CY7C1399BN

256K (32K x 8) Static RAM

Features

- **Temperature Ranges**
  - **— Industrial: –40°C to 85°C**
  - **— Automotive-A: –40°C to 85°C**
- **Single 3.3V power supply**
- **Ideal for low-voltage cache memory applications**
- **High speed: 12 ns**
- **Low active power**
  - **— 180 mW (max.)**
- **Low-power alpha immune 6T cell**
- **Available in Pb-free and non Pb-free Plastic SOJ and TSOP I packages**

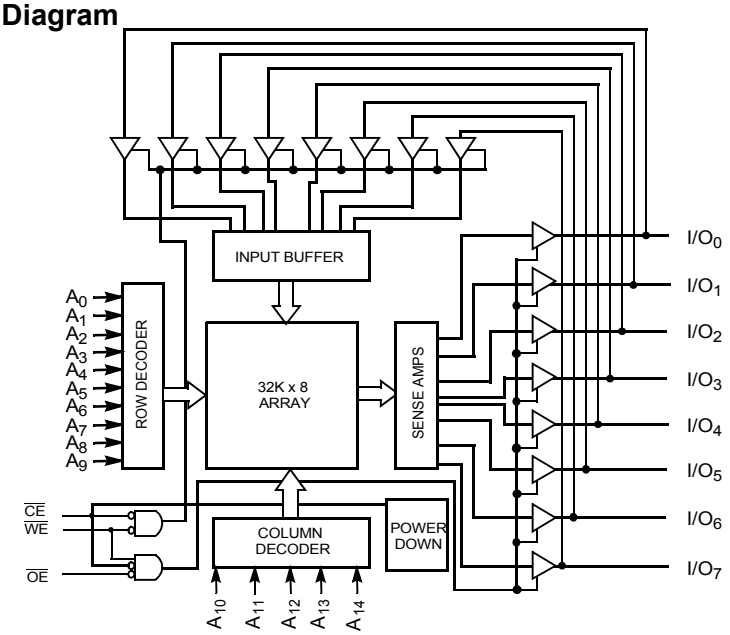
Functional Description[1]

The CY7C1399BN 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 tri-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.

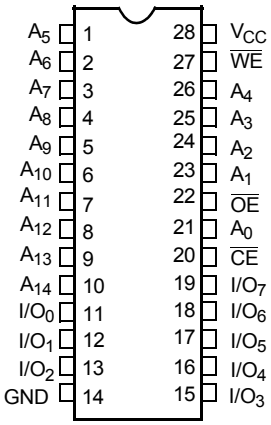
The input/output pins remain in a high-impedance state unless the chip is selected, outputs are enabled, and Write Enable ($\overline{WE}$) is HIGH. The CY7C1399BN is available in 28-pin standard 300-mil-wide SOJ and TSOP Type I packages.

Logic Block Diagram



Pin Configurations

SOJ
Top View

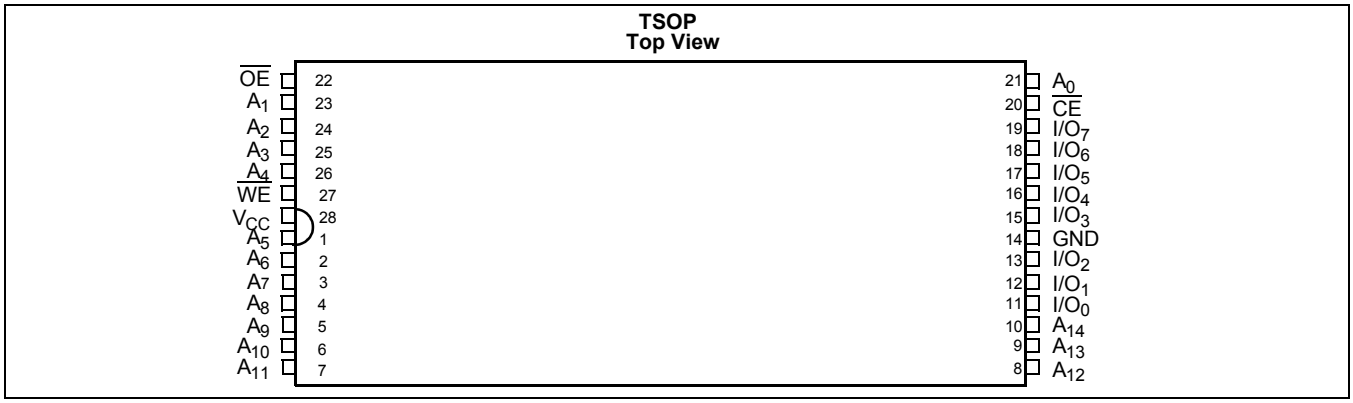


Selection Guide

		-12	-15	-20
Maximum Access Time (ns)		12	15	20
Maximum Operating Current (mA)		55	50	45
Maximum CMOS Standby Current (μA)	Commercial	500	500	500
	Commercial (L)	50	50	50
	Industrial	500	500	
	Automotive-A		500	

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.

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[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	
Automotive-A	–40°C to +85°C	

Electrical Characteristics Over the Operating Range[1]

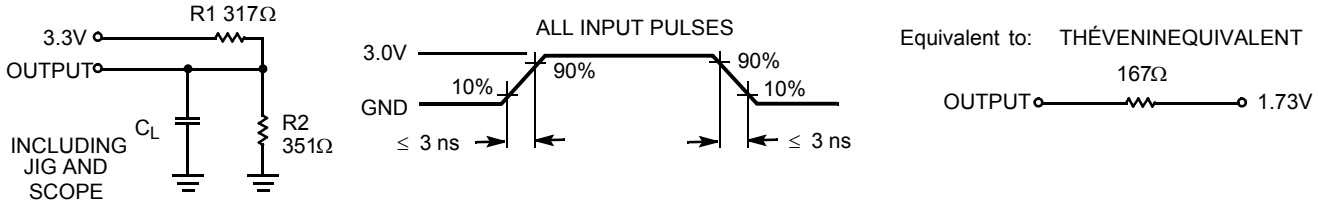
Parameter	Description	Test Conditions		-12 Min.	-12 Max.	-15 Min.	-15 Max.	-20 Min.	-20 Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = –2.0 mA		2.4		2.4		2.4		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 4.0 mA			0.4		0.4		0.4	V
V_{IH}	Input HIGH Voltage			2.2	V_{CC} + 0.3V	2.2	V_{CC} + 0.3V	2.2	V_{CC} + 0.3V	V
V_{IL}	Input LOW Voltage[2]			–0.3	0.8	–0.3	0.8	–0.3	0.8	V
I_{IX}	Input Leakage Current			–1	+1	–1	+1	–1	+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_I ≤ V_{CC}, Output Disabled		–5	+5	–5	+5	–5	+5	µA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max., I_{OUT} = 0 mA, f = f_{MAX} = $1/t_{RC}$			55		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}	Comm'l		5		5		5	mA
			Comm'l (L)		4		4			mA
			Ind'l		5		5			
			Auto-A				5			
I_{SB2}	Automatic CE Power-Down Current— CMOS Inputs[3]	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}	Comm'l		500		500		500	µA
			Comm'l (L)		50		50			µA
			Ind'l		500		500			µA
			Auto-A				500			µA

Notes:
2. Minimum voltage is equal to –2.0V for pulse durations of less than 20 ns.
3. Device draws low standby current regardless of switching on the addresses.

Capacitance[4]

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[5]



Switching Characteristics Over the Operating Range[5]

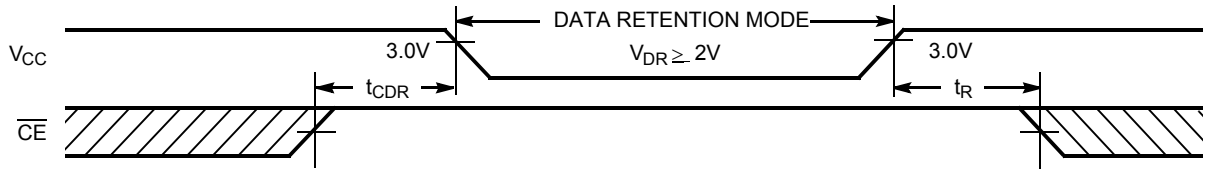
Parameter	Description	-12		-15		-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle								
t_{RC}	Read Cycle Time	12		15		20		ns
t_{AA}	Address to Data Valid		12		15		20	ns
t_{OHA}	Data Hold from Address Change	3		3		3		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		12		15		20	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		5		6		7	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z[6]	0		0		0		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[6, 7]		5		6		6	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[6]	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		20	ns
Write Cycle[8, 9]								
t_{WC}	Write Cycle Time	12		15		20		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	8		10		12		ns
t_{AW}	Address Set-Up to Write End	8		10		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	8		10		12		ns
t_{SD}	Data Set-Up to Write End	7		8		10		ns
t_{HD}	Data Hold from Write End	0		0		0		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[8]		7		7		7	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[6]	3		3		3		ns

Notes:
4. Tested initially and after any design or process changes that may affect these parameters.
5. 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.
6. 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.
7. 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.
8. 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.
9. The minimum write cycle time for write cycle #3 ($\overline{WE}$ controlled, $\overline{OE}$ LOW) is the sum of t_{HZWE} and t_{SD}.

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

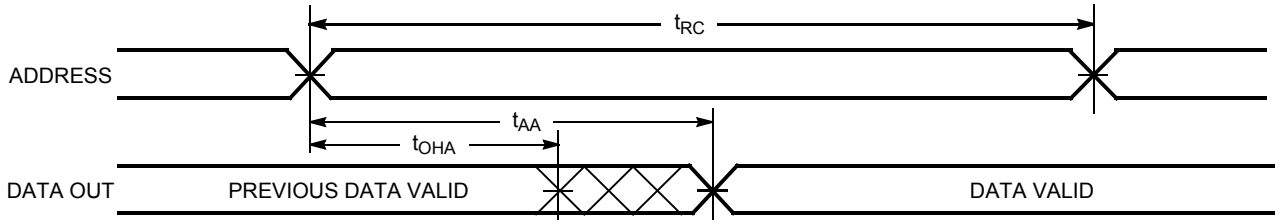
Parameter	Description	Conditions	Min.	Max.	Unit
V_{DR}	V_{CC} for Data Retention		2.0		V
I_{CCDR}	Data Retention Current	$\overline{V_{CC}} = V_{DR} = 2.0V$, $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$	0	20	µA
t_{CDR}	Chip Deselect to Data Retention Time		0		ns
t_R	Operation Recovery Time		t_{RC}		ns

Data Retention Waveform

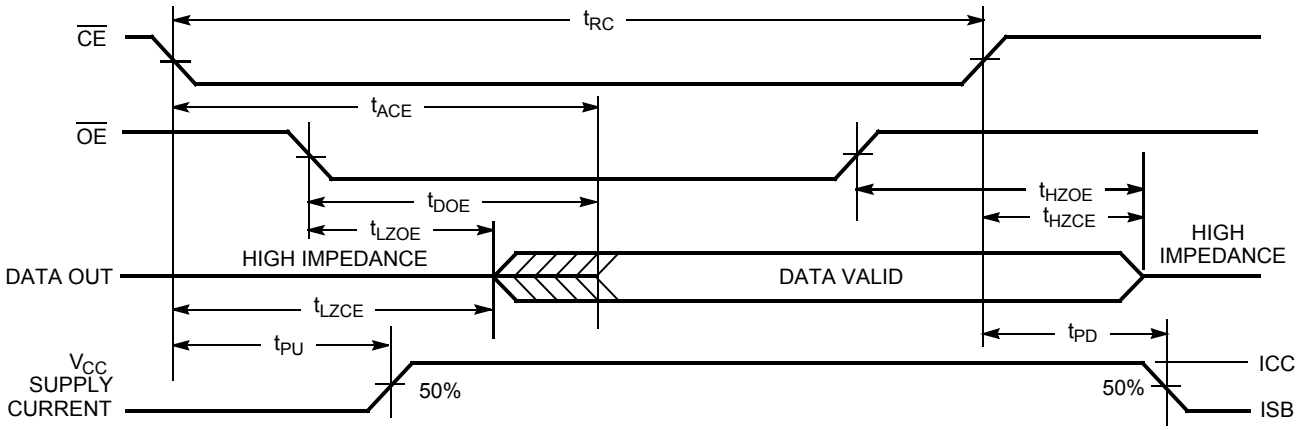


Switching Waveforms

Read Cycle No. 1[10, 11]



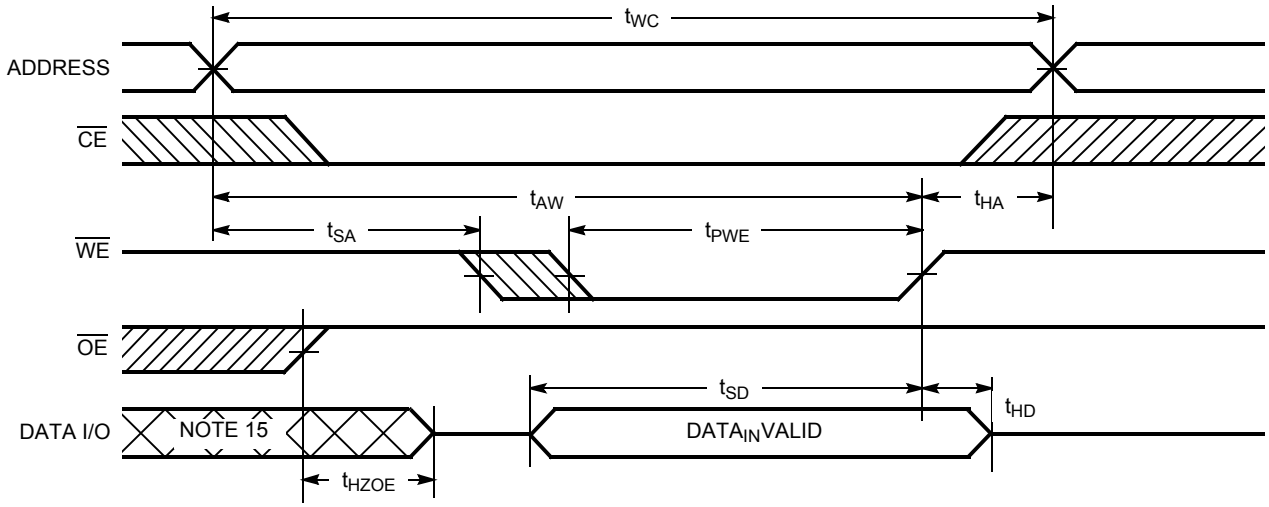
Read Cycle No. 2[11, 12]



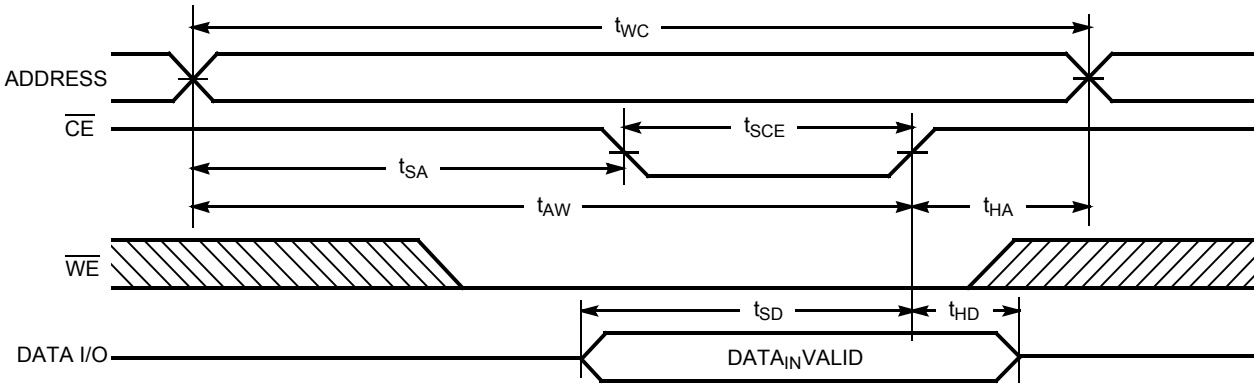
Notes:
10. Device is continuously selected. $\overline{OE}$, $\overline{CE}$ = V_{IL}.
11. $\overline{WE}$ is HIGH for read cycle.
12. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

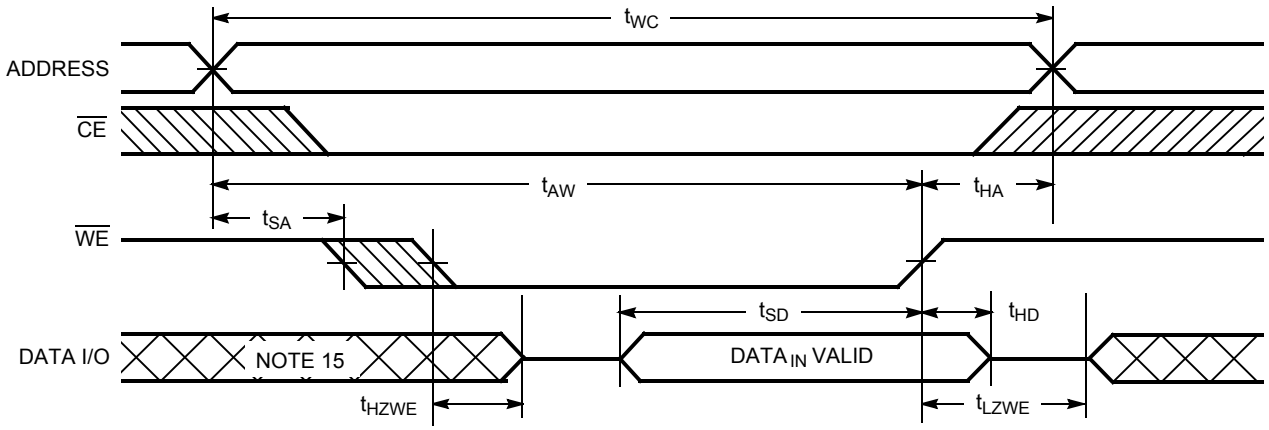
Write Cycle No. 1 ($\overline{WE}$ Controlled)[8, 13, 14]



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



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



Notes:
13. Data I/O is high impedance if $\overline{OE}$ = V_{IH}.
14. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ 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

$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	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 Diagram	Package Type	Operating Range
12	CY7C1399BN-12VC	51-85031	28-Lead Molded SOJ	Commercial
	CY7C1399BN-12VXC		28-Lead Molded SOJ (Pb-free)	
	CY7C1399BN-12ZC	51-85071	28-Lead TSOP I	
	CY7C1399BN-12ZXC		28-Lead TSOP I (Pb-free)	
	CY7C1399BNL-12ZC		28-Lead TSOP I	
	CY7C1399BNL-12ZXC		28-Lead TSOP I (Pb-free)	
	CY7C1399BN-12VXI	51-85031	28-Lead Molded SOJ (Pb-free)	Industrial
15	CY7C1399BN-15VC		28-Lead Molded SOJ	Commercial
	CY7C1399BN-15VXC		28-Lead Molded SOJ (Pb-free)	
	CY7C1399BN-15ZC	51-85071	28-Lead TSOP I	
	CY7C1399BN-15ZXC		28-Lead TSOP I (Pb-free)	
	CY7C1399BNL-15ZXC		28-Lead TSOP I (Pb-free)	
	CY7C1399BNL-15VXC	51-85031	28-Lead Molded SOJ (Pb-free)	
	CY7C1399BN-15VI		28-Lead Molded SOJ	Industrial
	CY7C1399BN-15VXI		28-Lead Molded SOJ (Pb-free)	
	CY7C1399BN-15ZI	51-85071	28-Lead TSOP I	
	CY7C1399BN-15ZXI		28-Lead TSOP I (Pb-free)	
	CY7C1399BN-15VXA	51-85031	28-Lead Molded SOJ (Pb-free)	Automotive-A
20	CY7C1399BN-20ZXC	51-85071	28-Lead TSOP I (Pb-free)	Commercial

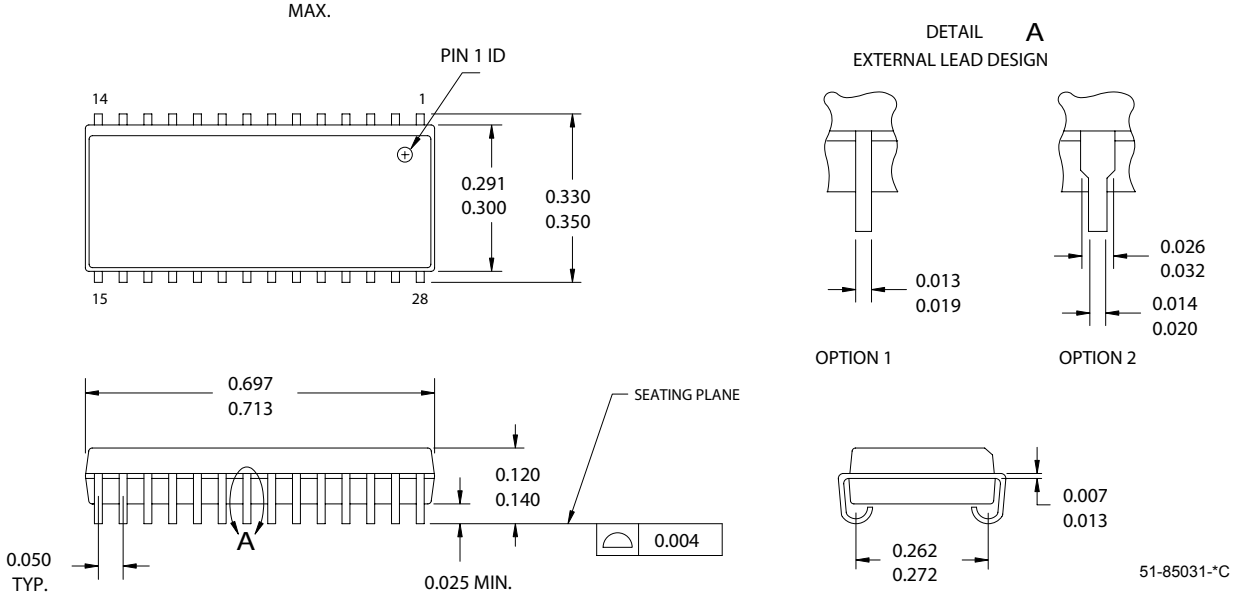
Please contact local sales representative regarding availability of these parts.

Package Diagrams

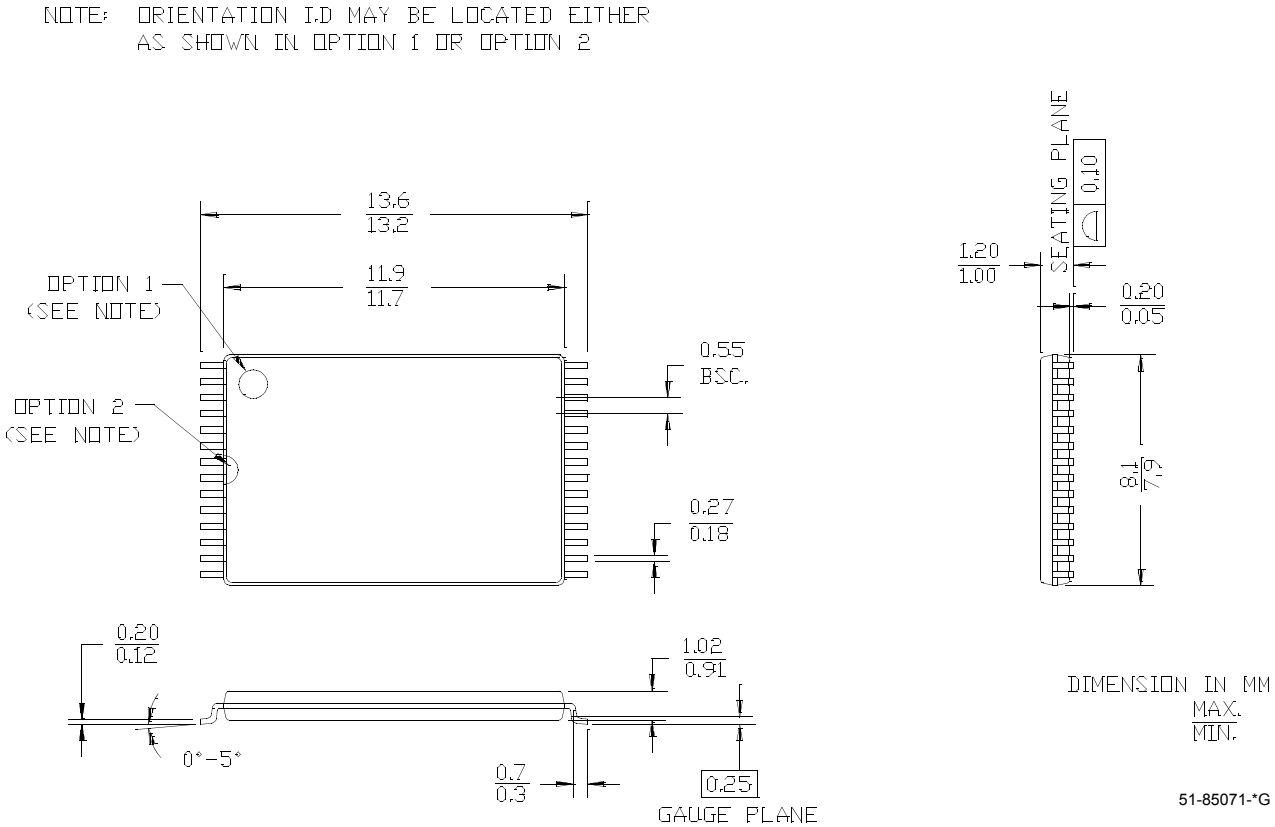
NOTE :

1. JEDEC STD REF MO088
2. BODY LENGTH DIMENSION DOES NOT INCLUDE MOLD PROTRUSION/END FLASH
   MOLD PROTRUSION/END FLASH SHALL NOT EXCEED 0.006 in (0.152 mm) PER SIDE
3. DIMENSIONS IN INCHES MIN.
   MAX.

28-Lead (300-Mil) Molded SOJ (51-85031)



28-Lead TSOP 1 (8x13.4 mm) (51-85071)



Document History Page

Document Title: CY7C1399BN 256K (32K x 8) Static RAM Document Number: 001-06490				
REV.	**ECN NO.**	**ISSUE DATE**	**ORIG. OF CHANGE**	**DESCRIPTION OF CHANGE**
**	423877	See ECN	NXR	New Data Sheet
*A	498575	See ECN	NXR	Added Automotive-A range Removed I_{OS} parameter from DC Electrical Characteristics table Updated Ordering Information table.