2-Mbit (128K x 16) Static RAM

Features

- **High speed**
  - **— 55 ns**
- **Temperature Ranges**
  - **— Industrial: –40°C to 85°C**
  - **— Automotive: –40°C to 125°C**
- **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**
- **Available in a Pb-free and non Pb-free 44-pin TSOP Type II (forward pinout) and 48-ball FBGA packages**

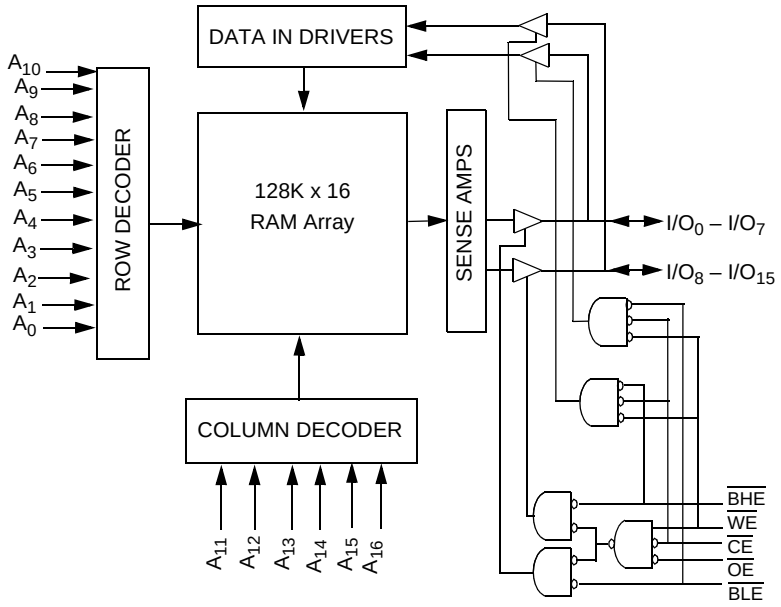
Functional Description[1]

The CY62136V is a high-performance CMOS static RAM organized as 128K words by 16 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 99% when addresses are not toggling. The device can also be put into standby mode when deselected (CE HIGH). The input/output pins (I/O_0 through I/O_{15}) are placed in a high-impedance state when: deselected (CE HIGH), outputs are disabled (OE HIGH), BHE and BLE are disabled (BHE, BLE HIGH), or during a write operation (CE LOW, and WE LOW).

Writing to the device is accomplished by taking Chip Enable (CE) and Write Enable (WE) inputs LOW. If Byte Low Enable (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 (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_{16}).

Reading from the device is accomplished by taking Chip Enable (CE) and Output Enable (OE) LOW while forcing the Write Enable (WE) HIGH. If Byte Low Enable (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 (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



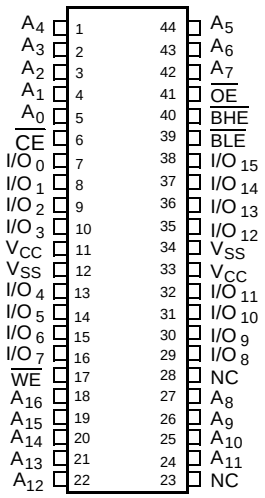
Note:
1. For best practice recommendations, please refer to the Cypress application note “System Design Guidelines” on http://www.cypress.com.

Product Portfolio

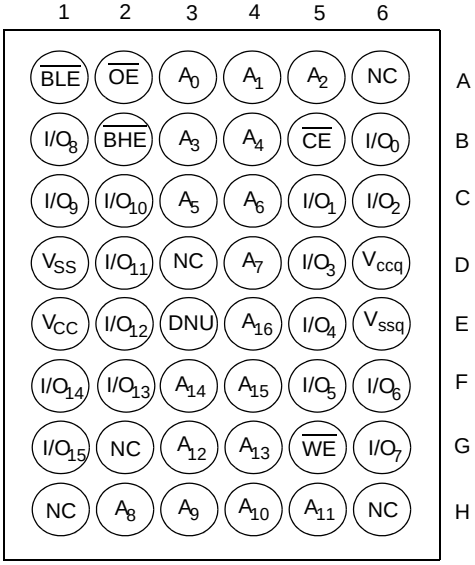
Product	V_{CC} Range (V)			Speed	Grades	Power Dissipation (Industrial)			
						Operating, I_{CC} (mA)		Standby, I_{SB2} (µA)	
	Min.	Typ.[2]	Max.			Typ.[2]	Maximum	Typ.[2]	Maximum
CY62136VLL	2.7	3.0	3.6	55	Industrial	7	20	1	15
				70	Industrial	7	15	1	15
					Automotive	7	20	1	20

Pin Configurations[3, 4]

TSOP II (Forward)
Top View



48-ball FBGA
Top View



Notes:
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.
3. NC pins are not connected on the die.
4. E3 (DNU) pin have to be left floating or tied to V_{SS} to ensure proper operation.

Pin Definitions

Pin Number	Type	Description
1–5, 18–22, 24–27, 42–45	Input	**A_0–A_{16}**. Address Inputs
7–10, 13–16, 29–32, 35–38	Input/Output	**I/O_0–I/O_{15}**. Data lines. Used as input or output lines depending on operation
23	No Connect	**NC**. This pin is not connected to the die
17	Input/Control	**$\overline{WE}$**. When selected LOW, a WRITE is conducted. When selected HIGH, a READ is conducted
6	Input/Control	**$\overline{CE}$**. When LOW, selects the chip. When HIGH, deselects the chip
40, 39	Input/Control	**$\overline{BHE}$**, **$\overline{BLE}$**. $\overline{BHE}$ = LOW selects higher order byte WRITEs or READs on the SRAM $\overline{BLE}$ = LOW selects lower order byte WRITEs or READs on the SRAM
41	Input/Control	**$\overline{OE}$**. Output Enable. Controls the direction of the I/O pins. When LOW, the I/O pins behave as outputs. When deasserted HIGH, I/O pins are Tri-stated, and act as input data pins
12, 34	Ground	**V_{SS}**. Ground for the device
11, 33	Power Supply	**V_{CC}**. Power supply for the device

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[5] ..... –0.5V to V_{CC} + 0.5V

DC Input Voltage[5]..... –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 [T_A][7]	V_{CC}
Industrial	–40°C to +85°C	2.7V to 3.6V
Automotive	–40°C to +125°C	

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions			CY62136V-55			CY62136V-70			Unit
					Min.	Typ.[2]	Max.	Min.	Typ.[2]	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		V_{CC} = 3.6V		2.2		V_{CC}+ 0.5V	2.2		V_{CC}+ 0.5V	V
V_{IL}	Input LOW Voltage		V_{CC} = 2.7V		–0.5		0.8	–0.5		0.8	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}		Industrial	–1		+1	–1		+1	µA
				Automotive				–10		+10	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled		Industrial	–1		+1	–1		+1	µA
				Automotive				–10		+10	µA
I_{CC}	V_{CC} Operating Supply Current	f = f_{Max} = $1/t_{RC}$,	V_{CC} = 3.6V, I_{OUT} = 0 mA, CMOS Levels	Industrial		7	20		7	15	mA
				Automotive					7	20	mA
		f = 1 MHz,				1	2		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			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	Industrial		1	15		1	15	µA
				Automotive					1	20	

Capacitance[6]

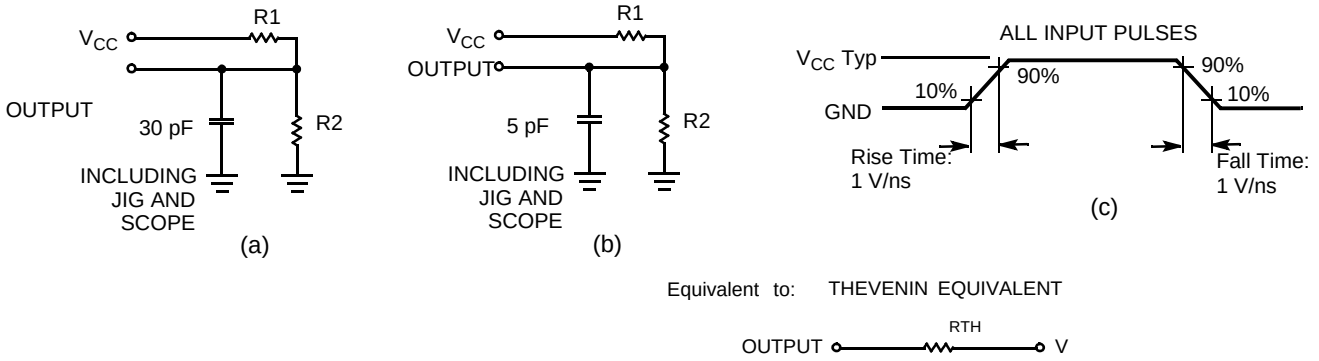
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = $V_{CC(typ)}$	6	pF
C_{OUT}	Output Capacitance		8	pF

Thermal Resistance[6]

Parameter	Description	Test Conditions	FBGA	TSOPII	Unit
Θ_{JA}	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 4.25 x 1.125 inch, 2-layer printed circuit board	41.17	60	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		11.74	22	°C/W

Notes:
5. V_{IL}(min) = –2.0V for pulse durations less than 20 ns.
6. Tested initially and after any design or process changes that may affect these parameters.
7. T_A is the "Instant-On" case temperature.

AC Test Loads and Waveforms

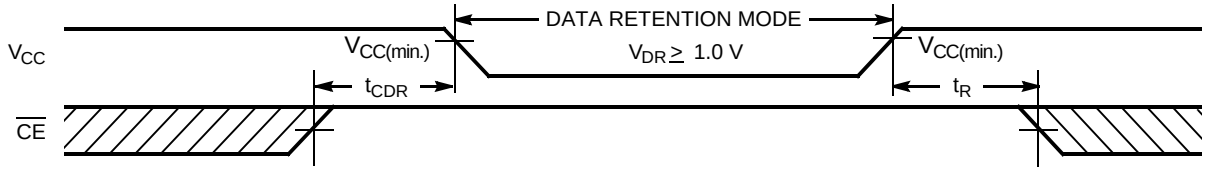


Parameters	3.0V	Unit
R1	1105	Ohms
R2	1550	Ohms
R_{TH}	645	Ohms
V_{TH}	1.75	Volts

Data Retention Characteristics (Over the Operating Range)

Parameter	Description	Conditions[9]	Min.	Typ.[2]	Max.	Unit
V_{DR}	V_{CC} for Data Retention		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		0.5	7.5	µA
t_{CDR}[6]	Chip Deselect to Data Retention Time		0			ns
t_R[8]	Operation Recovery Time		70			ns

Data Retention Waveform



Notes:
8. 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.
9. 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.

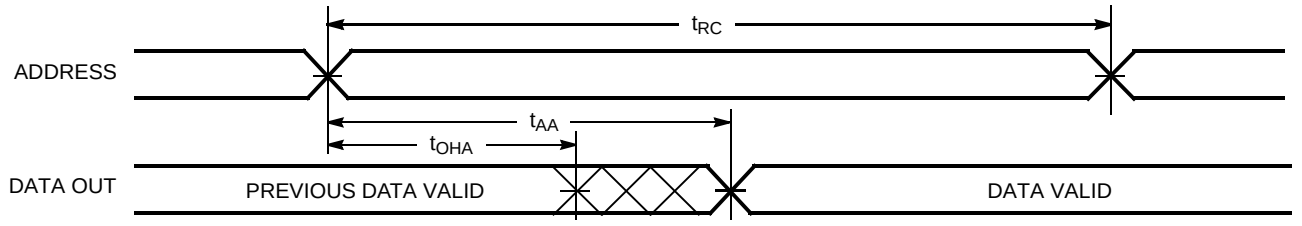
Switching Characteristics Over the Operating Range [9]

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[10]	5		5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High-Z[10, 11]		25		25	ns
t_{LZCE}	$\overline{CE}$ LOW to Low-Z[10]	10		10		ns
t_{HZCE}	$\overline{CE}$ HIGH to High-Z[10, 11]		25		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}	$\overline{BLE}$/$\overline{BHE}$ LOW to Data Valid		25		35	ns
t_{LZBE}	$\overline{BLE}$/$\overline{BHE}$ LOW to Low-Z[10, 11]	5		5		ns
t_{HZBE}	$\overline{BLE}$/$\overline{BHE}$ HIGH to High-Z[12]		25		25	ns
Write Cycle[12, 13]						
t_{WC}	Write Cycle Time	55		70		ns
t_{SCE}	$\overline{CE}$ LOW 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	40		50		ns
t_{BW}	$\overline{BLE}$/$\overline{BHE}$ LOW to Write End	50		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[10, 11]		20		25	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[10]	5		10		ns

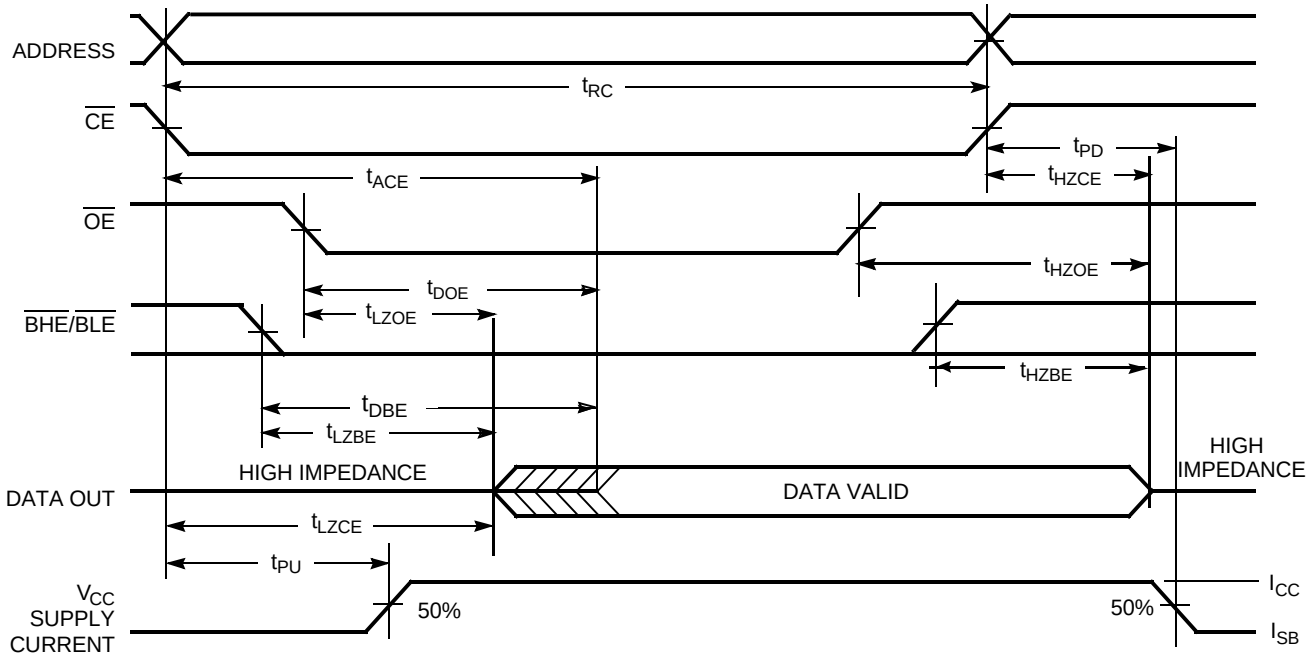
Notes:
10. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZOE} is less than t_{LZOE}, and t_{HZWE} is less than t_{LZWE} for any given device.
11. t_{HZOE}, t_{HZCE}, and t_{HZWE} are specified with C_L = 5 pF as in (b) of AC Test Loads. Transition is measured ±500 mV from steady-state voltage.
12. 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.
13. 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 (Address Transition Controlled)[14, 15]



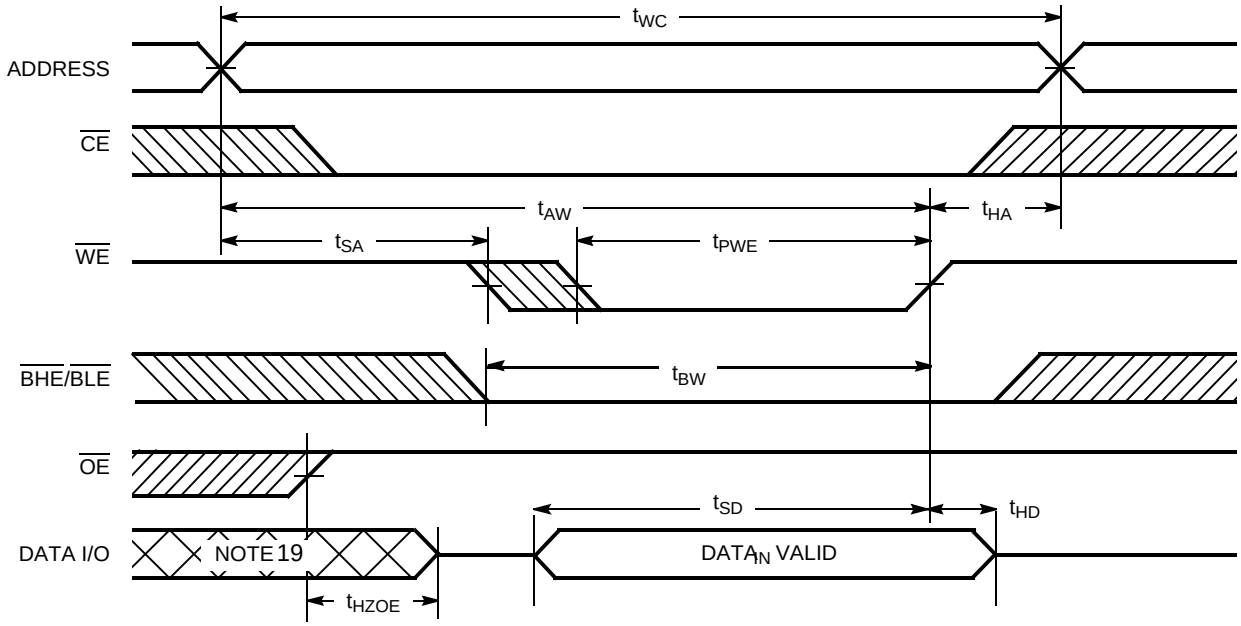
Read Cycle No. 2 ($\overline{OE}$ Controlled)[15, 16]



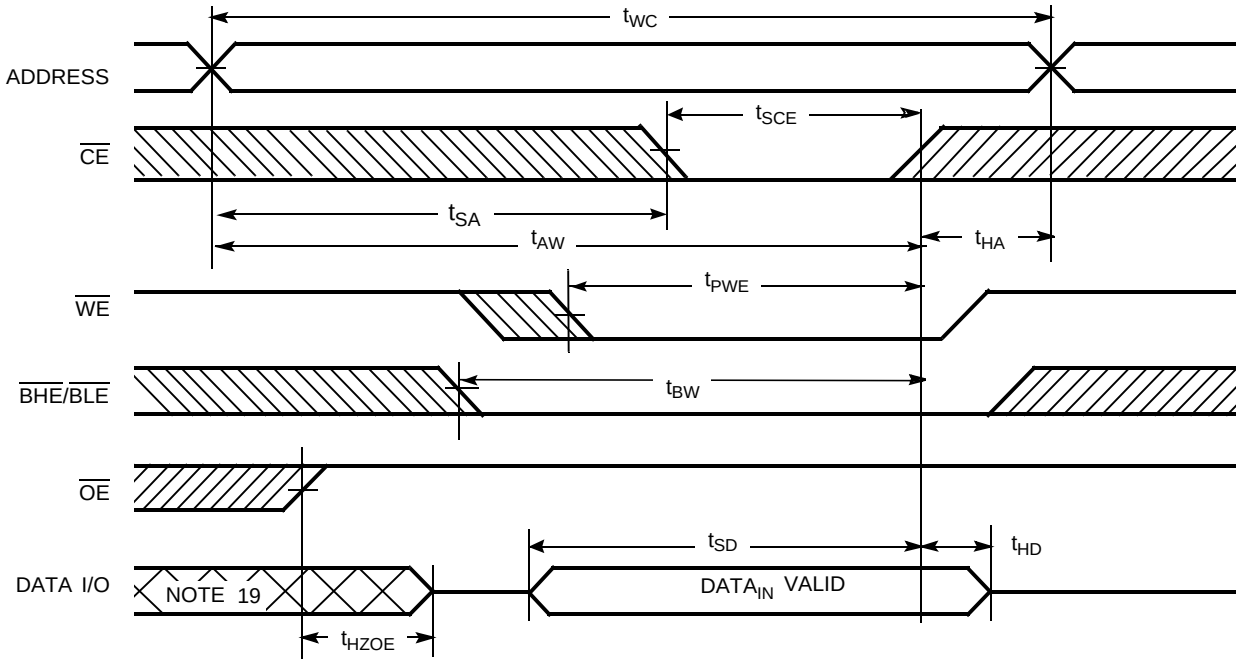
Notes:
14. Device is continuously selected. $\overline{OE}$, $\overline{CE}$ = V_{IL}.
15. $\overline{WE}$ is HIGH for read cycle.
16. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 (WE Controlled)[12, 17, 18]



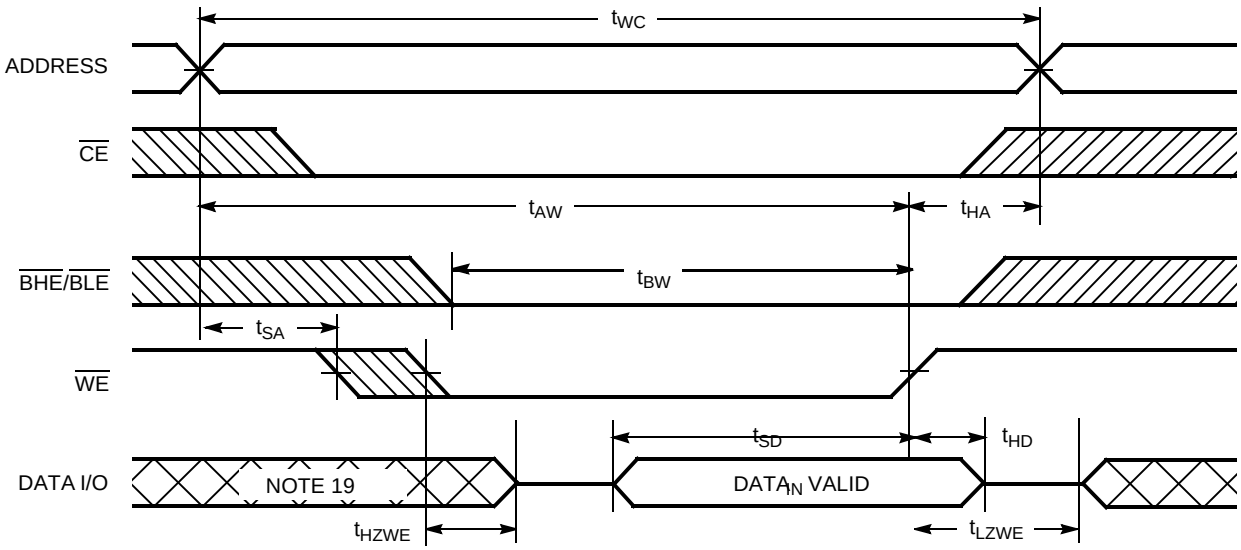
Write Cycle No. 2 (CE Controlled)[12, 17, 18]



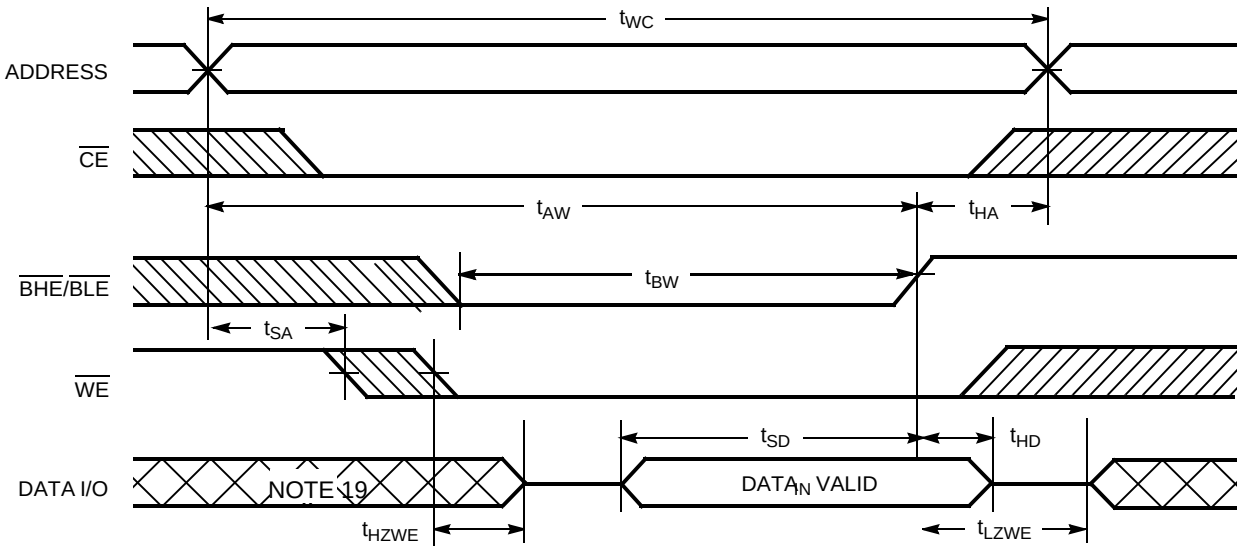
Notes:
17. Data I/O is high impedance if $\overline{OE} = V_{IH}$.
18. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ HIGH, the output remains in a high-impedance state.
19. During this period, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

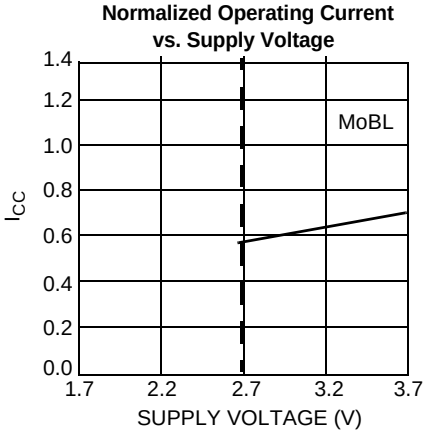
Write Cycle No. 3 (WE Controlled, OE LOW)[13, 18]

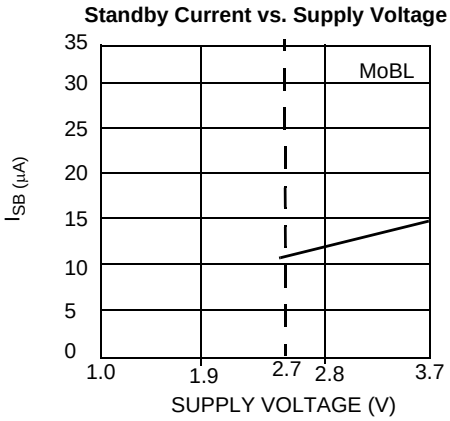


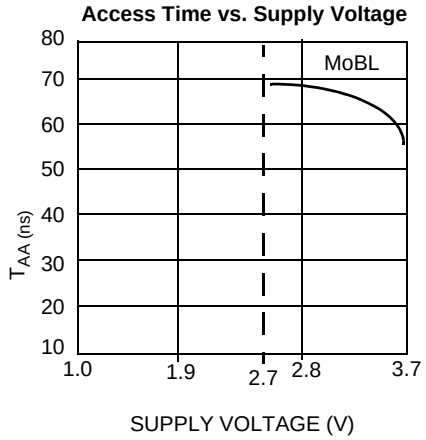
Write Cycle No. 4 (BHE/BLE Controlled, OE LOW)[19]



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	H	L	L	L	Data Out (I/O_0–I/O_{15})	Read	Active (I_{CC})
L	H	L	H	L	High Z (I/O_8–I/O_{15}); Data Out (I/O_0–I/O_7)	Read	Active (I_{CC})
L	H	L	L	H	Data Out (I/O_8–I/O_{15}); High Z (I/O_0–I/O_7)	Read	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	High Z (I/O_8–I/O_{15}); Data In (I/O_0–I/O_7)	Write	Active (I_{CC})
L	L	X	L	H	Data in (I/O_8–I/O_{15}); High Z (I/O_0–I/O_7)	Write	Active (I_{CC})
L	H	L	H	H	High-Z	Deselect/Output Disabled	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})

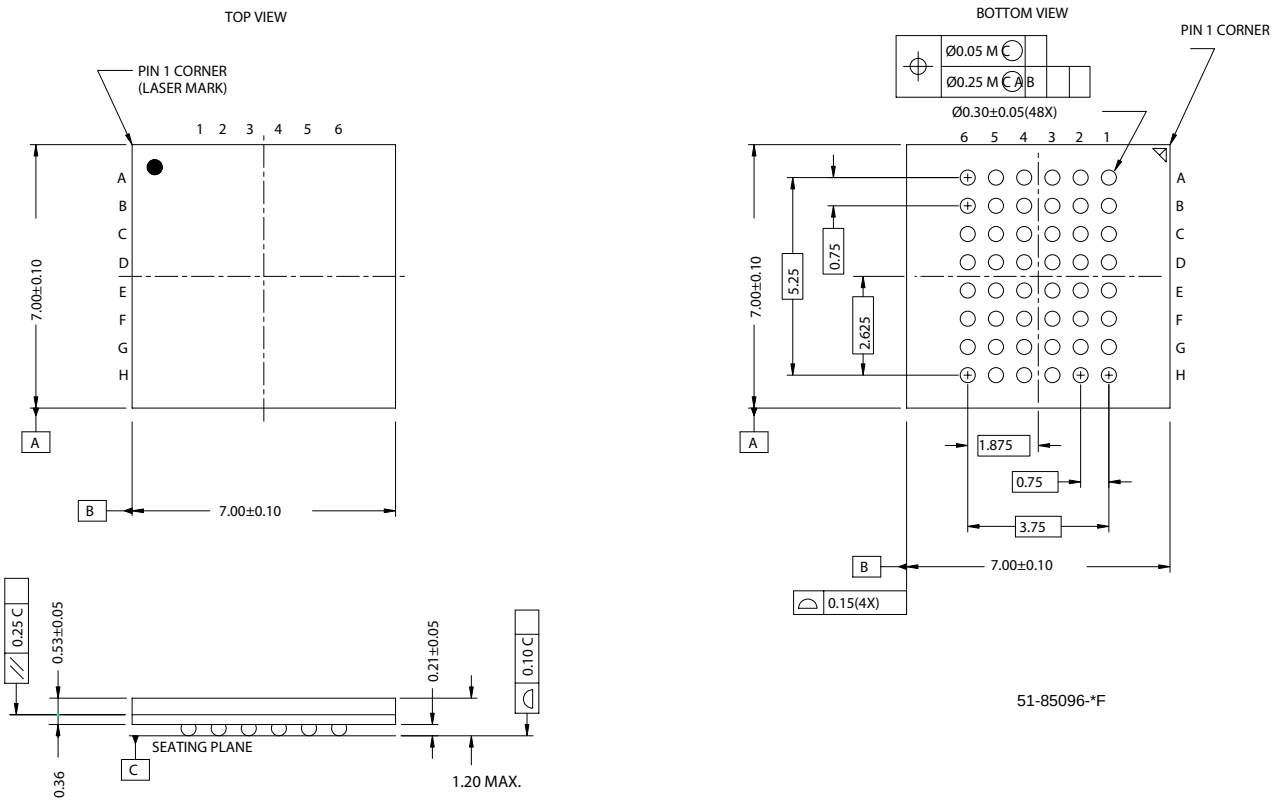
Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
55	CY62136VLL-55BAI	51-85096	48-ball Fine-Pitch Ball Grid Array (7 x 7 x 1.2 mm)	Industrial
	CY62136VLL-55ZI	51-85087	44-pin TSOP II	
	CY62136VLL-55ZXI		44-pin TSOP II (Pb-free)	
70	CY62136VLL-70BAI	51-85096	48-ball Fine-Pitch Ball Grid Array (7 x 7 x 1.2 mm)	Industrial
	CY62136VLL-70ZI	51-85087	44-pin TSOP II	
	CY62136VLL-70ZXI		44-pin TSOP II (Pb-free)	
	CY62136VLL-70ZSE		44-pin TSOP II	Automotive
	CY62136VLL-70ZSXE		44-pin TSOP II (Pb-free)	

Please contact your local Cypress sales representative for availability of these parts

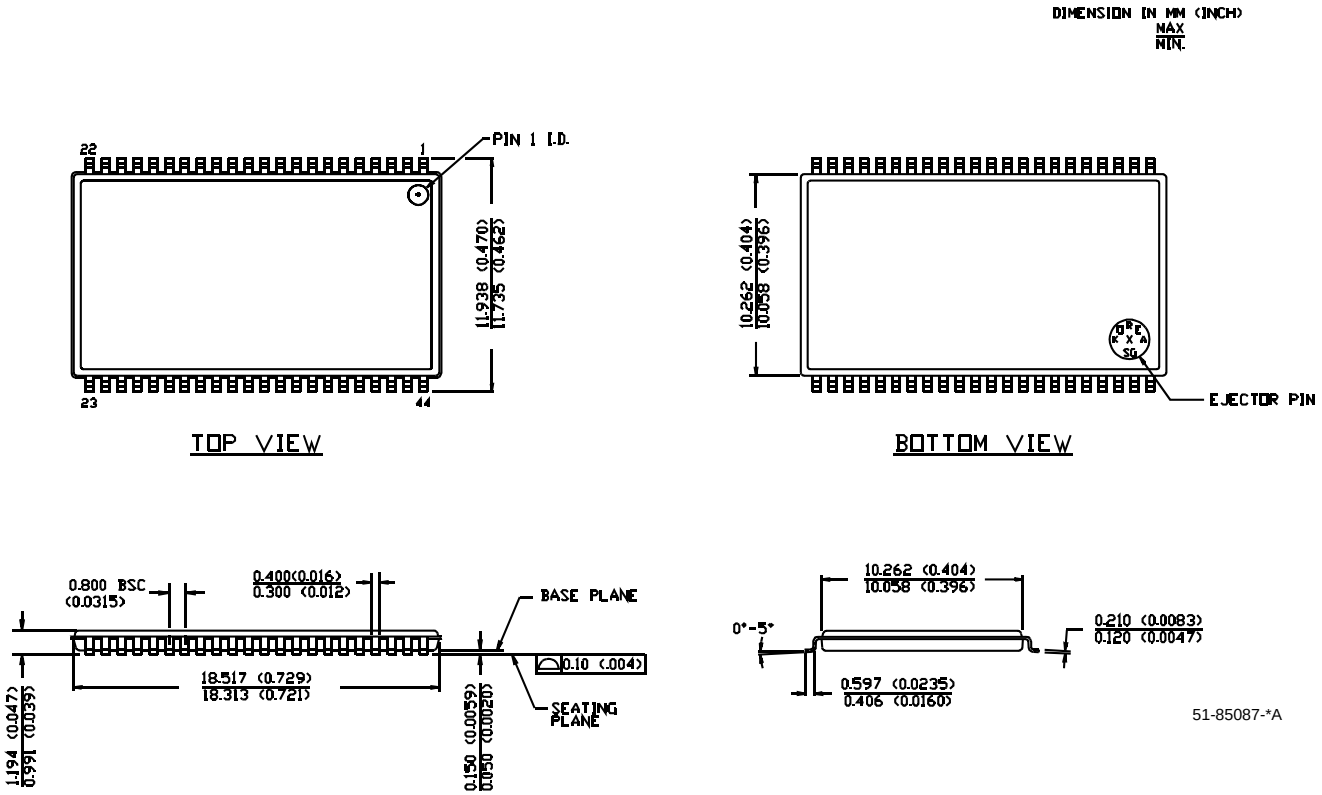
Package Diagrams

48-ball FBGA (7 x 7 x 1.2 mm) (51-85096)



Package Diagrams (continued)

44-pin TSOP II (51-85087)



Document History Page

Document Title: CY62136V MoBL® 2-Mbit (128K x 16) Static RAM Document Number: 38-05087				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	107347	05/25/01	SZV	Changed from Spec #: 38-00728 to 38-05087
*A	116509	09/04/02	GBI	Added footnote 1 Added SL power bin Deleted fBGA package; replacement fBGA package available in CY62136CV30
*B	269729	See ECN	SYT	Added Automotive Information for 70-ns Speed Bin. Added Footnotes # 3 and # 6. Corrected Typo in Electrical Characteristics for I_{CC}(Max)-55 ns from 15 to 20 mA. Added SL row for I_{SB2} in the Electrical Characteristics table. Changed Package Name from Z44 to ZS44. Replaced ‘Z’ with ‘ZS’ in the Ordering Code.
*C	344595	See ECN	SYT	Added Lead-Free Package on page# 9 Changed Package Name from ZS44 to Z44 for the 44 TSOP II Package Replaced ‘ZS’ with ‘Z’ in the Ordering Code for Industrial
*D	486789	See ECN	VKN	Changed address of Cypress Semiconductor Corporation on Page# 1 from “3901 North First Street” to “198 Champion Court”. Added FBGA Package for Industrial Operating range. Removed SL Power bin. Updated Ordering Information table.