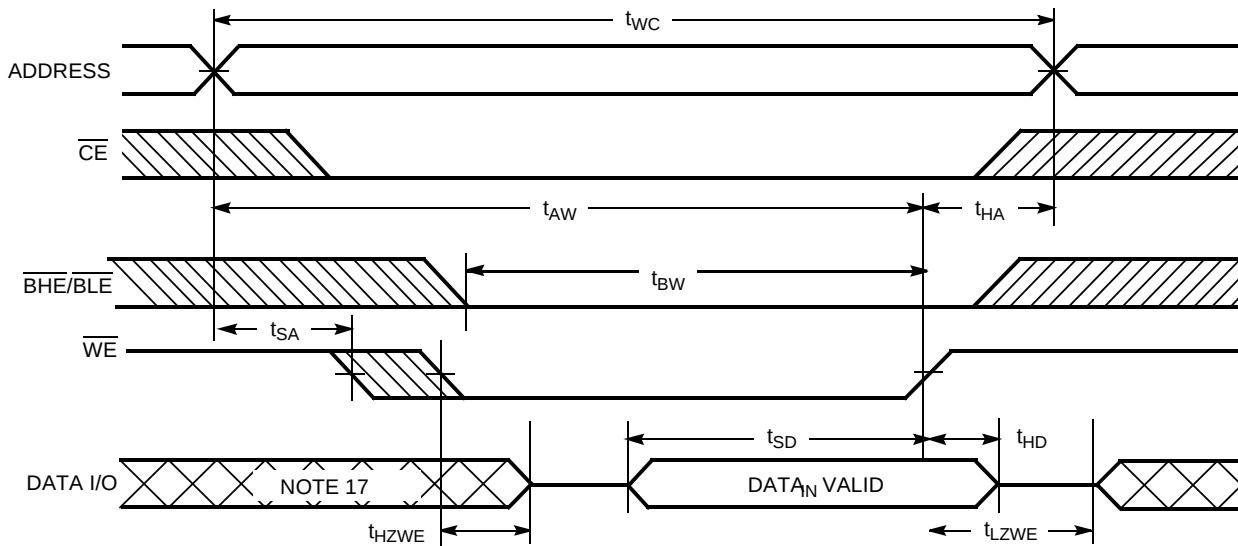


Write Cycle No. 1 (WE Controlled) [10, 15, 16]

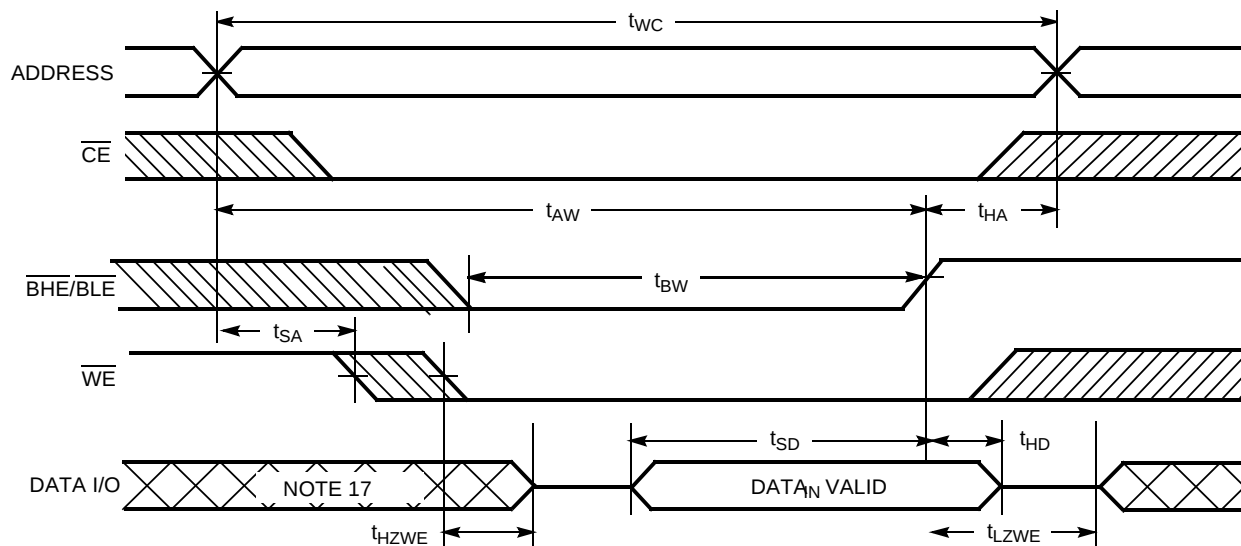
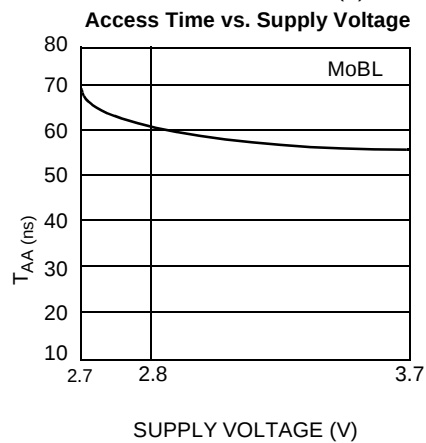
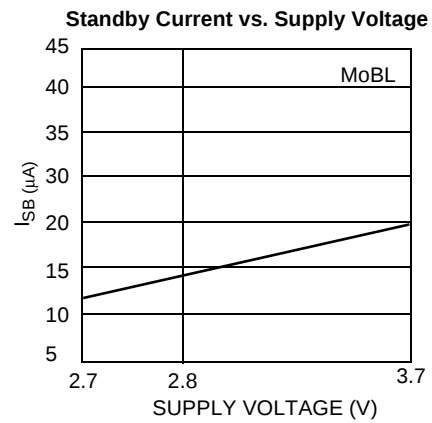
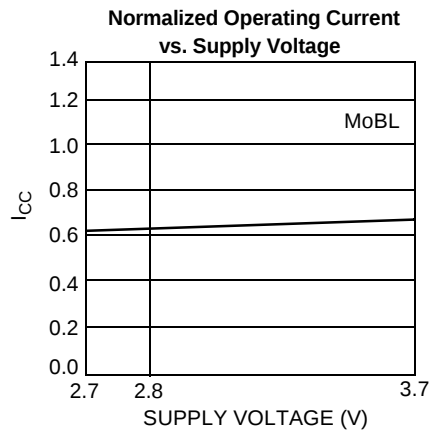


Notes:

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

Switching Waveforms (continued)
Write Cycle No. 2 ($\overline{\text{CE}}$ Controlled)^[8, 15, 16]

Write Cycle No. 3 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ LOW)^[11, 16]

Notes:

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

Switching Waveforms (continued)
Write Cycle No. 4 ($\overline{\text{BHE/BLE}}$ Controlled, $\overline{\text{OE}}$ LOW)^[17]

Typical DC and AC Characteristics


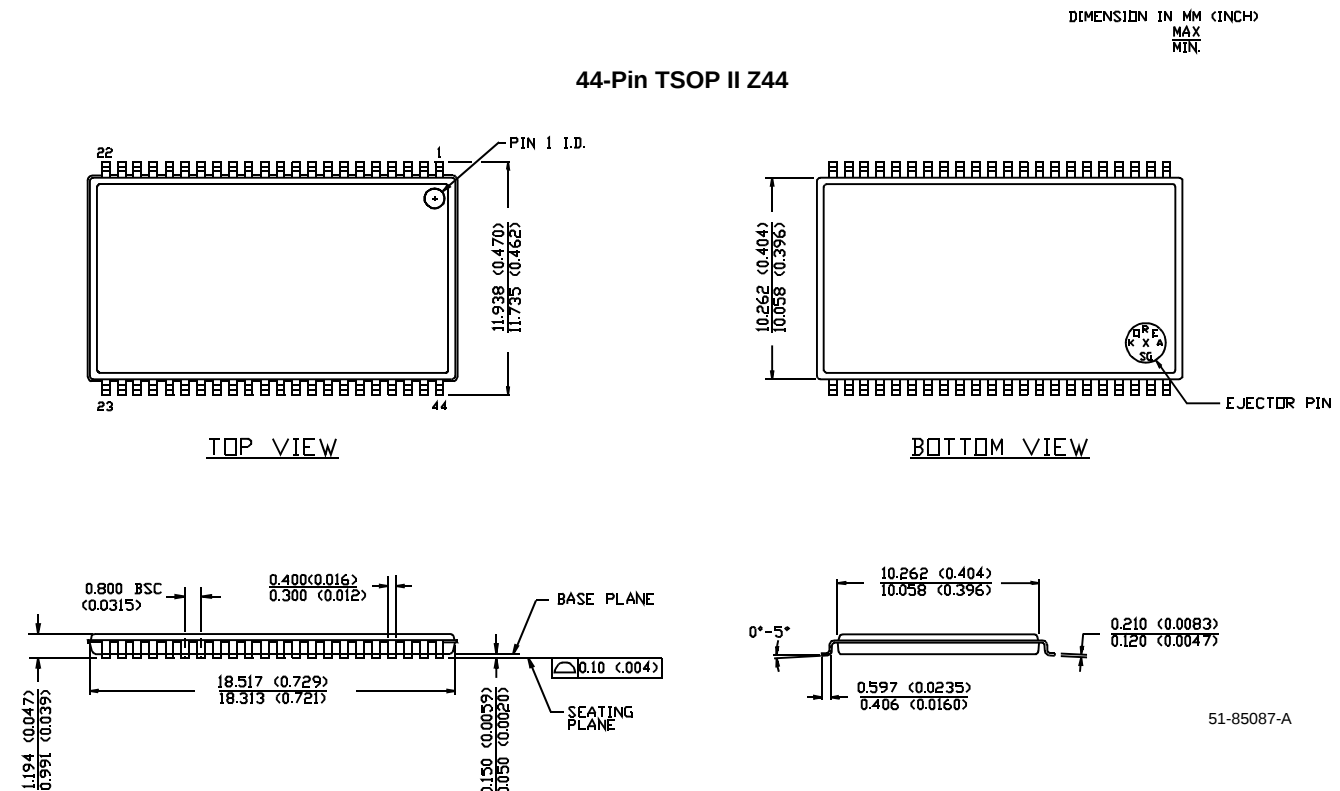
Truth Table

$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Inputs/Outputs	Mode	Power
H	X	X	X	X	High-Z	Deselect/Power-down	Standby (I_{SB})
L	X	X	H	H	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	H	L	L	High-Z	Deselect/Output Disabled	Active (I_{CC})
L	H	H	H	L	High-Z	Deselect/Output Disabled	Active (I_{CC})
L	H	H	L	H	High-Z	Deselect/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})

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
70	CY62147VLL-70ZI	Z44	44-pin TSOP II	Industrial

Package Diagram



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Document Number: 38-05050

REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	109958	12/16/01	SZV	Changed from Spec number: 38-00757 to 38-05050
A	116514	09/04/02	GBI	Added footnote 1. Deleted fBGA package (replacement fBGA package is available in CY62147CV30).