



CYPRESS SEMICONDUCTOR

T-46-23-14

CYM1465

512K x 8 SRAM Module

Features

- High-density 4-megabit SRAM module
- High-speed CMOS SRAMs  
— Access time of 70 ns
- Low active power  
— 605 mW (max.)
- JEDEC-compatible pinout
- 32-pin, 0.6-inch-wide DIP package
- TTL-compatible inputs and outputs
- Low profile  
— Max. height of .27 inches
- Small PCB footprint  
— 0.98 sq. in.

Functional Description

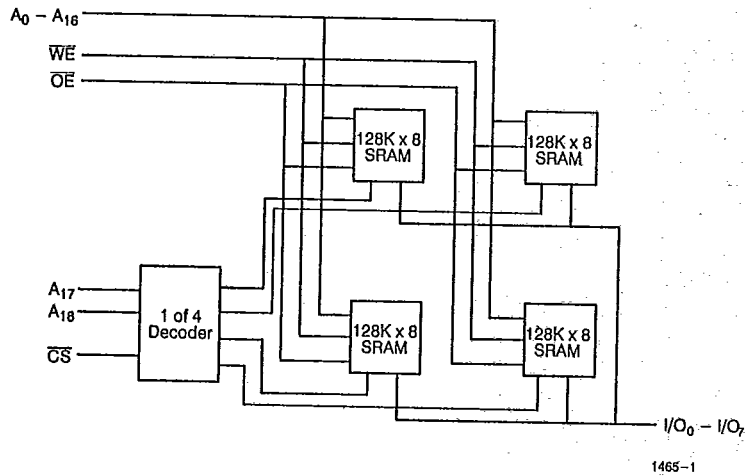
The CYM1465 is a high-performance 4-megabit static RAM module organized as 512K words by 8 bits. This module is constructed using four 128K x 8 RAMs mounted on a substrate with pins. A decoder is used to interpret the higher-order addresses ( $A_{17}$  and  $A_{18}$ ) and to select one of the four RAMs. Two packaging options are offered: VSOP packages on FR4 substrate (PD), and SOIC packages on ceramic substrate (SD).

Writing to the module is accomplished when the chip select ( $\overline{CS}$ ) and write enable ( $\overline{WE}$ ) inputs are both LOW. Data on the

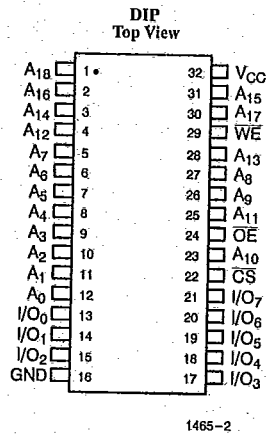
eight input/output pins ( $I/O_0$  through  $I/O_7$ ) of the device is written into the memory location specified on the address pins ( $A_0$  through  $A_{18}$ ). Reading the device is accomplished by taking chip select and output enable ( $\overline{OE}$ ) LOW while write enable remains inactive or HIGH. Under these conditions, the contents of the memory location specified on the address pins ( $A_0$  through  $A_{18}$ ) will appear on the eight appropriate data input/output pins ( $I/O_0$  through  $I/O_7$ ).

The input/output pins remain in a high-impedance state unless the module is selected, outputs are enabled, and write enable is HIGH.

Logic Block Diagram



Pin Configuration



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Selection Guide

	1465-70	1465-85	1465-100	1465-120	1465-150
Maximum Access Time (ns)	70	85	100	120	150
Maximum Operating Current (mA)	110	110	110	110	110
Maximum Standby Current (mA)	12	12	12	12	12



**Maximum Ratings**

(Above which the useful life may be impaired.)

Storage Temperature	- 55°C to +125°C
Ambient Temperature with Power Applied	-10°C to +85°C
Supply Voltage to Ground Potential	-0.5V to +7.0V
DC Voltage Applied to Outputs in High Z State	-0.5V to +7.0V
DC Input Voltage	-0.5V to +7.0V

**Operating Range**

Range	Ambient Temperature	V <sub>CC</sub>
Commercial	0°C to +70°C	5V ± 10%
Industrial	-40°C to +85°C	5V ± 10%

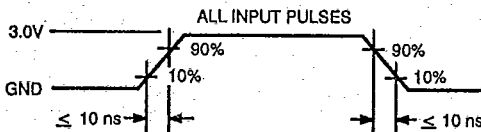
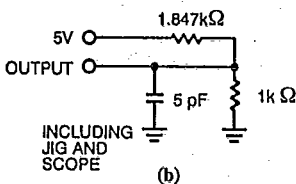
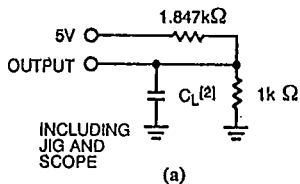
**Electrical Characteristics Over the Operating Range**

Parameters	Description	Test Conditions	1465		Units
			Min.	Max.	
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = Min., I <sub>OH</sub> = -1.0 mA	2.4		V
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = Min., I <sub>OL</sub> = 2.1 mA		0.4	V
V <sub>IH</sub>	Input HIGH Voltage		2.2	V <sub>CC</sub> + 0.3	V
V <sub>IL</sub>	Input LOW Voltage		-0.3	0.8	V
I <sub>Ix</sub>	Input Load Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	-10	+10	μA
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> , Output Disabled	-20	+20	μA
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	V <sub>CC</sub> = Max., I <sub>OUT</sub> = 0 mA, CS ≤ V <sub>IL</sub>		110	mA
I <sub>SB1</sub>	Automatic CS Power-Down Current	V <sub>CC</sub> = Max., CS ≥ V <sub>IH</sub> , Min. Duty Cycle = 100%		12	mA
I <sub>SB2</sub>	Automatic CS Power-Down Current	V <sub>CC</sub> = Max., CS ≥ V <sub>CC</sub> - 0.2V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V or V <sub>IN</sub> ≤ 0.2V	Standard Version	8	mA
			L Version	420	μA

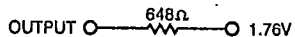
**Capacitance<sup>(1)</sup>**

Parameters	Description	Test Conditions	Max.	Units
C <sub>IN</sub>	Input Capacitance	T <sub>A</sub> = 25°C, f = 1 MHz, V <sub>CC</sub> = 5.0V	45	pF
C <sub>OUT</sub>	Output Capacitance		45	pF

**AC Test Loads and Waveforms**



Equivalent to: THEVENIN EQUIVALENT



1465-3

1465-4

**Notes:**

1. Tested on a sample basis.
2. Test conditions assume signal transition times of 10 ns or less, timing reference levels of 1.5V, input levels of 0 to 3.0V, and output loading of

the specified I<sub>OL</sub>/I<sub>OH</sub> and 100-pF load capacitance for 85, 100, 120, and 150 ns speeds. C<sub>L</sub> = 30 pF for 70 ns speed.



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Switching Characteristics Over the Operating Range<sup>[2]</sup>

Parameters	Description	1465-70		1465-85		1465-100		1465-120		1465-150		Units
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
<b>READ CYCLE</b>												
t <sub>RC</sub>	Read Cycle Time	70		85		100		120		150		ns
t <sub>AA</sub>	Address to Data Valid		70		85		100		120		150	ns
t <sub>OHA</sub>	Data Hold from Address Change	10		10		10		10		10		ns
t <sub>ACS</sub>	CS LOW to Data Valid		70		85		100		120		150	ns
t <sub>DOE</sub>	OE LOW to Data Valid		35		45		50		60		75	ns
t <sub>LZOE</sub>	OE LOW to Low Z	5		5		5		5		5		ns
t <sub>HZOE</sub>	OE HIGH to High Z <sup>[3]</sup>		25		30		35		45		55	ns
t <sub>LZCS</sub>	CS LOW to Low Z	10		10		10		10		10		ns
t <sub>HZCS</sub>	CS HIGH to High Z <sup>[3]</sup>		30		30		35		45		60	ns
<b>WRITE CYCLE</b>												
t <sub>WC</sub>	Write Cycle Time	70		85		100		120		150		ns
t <sub>SCS</sub>	CS LOW to Write End	65		75		90		100		115		ns
t <sub>AW</sub>	Address Set-Up to Write End	65		75		90		100		110		ns
t <sub>HA</sub>	Address Hold from Write End	0		5		5		5		5		ns
t <sub>SA</sub>	Address Set-Up from Write Start	0		5		5		5		5		ns
t <sub>PWE</sub>	WE Pulse Width	55		65		75		85		95		ns
t <sub>SD</sub>	Data Set-Up to Write End	30		35		40		45		50		ns
t <sub>HD</sub>	Data Hold from Write End	0		0		0		0		0		ns
t <sub>LZWE</sub>	WE HIGH to Low Z	5		5		5		5		5		ns
t <sub>HZWE</sub>	WE LOW to High Z <sup>[3]</sup>		25		30		35		40		45	ns

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Data Retention Characteristics Over the Operating Range (L Version Only)

Parameters	Description	Test Conditions	Commercial		Industrial		Units
			Min.	Max.	Min.	Max.	
V <sub>DR</sub>	V <sub>CC</sub> for Retention Data	CS ≥ V <sub>CC</sub> - 0.2V	2.0		2.0		V
I <sub>CCDR3</sub>	Data Retention Current	V <sub>CC</sub> = Max., CS ≥ V <sub>CC</sub> - 0.2V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V or V <sub>IN</sub> ≤ 0.2V		50		150	μA
t <sub>CDR</sub> <sup>[4]</sup>	Chip Deselect to Data Retention Time		0		0		ns
t <sub>R</sub> <sup>[4]</sup>	Operation Recovery Time		5		5		ms

Notes:

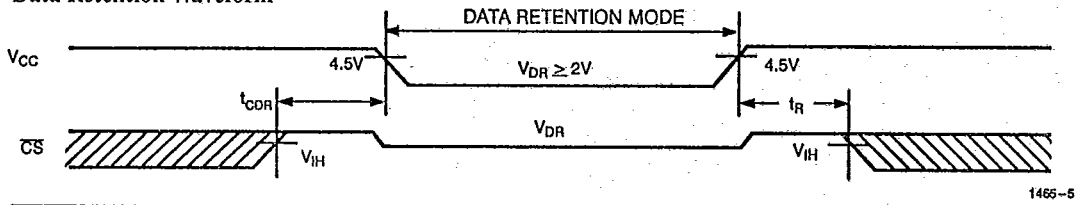
- CL = 5 pF as in part (b) of AC Test Loads. Transition is measured ±500 mV from steady state voltage.
- Guaranteed, not tested.
- WE is HIGH for the read cycle.
- Device is continuously selected, CS = VIL.
- Address valid prior to or coincident with CS transition LOW.
- The internal write time of the memory is defined by the overlap of CS 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.
- If CS goes HIGH simultaneously with WE HIGH, the output remains in a high-impedance state.



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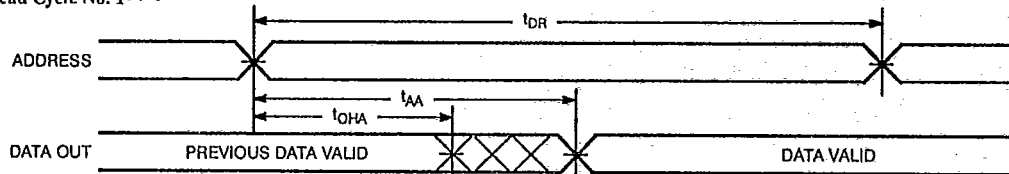
Data Retention Waveform



1465-5

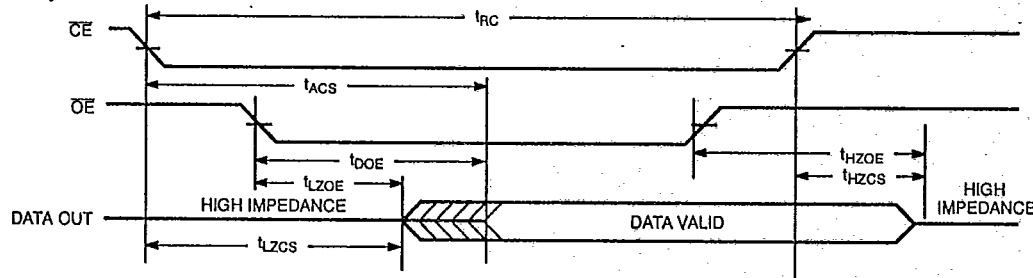
Switching Waveforms

Read Cycle No. 1<sup>[5, 6]</sup>



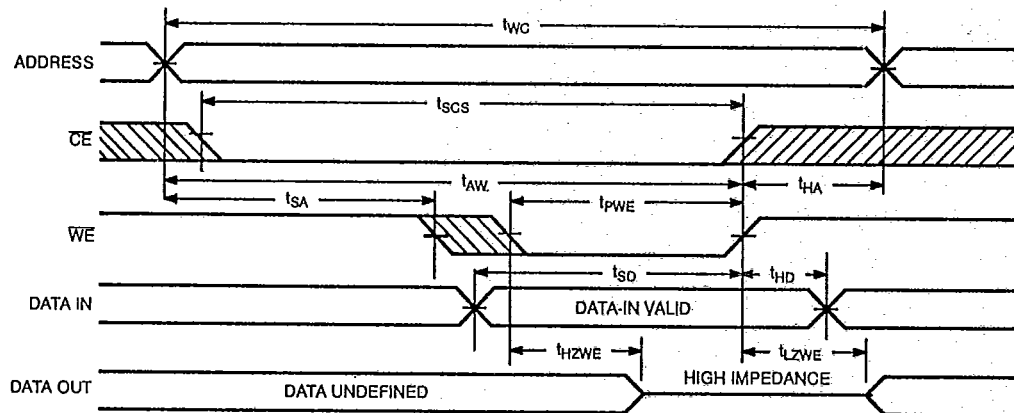
1465-6

Read Cycle No. 2<sup>[5, 7]</sup>



1465-7

Write Cycle No. 1 (WE Controlled)<sup>[8]</sup>



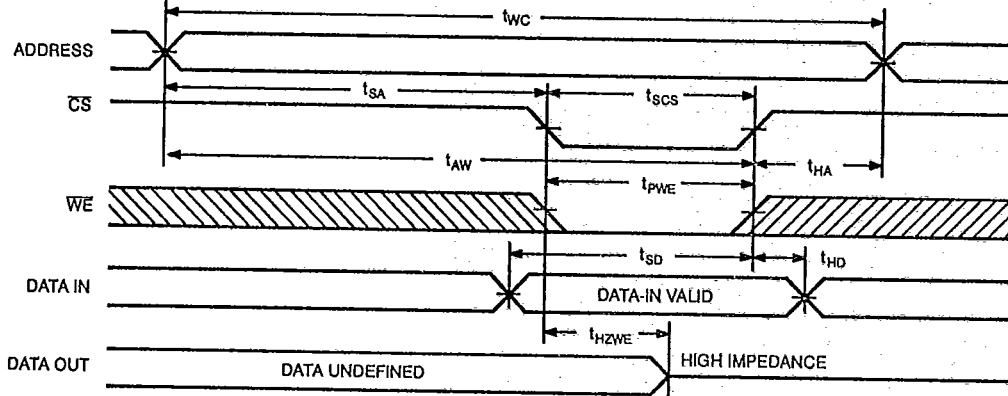
1465-8



CYM1465

Switching Waveforms (continued)<sup>[8,9]</sup>

Write Cycle No. 2 ( $\overline{CS}$  Controlled)



1465-9

Truth Table

Inputs			Outputs	Mode
CS	WE	OE		
H	X	X	High Z	Deselect/Power-Down
L	H	L	Data Out	Read Word
L	L	X	Data In	Write Word
L	H	H	High Z	Deselect

Ordering Information

Speed (ns)	Ordering Code	Package Type	Operating Range
70	CYM1465PD-70C	PD03	Commercial
	CYM1465LPD-70C		
	CYM1465SSD-70C	SD01	
	CYM1465LSD-70C		
85	CYM1465PD-85C	PD03	Commercial
	CYM1465LPD-85C		
	CYM1465SSD-85C	SD01	
	CYM1465LSD-85C		
	CYM1465PD-85I	PD03	Industrial
	CYM1465LPD-85I		
	CYM1465SSD-85I	SD01	
	CYM1465LSD-85I		
100	CYM1465PD-100C	PD03	Commercial
	CYM1465LPD-100C		
	CYM1465SSD-100C	SD01	
	CYM1465LSD-100C		
	CYM1465PD-100I	PD03	Industrial
	CYM1465LPD-100I		

Speed (ns)	Ordering Code	Package Type	Operating Range
100	CYM1465SD-100I	SD01	Industrial
	CYM1465LSD-100I		
120	CYM1465PD-120C	PD03	Commercial
	CYM1465LPD-120C		
	CYM1465SSD-120C	SD01	
	CYM1465LSD-120C		
	CYM1465PD-120I	PD03	Industrial
	CYM1465LPD-120I		
CYM1465SSD-120I	SD01		
CYM1465LSD-120I			
150	CYM1465PD-150C	PD03	Commercial
	CYM1465LPD-150C		
	CYM1465SSD-150C	SD01	
	CYM1465LSD-150C		
	CYM1465PD-150I	PD03	Industrial
	CYM1465LPD-150I		
CYM1465SSD-150I	SD01		
CYM1465LSD-150I			



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