

512K x 8 Static RAM

Features

- **High speed**
 - $t_{AA} = 12 \text{ ns}$
- **Low active power**
 - 504 mW (max.)
- **Low CMOS standby power (Commercial L version)**
 - 1.8 mW (max.)
- **2.0V Data Retention (660 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**

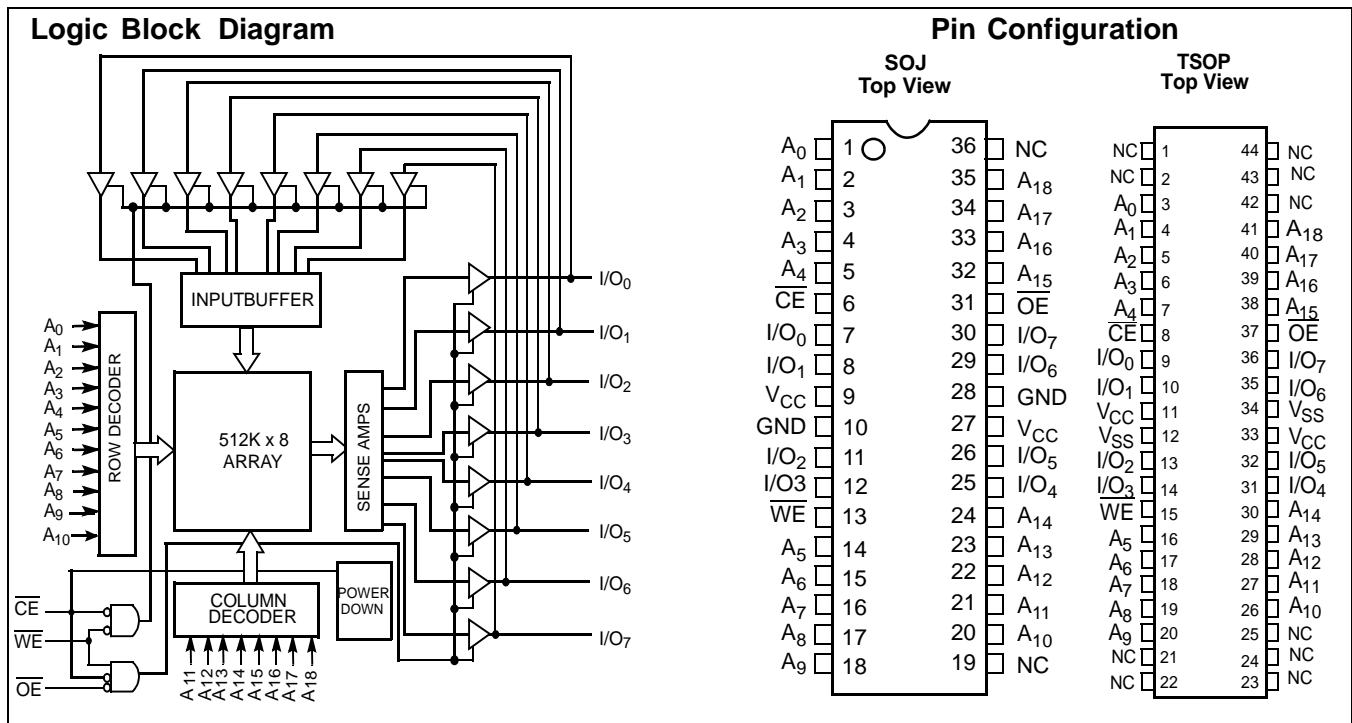
Functional Description^[1]

The CY7C1049BNV33 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 three-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 CY7C1049BNV33 is available in a standard 400-mil-wide 36-pin SOJ and 44-pin TSOPII packages with center power and ground (revolutionary) pinout.



Selection Guide

			-12	-15	-20
Maximum Access Time (ns)			12	15	20
Maximum Operating Current (mA)	Com'l		200	180	160
	Ind'l		220	200	170
Maximum CMOS Standby Current (mA)	Com'l/Ind'l		8	8	8
	Com'l	L	0.5	0.5	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 +4.6V

DC Voltage Applied to Outputs^[2]

in High Z State -0.5V to $V_{CC} + 0.5V$

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

Current into Outputs (LOW) 20 mA

Operating Range

Range	Ambient Temperature	V_{CC}
Commercial	0°C to +70°C	3.3V ± 0.3V
Industrial	-40°C to +85°C	

DC Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	-12		-15		-20		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	$V_{CC} + 0.5$	2.2	$V_{CC} + 0.5$	2.2	$V_{CC} + 0.5$	V			
V_{IL}	Input LOW Voltage ^[2]		-0.5	0.8	-0.5	0.8	-0.5	0.8	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	$V_{CC} = \text{Max.},$ $f = f_{MAX} = 1/t_{RC}$	Com'l						200	180	160	mA
			Ind'l						220	200	170	mA
I_{SB1}	Automatic CE Power-Down Current —TTL Inputs	Max. $V_{CC}, \overline{CE} \geq V_{IH}$ $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}, f = f_{MAX}$		30		30		30		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/Ind'l						8	8	8	mA
			Com'l	L					0.5	0.5	0.5	mA

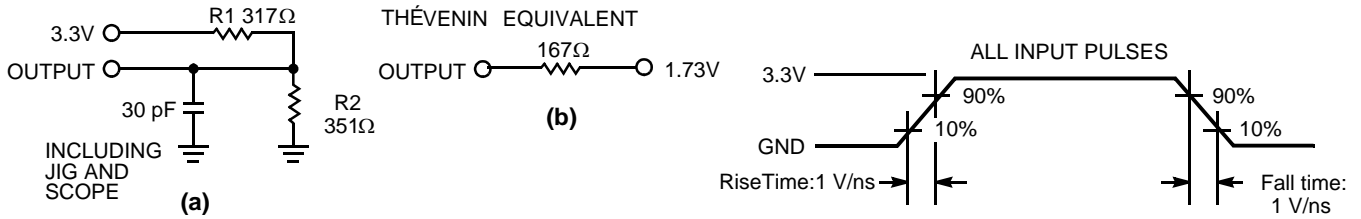
Capacitance^[3]

Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	$T_A = 25^\circ\text{C}, f = 1 \text{ MHz},$ $V_{CC} = 3.3V$	8	pF
C_{OUT}	I/O Capacitance		8	pF

Notes:

- For guidelines on SRAM system design, please refer to the 'System Design Guidelines' Cypress application note, available on the internet at www.cypress.com.
- V_{IL} (min.) = -2.0V for pulse durations of less than 20 ns.
- Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms



AC Switching Characteristics^[4] Over the Operating Range

Parameter	Description	-12		-15		-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle								
t _{power}	V _{CC} (typical) to the First Access ^[5]	1		1		1		μs
t _{RC}	Read Cycle Time	12		15		20		ns
t _{AA}	Address to Data Valid		12		15		20	ns
t _{OHA}	Data Hold from Address Change	3		3		3		ns
t _{ACE}	\overline{CE} LOW to Data Valid		12		15		20	ns
t _{DOE}	\overline{OE} LOW to Data Valid		6		7		8	ns
t _{LZOE}	\overline{OE} LOW to Low Z	0		0		0		ns
t _{HZOE}	\overline{OE} HIGH to High Z ^[6, 7]		6		7		8	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		8	ns
t _{PU}	\overline{CE} LOW to Power-Up	0		0		0		ns
t _{PD}	\overline{CE} HIGH to Power-Down		12		15		20	ns
Write Cycle^[8, 9]								
t _{WC}	Write Cycle Time	12		15		20		ns
t _{SCE}	\overline{CE} LOW to Write End	10		12		13		ns
t _{AW}	Address Set-Up to Write End	10		12		13		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		13		ns
t _{SD}	Data Set-Up to Write End	7		8		9		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

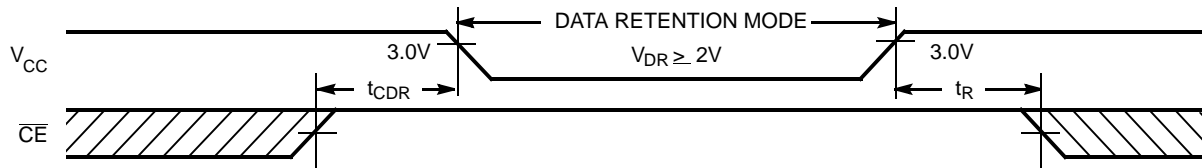
Notes:

- 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}.
- No input may exceed V_{CC} + 0.5V
- t_r ≤ 3 ns for the -12 and -15 speeds. t_r ≤ 5 ns for the -20 ns and slower speeds.

Data Retention Characteristics Over the Operating Range (For L version only)

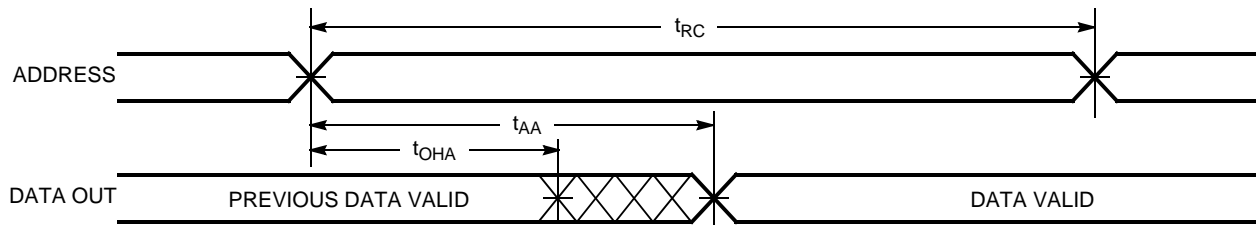
Parameter	Description	Conditions ^[10]	Min.	Max	Unit
V _{DR}	V _{CC} for Data Retention		2.0		V
I _{CCDR}	Data Retention Current	V _{CC} = V _{DR} = 2.0V, CE ≥ V _{CC} - 0.3V V _{IN} ≥ V _{CC} - 0.3V or V _{IN} ≤ 0.3V		330	μA
t _{CDR} ^[3]	Chip Deselect to Data Retention Time		0		ns
t _R ^[11]	Operation Recovery Time		t _{RC}		ns

Data Retention Waveform

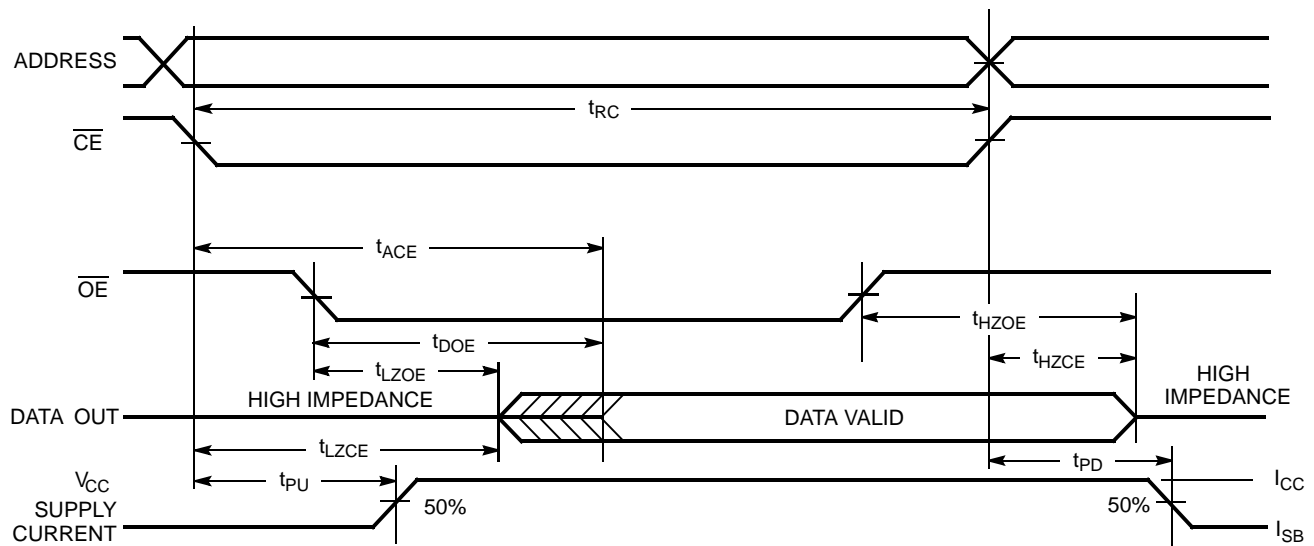


Switching Waveforms

Read Cycle No. 1^[12, 13]



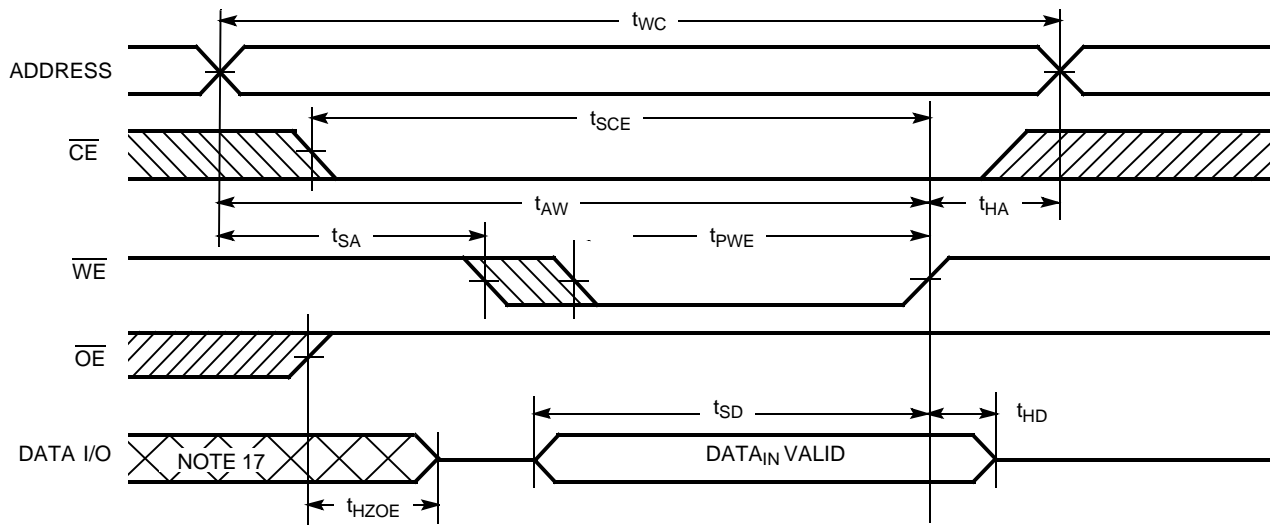
Read Cycle No. 2 (OE Controlled)^[13, 14]



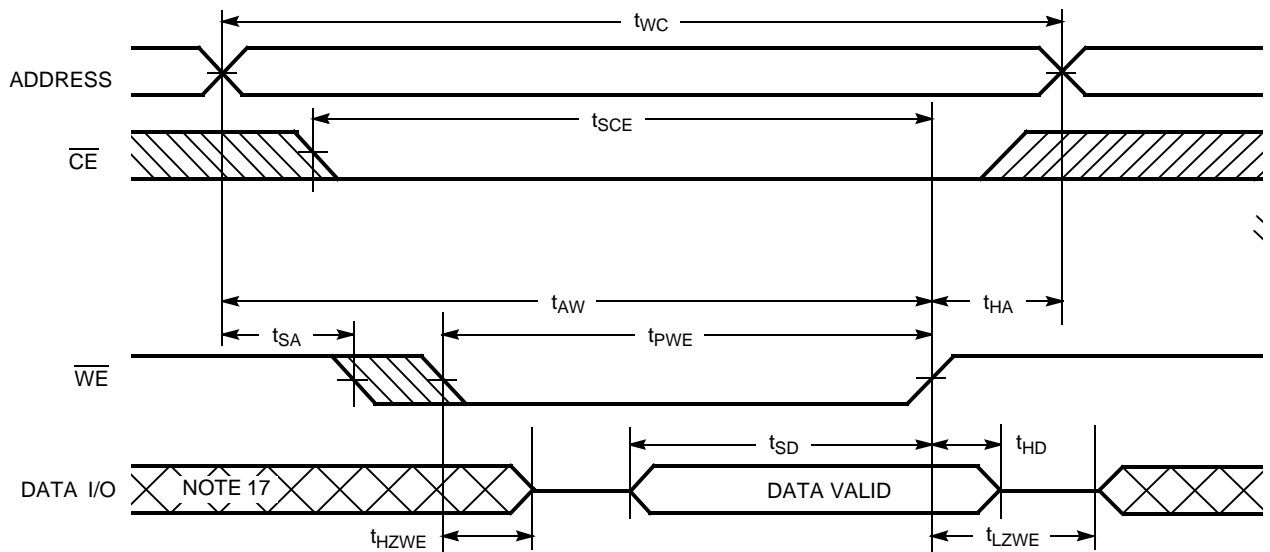
- Notes:**
 12. Device is continuously selected. \overline{OE} , $\overline{CE} = V_{IL}$.
 13. WE is HIGH for read cycle.
 14. Address valid prior to or coincident with \overline{CE} transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 (\overline{WE} Controlled, \overline{OE} HIGH During Write)^[15, 16]



Write Cycle No. 2 (\overline{WE} Controlled, \overline{OE} LOW)^[16]



Truth Table

\overline{CE}	\overline{OE}	\overline{WE}	I/O ₀ - I/O ₇	Mode	Power
H	X	X	High Z	Power-Down	Standby (I _{SB})
L	L	H	Data Out	Read	Active (I _{CC})
L	X	L	Data In	Write	Active (I _{CC})
L	H	H	High Z	Selected, Outputs Disabled	Active (I _{CC})

Notes:

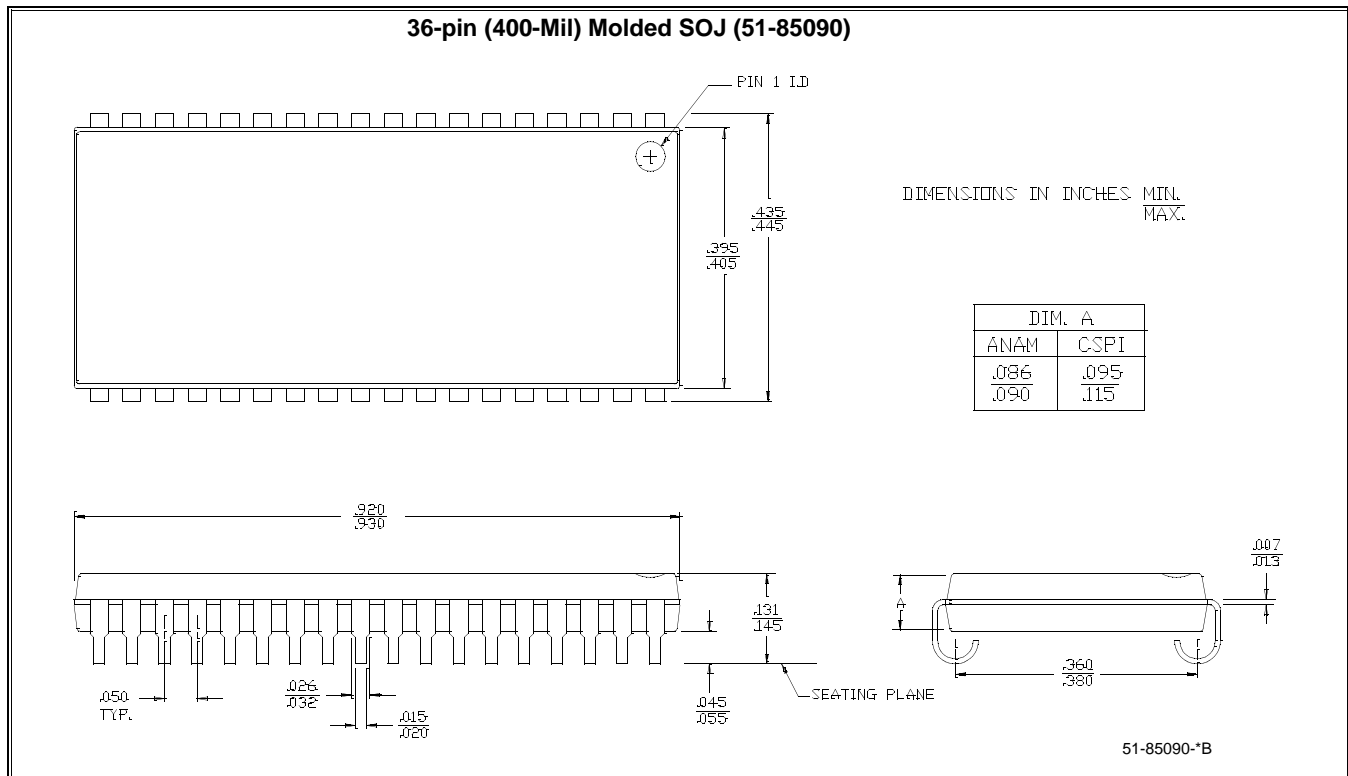
- 15. Data I/O is high-impedance if $\overline{OE} = V_{IH}$.
- 16. If \overline{CE} goes HIGH simultaneously with \overline{WE} going HIGH, the output remains in a high-impedance state.
- 17. During this period the I/Os are in the output state and input signals should not be applied.

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
12	CY7C1049BNV33-12ZC	51-85087	44-Pin TSOP II Z44	Commercial
	CY7C1049BNV33-12VXC	51-85090	36-Lead (400-Mil) Molded SOJ (Pb-free)	
	CY7C1049BNV33-12VI	51-85090	36-Lead (400-Mil) Molded SOJ	Industrial
	CY7C1049BNV33-12VXI	51-85090	36-Lead (400-Mil) Molded SOJ (Pb-free)	
15	CY7C1049BNV33-15VC	51-85090	36-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1049BNV33-15VXC	51-85090	36-Lead (400-Mil) Molded SOJ (Pb-free)	
	CY7C1049BNV33L-15VXC	51-85090	36-Lead (400-Mil) Molded SOJ (Pb-free)	
	CY7C1049BNV33-15ZC	51-85087	44-Pin TSOP II Z44	
	CY7C1049BNV33-15VI	51-85090	36-Lead (400-Mil) Molded SOJ	Industrial
	CY7C1049BNV33-15VXI	51-85090	36-Lead (400-Mil) Molded SOJ (Pb-free)	
	CY7C1049BNV33-15ZI	51-85087	44-Pin TSOP II Z44	
	CY7C1049BNV33-15ZL	51-85087	44-Pin TSOP II Z44	
20	CY7C1049BNV33-20VC	51-85090	36-Lead (400-Mil) Molded SOJ	Commercial
	CY7C1049BNV33-20VXC	51-85090	36-Lead (400-Mil) Molded SOJ (Pb-free)	
	CY7C1049BNV33-20VXI	51-85090	36-Lead (400-Mil) Molded SOJ (Pb-free)	Industrial

Please contact local sales representative regarding availability of these parts

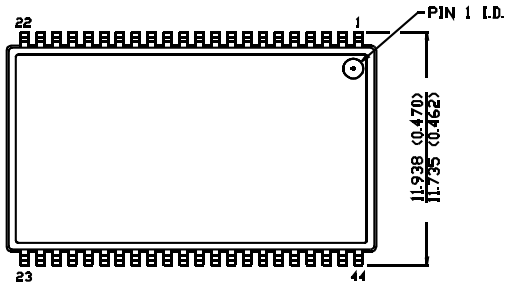
Package Diagrams



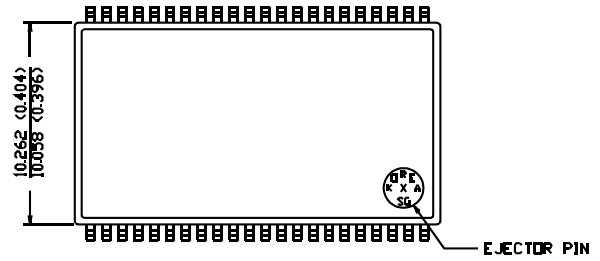
Package Diagrams (continued)

44-Pin TSOP II Z44 (51-85087)

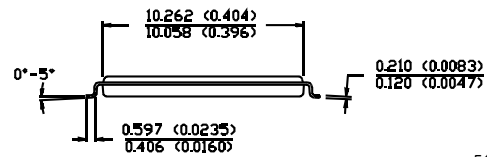
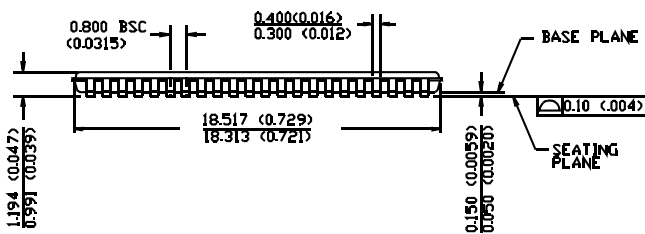
DIMENSION IN MM (INCH)
MAX
RTT



TOP VIEW



BOTTOM VIEW



51-85087-A

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Document History Page

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REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	423847	See ECN	NXR	New Data Sheet