Pin Configuration

TSOP
Top View

$\overline{OE}$	22			21	A_0
A_1	23			20	$\overline{CE}$
A_2	24			19	I/O_7
A_3	25			18	I/O_6
A_4	26			17	I/O_5
$\overline{WE}$	27			16	I/O_4
V_{CC}	28			15	I/O_3
A_5	1			14	GND
A_6	2			13	I/O_2
A_7	3			12	I/O_1
A_8	4			11	I/O_0
A_9	5			10	A_{14}
A_{10}	6			9	A_{13}
A_{11}	7			8	A_{12}

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
in High Z State[2] ....–0.5V to V_{CC} + 0.5V

DC Input Voltage[2].................................–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 ±300 mV
Industrial	–40°C to +85°C	3.3V ±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} = Min., I_{OH} = –2.0 mA	2.4		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 4.0 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[2]		–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[3]	V_{CC} = Max., V_{OUT} = GND		–300		–300	mA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., I_{OUT} = 0 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[4]	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:
2. Minimum voltage is equal to –2.0V for pulse durations of less than 20 ns.
3. Not more than one output should be shorted at one time. Duration of the short circuit should not exceed 30 seconds.
4. Device draws low standby current regardless of switching on the addresses.

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[+] Feedback

Electrical Characteristics Over the Operating Range (continued)

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

Capacitance[5]

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

AC Test Loads and Waveforms
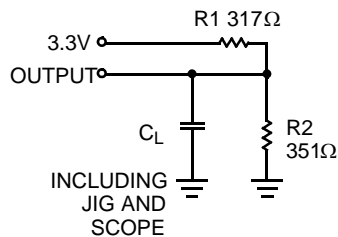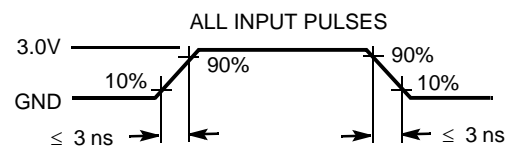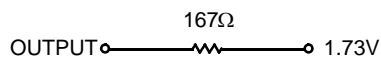
Note:
5. Tested initially and after any design or process changes that may affect these parameters.

Switching Characteristics Over the Operating Range[6]

Parameter	Description	1399B-10 Min.	1399B-10 Max.	1399B-12 Min.	1399B-12 Max.	Unit
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[7]	0		0		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[7, 8]		5		5	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[7]	3		3		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[7, 8]		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[9, 10]						
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[9]		7		7	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[7]	3		3		ns

Notes:
6. 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.
7. 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.
8. 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.
9. 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.
10. The minimum write cycle time for write cycle #3 ($\overline{WE}$ controlled, $\overline{OE}$ LOW) is the sum of t_{HZWE} and t_{SD}.

[+] Feedback

Switching Characteristics Over the Operating Range[6] (continued)

Parameter	Description	1399B-15 Min.	1399B-15 Max.	1399B-20 Min.	1399B-20 Max.	Unit
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[7]	0		0		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[7, 8]		6		6	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[7]	3		3		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[7, 8]		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[9, 10]						
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[9]		7		7	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[7]	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	$V_{CC} = V_{DR} = 2.0V$, $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$	0	20	μA
t_{CDR}	Chip Deselect to Data Retention Time			0		ns
t_R	Operation Recovery Time			t_{RC}		ns

[+] Feedback

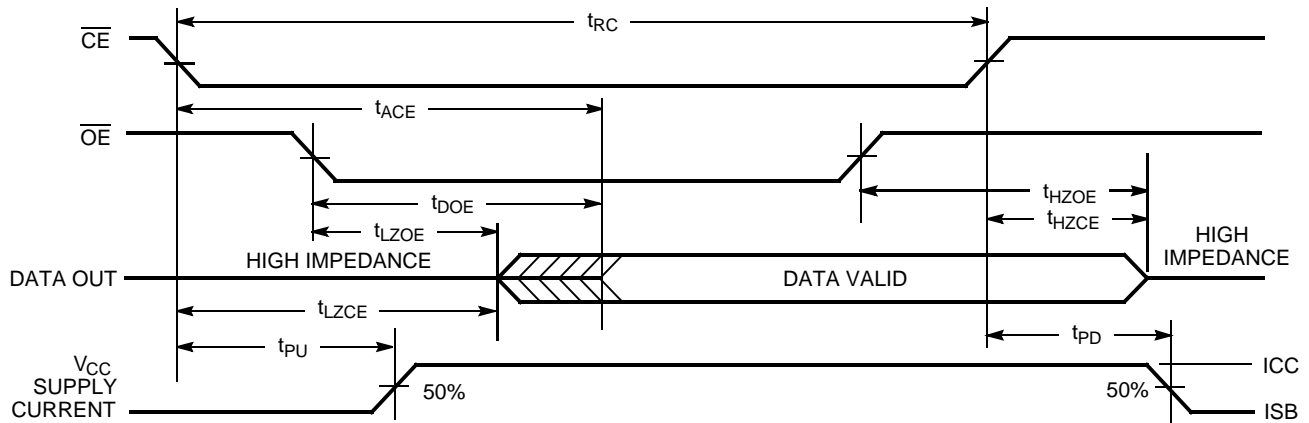## Data Retention Waveform
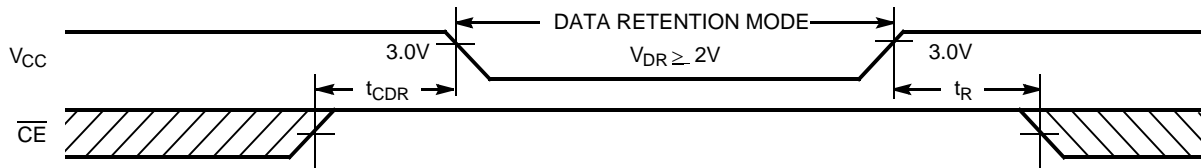
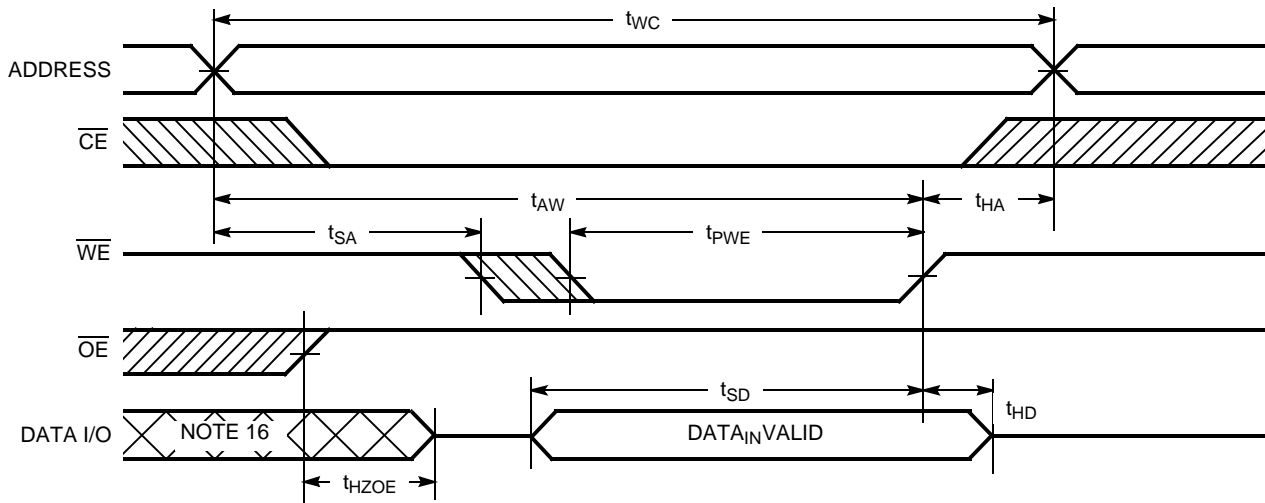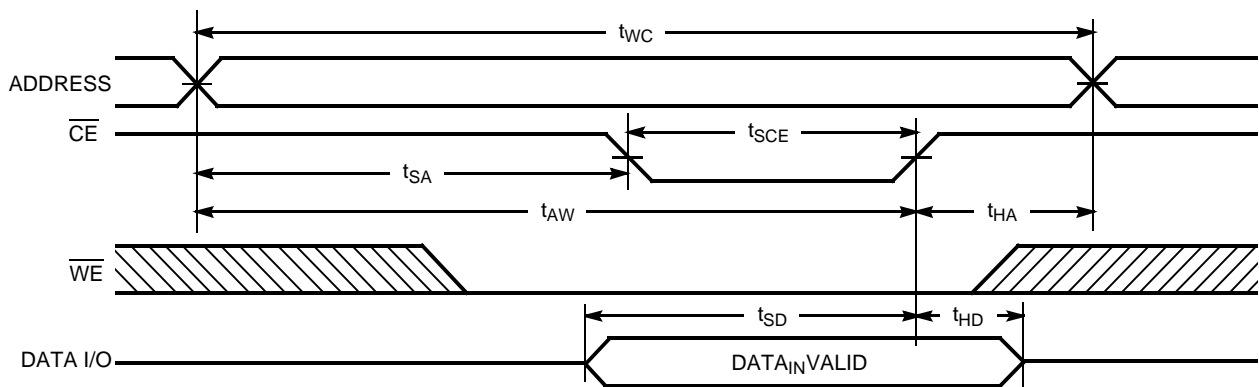## Switching Waveforms

Read Cycle No. 1[11, 12]
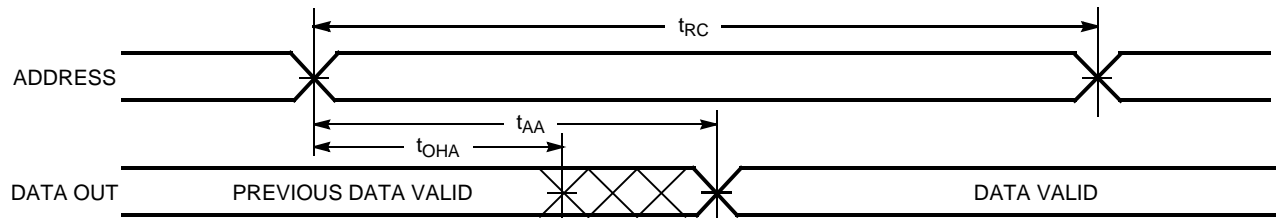
Read Cycle No. 2[12, 13]

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

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Switching Waveforms (continued)

Write Cycle No. 1 (WE Controlled)[9, 14, 15]

Write Cycle No. 2 (CE Controlled)[9, 14, 15]

Write Cycle No. 3 (WE Controlled, OE LOW)[10, 15]
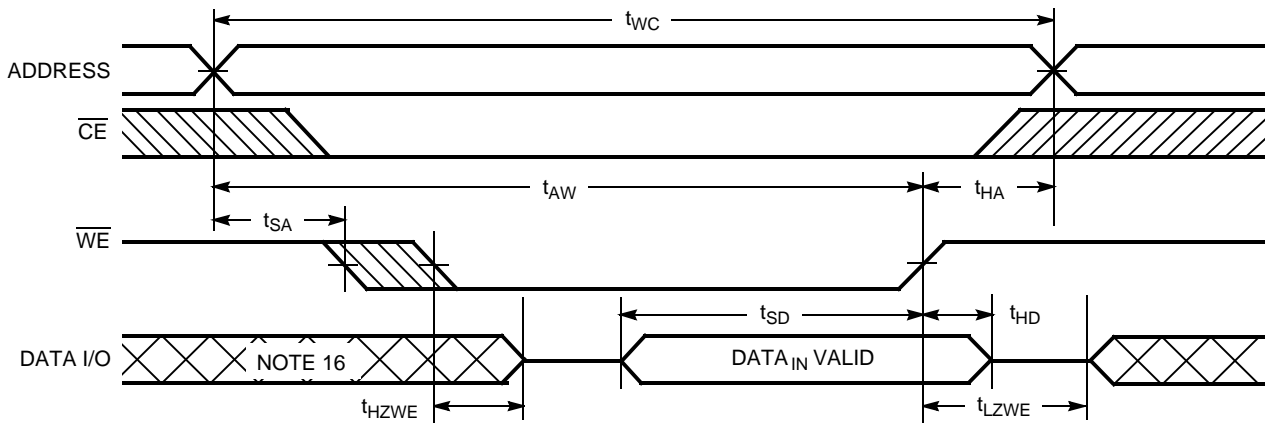
Notes:
14. Data I/O is high impedance if OE = V$_{IH}$.
15. If CE goes HIGH simultaneously with WE HIGH, the output remains in a high-impedance state.
16. During this period, the I/Os are in the output state and input signals should not be applied.

[+] Feedback

Truth Table

$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	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

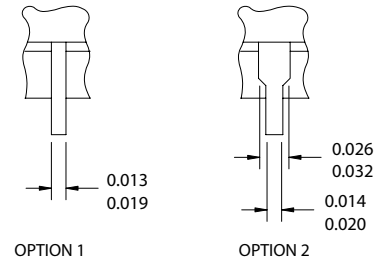| Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
12	CY7C1399B-12VC	V21	28-Lead Molded SOJ	Commercial
	CY7C1399B-12VXC	V21	28-Lead Molded SOJ (Pb-Free)	
	CY7C1399B-12ZC	Z28	28-Lead Thin Small Outline Package	
	CY7C1399B-12ZXC	Z28	28-Lead Thin Small Outline Package (Pb-Free)	
	CY7C1399BL-12ZC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

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[+] Feedback

Package Diagrams

28-Lead (300-Mil) Molded SOJ V21

DIMENSIONS IN INCHES

MIN.
MAX.

PIN 1 ID
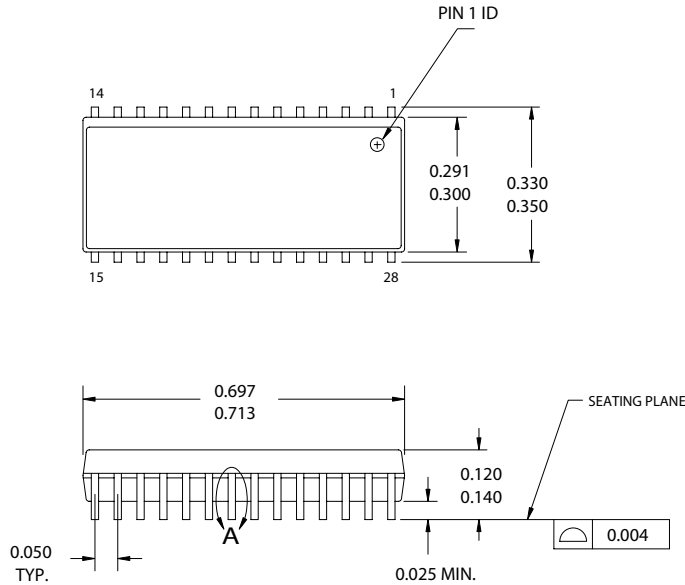
DETAIL **A**
EXTERNAL LEAD DESIGN

14

1

15

28

0.291
0.300

0.330
0.350

0.013
0.019

OPTION 1

0.026
0.032

0.014
0.020

OPTION 2

0.697
0.713

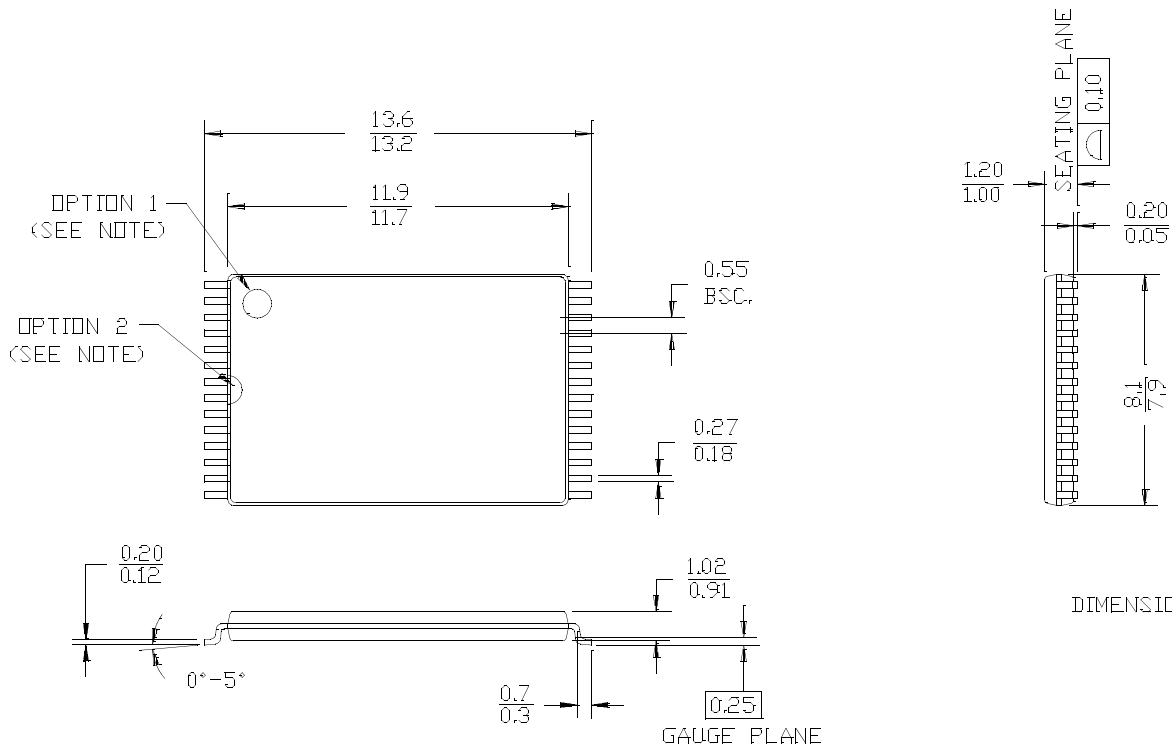SEATING PLANE

0.120
0.140

0.004

A

0.050
TYP.

0.025 MIN.

0.007
0.013

0.262
0.272

51-85031-*B

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

OPTION 1
(SEE NOTE)

OPTION 2
(SEE NOTE)

13.6
13.2

11.9
11.7

0.55
BSC.

0.27
0.18

SEATING PLANE

0.10

1.20
1.00

0.20
0.05

8.1
8.0

0.20
0.12

1.02
0.91

0°–5°

0.7
0.3

0.25

GAUGE PLANE

DIMENSION IN MM
MAX.
MIN.

51-85071-*G

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Document History Page

Document Title: CY7C1399B 256K(32K x 8) 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
*B	116472	09/17/02	CEA	Add applications foot note to data sheet, page 1.
*C	224340	See ECN	RKF	Option 1 of the Orientation ID on TSOP-I Package Diagram [Page #9] removed
*D	386100	See ECN	SYT	Converted the Datasheet from "Preliminary" to "Final" Added Pb-Free offerings in the Ordering Information Edited the title to "256K (32K x 8) Static RAM" from "32K x 8 3.3V Static RAM"