

512K x 8 Static RAM

Features

- **High speed**
 - $t_{AA} = 12 \text{ ns}$
- **Low active power**
 - 1320 mW (max.)
- **Low CMOS standby power (Commercial L version)**
 - 2.75 mW (max.)
- **2.0V Data Retention (400 μW at 2.0V retention)**
- **Automatic power-down when deselected**
- **TTL-compatible inputs and outputs**
- **Easy memory expansion with $\overline{\text{CE}}$ and $\overline{\text{OE}}$ features**
- **Available in Pb-free and non Pb-free 36-Lead (400-Mil) Molded SOJ**

Functional Description^[1]

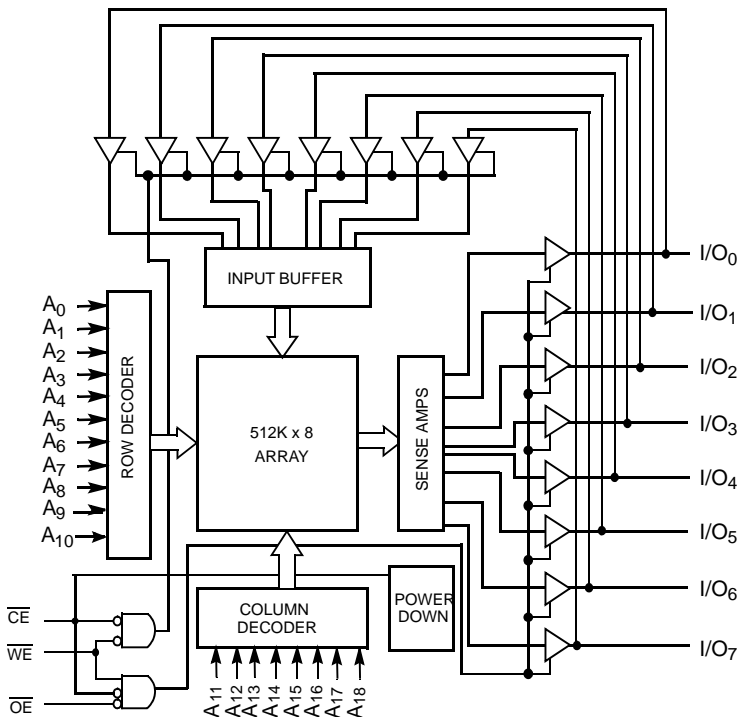
The CY7C1049B is a high-performance CMOS static RAM organized as 524,288 words by 8 bits. Easy memory expansion is provided by an active LOW Chip Enable ($\overline{\text{CE}}$), an active LOW Output Enable ($\overline{\text{OE}}$), and tri-state drivers. Writing to the device is accomplished by taking Chip Enable ($\overline{\text{CE}}$) and Write Enable ($\overline{\text{WE}}$) inputs LOW. Data on the eight I/O pins (I/O_0 through I/O_7) is then written into the location specified on the address pins (A_0 through A_{18}).

Reading from the device is accomplished by taking Chip Enable ($\overline{\text{CE}}$) and Output Enable ($\overline{\text{OE}}$) LOW while forcing Write Enable ($\overline{\text{WE}}$) HIGH. Under these conditions, the contents of the memory location specified by the address pins will appear on the I/O pins.

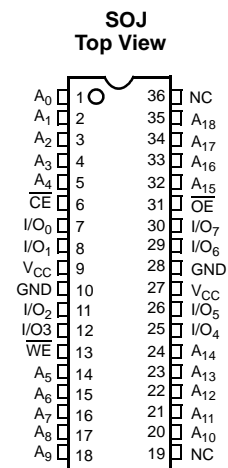
The eight input/output pins (I/O_0 through I/O_7) are placed in a high-impedance state when the device is deselected ($\overline{\text{CE}}$ HIGH), the outputs are disabled ($\overline{\text{OE}}$ HIGH), or during a write operation ($\overline{\text{CE}}$ LOW, and $\overline{\text{WE}}$ LOW).

The CY7C1049B is available in a standard 400-mil-wide 36-pin SOJ package with center power and ground (revolutionary) pinout.

Logic Block Diagram



Pin Configuration



Note:

1. For guidelines on SRAM system design, please refer to the 'System Design Guidelines' Cypress application note, available on the internet at www.cypress.com.

Selection Guide

		-12	-15	-17
Maximum Access Time (ns)		12	15	17
Maximum Operating Current (mA)		240	220	195
Maximum CMOS Standby Current (mA)	Commercial	8	8	8
	Industrial	-	-	-
	Commercial L	-	-	0.5

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 on V_{CC} to Relative GND^[2] -0.5V to +7.0V

DC Voltage Applied to Outputs in High Z State^[2] -0.5V to $V_{CC} + 0.5V$

DC Input Voltage^[2] -0.5V to $V_{CC} + 0.5V$

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}
Commercial	0°C to +70°C	4.5V–5.5V
Industrial	-40°C to +85°C	

Electrical Characteristics Over the Operating Range

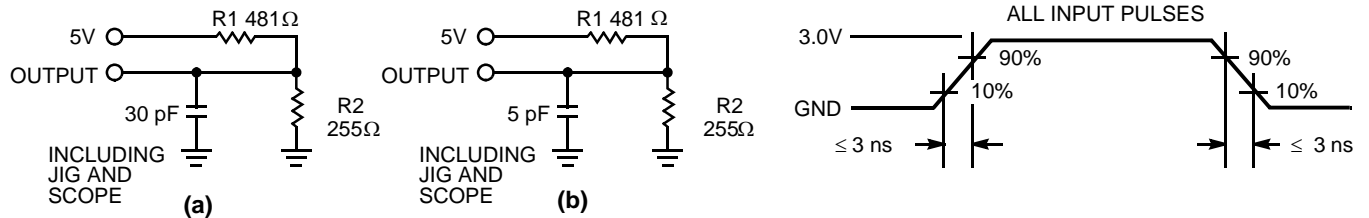
Parameter	Description	Test Conditions	-12		-15		-17		Unit	
			Min.	Max.	Min.	Max.	Min.	Max.		
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}, I_{OH} = -4.0 \text{ mA}$	2.4		2.4		2.4		V	
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}, I_{OL} = 8.0 \text{ mA}$		0.4		0.4		0.4	V	
V_{IH}	Input HIGH Voltage		2.2	$V_{CC} + 0.3$	2.2	$V_{CC} + 0.3$	2.2	$V_{CC} + 0.3$	V	
V_{IL}	Input LOW Voltage ^[2]		-0.3	0.8	-0.3	0.8	-0.3	0.3	V	
I_{IX}	Input Leakage Current	$GND \leq V_I \leq V_{CC}$	-1	+1	-1	+1	-1	+1	μA	
I_{OZ}	Output Leakage Current	$GND \leq V_{OUT} \leq V_{CC}$, Output Disabled	-1	+1	-1	+1	-1	+1	μA	
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max.}$, $f = f_{MAX} = 1/t_{RC}$		240		220		195	mA	
I_{SB1}	Automatic CE Power-Down Current —TTL Inputs	Max. V_{CC} , $\overline{CE} \geq V_{IH}$ $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$, $f = f_{MAX}$		40		40		40	mA	
I_{SB2}	Automatic CE Power-Down Current —CMOS Inputs	Max. V_{CC} , $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$, or $V_{IN} \leq 0.3V$, $f = 0$	Com'l	8		8		8	mA	
			Com'l L		-		-		0.5	mA
			Ind'l		-		-		8	mA

Note:

2. Minimum voltage is -2.0V for pulse durations of less than 20 ns.

Capacitance^[3]

Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	$T_A = 25^\circ\text{C}$, $f = 1\text{ MHz}$, $V_{CC} = 5.0\text{V}$	8	pF
C_{OUT}	I/O Capacitance		8	pF

AC Test Loads and Waveforms


Equivalent to: THÉVENIN EQUIVALENT
 OUTPUT $\text{---} \frac{167\ \Omega}{\text{---}} \text{---} 1.73\text{V}$

Note:

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

Switching Characteristics Over the Operating Range^[4]

Parameter	Description	-12		-15		-17		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle								
t_{power}	V_{CC} (typical) to the First Access ^[5]	1		1		1		ms
t_{RC}	Read Cycle Time	12		15		17		ns
t_{AA}	Address to Data Valid		12		15		17	ns
t_{OHA}	Data Hold from Address Change	3		3		3		ns
t_{ACE}	\overline{CE} LOW to Data Valid		12		15		17	ns
t_{DOE}	\overline{OE} LOW to Data Valid		6		7		8	ns
t_{LZOE}	\overline{OE} LOW to Low Z ^[7]	0		0		0		ns
t_{HZOE}	\overline{OE} HIGH to High Z ^[6, 7]		6		7		7	ns
t_{LZCE}	\overline{CE} LOW to Low Z ^[7]	3		3		3		ns
t_{HZCE}	\overline{CE} HIGH to High Z ^[6, 7]		6		7		7	ns
t_{PU}	\overline{CE} LOW to Power-Up	0		0		0		ns
t_{PD}	\overline{CE} HIGH to Power-Down		12		15		17	ns
Write Cycle^[8, 9]								
t_{WC}	Write Cycle Time	12		15		17		ns
t_{SCE}	\overline{CE} LOW to Write End	10		12		12		ns
t_{AW}	Address Set-Up to Write End	10		12		12		ns
t_{HA}	Address Hold from Write End	0		0		0		ns
t_{SA}	Address Set-Up to Write Start	0		0		0		ns
t_{PWE}	\overline{WE} Pulse Width	10		12		12		ns
t_{SD}	Data Set-Up to Write End	7		8		8		ns
t_{HD}	Data Hold from Write End	0		0		0		ns
t_{LZWE}	\overline{WE} HIGH to Low Z ^[7]	3		3		3		ns
t_{HZWE}	\overline{WE} LOW to High Z ^[6, 7]		6		7		8	ns

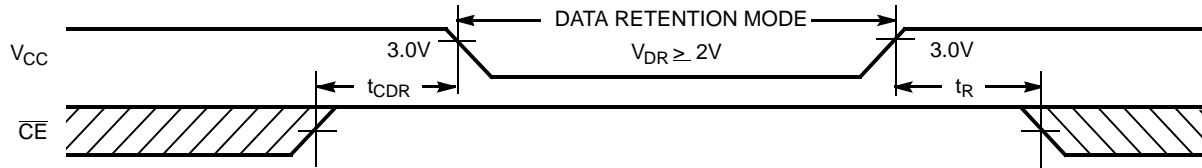
Data Retention Characteristics Over the Operating Range

Parameter	Description		Conditions ^[11]		Min.	Max.	Unit
V_{DR}	V_{CC} for Data Retention				2.0		V
I_{CCDR}	Data Retention Current	Com'I	L	$V_{CC} = V_{DR} = 2.0V$, $CE \geq V_{CC} - 0.3V$ $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$		200	μA
$t_{CDR}^{[3]}$	Chip Deselect to Data Retention Time				0		ns
$t_R^{[10]}$	Operation Recovery Time				t_{RC}		ns

Notes:

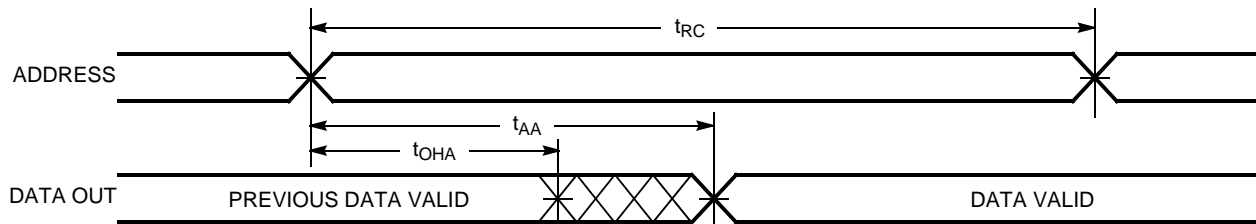
- Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
- This part has a voltage regulator which steps down the voltage from 5V to 3.3V internally. t_{power} time has to be provided initially before a read/write operation is started.
- t_{HZOE} , t_{HZCE} , and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of AC Test Loads. Transition is measured ± 500 mV from steady-state voltage.
- 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.
- The internal write time of the memory is defined by the overlap of \overline{CE} LOW, and \overline{WE} LOW. \overline{CE} and \overline{WE} must be LOW to initiate a write, and the transition of either of these signals can terminate the write. The input data set-up and hold timing should be referenced to the leading edge of the signal that terminates the write.
- The minimum write cycle time for Write Cycle no. 3 (\overline{WE} controlled, \overline{OE} LOW) is the sum of t_{HZWE} and t_{SD} .
- $t_r \leq 3$ ns for all the speeds
- No input may exceed $V_{CC} + 0.5V$.

Data Retention Waveform

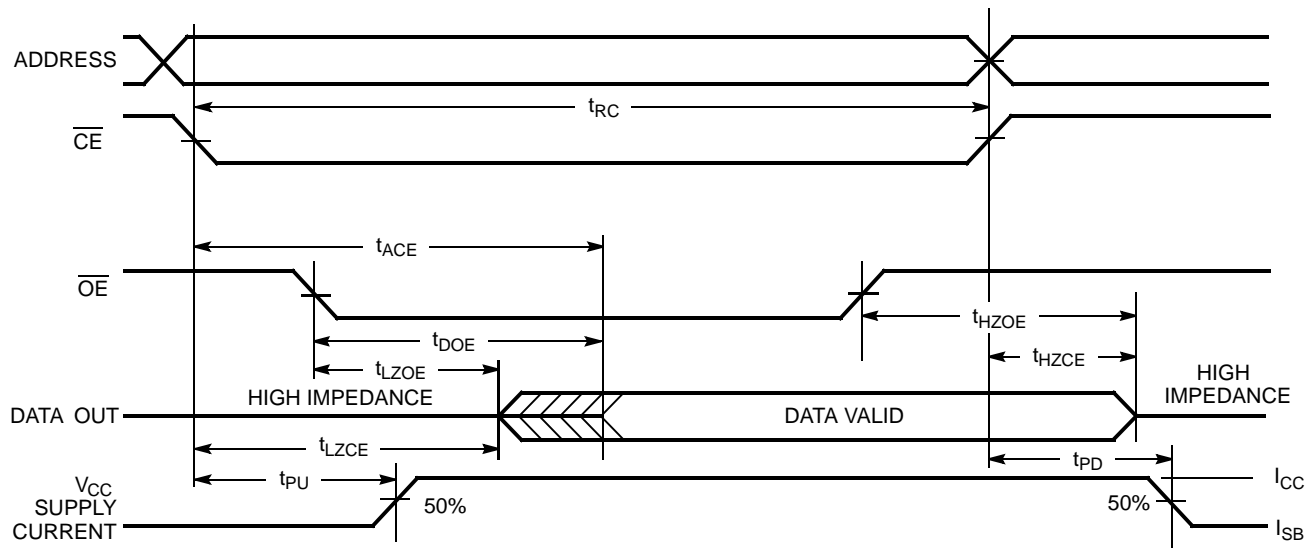


Switching Waveforms

Read Cycle No. 1^[12, 13]



Read Cycle No. 2 (\overline{OE} Controlled)^[13, 14]

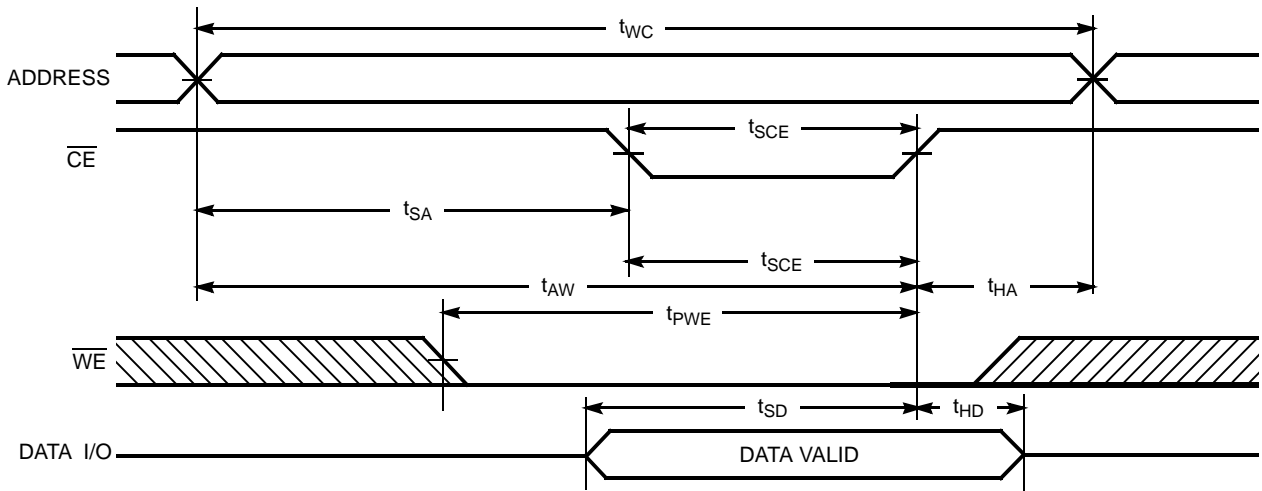


Notes:

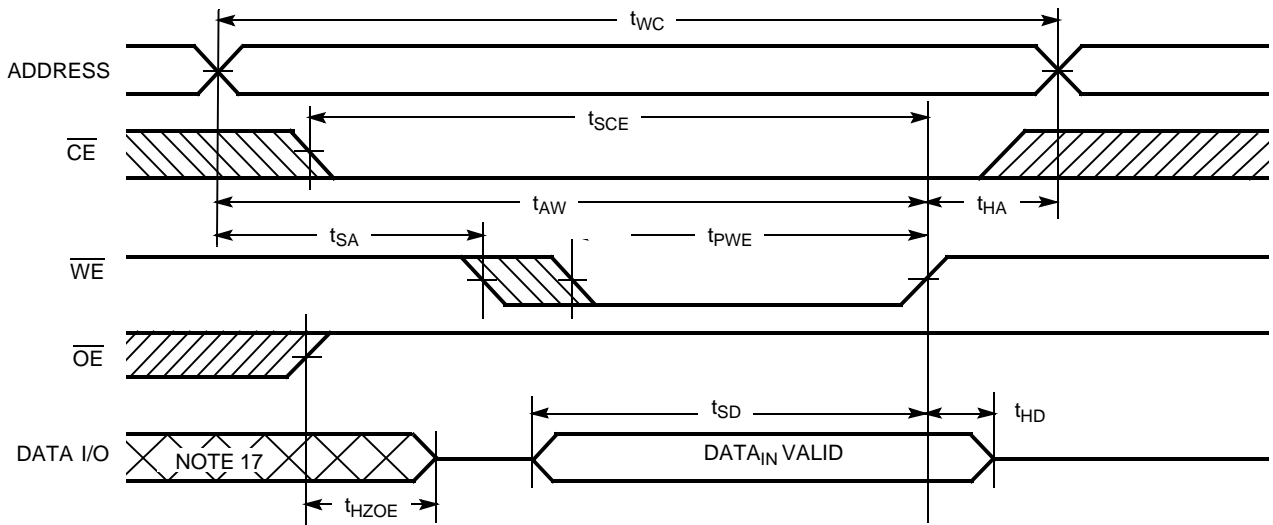
- 12. Device is continuously selected. $\overline{OE}, \overline{CE} = V_{IL}$.
- 13. \overline{WE} is HIGH for read cycle.
- 14. Address valid prior to or coincident with \overline{CE} transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled)^[15, 16]



Write Cycle No. 2 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ HIGH During Write)^[15, 16]

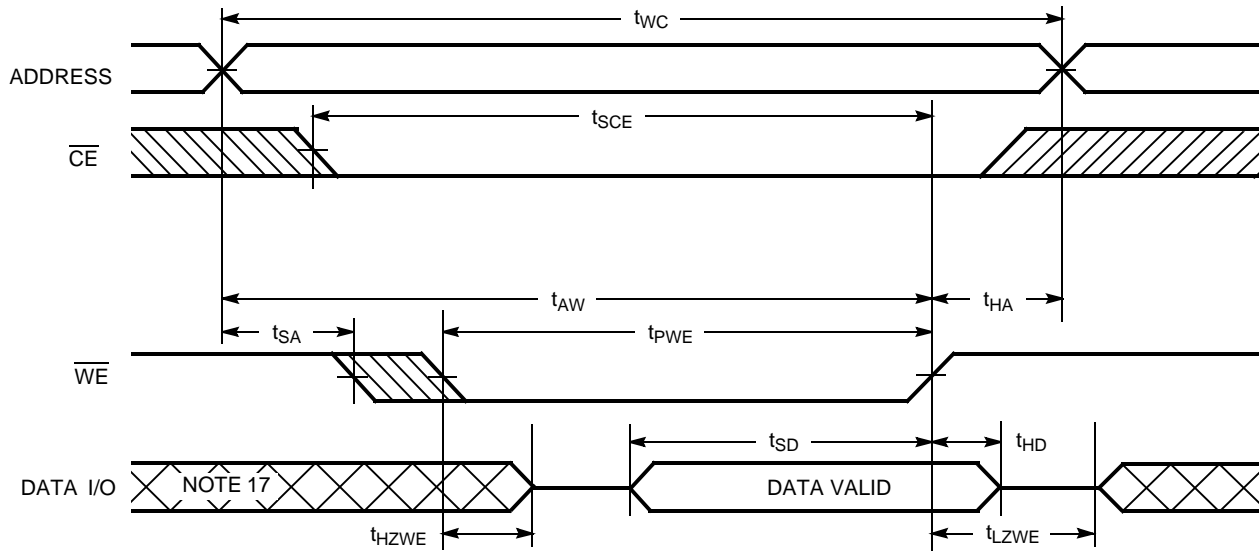


Notes:

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

Switching Waveforms (continued)

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

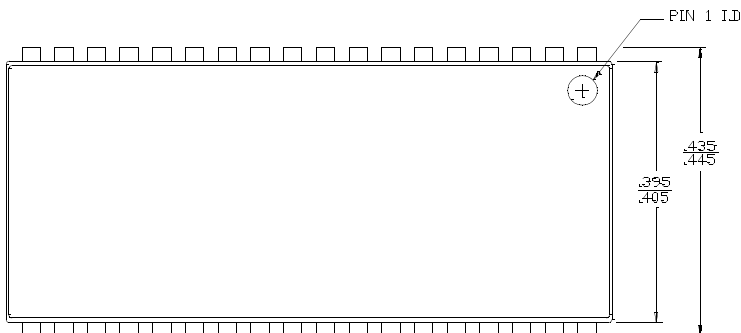


Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
12	CY7C1049B-12VC	51-85090	36-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1049B-12VXC		36-Lead (400-Mil) Molded SOJ (Pb-free)	
15	CY7C1049B-15VC		36-Lead (400-Mil) Molded SOJ	Industrial
	CY7C1049B-15VXC		36-Lead (400-Mil) Molded SOJ (Pb-free)	
	CY7C1049B-15VI		36-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1049B-15VXI		36-Lead (400-Mil) Molded SOJ (Pb-free)	
17	CY7C1049BL-17VC	36-Lead (400-Mil) Molded SOJ	Commercial	

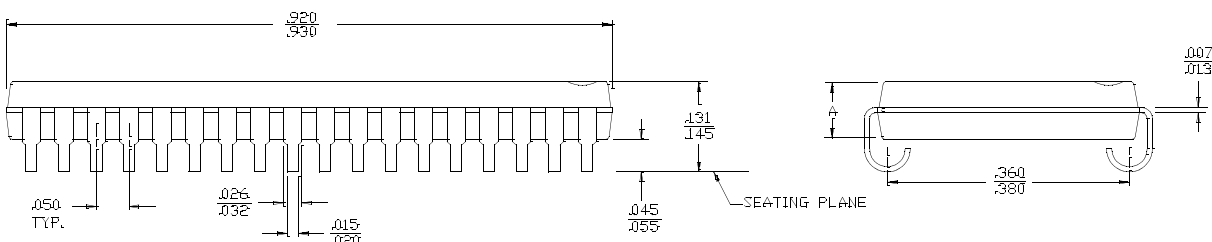
Package Diagram

36-lead (400-Mil) Molded SOJ (51-85090)



DIMENSIONS IN INCHES MILL
MAX.

DIM. A	
ANAM	CSPI
.086	.095
.090	.115



51-85090-*B

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Document History Page

Document Title: CY7C1049B 512K x 8 Static RAM				
Document Number: 38-05169				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	110209	12/02/01	SZV	Change from Spec number: 38-00937 to 38-05169
*A	116465	09/16/02	CEA	Add applications foot note to data sheet, page 1
*B	498501	See ECN	NXR	Removed 20 ns and 25 ns speed bin Changed the description of I_{IX} from Input Load Current to Input Leakage Current in DC Electrical Characteristics table Updated the Ordering Information Table