



CYPRESS
SEMICONDUCTOR

4K x 8 Dual-Port Static RAMs and 4K x 8 Dual-Port Static RAM with Semaphores

2

SRAMS

Features

- 0.8-micron BiCMOS for high performance
- High-speed access
 - 20 ns (commercial)
 - 25 ns (military)
- Automatic power-down
- Fully asynchronous operation
- 7B1342 includes semaphores
- 7B134 available in 48-pin DIP, 48-pin LCC
- 7B135/7B1342 available in 52-pin LCC/PLCC

Functional Description

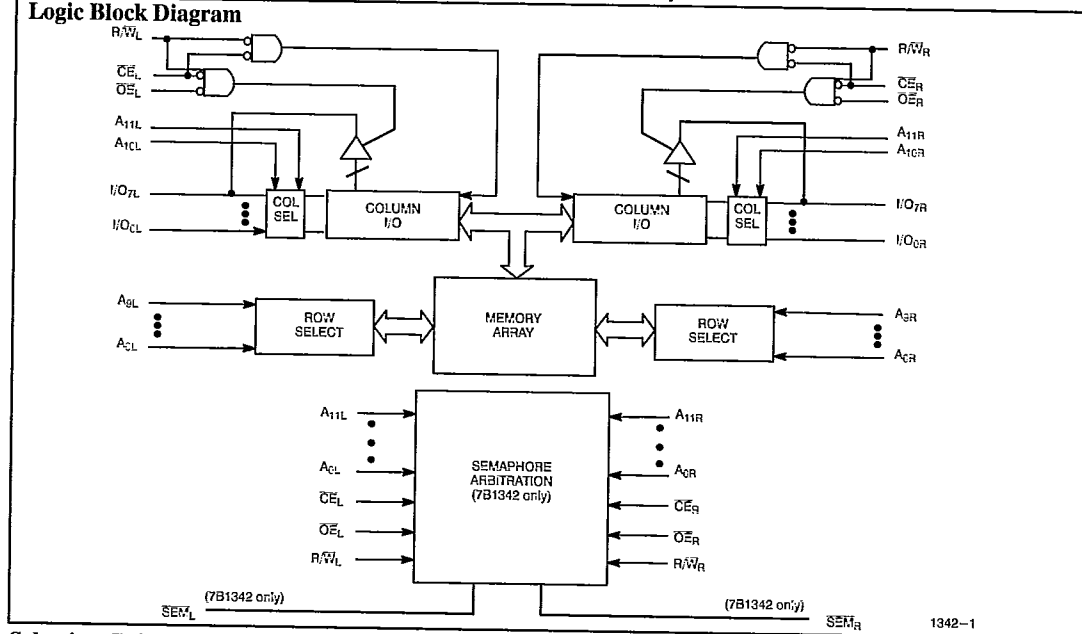
The CY7B134, CY7B135, and CY7B1342 are high-speed BiCMOS 4K x 8 dual-port static RAMs. The CY7B1342 includes semaphores that provide a means to allocate portions of the dual-port RAM or any shared resource. Two ports are provided permitting independent, asynchronous access for reads and writes to any location in memory. Application areas include interprocessor/multi-processor designs, communications status buffering, and dual-port video/graphics memory.

Each port has independent control pins: chip enable (CE), read or write enable (R/W), and output enable (OE). The CY7B134/135 are suited for those systems

that do not require on-chip arbitration or are intolerant of wait states. Therefore, the user must be aware that simultaneous access to a location is possible. Semaphores are offered on the CY7B1342 to assist in arbitrating between ports. The semaphore logic is comprised of eight shared latches. Only one side can control the latch (semaphore) at any time. Control of a semaphore indicates that a shared resource is in use. An automatic power-down feature is controlled independently on each port by a chip enable (CE) pin or SEM pin (CY7B1342 only).

The CY7B134 is available in 48-pin DIP and 48-pin LCC. The CY7B135 and CY7B1342 are available in 52-pin LCC/PLCC.

Logic Block Diagram



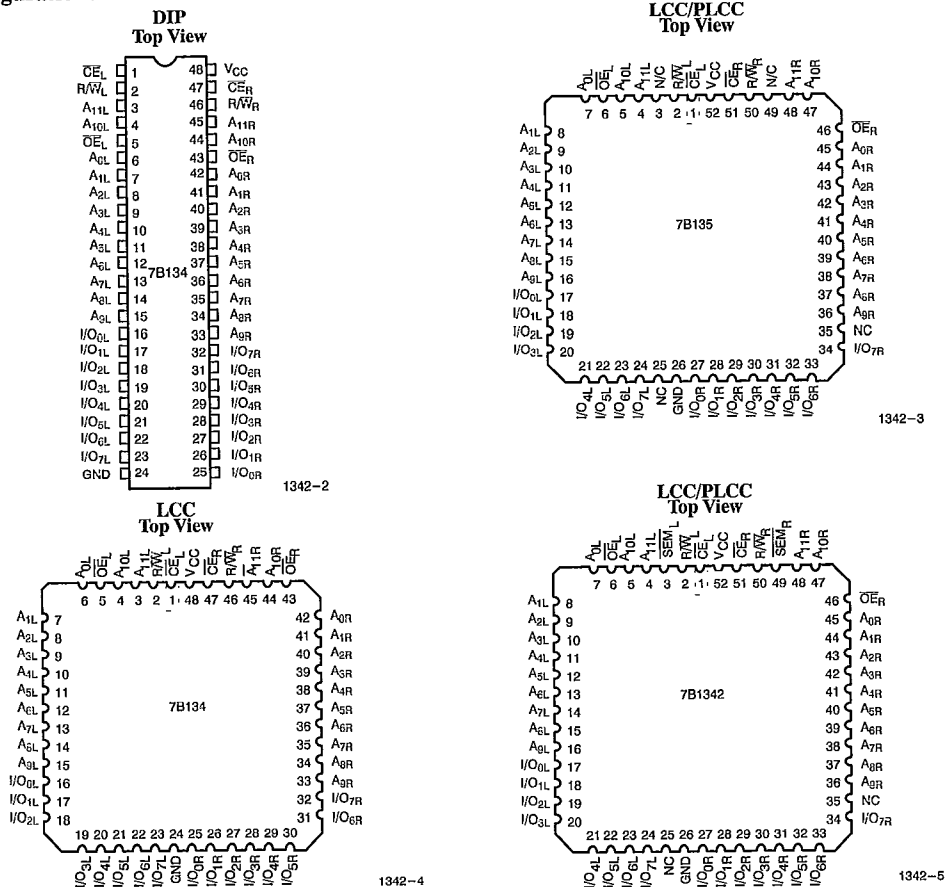
Selection Guide

		7B134-20 7B135-20 7B1342-20	7B134-25 7B135-25 7B1342-25	7B134-35 7B135-35 7B1342-35
Maximum Access Time (ns)		20	25	35
Maximum Operating Current (mA)	Commercial	240	220	210
	Military		260	250
Maximum Standby Current (mA)	Commercial	80	75	70
	Military		80	75



CY7B134
CY7B135
CY7B134Z

Pin Configurations



Pin Definitions

Left Port	Right Port	Description
A0L--11L	A0R--11R	Address Lines
CE_L	CE_R	Chip Enable
OE_L	OE_R	Output Enable
R/W_L	R/W_R	Read/Write Enable
SEM_L (CY7B134Z only)	SEM_R (CY7B134Z only)	Semaphore Enable. When asserted LOW, allows access to eight semaphores. The three least significant bits of the address lines will determine which semaphore to write or read. The I/O0 pin is used when writing to a semaphore. Semaphores are requested by writing a 0 into the respective location.



CY7B134
CY7B135
CY7B1342

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 (Pin 48 to Pin 24)	- 0.5V to +7.0V
DC Voltage Applied to Outputs in High Z State	- 0.5V to +7.0V
DC Input Voltage ^[1]	- 3.0V to +7.0V

Static Discharge Voltage > 2001V
(per MIL-STD-883, Method 3015)

Latch-Up Current > 200 mA

Operating Range

Range	Ambient Temperature	V _{CC}
Commercial	0°C to +70°C	5V ± 10%
Industrial	-40°C to +85°C	5V ± 10%
Military ^[2]	-55°C to +125°C	5V ± 10%

2
SRAMS

Electrical Characteristics Over the Operating Range^[3]

Parameter	Description	Test Conditions	7B134-20 7B135-20 7B1342-20		7B134-25 7B135-25 7B1342-25		7B134-35 7B135-35 7B1342-35		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
V _{OH}	Output HIGH Voltage	V _{CC} = Min., I _{OH} = -4.0 mA	2.4			2.4			V
V _{OL}	Output LOW Voltage	V _{CC} = Min., I _{OL} = 4.0 mA		0.4		0.4		0.4	V
V _{IH}	Input HIGH Voltage		2.2		2.2		2.2		V
V _{IL}	Input LOW Voltage			0.8		0.8		0.8	V
I _{Ix}	Input Load Current	GND ≤ V _I ≤ V _{CC}	-10	+10	-10	+10	-10	+10	μA
I _{OZ}	Output Leakage Current	Outputs Disabled, GND ≤ V _O ≤ V _{CC}	-10	+10	-10	+10	-10	+10	μA
I _{CC}	Operating Current	V _{CC} = Max., I _{OUT} = 0 mA	Com'l	240		220		210	mA
			Mil			260		250	
I _{SB1}	Standby Current (Both Ports TTL Levels)	$\overline{CE}_L$ and $\overline{CE}_R \geq V_{IH}$, f = f _{MAX} ^[4]	Com'l	80		75		70	mA
			Mil			80		75	
I _{SB2}	Standby Current (One Port TTL Level)	$\overline{CE}_L$ and $\overline{CE}_R \geq V_{IH}$, f = f _{MAX} ^[4]	Com'l	150		140		130	mA
			Mil			170		160	
I _{SB3}	Standby Current (Both Ports CMOS Levels)	Both Ports $\overline{CE}$ and $\overline{CE}_R \geq V_{CC} - 0.2V$, V _{IN} ≥ V _{CC} - 0.2V or V _{IN} ≤ 0.2V, f = 0 ^[4]	Com'l	25		25		25	mA
			Mil			30		30	
I _{SB4}	Standby Current (One Port CMOS Level)	One Port $\overline{CE}_L$ or $\overline{CE}_R \geq V_{CC} - 0.2V$, V _{IN} ≥ V _{CC} - 0.2V or V _{IN} ≤ 0.2V, Active Port Outputs, f = f _{MAX} ^[4]	Com'l	130		120		110	mA
			Mil			150		130	

Capacitance^[5]

Parameter	Description	Test Conditions	Max. ^[6]	Unit
C _{IN}	Input Capacitance	T _A = 25°C, f = 1 MHz, V _{CC} = 5.0V	10	pF
C _{OUT}	Output Capacitance		10	pF

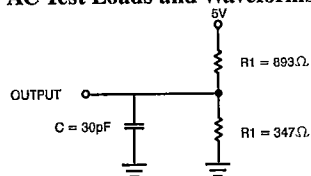
Notes:

- Pulse width < 20 ns.
- T_A is the "instant on" case temperature.
- See the last page of this specification for Group A subgroup testing information.
- f_{MAX} = 1/t_{RC} = All inputs cycling at f = 1/t_{RC} (except output enable). f = 0 means no address or control lines change. This applies only to inputs at CMOS level standby I_{SB3}.
- Tested initially and after any design or process changes that may affect these parameters.
- For all packages except DIP and cerDIP (D26, P25), which have maximums of C_{IN} = 15 pF, C_{OUT} = 15 pF.



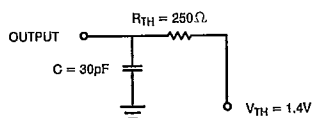
CY7B134
CY7B135
CY7B1342

AC Test Loads and Waveforms



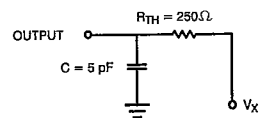
(a) Normal Load (Load 1)

1342-6



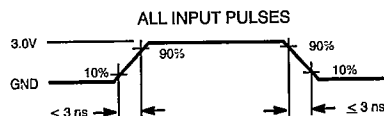
(b) Thevenin Equivalent (Load 1)

1342-7



(c) Three-State Delay (Load 3)

1342-8



1342-9

Switching Characteristics Over the Operating Range^[7,8]

Parameter	Description	7B134-20 7B135-20 7B1342-20		7B134-25 7B135-25 7B1342-25		7B134-35 7B135-35 7B1342-35		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE								
t _{RC}	Read Cycle Time	20		25		35		ns
t _{AA}	Address to Data Valid		20		25		35	ns
t _{OHA}	Output Hold From Address Change	3		3		3		ns
t _{ACE}	CE LOW to Data Valid		20		25		35	ns
t _{DOE}	OE LOW to Data Valid		13		15		20	ns
t _{LZOE} ^[9, 10]	OE Low to Low Z	3		3		3		ns
t _{HZOE} ^[9, 10]	OE HIGH to High Z		13		15		20	ns
t _{LZCE} ^[9, 10]	CE LOW to Low Z	3		3		3		ns
t _{HZCE} ^[9, 10]	CE HIGH to High Z		13		15		20	ns
t _{PU}	CE LOW to Power Up	0		0		0		ns
t _{PD}	CE HIGH to Power Down		20		25		35	ns
WRITE CYCLE								
t _{WC}	Write Cycle Time	20		25		35		ns
t _{SCE}	CE LOW to Write End	15		20		30		ns
t _{AW}	Address Set-Up to Write End	15		20		30		ns
t _{HA}	Address Hold from Write End	2		2		2		ns
t _{SA}	Address Set-Up to Write Start	0		0		0		ns
t _{PWE}	Write Pulse Width	15		20		25		ns
t _{SD}	Data Set-Up to Write End	13		15		15		ns
t _{HD}	Data Hold from Write End	0		0		0		ns
t _{HZWE} ^[10]	R/W LOW to High Z		13		15		20	ns
t _{LZWE} ^[10]	R/W HIGH to Low Z	3		3		3		ns



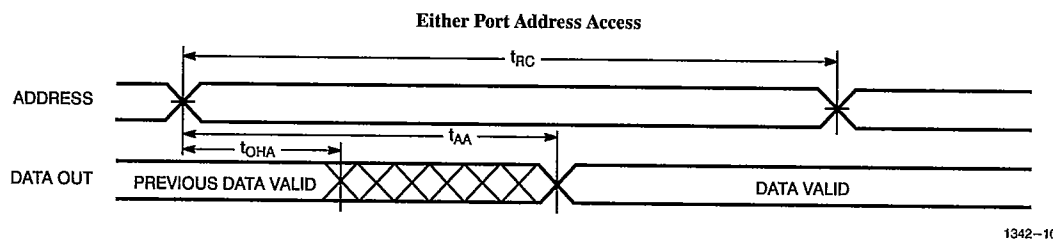
CY7B134
CY7B135
CY7B1342

Switching Characteristics Over the Operating Range^[7,8] (continued)

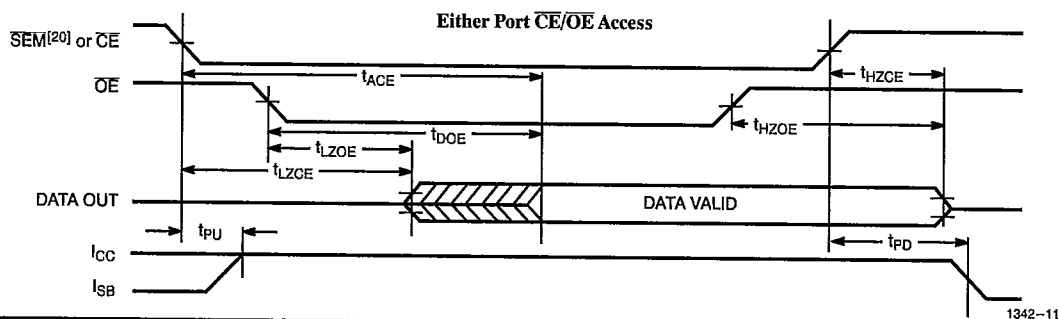
Parameter	Description	7B134-20 7B135-20 7B1342-20		7B134-25 7B135-25 7B1342-25		7B134-35 7B135-35 7B1342-35		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
WRITE CYCLE (continued)								
tWDD ^[11]	Write Pulse to Data Delay		40		50		60	ns
tDDD ^[11]	Write Data Valid to Read Data Valid		30		30		35	ns
SEMAPHORE TIMING ^[12]								
tSOP	SEM Flag Update Pulse (OE or SEM)	10		10		15		ns
tSWRD	SEM Flag Write to Read Time	5		5		5		ns
tSPS	SEM Flag Contention Window	5		5		5		ns

Switching Waveforms

Read Cycle No. 1^[13,14]



Read Cycle No. 2^[13,15]

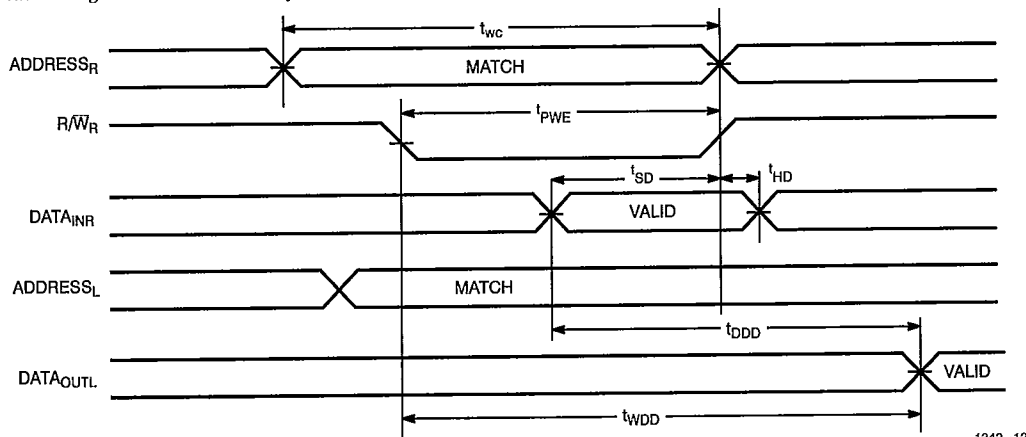


Notes:

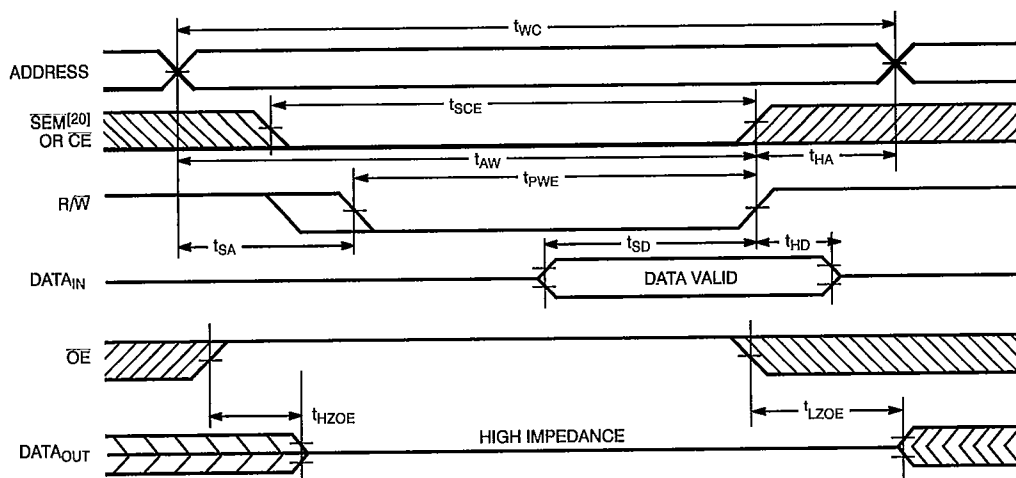
- See the last page of this specification for Group A subgroup testing information.
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- At any given temperature and voltage condition for any given device, t_{HZCE} is less than t_{LZCE} and t_{HZOE} is less than t_{LZOE} .
- Test conditions used are Load 3.
- For information on port-to-port delay through RAM cells from writing port to reading port, refer to Read Timing with Port-to-Port Delay waveform.
- Semaphore timing applies only to CY7B1342.
- R/W is HIGH for read cycle.
- Device is continuously selected, $\overline{CE} = V_{IL}$ and $\overline{OE} = V_{IL}$.
- Address valid prior to or coincident with $\overline{CE}$ transition LOW.



Switching Waveforms

Read Timing with Port-to-Port Delay^[16]

1342-12

Write Cycle No. 1: $\overline{OE}$ Three-States Data I/Os (Either Port)^[17,18,19]

1342-13

Notes:

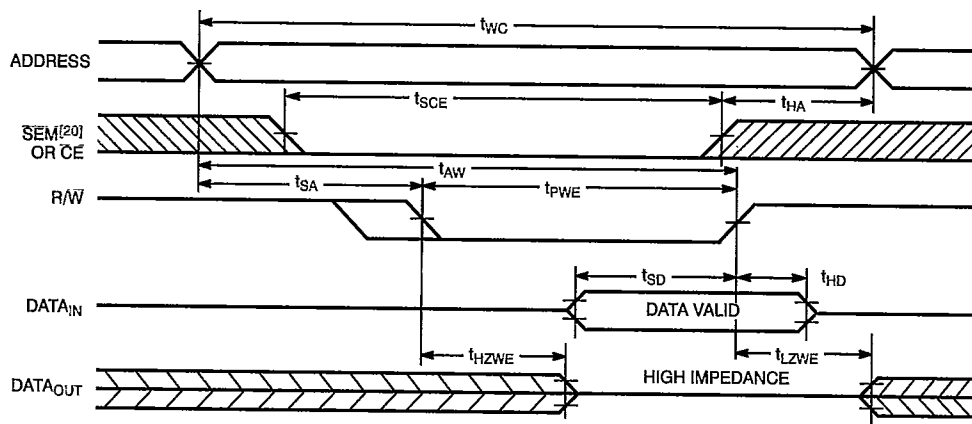
16. $\overline{CE}_L = \overline{CE}_R = \text{LOW}$; $R/\overline{W}_L = \text{HIGH}$
17. The internal write time of the memory is defined by the overlap of $\overline{CE}$ or $\overline{SEM}$ LOW and $R/\overline{W}$ LOW. Both signals must be LOW to initiate a write and either signal can terminate 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.
18. $R/\overline{W}$ must be HIGH during all address transactions.
19. If $\overline{OE}$ is LOW during a $R/\overline{W}$ controlled write cycle, the write pulse width must be the larger of t_{PWE} or $(t_{HZWE} + t_{SD})$ to allow the I/O drivers to turn off and data to be placed on the bus for the required t_{SD} . If $\overline{OE}$ is HIGH during a $R/\overline{W}$ controlled write cycle (as in this example), this requirement does not apply and the write pulse can be as short as the specified t_{PWE} .
20. $\overline{SEM}$ only applies to CY7B1342.



CY7B134
CY7B135
CY7B1342

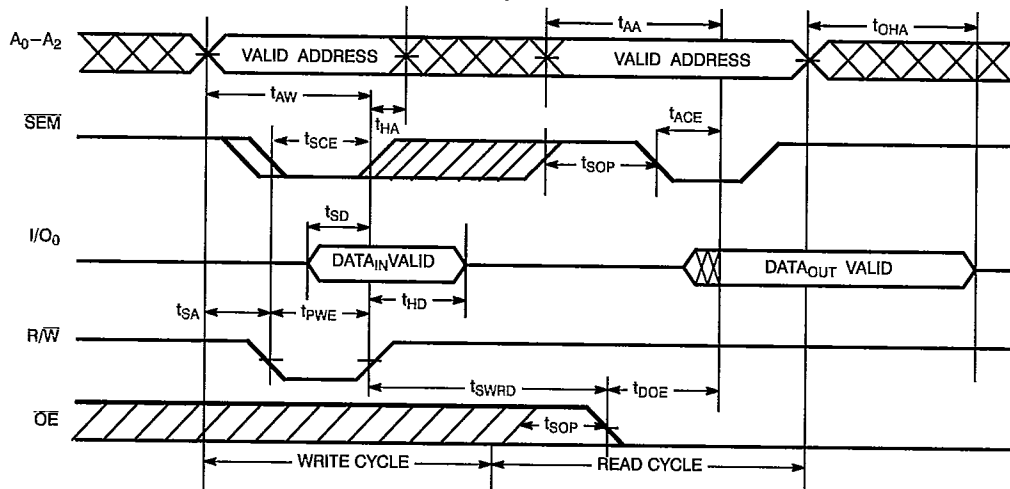
Switching Waveforms (continued)

Write Cycle No. 2: R/W Three-States Data I/Os (Either Port)^[18,21]



1342-14

Semaphore Read After Write Timing, Either Side (CY7B1342 only)^[22]



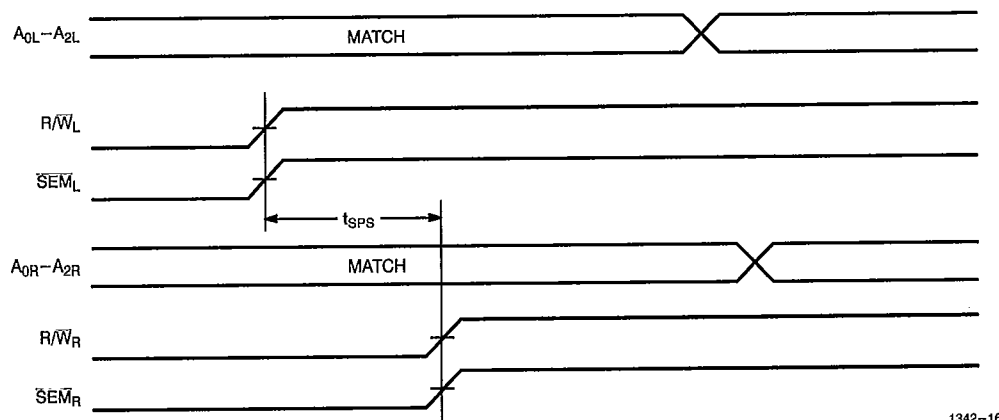
1342-15

Notes:

21. Data I/O pins enter high-impedance when $\overline{OE}$ is held LOW during write.
22. $\overline{CE}$ = HIGH for the duration of the above timing (both write and read cycle).



Switching Waveforms (continued)

Timing Diagram of Semaphore Contention (CY7B1342 only)^[23,24,25]

1342-16

Notes:

23. $I/O_{0R} = I/O_{0L} = \text{LOW}$ (request semaphore); $\overline{CE}_R = \overline{CE}_L = \text{HIGH}$
24. Semaphores are reset (available to both ports) at cycle start.
25. If t_{SPS} is violated, it is guaranteed that only one side will gain access to the semaphore.



CY7B134
CY7B135
CY7B1342

Architecture

The CY7B134 and CY7B135 consist of an array of 4K words of 8 bits each of dual-port RAM cells, I/O and address lines, and control signals (CE, OE, R/W). Two semaphore control pins exist for the CY7B1342 (SEM_{L/R}).

Functional Description

Write Operation

Data must be set up for a duration of t_{SD} before the rising edge of R/W in order to guarantee a valid write. Since there is no on-chip arbitration, the user must be sure that a specific location will not be accessed simultaneously by both ports or erroneous data could result. A write operation is controlled by either the OE pin (see Write Cycle No. 1 timing diagram) or the R/W pin (see Write Cycle No. 2 timing diagram). Data can be written t_{HZOE} after the OE is deasserted or t_{HZWE} after the falling edge of R/W. Required inputs for write operations are summarized in Table 1.

If a location is being written to by one port and the opposite port attempts to read the same location, a port-to-port flowthrough delay is met before the data is valid on the output. Data will be valid on the port wishing to read the location t_{DD} after the data is presented on the writing port.

Read Operation

When reading the device, the user must assert both the OE and CE pins. Data will be available t_{ACE} after CE or t_{DOE} after OE are asserted. If the user of the CY7B1342 wishes to access a semaphore, the SEM pin must be asserted instead of the CE pin. Required inputs for read operations are summarized in Table 1.

Semaphore Operation

The CY7B1342 provides eight semaphore latches which are separate from the dual port memory locations. Semaphores are used to reserve resources which are shared between the two ports. The state of the semaphore indicates that a resource is in use. For example, if the left port wants to request a given resource, it sets a latch by writing a zero to a semaphore location. The left port then verifies its success in setting the latch by reading it. After writing to the semaphore, SEM or OE must be deasserted for t_{SD} before attempting to read the semaphore. The semaphore value will be available $t_{SWRD} + t_{DOE}$ after the rising edge of the semaphore write. If the left port was successful (reads a zero), it assumes control over the shared resource, otherwise (reads a one) it assumes the right port has control and continues to poll the semaphore. When the right side has relinquished control of the semaphore (by writing a one), the left side will succeed in gaining control of the semaphore. If the left side no longer requires the semaphore, a one is written to cancel its request.

Semaphores are accessed by asserting SEM LOW. The SEM pin functions as a chip enable for the semaphore latches. CE must remain HIGH during SEM LOW. A₀₋₂ represents the semaphore address. OE and R/W are used in the same manner as a normal memory access. When writing or reading a semaphore, the other address pins have no effect.

When writing to the semaphore, only I/O₀ is used. If a 0 is written to the left port of an unused semaphore, a one will appear at the same semaphore address on the right port. That semaphore can now only be modified by the side showing a zero (the left port in this case). If the left port now relinquishes control by writing a one to the semaphore, the semaphore will be set to one for both sides. However, if the right port had requested the semaphore (written a zero) while the left port had control, the right port would immediately own the semaphore. Table 2 shows sample semaphore operations.

When reading a semaphore, all eight data lines output the semaphore value. The read value is latched in an output register to prevent the semaphore from changing state during a write from the other port. If both ports request a semaphore control by writing a 0 to a semaphore within t_{SPS} of each other, it is guaranteed that only one side will gain access to the semaphore.

Table 1. Non-contending Read/Write

Inputs				Outputs	Operation
CE	R/W	OE	SEM	I/O ₀ - I/O ₇	
H	X	X	H	High Z	Power-Down
H	H	L	L	Data Out	Read Data _{IN} Semaphore
X	X	H	X	High Z	I/O Lines Disabled
H		X	L	Data In	Write to Semaphore
L	H	L	H	Data Out	Read
L	L	X	H	Data In	Write
L	X	X	L		Illegal Condition

Table 2. Semaphore Operation Example

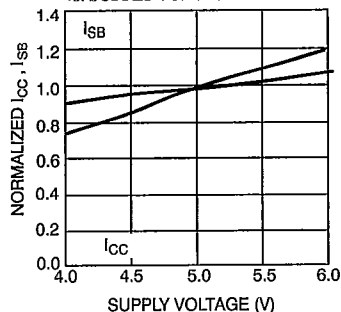
Function	I/O ₀ Left	I/O ₀ Right	Status
No Action	1	1	Semaphore free
Left port writes semaphore	0	1	Left port obtains semaphore
Right port writes 0 to semaphore	0	1	Right side is denied access
Left port writes 1 to semaphore	1	0	Right port is granted access to Semaphore
Left port writes 0 to semaphore	1	0	No change. Left port is denied access
Right port writes 1 to semaphore	0	1	Left port obtains semaphore
Left port writes 1 to semaphore	1	1	No port accessing semaphore address
Right port writes 0 to semaphore	1	0	Right port obtains semaphore
Right port writes 1 to semaphore	1	1	No port accessing semaphore
Left port writes 0 to semaphore	0	1	Left port obtains semaphore
Left port writes 1 to semaphore	1	1	No port accessing semaphore



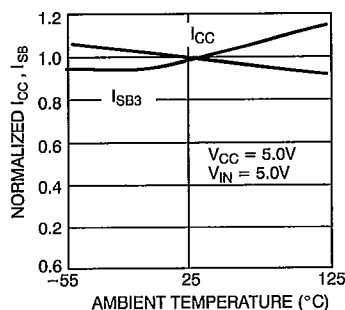
CY7B134
CY7B135
CY7B1342

Typical DC and AC Characteristics

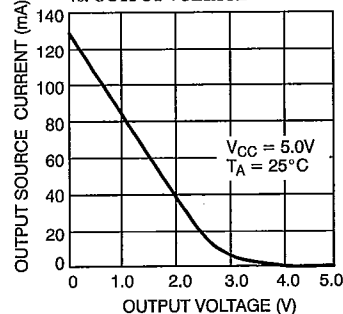
**NORMALIZED SUPPLY CURRENT
vs. SUPPLY VOLTAGE**



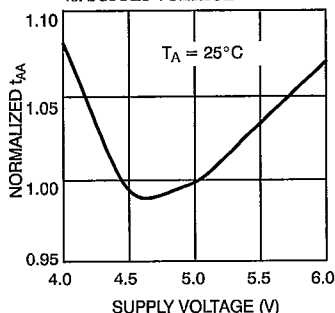
**NORMALIZED SUPPLY CURRENT
vs. AMBIENT TEMPERATURE**



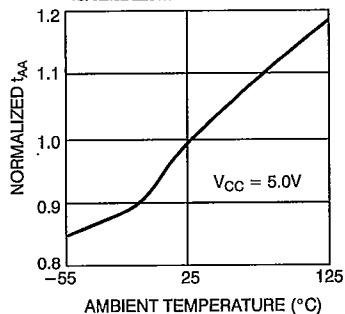
**OUTPUT SOURCE CURRENT
vs. OUTPUT VOLTAGE**



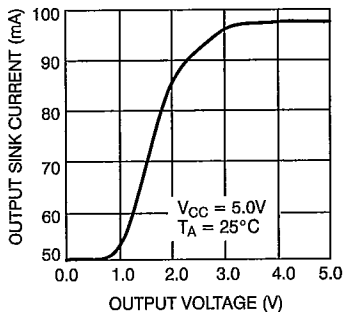
**NORMALIZED ACCESS TIME
vs. SUPPLY VOLTAGE**



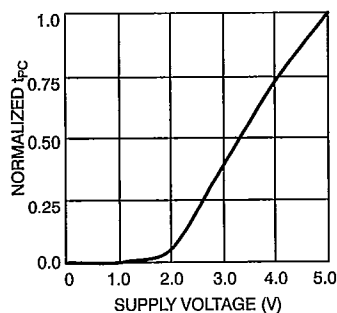
**NORMALIZED ACCESS TIME
vs. AMBIENT TEMPERATURE**



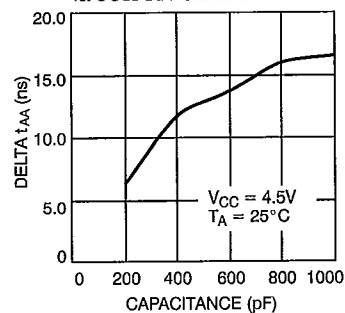
**OUTPUT SINK CURRENT
vs. OUTPUT VOLTAGE**



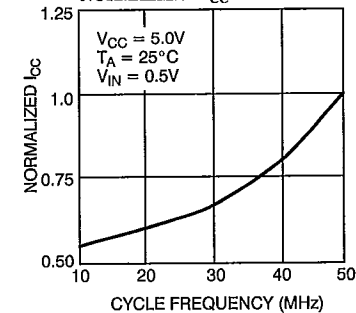
**TYPICAL POWER-ON CURRENT
vs. SUPPLY VOLTAGE**



**TYPICAL ACCESS TIME CHANGE
vs. OUTPUT LOADING**



NORMALIZED I_{CC} vs. CYCLE TIME





CY7B134
CY7B135
CY7B1342

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
20	CY7B134-20PC	P25	48-Lead (600-Mil) Molded DIP	Commercial
25	CY7B134-25PC	P25	48-Lead (600-Mil) Molded DIP	Commercial
	CY7B134-25PI	P25	48-Lead (600-Mil) Molded DIP	Industrial
	CY7B134-25DMB	D26	48-Lead (600-Mil) Sidebraze DIP	Military
	CY7B134-25LMB	L68	48-Square Leadless Chip Carrier	
35	CY7B134-35PC	P25	48-Lead (600-Mil) Molded DIP	Commercial
	CY7B134-35PI	P25	48-Lead (600-Mil) Molded DIP	Industrial
	CY7B134-35DMB	D26	48-Lead (600-Mil) Sidebraze DIP	Military
	CY7B134-35LMB	L68	48-Square Leadless Chip Carrier	

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
20	CY7B135-20JC	J69	52-Lead Plastic Leaded Chip Carrier	Commercial
25	CY7B135-25JC	J69	52-Lead Plastic Leaded Chip Carrier	Commercial
	CY7B135-25JI	J69	52-Lead Plastic Leaded Chip Carrier	Industrial
	CY7B135-25LMB	L69	52-Square Leadless Chip Carrier	Military
35	CY7B135-35JC	J69	52-Lead Plastic Leaded Chip Carrier	Commercial
	CY7B135-35JI	J69	52-Lead Plastic Leaded Chip Carrier	Industrial
	CY7B135-35LMB	L69	52-Square Leadless Chip Carrier	Military

Speed (ns)	Ordering Code	Package Type	Package Type	Operating Range
20	CY7B1342-20JC	J69	52-Lead Plastic Leaded Chip Carrier	Commercial
25	CY7B1342-25JC	J69	52-Lead Plastic Leaded Chip Carrier	Commercial
	CY7B1342-25JI	J69	52-Lead Plastic Leaded Chip Carrier	Industrial
	CY7B1342-25LMB	L69	52-Square Leadless Chip Carrier	Military
35	CY7B1342-35JC	J69	52-Lead Plastic Leaded Chip Carrier	Commercial
	CY7B1342-35JI	J69	52-Lead Plastic Leaded Chip Carrier	Industrial
	CY7B1342-35LMB	L69	52-Square Leadless Chip Carrier	Military