



CY7C1399B

32K x 8 3.3V Static RAM

Features

- Single 3.3V power supply
- Ideal for low-voltage cache memory applications
- High speed
 - 10/12/15 ns
- Low active power
 - 216 mW (max.)
- Low-power alpha immune 6T cell
- Plastic SOJ and TSOP packaging

Functional Description

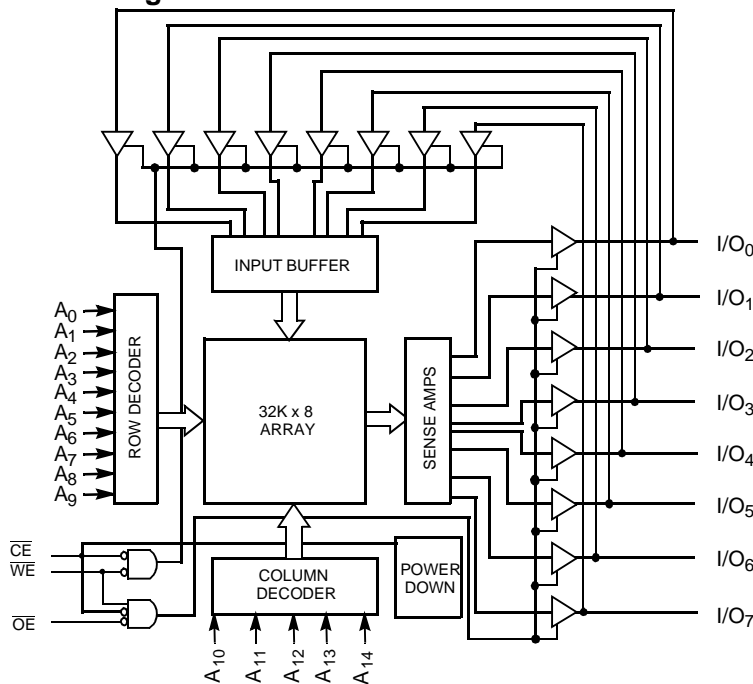
The CY7C1399B is a high-performance 3.3V CMOS Static RAM organized as 32,768 words by 8 bits. Easy memory expansion is provided by an active LOW Chip Enable (\overline{CE}) and

active LOW Output Enable (\overline{OE}) and three-state drivers. The device has an automatic power-down feature, reducing the power consumption by more than 95% when deselected.

An active LOW Write Enable signal (\overline{WE}) controls the writing/reading operation of the memory. When \overline{CE} and \overline{WE} inputs are both LOW, data on the eight data input/output pins (I/O_0 through I/O_7) is written into the memory location addressed by the address present on the address pins (A_0 through A_{14}). Reading the device is accomplished by selecting the device and enabling the outputs, \overline{CE} and \overline{OE} active LOW, while \overline{WE} remains inactive or HIGH. Under these conditions, the contents of the location addressed by the information on address pins is present on the eight data input/output pins.

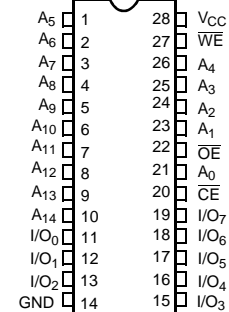
The input/output pins remain in a high-impedance state unless the chip is selected, outputs are enabled, and Write Enable (\overline{WE}) is HIGH. The CY7C1399B is available in 28-pin standard 300-mil-wide SOJ and TSOP Type I packages.

Logic Block Diagram



Pin Configurations

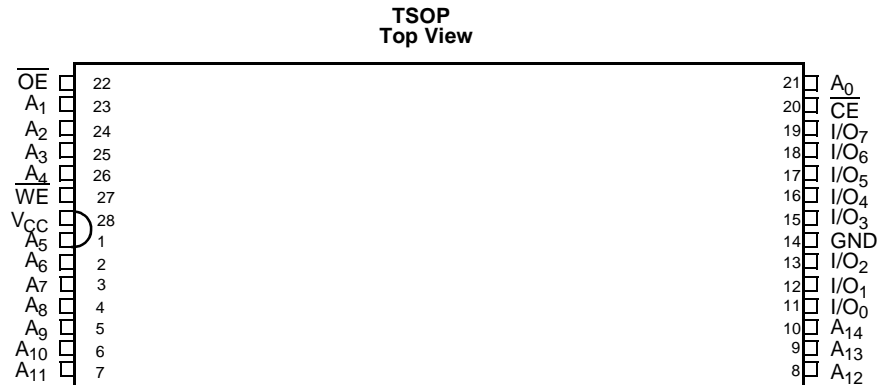
SOJ Top View



Selection Guide

	1399B-10	1399B-12	1399B-15	1399B-20
Maximum Access Time (ns)	10	12	15	20
Maximum Operating Current (mA)	60	55	50	45
Maximum CMOS Standby Current (μ A)	500	500	500	500
L	50	50	50	50

Pin Configuration



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^[1] -0.5V to +4.6V

DC Voltage Applied to Outputs
in High Z State^[1] -0.5V to $V_{CC} + 0.5V$

DC Input Voltage^[1] -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	V_{CC}
Commercial	0°C to +70°C	3.3V \pm 300 mV
Industrial	-40°C to +85°C	3.3V \pm 300 mV

Electrical Characteristics Over the Operating Range^[1]

Parameter	Description	Test Conditions	7C1399B-10		7C1399B-12		Unit
			Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}, I_{OH} = -2.0 \text{ mA}$	2.4		2.4		V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}, I_{OL} = 4.0 \text{ mA}$		0.4		0.4	V
V_{IH}	Input HIGH Voltage		2.2	$V_{CC} + 0.3V$	2.2	$V_{CC} + 0.3V$	V
V_{IL}	Input LOW Voltage		-0.3	0.8	-0.3	0.8	V
I_{IX}	Input Load Current		-1	+1	-1	+1	μA
I_{OZ}	Output Leakage Current	$GND \leq V_I \leq V_{CC}$, Output Disabled	-5	+5	-5	+5	μA
I_{OS}	Output Short Circuit Current ^[2]	$V_{CC} = \text{Max.}, V_{OUT} = GND$		-300		-300	mA
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max.}, I_{OUT} = 0 \text{ mA}$, $f = f_{MAX} = 1/t_{RC}$		60		55	mA
I_{SB1}	Automatic CE Power-Down Current — TTL Inputs	Max. V_{CC} , $\overline{CE} \geq V_{IH}$, $V_{IN} \geq V_{IH}$, or $V_{IN} \leq V_{IL}$, $f = f_{MAX}$		5		5	mA
		L		4		4	mA
I_{SB2}	Automatic CE Power-Down Current — CMOS Inputs ^[3]	Max. V_{CC} , $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$, or $V_{IN} \leq 0.3V$, $WE \geq V_{CC} - 0.3V$ or $WE \leq 0.3V$, $f = f_{MAX}$		500		500	μA
		L		50		50	μA

Notes:

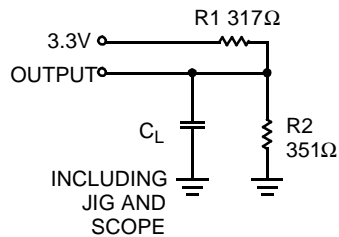
- Minimum voltage is equal to -2.0V for pulse durations of less than 20 ns.
- Not more than one output should be shorted at one time. Duration of the short circuit should not exceed 30 seconds.
- Device draws low standby current regardless of switching on the addresses.

Electrical Characteristics Over the Operating Range (continued)

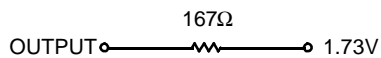
Parameter	Description	Test Conditions	1399B-15		1399B-20		Unit
			Min.	Max.	Min.	Max.	
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}, I_{OH} = -2.0 \text{ mA}$	2.4		2.4		V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}, I_{OL} = 4.0 \text{ mA}$		0.4		0.4	V
V_{IH}	Input HIGH Voltage		2.2	$V_{CC} + 0.3V$	2.2	$V_{CC} + 0.3V$	V
V_{IL}	Input LOW Voltage		-0.3	0.8	-0.3	0.8	V
I_{IX}	Input Load Current		-1	+1	-1	+1	μA
I_{OZ}	Output Leakage Current	$GND \leq V_I \leq V_{CC}$, Output Disabled	-5	+5	-5	+5	μA
I_{OS}	Output Short Circuit Current ^[2]	$V_{CC} = \text{Max.}, V_{OUT} = GND$		-300		-300	mA
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max.}, I_{OUT} = 0 \text{ mA}$, $f = f_{MAX} = 1/t_{RC}$		50		45	mA
I_{SB1}	Automatic CE Power-Down Current — TTL Inputs	Max. V_{CC} , $\overline{CE} \geq V_{IH}$, $V_{IN} \geq V_{IH}$, or $V_{IN} \leq V_{IL}$, $f = f_{MAX}$		5		5	mA
			L	4		4	mA
I_{SB2}	Automatic CE Power-Down Current — CMOS Inputs ^[3]	Max. V_{CC} , $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$, or $V_{IN} \leq 0.3V$, $WE \geq V_{CC} - 0.3V$ or $WE \leq 0.3V$, $f = f_{MAX}$		500		500	μA
			L	50		50	μA

Capacitance^[4]

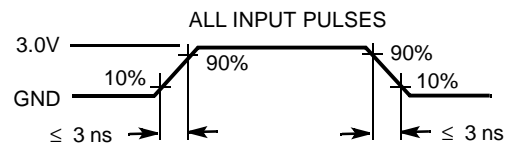
Parameter	Description	Test Conditions	Max.	Unit
C_{IN} : Addresses	Input Capacitance	$T_A = 25^\circ\text{C}$, $f = 1 \text{ MHz}$, $V_{CC} = 3.3V$	5	pF
C_{IN} : Controls			6	pF
C_{OUT}	Output Capacitance		6	pF

AC Test Loads and Waveforms


Equivalent to: THÉVENIN EQUIVALENT


Note:

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



Switching Characteristics Over the Operating Range^[5]

Parameter	Description	1399B-10		1399B-12		Unit
		Min.	Max.	Min.	Max.	
READ CYCLE						
t _{RC}	Read Cycle Time	10		12		ns
t _{AA}	Address to Data Valid		10		12	ns
t _{OHA}	Data Hold from Address Change	3		3		ns
t _{ACE}	\overline{CE} LOW to Data Valid		10		12	ns
t _{DOE}	\overline{OE} LOW to Data Valid		5		5	ns
t _{LZOE}	\overline{OE} LOW to Low Z ^[6]	0		0		ns
t _{HZOE}	\overline{OE} HIGH to High Z ^[6, 7]		5		5	ns
t _{LZCE}	\overline{CE} LOW to Low Z ^[6]	3		3		ns
t _{HZCE}	\overline{CE} HIGH to High Z ^[6, 7]		5		6	ns
t _{PU}	\overline{CE} LOW to Power-Up	0		0		ns
t _{PD}	\overline{CE} HIGH to Power-Down		10		12	ns
WRITE CYCLE ^[8, 9]						
t _{WC}	Write Cycle Time	10		12		ns
t _{SCE}	\overline{CE} LOW to Write End	8		8		ns
t _{AW}	Address Set-Up to Write End	7		8		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	7		8		ns
t _{SD}	Data Set-Up to Write End	5		7		ns
t _{HD}	Data Hold from Write End	0		0		ns
t _{HZWE}	\overline{WE} LOW to High Z ^[8]		7		7	ns
t _{LZWE}	\overline{WE} HIGH to Low Z ^[6]	3		3		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 capacitance $C_L = 30$ pF.
- 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.
- t_{HZOE} , t_{HZCE} , t_{HZWE} are specified with $C_L = 5$ pF as in AC Test Loads. Transition is measured ± 500 mV from steady state voltage.
- 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.
- The minimum write cycle time for write cycle #3 (\overline{WE} controlled, \overline{OE} LOW) is the sum of t_{HZWE} and t_{SD} .

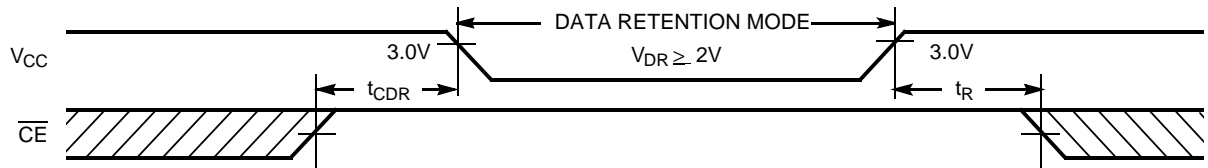
Switching Characteristics Over the Operating Range^[5] (Continued)

Parameter	Description	1399B–15		1399B–20		Unit
		Min.	Max.	Min.	Max.	
READ CYCLE						
t _{RC}	Read Cycle Time	15		20		ns
t _{AA}	Address to Data Valid		15		20	ns
t _{OHA}	Data Hold from Address Change	3		3		ns
t _{ACE}	\overline{CE} LOW to Data Valid		15		20	ns
t _{DOE}	\overline{OE} LOW to Data Valid		6		7	ns
t _{LZOE}	\overline{OE} LOW to Low Z ^[6]	0		0		ns
t _{HZOE}	\overline{OE} HIGH to High Z ^[6, 7]		6		6	ns
t _{LZCE}	\overline{CE} LOW to Low Z ^[6]	3		3		ns
t _{HZCE}	\overline{CE} HIGH to High Z ^[6, 7]		7		7	ns
t _{PU}	\overline{CE} LOW to Power-Up	0		0		ns
t _{PD}	\overline{CE} HIGH to Power-Down		15		20	ns
WRITE CYCLE ^[8, 9]						
t _{WC}	Write Cycle Time	15		20		ns
t _{SCE}	\overline{CE} LOW to Write End	10		12		ns
t _{AW}	Address Set-Up to Write End	10		12		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	10		12		ns
t _{SD}	Data Set-Up to Write End	8		10		ns
t _{HD}	Data Hold from Write End	0		0		ns
t _{HZWE}	\overline{WE} LOW to High Z ^[8]		7		7	ns
t _{LZWE}	\overline{WE} HIGH to Low Z ^[6]	3		3		ns

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

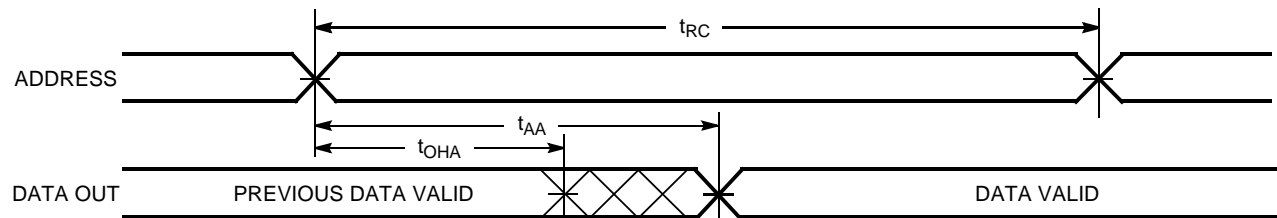
Parameter	Description		Conditions	Min.	Max.	Unit
V _{DR}	V _{CC} for Data Retention			2.0		V
I _{CCDR}	Data Retention Current	Com'l	V _{CC} = V _{DR} = 2.0V, CE ≥ V _{CC} − 0.3V, V _{IN} ≥ V _{CC} − 0.3V or V _{IN} ≤ 0.3V	0	20	uA
t _{CDR}	Chip Deselect to Data Retention Time			0		ns
t _R	Operation Recovery Time			t _{RC}		ns

Data Retention Waveform

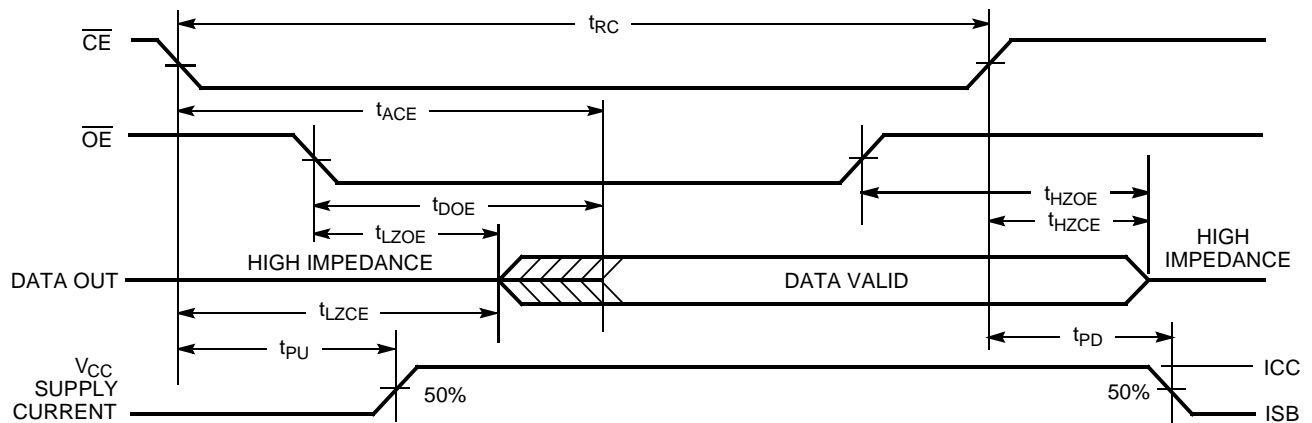


Switching Waveforms

Read Cycle No. 1^[10, 11]

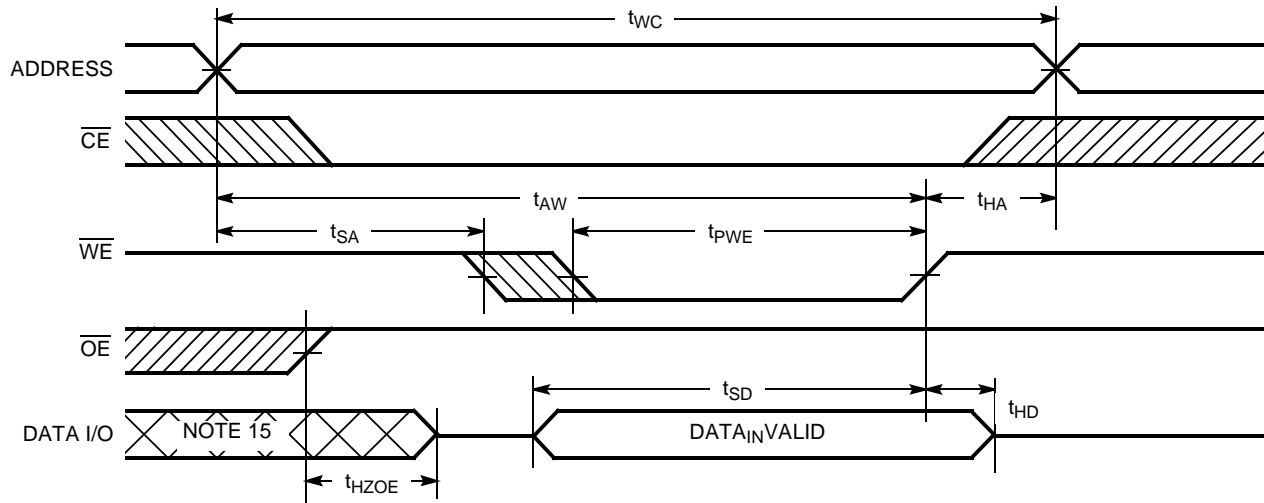
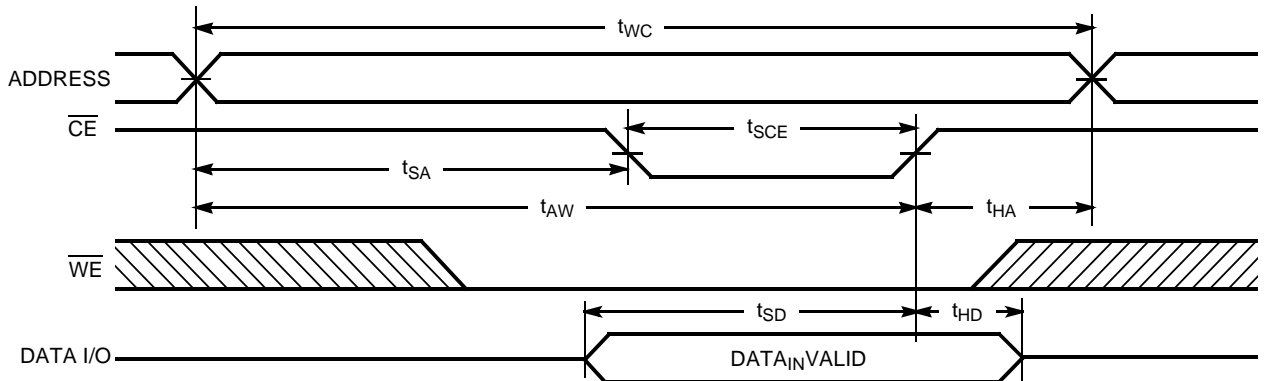
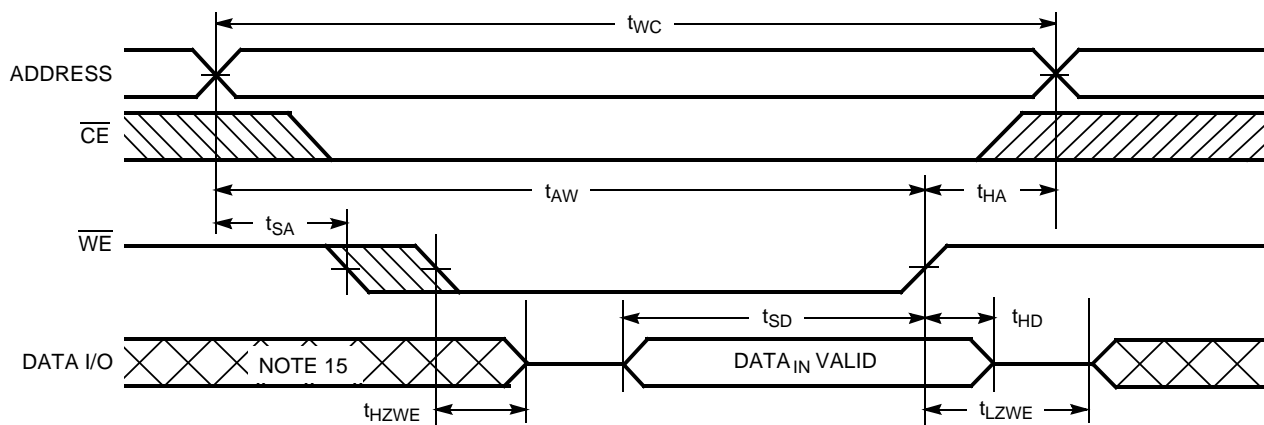


Read Cycle No. 2^[11, 12]



Notes:

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

Switching Waveforms (continued)
Write Cycle No. 1 ($\overline{\text{WE}}$ Controlled)^[8, 13, 14]

Write Cycle No. 2 ($\overline{\text{CE}}$ Controlled)^[8, 13, 14]

Write Cycle No. 3 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ LOW)^[9, 14]

Notes:

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

Truth Table

$\overline{\text{CE}}$	$\overline{\text{WE}}$	$\overline{\text{OE}}$	Input/Output	Mode	Power
H	X	X	High Z	Deselect/Power-Down	Standby (I_{SB})
L	H	L	Data Out	Read	Active (I_{CC})
L	L	X	Data In	Write	Active (I_{CC})
L	H	H	High Z	Deselect, Output Disabled	Active (I_{CC})

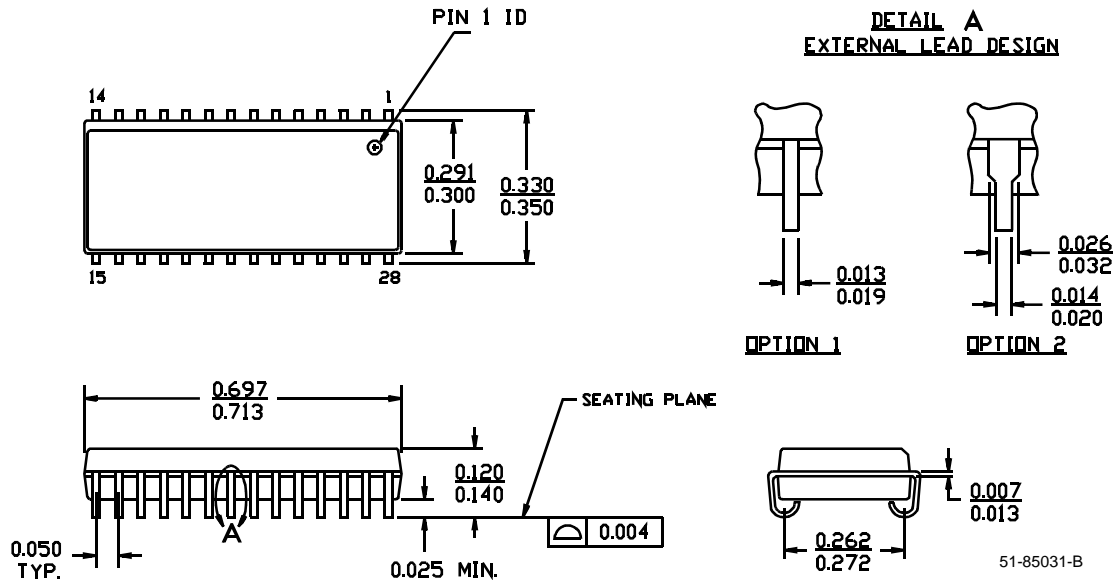
Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
10	CY7C1399B-10VC	V21	28-Lead Molded SOJ	Commercial
	CY7C1399B-10ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C1399BL-10VC	V21	28-Lead Molded SOJ	
	CY7C1399BL-10ZC	Z28	28-Lead Thin Small Outline Package	
12	CY7C1399B-12VC	V21	28-Lead Molded SOJ	
	CY7C1399B-12ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C1399BL-12VC	V21	28-Lead Molded SOJ	
	CY7C1399BL-12ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C1399B-12VI	V21	28-Lead Molded SOJ	Industrial
	CY7C1399B-12ZI	Z28	28-Lead Thin Small Outline Package	
15	CY7C1399B-15VC	V21	28-Lead Molded SOJ	Commercial
	CY7C1399B-15ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C1399BL-15VC	V21	28-Lead Molded SOJ	
	CY7C1399BL-15ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C1399B-15VI	V21	28-Lead Molded SOJ	Industrial
	CY7C1399B-15ZI	Z28	28-Lead Thin Small Outline Package	
20	CY7C1399B-20VC	V21	28-Lead Molded SOJ	Commercial
	CY7C1399B-20ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C1399BL-20VC	V21	28-Lead Molded SOJ	
	CY7C1399BL-20ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C1399B-20VI	V21	28-Lead Molded SOJ	Industrial
	CY7C1399B-20ZI	Z28	28-Lead Thin Small Outline Package	

Package Diagrams

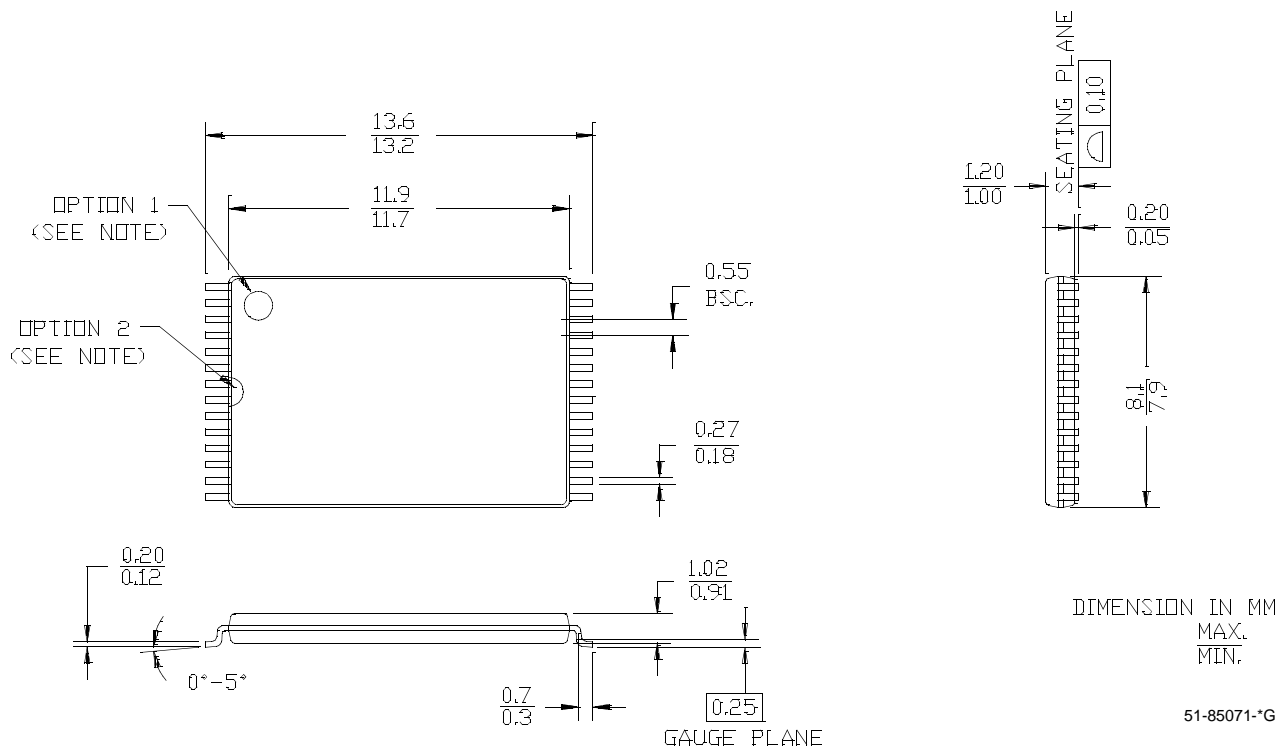
28-Lead (300-Mil) Molded SOJ V21

DIMENSIONS IN INCHES MIN.
MAX.



28-Lead Thin Small Outline Package Type 1 (8x13.4 mm) Z28

NOTE: ORIENTATION I.D. MAY BE LOCATED EITHER
AS SHOWN IN OPTION 1 OR OPTION 2



Revision History

Document Title: CY7C1399B 32K x 8 3.3V Static RAM Document Number: 38-05071				
REV.	ECN NO.	ISSUE DATE	ORIG. OF CHANGE	DESCRIPTION OF CHANGE
**	107264	05/25/01	SZV	Change from Spec #: 38-01102 to 38-05071
*A	107533	06/28/01	MAX	Add Low Power