CY62146V MoBL™
CY62146V18 MoBL2™

256K x 16 Static RAM

Features

- **Low voltage range:**
  - **— CY62146V18: 1.65V–1.95V**
  - **— CY62146V: 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**

Functional Description

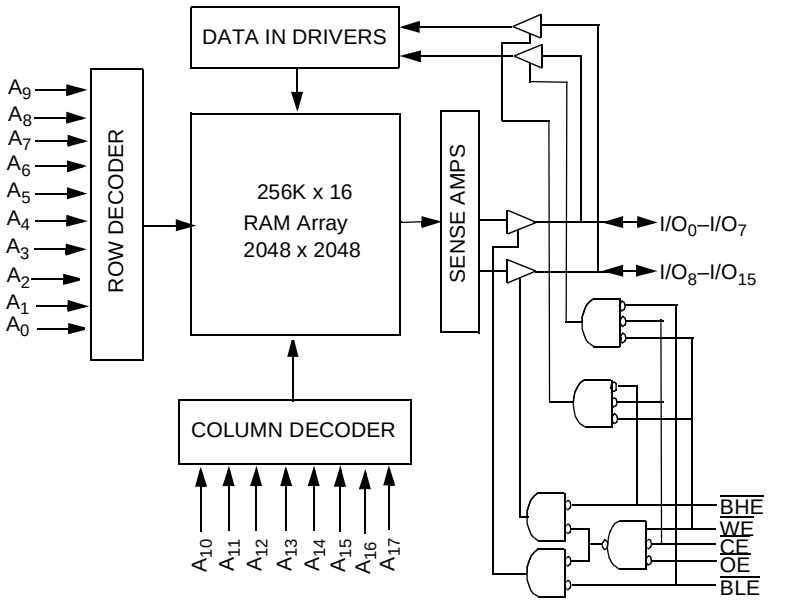
The CY62146V and CY62146V18 are high-performance CMOS static RAMs organized as 262,144 words by 16 bits. These devices feature advanced circuit design to provide ultra-low active current. This is ideal for providing More Battery Life™ (MoBL™) in portable applications such as cellular telephones. The 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 CY62146V and CY62146V18 are available in 48-Ball FBGA and standard 44-Pin TSOP Type II (forward pinout) packaging.

Logic Block Diagram

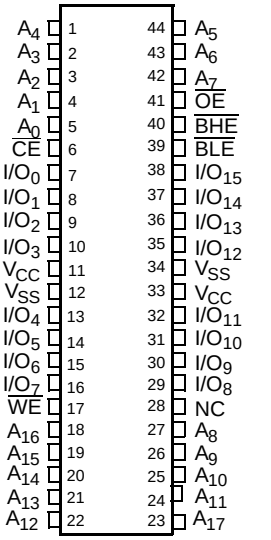


62146V–1

Pin Configurations

TSOP II (Forward)

Top View

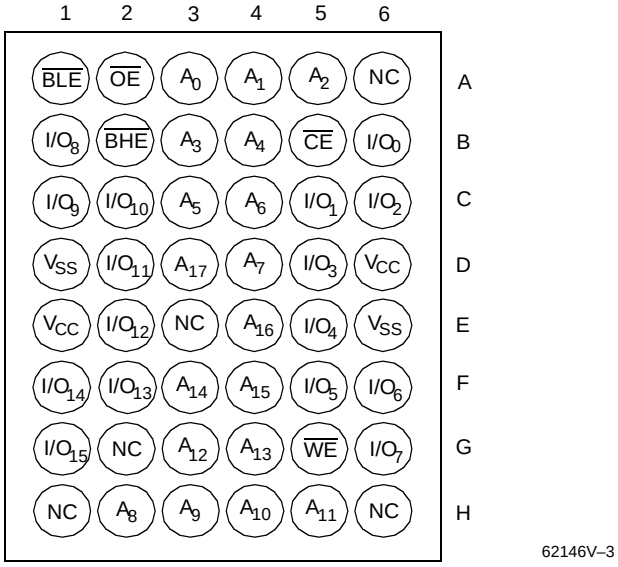


62146V–2

Pin Configuration (continued)

FBGA

Top View



62146V–3

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[1] ..... –0.5V to V_{CC} + 0.5V

DC Input Voltage[1] ..... –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}
CY62146V18	Industrial	–40°C to +85°C	1.65V to 1.95V
CY62146V	Industrial	–40°C to +85°C	2.7V to 3.6V

Product Portfolio

Product	V_{CC} Range			Speed	Power Dissipation (Industrial)			
					Operating (I_{CC})		Standby (I_{SB2})	
	$V_{CC(min)}$	$V_{CC(typ)}$[2]	$V_{CC(max)}$		Typ.[2]	Maximum	Typ.[2]	Maximum
CY62146V	2.7V	3.0V	3.6V	70 ns	7 mA	15 mA	2 µA	20 µA
CY62146V18	1.65V	1.80V	1.95V	70 ns	3 mA	7 mA		20 µA

Shaded areas contain preliminary information.

Notes:

1. V_{IL}(min) = –2.0V for pulse durations less than 20 ns.
2. 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			CY62146V Min.	CY62146V Typ.[2]	CY62146V Max.	Unit
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
I_{SB1}	Automatic CE Power-Down Current—CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V or V_{IN} ≤ 0.3V, f = f_{MAX}					100	µA
I_{SB2}	Automatic CE Power-Down Current—CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.3V V_{IN} ≥ V_{CC} – 0.3V or V_{IN} ≤ 0.3V, f = 0	V_{CC} = 3.6V	LL		2	20	µA

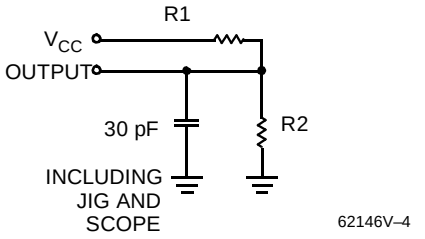
Parameter	Description	Test Conditions			CY62146V18 Min.	CY62146V18 Typ.[2]	CY62146V18 Max.	Unit
V_{OH}	Output HIGH Voltage	I_{OH} = –0.1 mA	V_{CC} = 1.65V		1.5			V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA	V_{CC} = 1.65V				0.2	V
V_{IH}	Input HIGH Voltage		V_{CC} = 1.95V		1.4		V_{CC} + 0.3V	V
V_{IL}	Input LOW Voltage		V_{CC} = 1.65V		–0.5		0.4	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} = 1.95V			3	7	mA
		I_{OUT} = 0 mA, f = 1 MHz, CMOS Levels				1	2	mA
I_{SB1}	Automatic CE Power-Down Current—CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V or V_{IN} ≤ 0.3V, f = f_{MAX}					100	µA
I_{SB2}	Automatic CE Power-Down Current—CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.3V V_{IN} ≥ V_{CC} – 0.3V or V_{IN} ≤ 0.3V, f = 0	V_{CC} = 1.95V	LL		2	20	µA

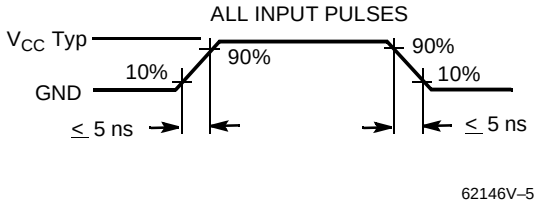
Capacitance[3]

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

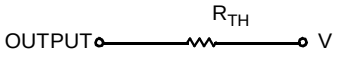
Note:
3. Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms





Equivalent to: THÉVENIN EQUIVALENT



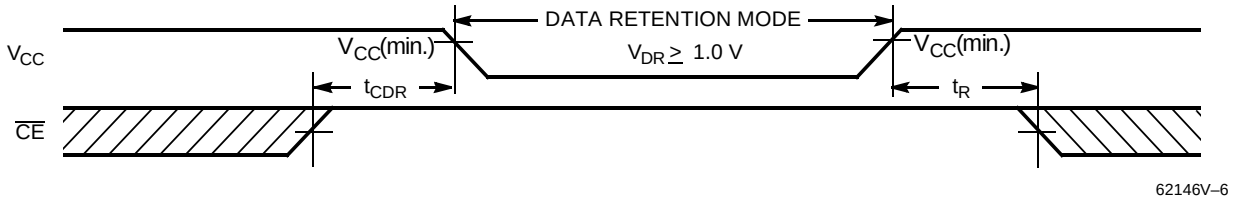
Parameters	3.0V	1.8V	Unit
R1	1105	15294	Ohms
R2	1550	11300	Ohms
R_{TH}	645	6500	Ohms
V_{TH}	1.75V	0.85V	Volts

Shaded areas contain preliminary information.

Data Retention Characteristics (Over the Operating Range)

Parameter	Description	Conditions		Min.	Typ.[2]	Max.	Unit
V_{DR}	V_{CC} for Data Retention (CY62146V18)			1.0		1.95	V
V_{DR}	V_{CC} for Data Retention (CY62146V)			1.0		3.6	V
I_{CCDR}	Data Retention Current	V_{CC}= 1.0V $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$ No input may exceed V_{CC} + 0.3V	LL		0.2	5.5	µA
t_{CDR}[3]	Chip Deselect to Data Retention Time			0			ns
t_R[4]	Operation Recovery Time			100			µs

Data Retention Waveform



Note:

4. 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[5]

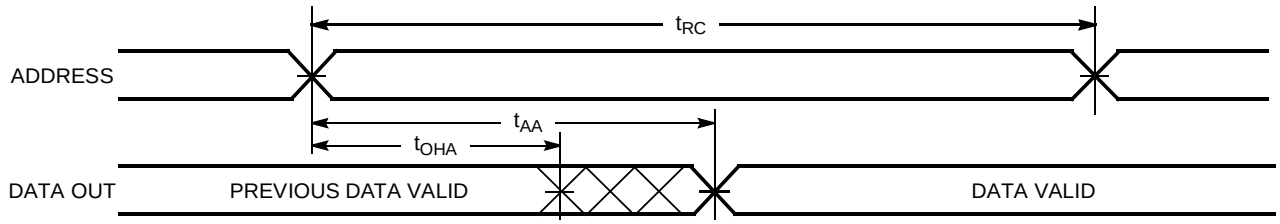
Parameter	Description	70 ns		Unit
		Min.	Max.	
READ CYCLE				
t_{RC}	Read Cycle Time	70		ns
t_{AA}	Address to Data Valid		70	ns
t_{OHA}	Data Hold from Address Change	10		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		70	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		35	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z[6, 7]	5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[7]		25	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[6]	10		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[6, 7]		25	ns
t_{PU}	$\overline{CE}$ LOW to Power-Up	0		ns
t_{PD}	$\overline{CE}$ HIGH to Power-Down		70	ns
t_{DBE}	$\overline{BLE}$ / $\overline{BHE}$ LOW to Data Valid		35	ns
t_{LZBE}	$\overline{BLE}$ / $\overline{BHE}$ LOW to Low Z[6, 7]	5		ns
t_{HZBE}	$\overline{BLE}$ / $\overline{BHE}$ HIGH to HIGH Z[6]		25	ns
WRITE CYCLE[8, 9]				
t_{WC}	Write Cycle Time	70		ns
t_{SCE}	$\overline{CE}$ 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}	$\overline{WE}$ Pulse Width	50		ns
t_{BW}	$\overline{BLE}$ / $\overline{BHE}$ LOW to Write End	60		ns
t_{SD}	Data Set-Up to Write End	30		ns
t_{HD}	Data Hold from Write End	0		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[6, 7]		25	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[6]	10		ns

Note:

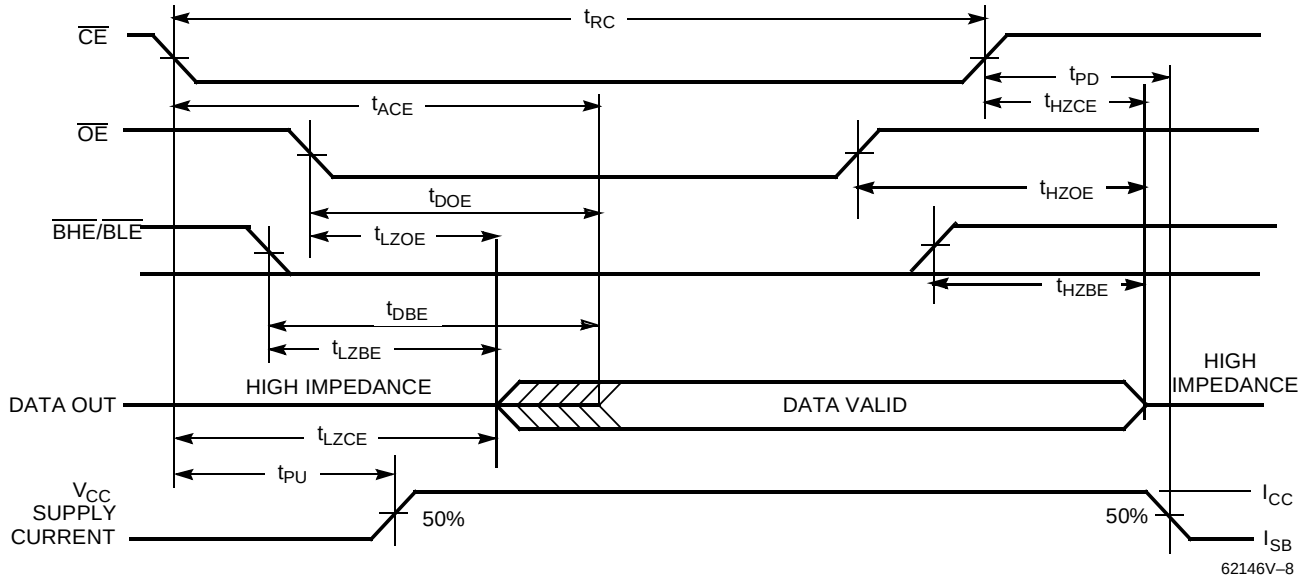
5. Test conditions assume signal transition time of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to V_{CC} typ., and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
6. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZOE} is less than t_{LZOE}, t_{HZBE} is less than t_{LZBE} and t_{HZWE} is less than t_{LZWE} for any given device.
7. t_{HZOE}, t_{HZCE}, t_{HZBE} 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.
8. The internal write time of the memory is defined by the overlap of $\overline{CE}$ LOW and $\overline{WE}$ 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.
9. The minimum write cycle time for write cycle #3 ($\overline{WE}$ controlled, $\overline{OE}$ LOW) is the sum of t_{HZWE} and t_{SD}.

Switching Waveforms

Read Cycle No. 1[10, 11]



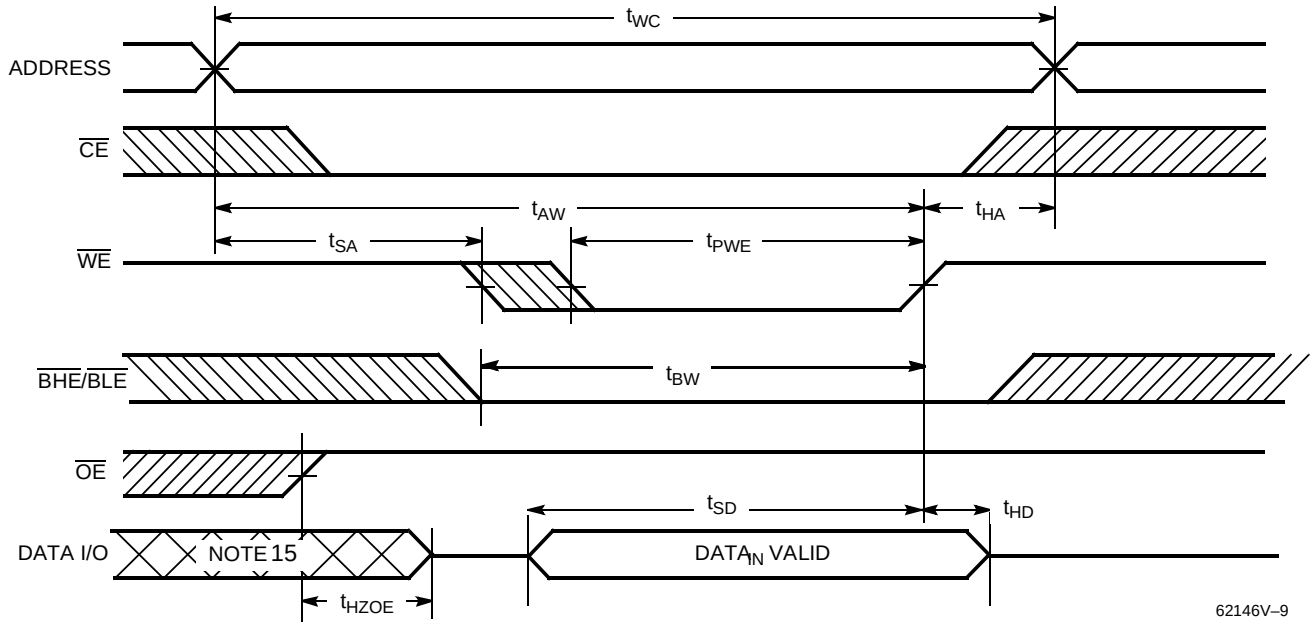
Read Cycle No. 2 [11, 12]



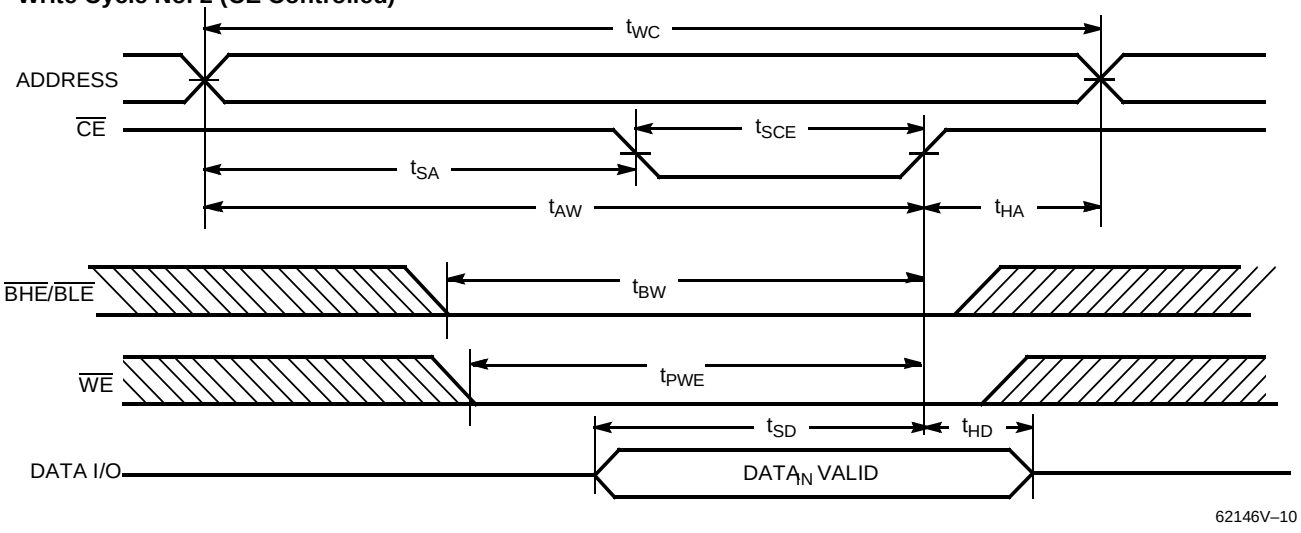
Notes:
10. Device is continuously selected. $\overline{OE}$, $\overline{CE}$ = V_{IL}.
11. $\overline{WE}$ is HIGH for read cycle.
12. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{WE}$ Controlled) [8, 13, 14]



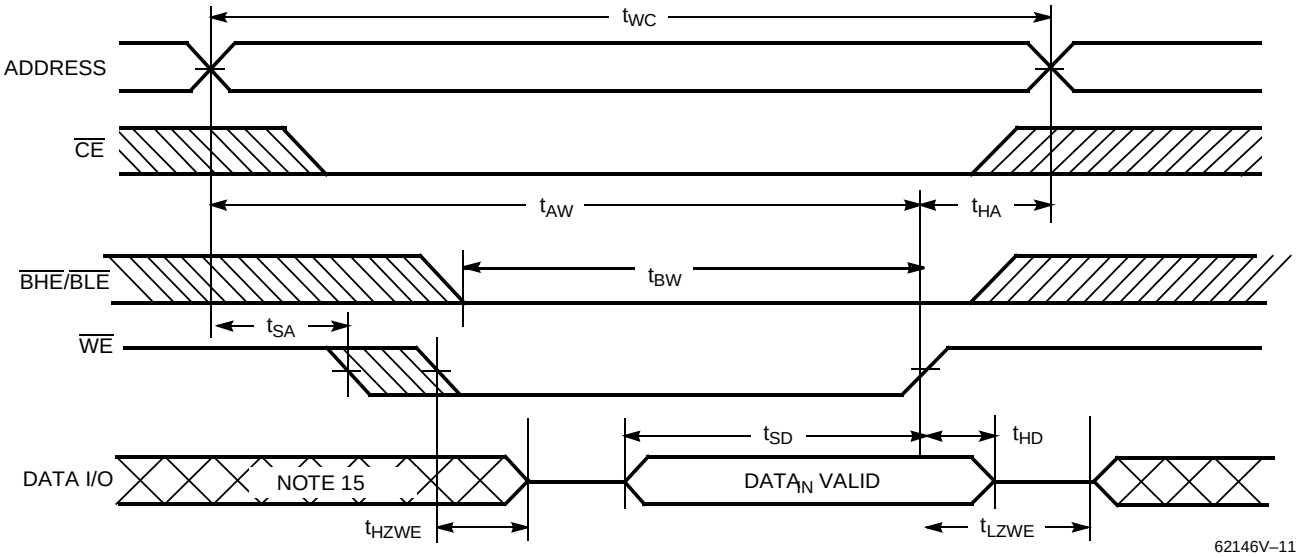
Write Cycle No. 2 ($\overline{CE}$ Controlled) [8, 13, 14]



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

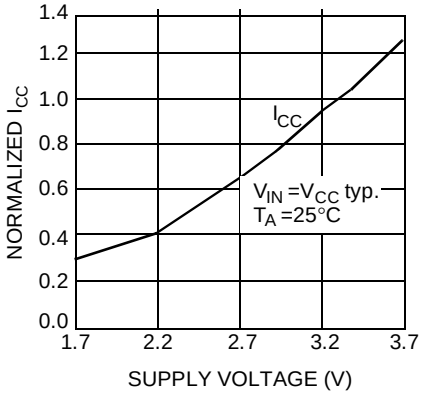
Switching Waveforms (continued)

Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) [9, 14]

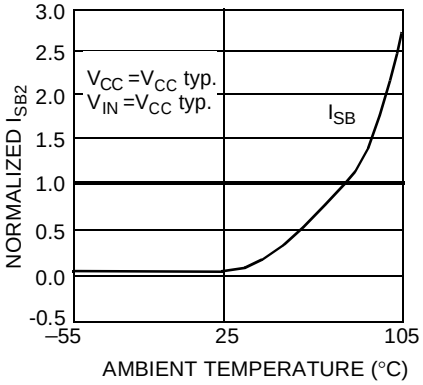


Typical DC and AC Characteristics

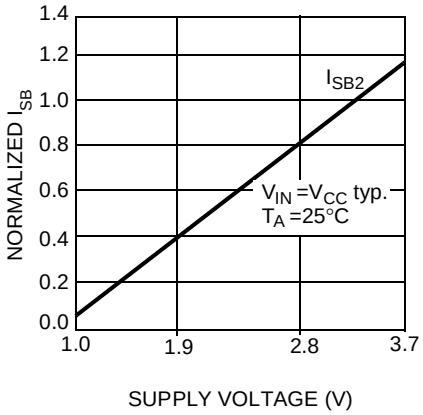
NORMALIZED SUPPLY CURRENT vs. SUPPLY VOLTAGE



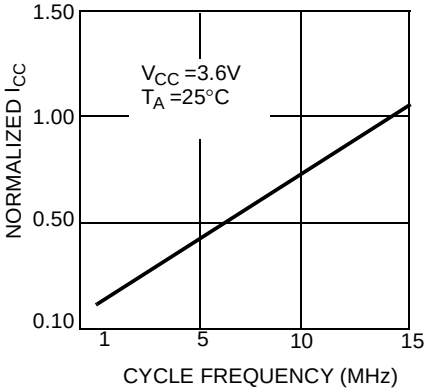
NORMALIZED STANDBY CURRENT vs. AMBIENT TEMPERATURE



NORMALIZED STANDBY CURRENT vs. SUPPLY VOLTAGE



NORMALIZED I_{CC} vs. CYCLE TIME



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

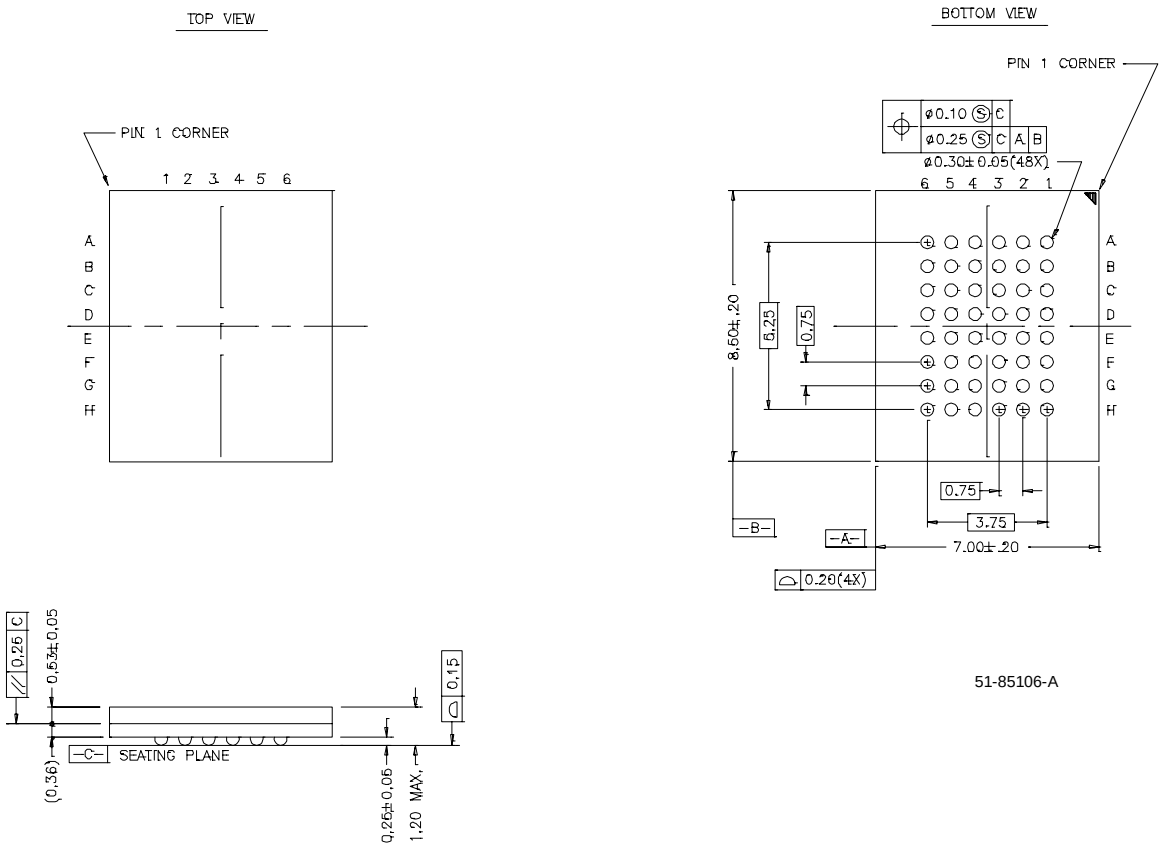
Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
70	CY62146VLL-70ZI	Z44	44-Pin TSOP II	Industrial
	CY62146VLL-70BAI	BA49	48-Ball Fine Pitch BGA	
70	CY62146V18LL-70BAI	BA49	48-Ball Fine Pitch BGA	

Shaded areas contain preliminary information.

Document #: 38-00647-B

Package Diagrams

48-Ball (7.00 mm x 8.5 mm x 1.5 mm) FBGA BA49



* THE BALL DIAMETER, BALL PITCH, STAND-OFF & PACKAGE THICKNESS ARE DIFFERENT FROM JEDEC SPEC M0192 (LOW PROFILE BGA FAMILY)

Package Diagrams (continued)

44-Pin TSOP II Z44