

Features

- Temperature ranges
 - Industrial: -40°C to 85°C
 - Automotive-E: -40°C to 125°C
- Pin and function compatible with CY7C199C
- High speed
 - $t_{AA} = 10$ ns (Industrial)
- Low active power
 - $I_{CC} = 80$ mA at 10 ns
- Low CMOS standby power
 - $I_{SB2} = 3$ mA
- 2.0V Data Retention
- Automatic power down when deselected
- CMOS for optimum speed/power
- TTL-compatible inputs and outputs
- Easy memory expansion with \overline{CE} and \overline{OE} features
- Available in Pb-free 28-pin 300-Mil wide Molded SOJ, 28-pin 300-Mil wide SOIC and 28-pin TSOP I packages

Functional Description

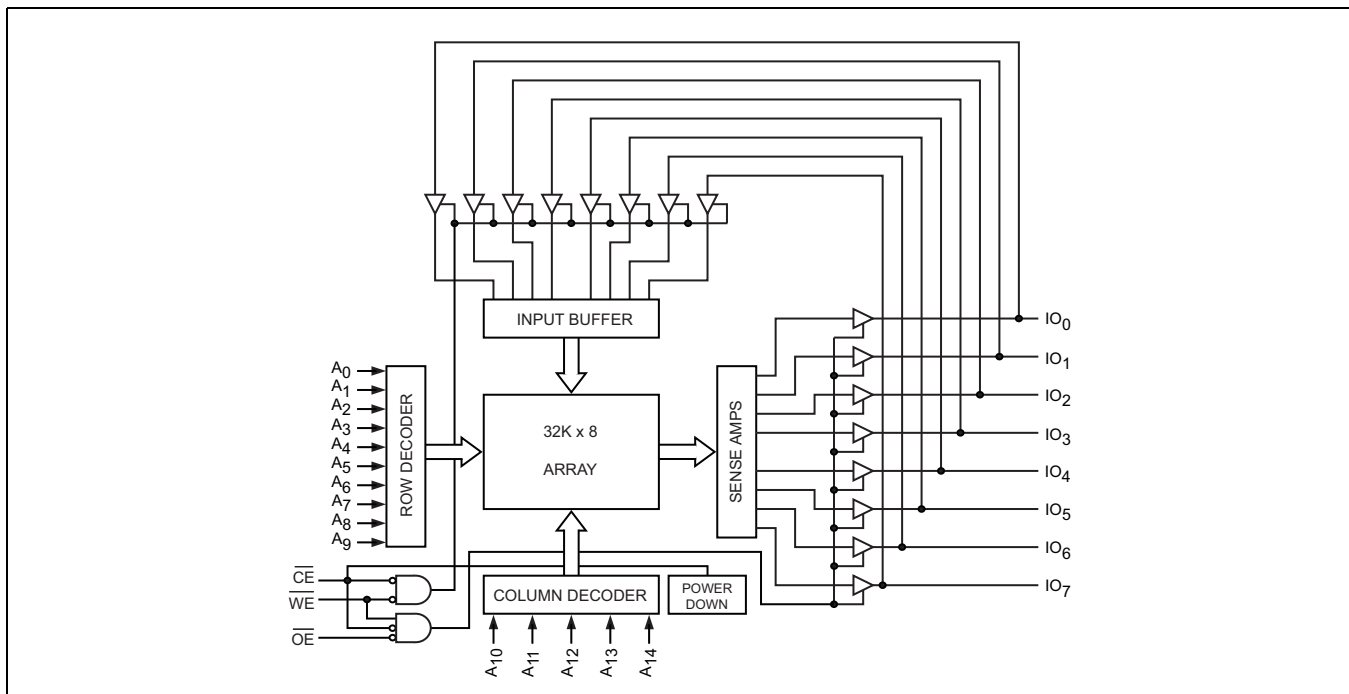
The CY7C199D is a high performance CMOS static RAM organized as 32,768 words by 8 bits. Easy memory expansion is provided by an active LOW Chip Enable (\overline{CE}), an active LOW Output Enable (\overline{OE}) and tri-state drivers. This device has an automatic power down feature, reducing the power consumption when deselected. The input and output pins (IO_0 through IO_7) are placed in a high impedance state when the device is deselected (\overline{CE} HIGH), the outputs are disabled (\overline{OE} HIGH), or during a write operation (\overline{CE} LOW and \overline{WE} LOW).

Write to the device by taking Chip Enable (\overline{CE}) and Write Enable (\overline{WE}) inputs LOW. Data on the eight IO pins (IO_0 through IO_7) is then written into the location specified on the address pins (A_0 through A_{14}).

Read from the device by taking Chip Enable (\overline{CE}) and Output Enable (\overline{OE}) LOW while forcing Write Enable (\overline{WE}) HIGH. Under these conditions, the contents of the memory location specified by the address pins appears on the IO pins.

For best practice recommendations, refer to the Cypress application note [AN1064, SRAM System Guidelines](#).

Logic Block Diagram



Pin Configuration

Figure 1. 28-Pin SOJ (Top View)

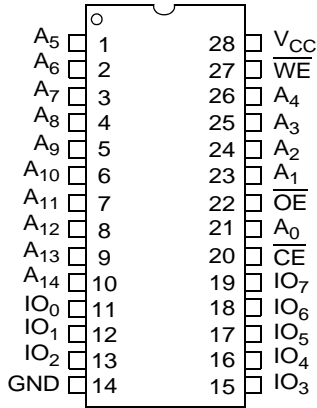


Figure 2. 28-Pin SOIC (Top View)

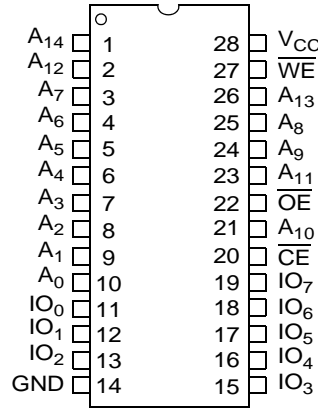
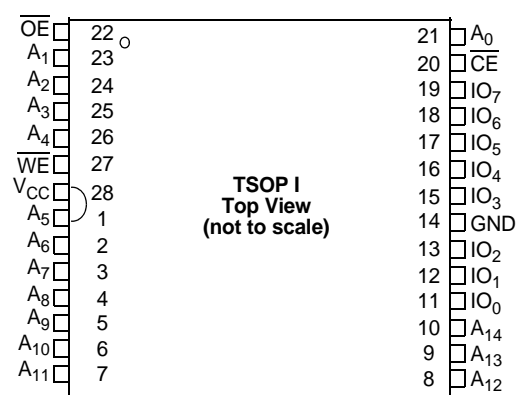


Figure 3. 28-Pin TSOP I (Top View)



Selection Guide

Description	-10 (Industrial)	-25 (Automotive) ^[1]	Unit
Maximum Access Time	10	25	ns
Maximum Operating Current	80	63	mA
Maximum CMOS Standby Current	3	15	mA

Note:

1. Automotive product information is preliminary

Maximum Ratings

Exceeding the maximum ratings may impair the useful life of the device. These user guidelines are 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 +6.0V
- 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

- Output Current into Outputs (LOW) 20 mA
- Static Discharge Voltage > 2,001V (per MIL-STD-883, Method 3015)
- Latch-up Current > 200 mA

Operating Range

Range	Ambient Temperature	V _{CC}	Speed
Industrial	-40°C to +85°C	5V ± 0.5V	10 ns
Automotive-E	-40°C to +125°C	5V ± 0.5V	25 ns

Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	7C199D-10		7C199D-25		Unit
			Min	Max	Min	Max	
V _{OH}	Output HIGH Voltage	I _{OH} =-4.0 mA	2.4		2.4		V
V _{OL}	Output LOW Voltage	I _{OL} =8.0 mA		0.4		0.4	V
V _{IH}	Input HIGH Voltage [2]		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	V
I _{IX}	Input Leakage Current	GND ≤ V _I ≤ V _{CC}	-1	+1	-5	+5	μA
I _{OZ}	Output Leakage Current	GND ≤ V _O ≤ V _{CC} , Output Disabled	-1	+1	-5	+5	μA
I _{CC}	V _{CC} Operating Supply Current	V _{CC} = Max, I _{OUT} = 0 mA, f = f _{max} = 1/t _{RC}	100 MHz	80	-	-	mA
			83 MHz	72	-	-	mA
			66 MHz	58	-	-	mA
			40 MHz	37	63	63	mA
I _{SB1}	Automatic CE Power down Current—TTL Inputs	Max V _{CC} , $\overline{CE} \geq V_{IH}$, V _{IN} ≥ V _{IH} or V _{IN} ≤ V _{IL} , f = f _{max}		10		50	mA
I _{SB2}	Automatic CE Power down Current—CMOS Inputs	Max V _{CC} , $\overline{CE} \geq V_{CC} - 0.3V$, V _{IN} ≥ V _{CC} - 0.3V or V _{IN} ≤ 0.3V, f = 0		3		15	mA

Note:

2. V_{IL}(min) = -2.0V and V_{IH}(max) = V_{CC} + 1V for pulse durations of less than 5 ns.

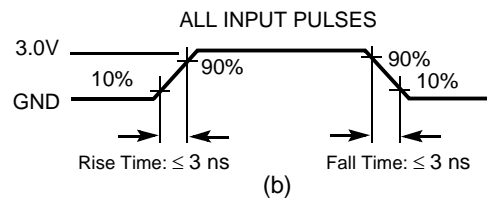
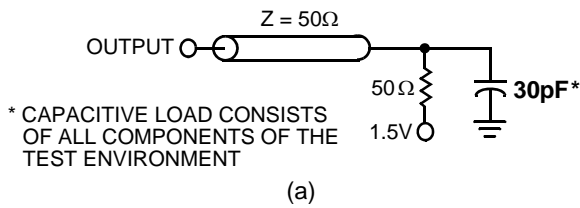
Capacitance [3]

Parameter	Description	Test Conditions	Max	Unit
C _{IN}	Input Capacitance	T _A = 25°C, f = 1 MHz, V _{CC} = 5.0V	8	pF
C _{OUT}	Output Capacitance		8	pF

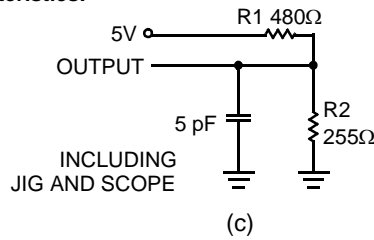
Thermal Resistance [3]

Parameter	Description	Test Conditions	SOJ	TSOP I	SOIC	Unit
Θ _{JA}	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 x 4.5 inch, four-layer printed circuit board	59.16	54.65	TBD	°C/W
Θ _{JC}	Thermal Resistance (Junction to Case)		40.84	21.49	TBD	°C/W

AC Test Loads and Waveforms [4]



High Z characteristics:



Notes:

- Tested initially and after any design or process changes that may affect these parameters.
- AC characteristics (except High Z) are tested using the load conditions shown in Figure (a). High Z characteristics are tested for all speeds using the test load shown in Figure (c).

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

Parameter	Description	7C199D-10		7C199D-25		Unit
		Min	Max	Min	Max	
Read Cycle						
$t_{\text{power}}^{[6]}$	V_{CC} (typical) to the first access	100		100		μs
t_{RC}	Read Cycle Time	10		25		ns
t_{AA}	Address to Data Valid		10		25	ns
t_{OHA}	Data Hold from Address Change	3		3		ns
t_{ACE}	$\overline{\text{CE}}$ LOW to Data Valid		10		25	ns
t_{DOE}	$\overline{\text{OE}}$ LOW to Data Valid		5		10	ns
$t_{\text{LZOE}}^{[7]}$	$\overline{\text{OE}}$ LOW to Low Z	0		0		ns
$t_{\text{HZOE}}^{[7, 8]}$	$\overline{\text{OE}}$ HIGH to High Z		5		11	ns
$t_{\text{LZCE}}^{[7]}$	$\overline{\text{CE}}$ LOW to Low Z	3		3		ns
$t_{\text{HZCE}}^{[7, 8]}$	$\overline{\text{CE}}$ HIGH to High Z		5		11	ns
$t_{\text{PU}}^{[9]}$	$\overline{\text{CE}}$ LOW to Power up	0		0		ns
$t_{\text{PD}}^{[9]}$	$\overline{\text{CE}}$ HIGH to Power down		10		25	ns
Write Cycle ^[10, 11]						
t_{WC}	Write Cycle Time	10		25		ns
t_{SCE}	$\overline{\text{CE}}$ LOW to Write End	7		18		ns
t_{AW}	Address Setup to Write End	7		18		ns
t_{HA}	Address Hold from Write End	0		0		ns
t_{SA}	Address Setup to Write Start	0		0		ns
t_{PWE}	$\overline{\text{WE}}$ Pulse Width	7		18		ns
t_{SD}	Data Setup to Write End	6		12		ns
t_{HD}	Data Hold from Write End	0		0		ns
$t_{\text{HZWE}}^{[7]}$	$\overline{\text{WE}}$ LOW to High Z		5		11	ns
$t_{\text{LZWE}}^{[7, 8]}$	$\overline{\text{WE}}$ HIGH to Low Z	3		3		ns

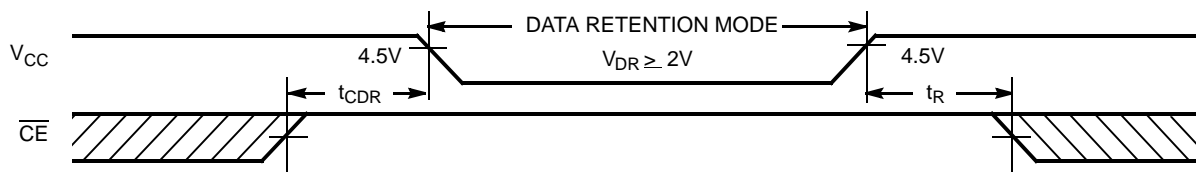
Notes:

- Test conditions assume signal transition time of 3 ns or less for all speeds, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified $I_{\text{OL}}/I_{\text{OH}}$ and 30-pF load capacitance.
- t_{POWER} gives the minimum amount of time that the power supply should be at typical V_{CC} values until the first memory access can be performed.
- 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} , and t_{HZWE} are specified with $C_{\text{L}} = 5 \text{ pF}$ as in part (b) of "AC Test Loads and Waveforms ^[4]" on page 4. Transition is measured $\pm 200 \text{ mV}$ from steady-state voltage.
- This parameter is guaranteed by design and is not tested.
- The internal write time of the memory is defined by the overlap of $\overline{\text{CE}}$ LOW and $\overline{\text{WE}}$ LOW. Both signals must be LOW to initiate a write and either signal can terminate a write by going HIGH. The data input setup 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 No. 3 (WE controlled, OE LOW) is the sum of t_{HZWE} and t_{SD} .

Data Retention Characteristics (Over the Operating Range)

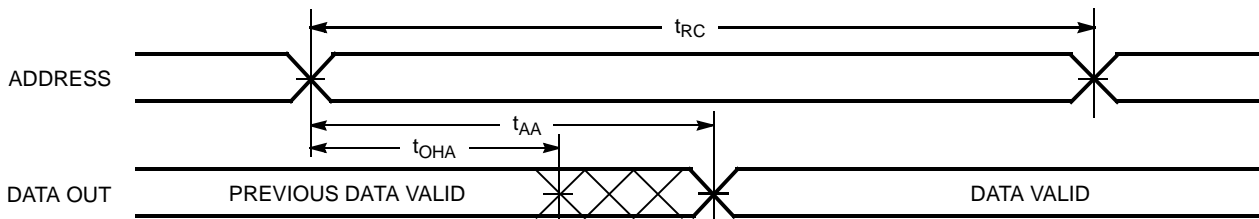
Parameter	Description	Conditions	Min	Max	Unit
V_{DR}	V_{CC} for Data Retention		2.0		V
I_{CCDR}	Data Retention Current	$V_{CC} = V_{DR} = 2.0V, \overline{CE} \geq V_{CC} - 0.3V,$ $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$	Industrial	3	mA
			Automotive-E	15	mA
$t_{CDR}^{[3]}$	Chip Deselect to Data Retention Time		0		ns
$t_R^{[12]}$	Operation Recovery Time		t_{RC}		ns

Data Retention Waveform

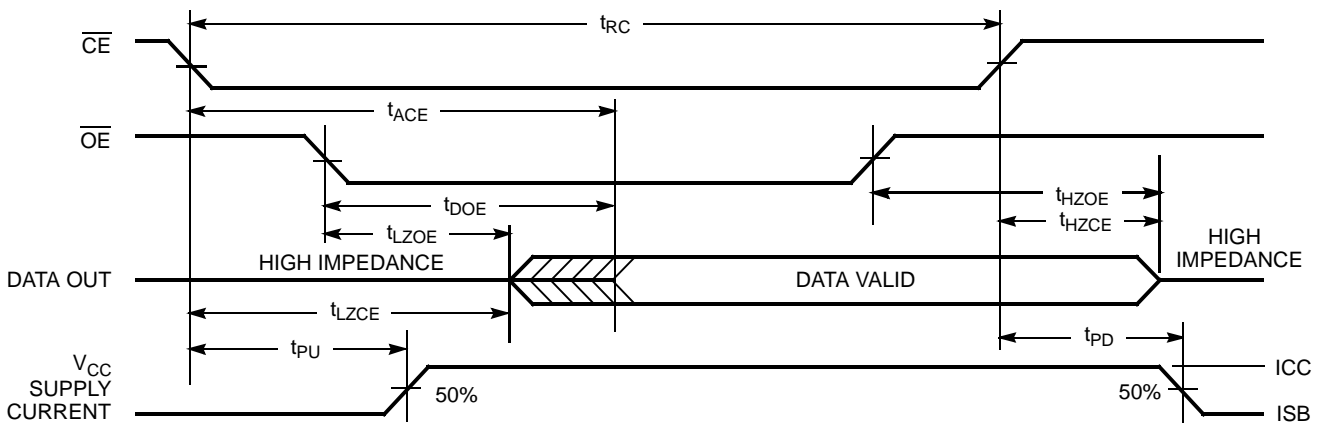


Switching Waveforms

Read Cycle No. 1 (Address Transition Controlled) [13, 14]



Read Cycle No. 2 (\overline{OE} Controlled) [14, 15]

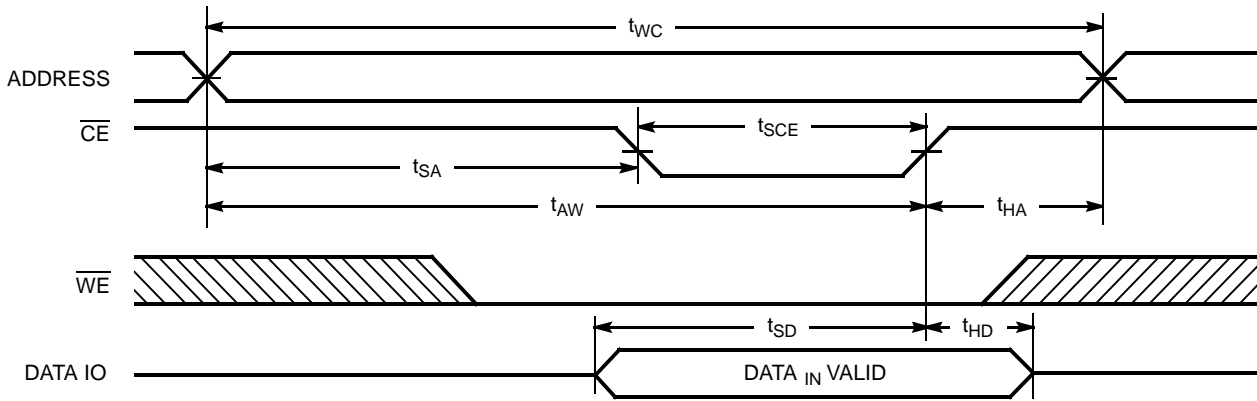


Notes:

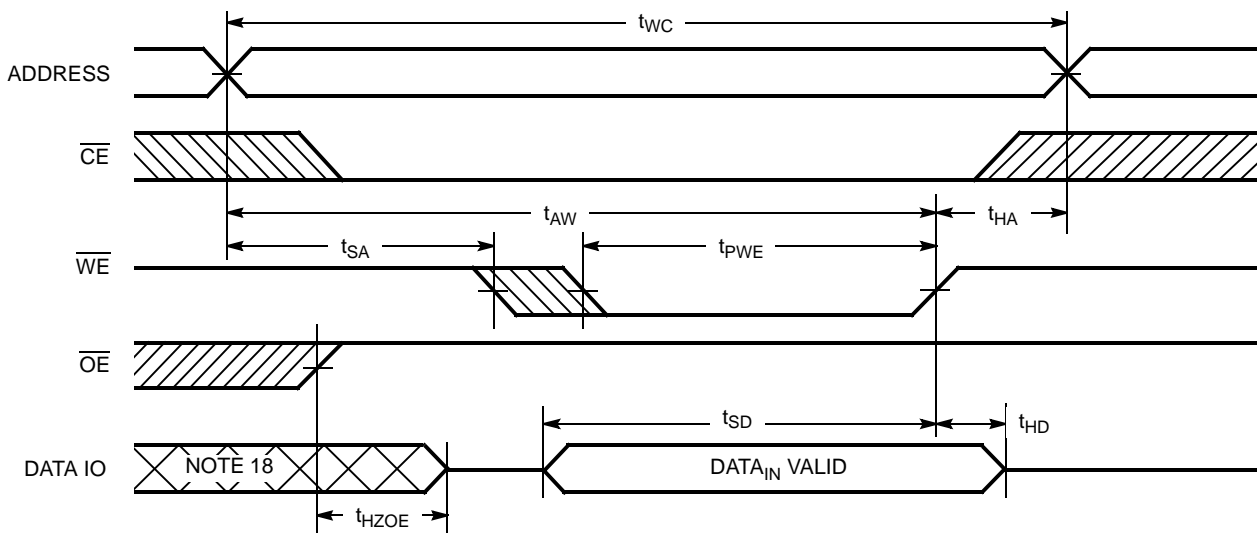
- 12. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min)} \geq 50 \mu s$ or stable at $V_{CC(min)} \geq 50 \mu s$.
- 13. Device is continuously selected. $\overline{OE}, \overline{CE} = V_{IL}$.
- 14. \overline{WE} is HIGH for read cycle.
- 15. Address valid prior to or coincident with \overline{CE} transition LOW.

Switching Waveforms (continued)

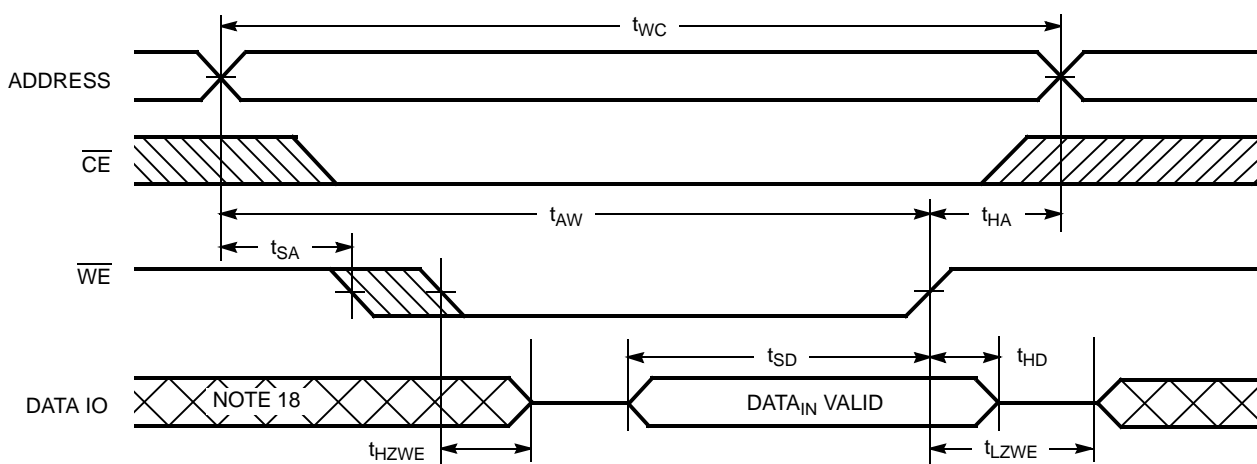
Write Cycle No. 1 (\overline{CE} Controlled) [10, 16, 17]



Write Cycle No. 2 (\overline{WE} Controlled) [10, 16, 17]



Write Cycle No. 3 (\overline{WE} Controlled, \overline{OE} LOW) [11, 17]



Notes:

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

Truth Table

CE	WE	OE	Inputs/Outputs	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
10	CY7C199D-10VXI	51-85031	28-pin (300-Mil) Molded SOJ (Pb-Free)	Industrial
	CY7C199D-10ZXI	51-85071	28-pin TSOP Type I (Pb-free)	
25	CY7C199D-25SXE	51-85026	28-pin (300-Mil) SOIC (Pb-Free)	Automotive-E

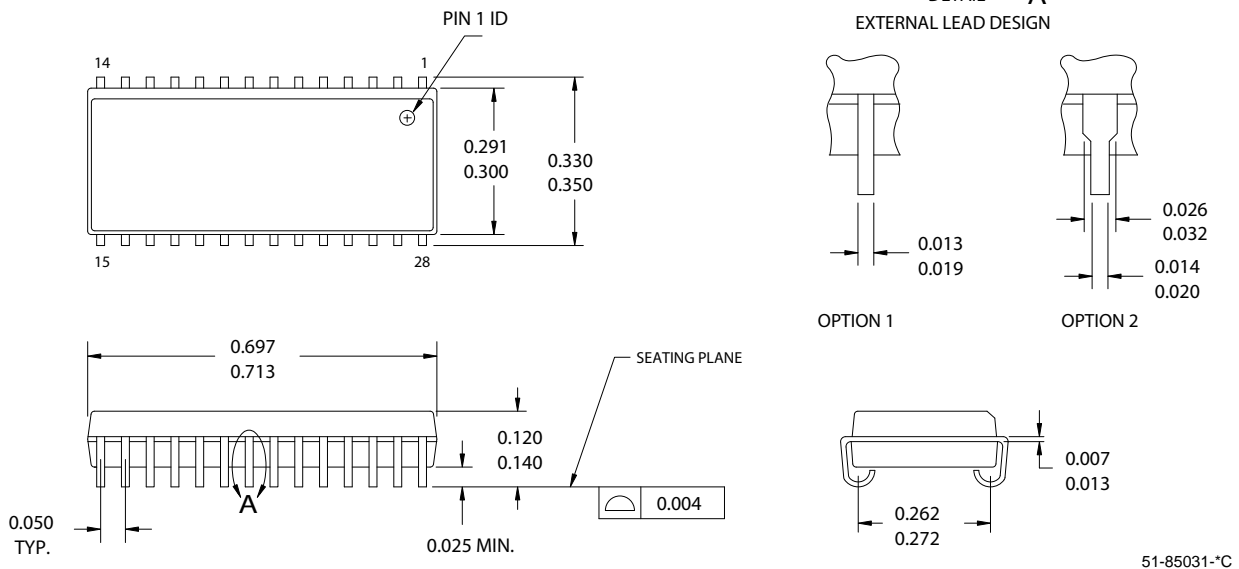
Please contact your local Cypress sales representative for availability of these parts.

Package Diagrams

Figure 4. 28-Pin (300-Mil) Molded SOJ

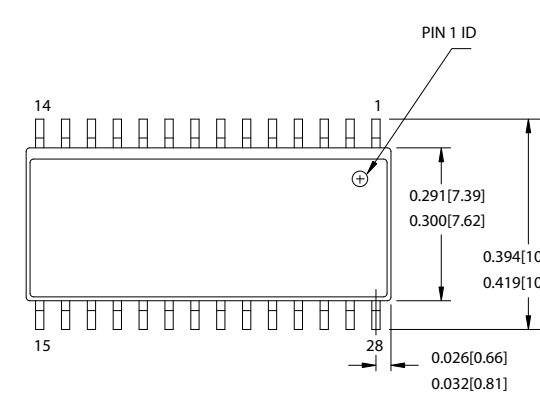
NOTE:

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.



Package Diagrams (continued)

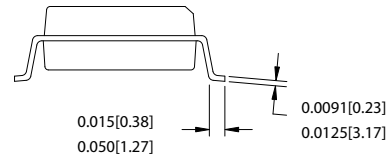
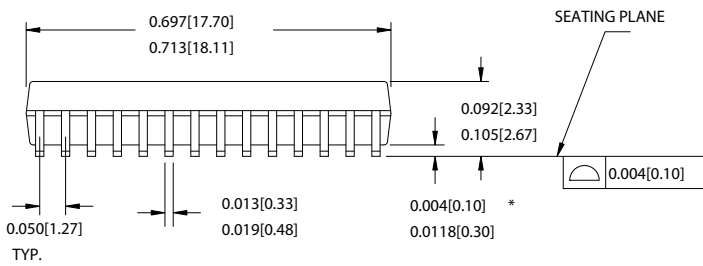
Figure 5. 28-Pin (300-Mil) SOIC



NOTE:

1. JEDEC STD REF MO-119
2. BODY LENGTH DIMENSION DOES NOT INCLUDE MOLD PROTRUSION/END FLASH, BUT DOES INCLUDE MOLD MISMATCH AND ARE MEASURED AT THE MOLD PARTING LINE. MOLD PROTRUSION/END FLASH SHALL NOT EXCEED 0.010 in (0.254 mm) PER SIDE
3. DIMENSIONS IN INCHES
MIN.
MAX.
4. PACKAGE WEIGHT 0.85gms

PART #	
S28.3	STANDARD PKG.
SZ28.3	LEAD FREE PKG.

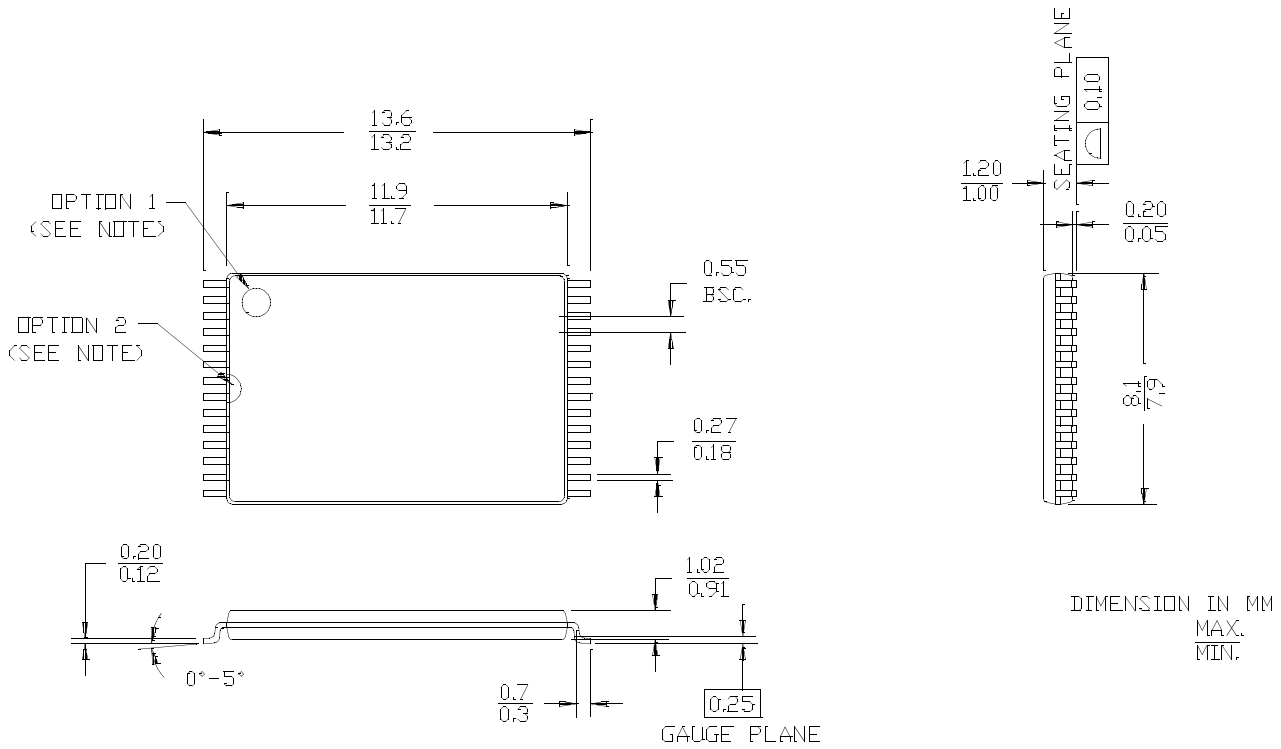


51-85026-*D

Package Diagrams (continued)

Figure 6. 28-Pin Thin Small Outline Package Type 1 (8x13.4 mm)

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



51-85071-G

Document History Page

Document Title: CY7C199D 256K (32K x 8) Static RAM Document Number: 38-05471				
Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	201560	SWI	See ECN	Advance Information datasheet for C9 IPP
*A	233728	RKF	See ECN	DC parameters modified as per EROS (Spec # 01-02165) Pb-free Offering in Ordering Information
*B	262950	RKF	See ECN	Removed 28-LCC Pinout and Package Diagrams Added Data Retention Characteristics table Added T _{power} Spec in Switching Characteristics table Shaded Ordering Information
*C	307594	RKF	See ECN	Reduced Speed bins to -10, -12 and -15 ns
*D	820660	VKN	See ECN	Converted from Preliminary to Final Removed 12 ns and 15 ns speed bin Removed Commercial Operating range Removed "L" part Removed 28-pin PDIP and 28-pin SOIC package Changed Overshoot spec from V _{CC} +2V to V _{CC} +1V in footnote #2 Changed I _{CC} spec from 60 mA to 80 mA for 100 MHz speed bin Added I _{CC} specs for 83 MHz, 66 MHz and 40 MHz speed bins Updated Thermal Resistance table Updated Ordering Information Table
*E	2745093	VKN	See ECN	Included 28-Pin SOIC package Changed V _{IH} level from 2.0V to 2.2V For Industrial grade, changed t _{SD} from 5 ns to 6 ns, and t _{HZWE} from 6 ns to 5 ns Included Automotive-E information

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