

Features

- Temperature ranges
 - Industrial: -40°C to 85°C
 - Automotive-E: -40°C to 125°C
- Pin and function compatible with CY7C199C
- High speed
 - $t_{AA} = 10\text{ ns}$ (Industrial)
- Low active power
 - $I_{CC} = 80\text{ mA}$ at 10 ns
- Low CMOS standby power
 - $I_{SB2} = 3\text{ mA}$
- 2.0V Data Retention
- Automatic power down when deselected
- CMOS for optimum speed/power
- TTL-compatible inputs and outputs
- Easy memory expansion with $\overline{\text{CE}}$ and $\overline{\text{OE}}$ 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

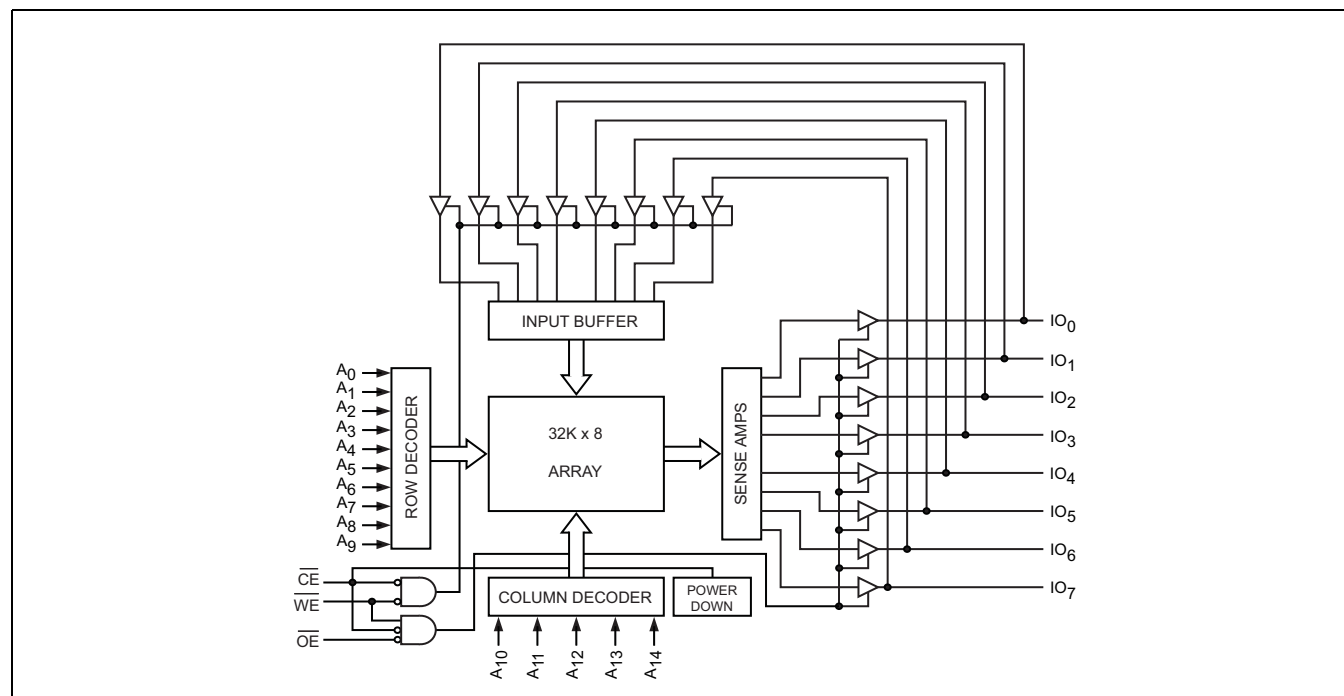
The CY7C199D is a high performance CMOS static RAM organized as 32,768 words by 8 bits. Easy memory expansion is provided by an active LOW Chip Enable ($\overline{\text{CE}}$), an active LOW Output Enable ($\overline{\text{OE}}$) and tri-state drivers. This device has an automatic power down feature, 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 ($\overline{\text{CE}}$ HIGH), the outputs are disabled ($\overline{\text{OE}}$ HIGH), or during a write operation ($\overline{\text{CE}}$ LOW and $\overline{\text{WE}}$ LOW).

Write to the device by taking Chip Enable ($\overline{\text{CE}}$) and Write Enable ($\overline{\text{WE}}$) 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 ($\overline{\text{CE}}$) 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 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)

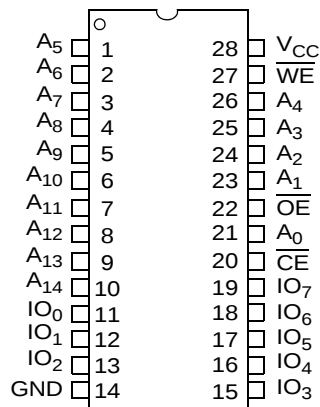


Figure 2. 28-Pin SOIC
(Top View)

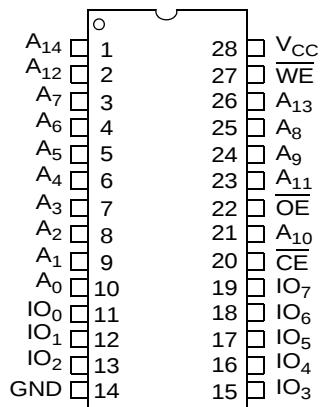
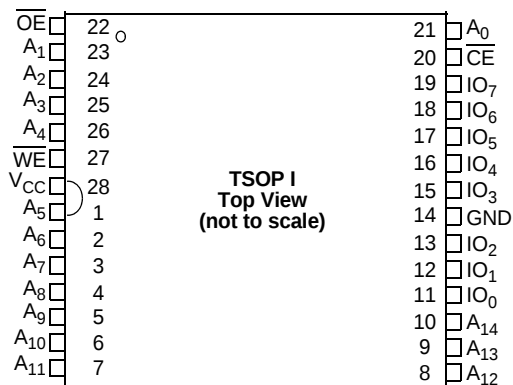


Figure 3. 28-Pin TSOP I
(Top View)



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:

- 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	$GND \leq V_I \leq V_{CC}$	–1	+1	–5	+5	μA
I_{OZ}	Output Leakage Current	$GND \leq V_O \leq V_{CC}$, Output Disabled	–1	+1	–5	+5	μA
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max}$, $I_{OUT} = 0$ mA, $f = f_{max} = 1/t_{RC}$	100 MHz	80		–	mA
			83 MHz	72		–	mA
			66 MHz	58		–	mA
			40 MHz	37		63	mA
I_{SB1}	Automatic CE Power down Current—TTL Inputs	Max V_{CC} , $\overline{CE} \geq V_{IH}$, $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$, $f = f_{max}$		10		50	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 $V_{IN} \leq 0.3V$, $f = 0$		3		15	mA

Note:

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

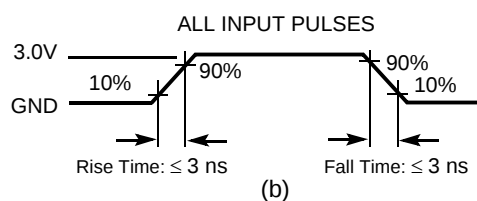
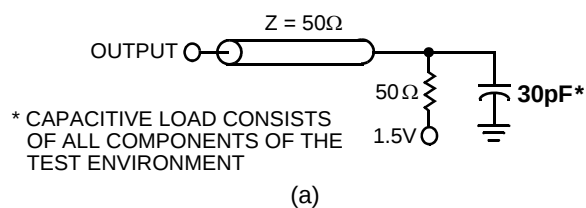
Capacitance ^[3]

Parameter	Description	Test Conditions	Max	Unit
C_{IN}	Input Capacitance	$T_A = 25^\circ\text{C}$, $f = 1\text{ MHz}$, $V_{CC} = 5.0\text{V}$	8	pF
C_{OUT}	Output Capacitance		8	pF

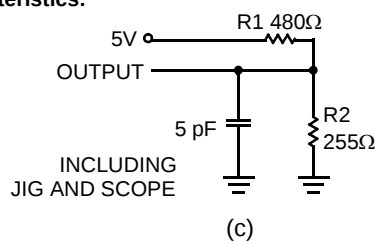
Thermal Resistance ^[3]

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

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 _{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 _{LZOE} ^[7]	$\overline{\text{OE}}$ LOW to Low Z	0		0		ns
t _{HZOE} ^[7, 8]	$\overline{\text{OE}}$ HIGH to High Z		5		11	ns
t _{LZCE} ^[7]	$\overline{\text{CE}}$ LOW to Low Z	3		3		ns
t _{HZCE} ^[7, 8]	$\overline{\text{CE}}$ HIGH to High Z		5		11	ns
t _{PU} ^[9]	$\overline{\text{CE}}$ LOW to Power up	0		0		ns
t _{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 _{HZWE} ^[7]	$\overline{\text{WE}}$ LOW to High Z		5		11	ns
t _{LZWE} ^[7, 8]	$\overline{\text{WE}}$ HIGH to Low Z	3		3		ns

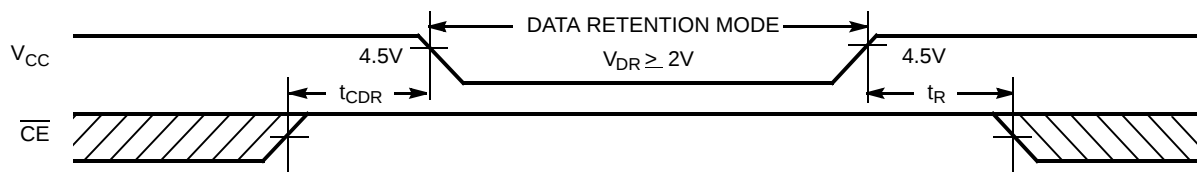
Notes:

- 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 ($\overline{\text{WE}}$ controlled, $\overline{\text{OE}}$ LOW) is the sum of t_{HZWE} and t_{SD} .

Data Retention Characteristics (Over the Operating Range)

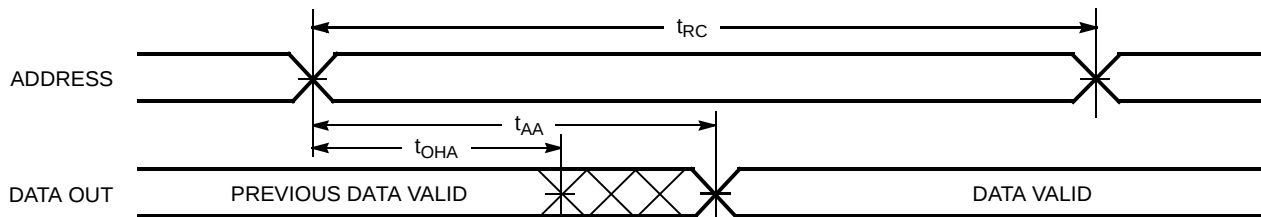
Parameter	Description	Conditions	Min	Max	Unit
V_{DR}	V_{CC} for Data Retention		2.0		V
I_{CCDR}	Data Retention Current	$V_{CC} = V_{DR} = 2.0V$, $\overline{CE} \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$	Industrial	3	mA
			Automotive-E	15	mA
$t_{CDR}^{[3]}$	Chip Deselect to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

Data Retention Waveform

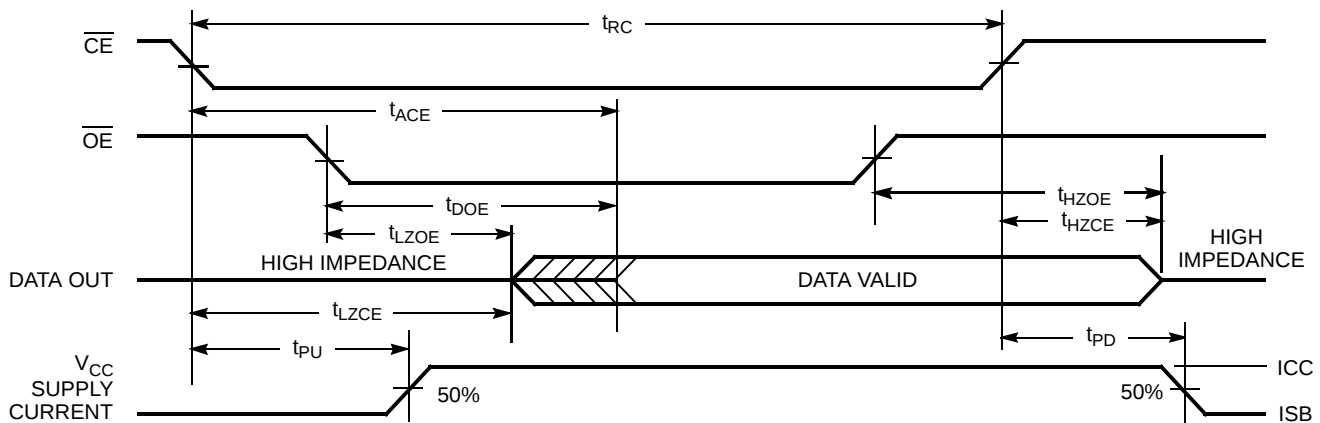


Switching Waveforms

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



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

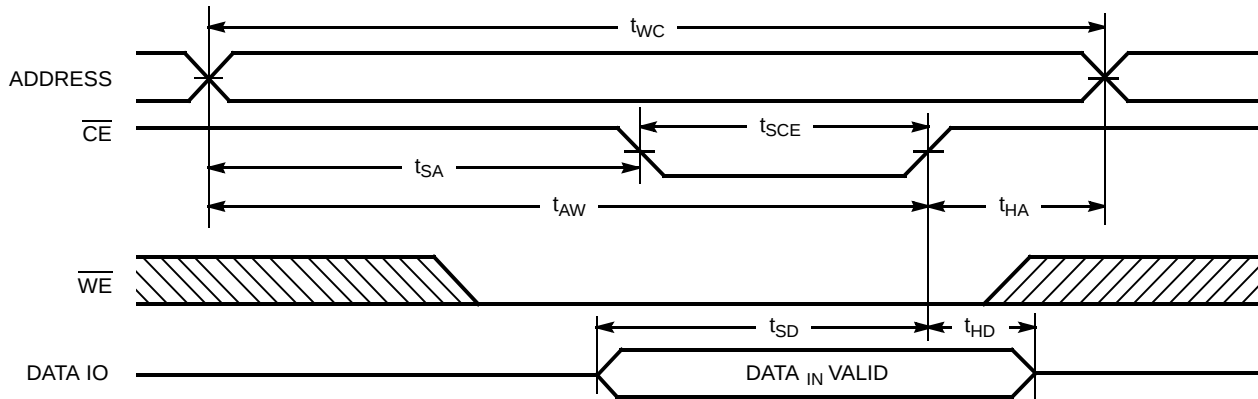


Notes:

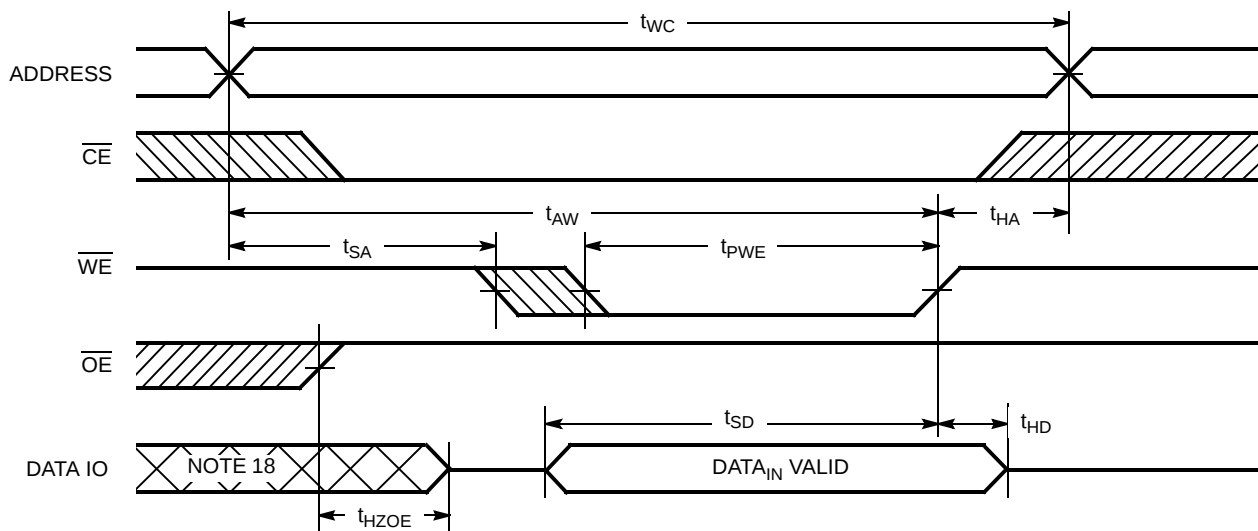
12. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min)} \geq 50 \mu s$ or stable at $V_{CC(min)} \geq 50 \mu s$.
13. Device is continuously selected. $\overline{OE}, \overline{CE} = V_{IL}$.
14. $\overline{WE}$ is HIGH for read cycle.
15. Address valid prior to or coincident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

Switching Waveforms (continued)

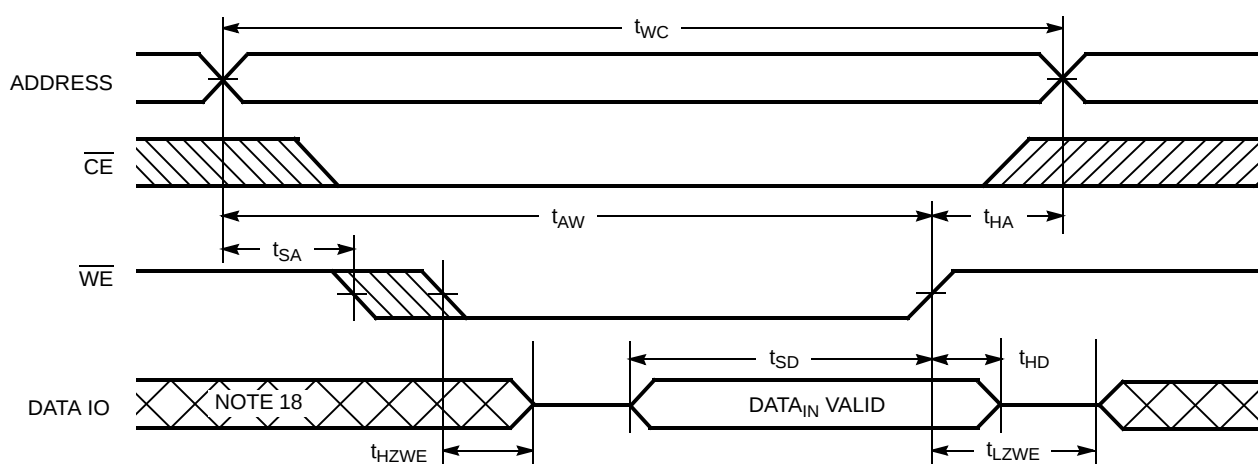
Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled) [10, 16, 17]



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



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



Notes:

16. Data IO is high impedance if $\overline{\text{OE}} = V_{IH}$.
17. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\overline{\text{WE}}$ 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

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

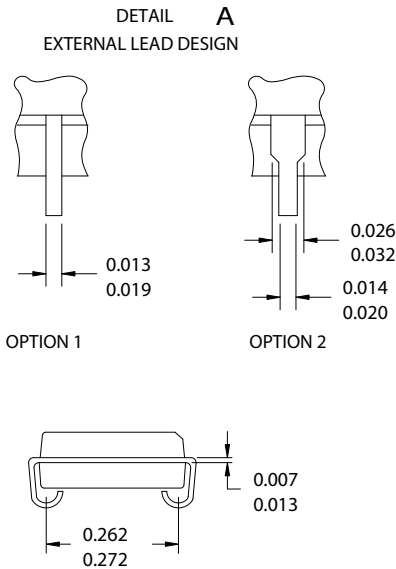
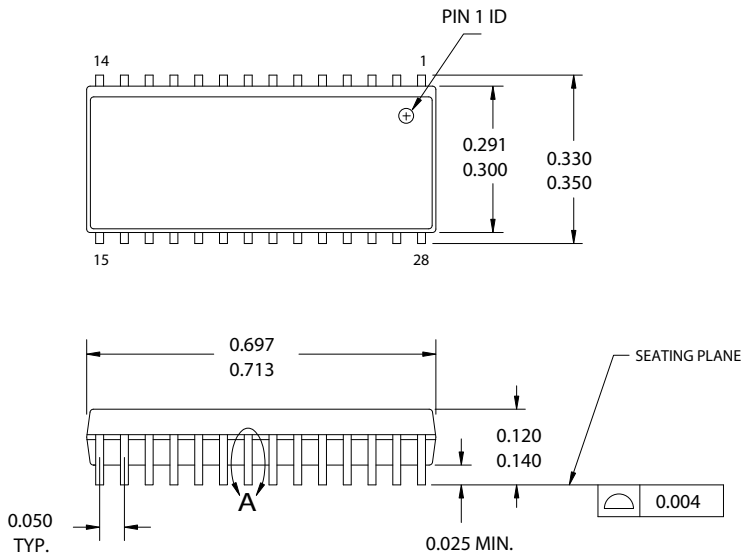
Please contact your local Cypress sales representative for availability of these parts.

Package Diagrams

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

NOTE :

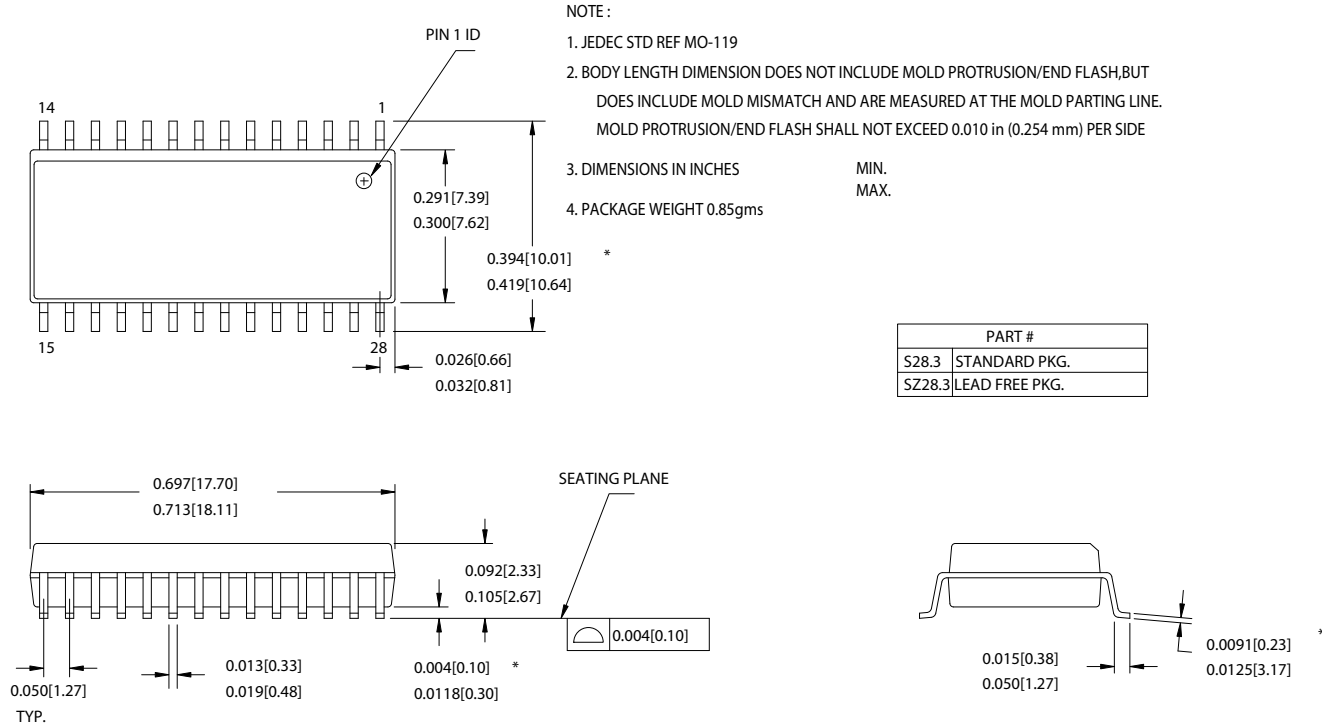
1. JEDEC STD REF MO088
2. BODY LENGTH DIMENSION DOES NOT INCLUDE MOLD PROTRUSION/END FLASH
MOLD PROTRUSION/END FLASH SHALL NOT EXCEED 0.006 in (0.152 mm) PER SIDE
3. DIMENSIONS IN INCHES
MIN.
MAX.



51-85031-1C

Package Diagrams (continued)

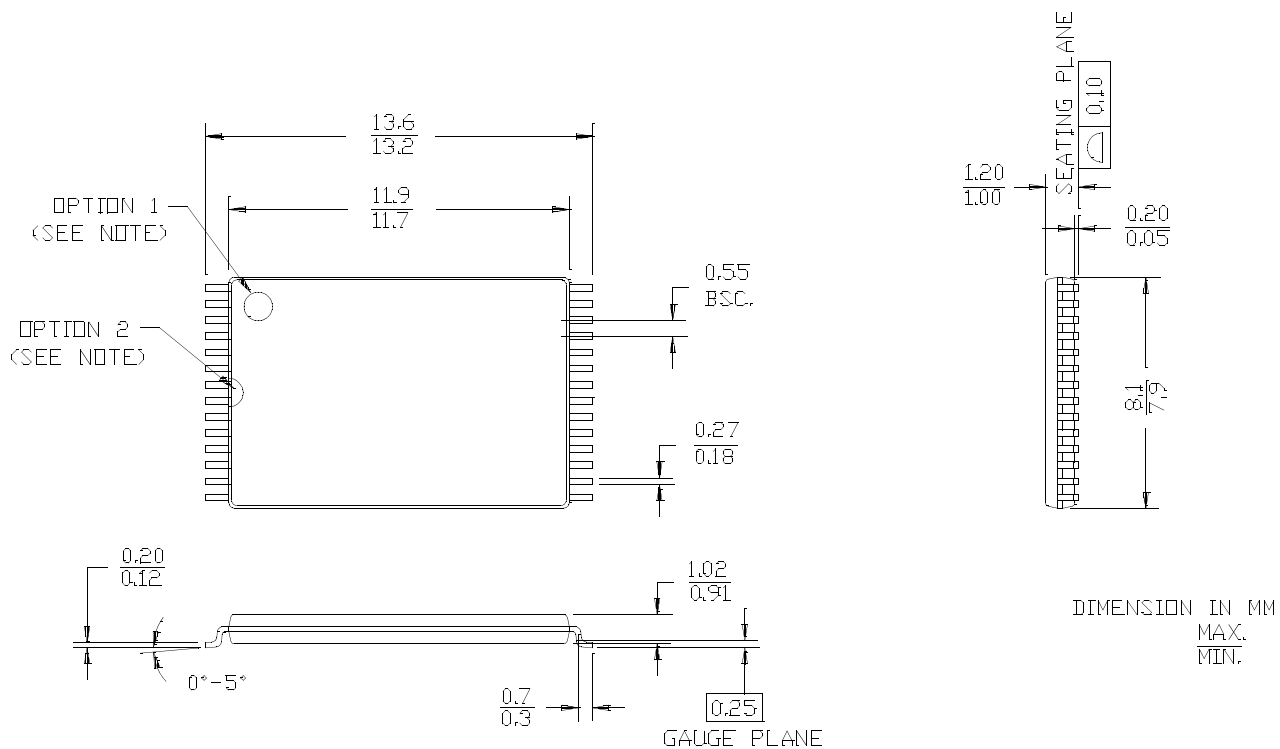
Figure 5. 28-Pin (300-Mil) SOIC



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



51-85071-0G

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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