

## Features

- Pin- and function-compatible with CY7C106B/CY7C1006B
- High speed
  - $t_{AA} = 10 \text{ ns}$
- Low active power
  - $I_{CC} = 80 \text{ mA @ } 10 \text{ ns}$
- Low CMOS standby power
  - $I_{SB2} = 3.0 \text{ mA}$
- 2.0 V Data Retention
- Automatic power-down when deselected
- CMOS for optimum speed/power
- TTL-compatible inputs and outputs
- CY7C106D available in Pb-free 28-pin 400-Mil wide Molded SOJ package. CY7C1006D available in Pb-free 28-pin 300-Mil wide Molded SOJ package

## Functional Description

The CY7C106D <sup>[1]</sup> and CY7C1006D <sup>[1]</sup> are high-performance CMOS static RAMs organized as 262,144 words by 4 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. These devices have an automatic power-down feature that reduces power consumption by more than 65% when the devices are deselected. The four input and output pins ( $IO_0$  through  $IO_3$ ) are placed in a high-impedance state when:

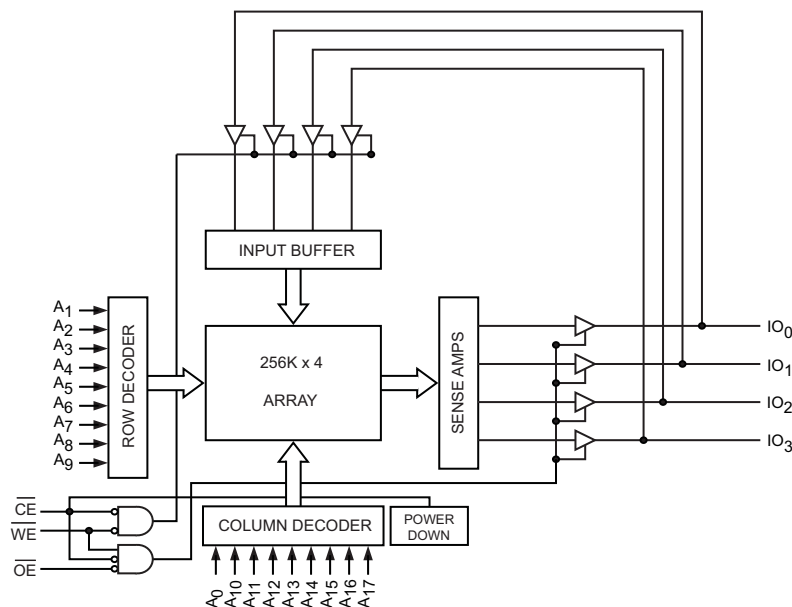
- Deselected ( $\overline{CE}$  HIGH)
- Outputs are disabled ( $\overline{OE}$  HIGH)
- When the write operation is active ( $\overline{CE}$  and  $\overline{WE}$  LOW)

Write to the device by taking Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs LOW. Data on the four IO pins ( $IO_0$  through  $IO_3$ ) is then written into the location specified on the address pins ( $A_0$  through  $A_{17}$ ).

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 four IO pins.

Both CY7C106D and CY7C1006D devices are suitable for interfacing with processors that have TTL I/P levels. They are not suitable for processors that require CMOS I/P levels. Please see [Electrical Characteristics on page 4](#) for more details and suggested alternatives.

## Logic Block Diagram



### Note

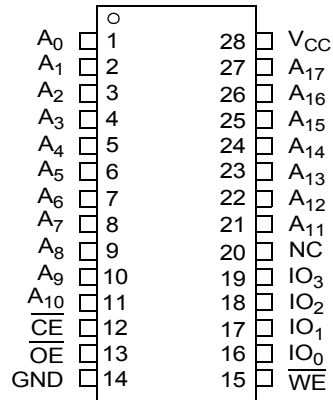
1. For guidelines on SRAM system design, please refer to the 'System Design Guidelines' Cypress application note, available on the internet at [www.cypress.com](http://www.cypress.com).

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## Pin Configurations

Figure 1. 28-pin SOJ pinout (Top View) <sup>[2]</sup>



## Selection Guide

	<b>CY7C106D-10</b> <b>CY7C1006D-10</b>	<b>Unit</b>
Maximum Access Time	10	ns
Maximum Operating Current	80	mA
Maximum Standby Current	3	mA

**Note**

2. NC pins are not connected on the die.

## 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<sub>CC</sub> Relative to GND <sup>[3]</sup>...-0.5 V to +6.0 V  
 DC Voltage Applied to Outputs in High Z State <sup>[3]</sup> ..... -0.5 V to V<sub>CC</sub> + 0.5 V

DC Input Voltage <sup>[3]</sup> ..... -0.5 V to V<sub>CC</sub> + 0.5 V  
 Current into Outputs (LOW) ..... 20 mA  
 Static Discharge Voltage (per MIL-STD-883, Method 3015) ..... > 2001 V  
 Latch-up Current..... > 200 mA

## Operating Range

Range	Ambient Temperature	V <sub>CC</sub>	Speed
Industrial	-40 °C to +85 °C	5 V ± 0.5 V	10 ns

## Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	7C106D-10 7C1006D-10		Unit	
			Min	Max		
V <sub>OH</sub>	Output HIGH Voltage	I <sub>OH</sub> = -4.0 mA	2.4	-	V	
		I <sub>OH</sub> = -0.1 mA	-	3.4 <sup>[4]</sup>		
V <sub>OL</sub>	Output LOW Voltage	I <sub>OL</sub> = 8.0 mA	-	0.4	V	
V <sub>IH</sub>	Input HIGH Voltage		2.2	V <sub>CC</sub> + 0.5	V	
V <sub>IL</sub>	Input LOW Voltage <sup>[3]</sup>		-0.5	0.8	V	
I <sub>IX</sub>	Input Leakage Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	-1	+1	μA	
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub> , Output Disabled	-1	+1	μA	
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	V <sub>CC</sub> = Max, I <sub>OUT</sub> = 0 mA, f = f <sub>max</sub> = 1/t <sub>RC</sub>	100 MHz	-	80	mA
			83 MHz	-	72	mA
			66 MHz	-	58	mA
			40 MHz	-	37	mA
I <sub>SB1</sub>	Automatic CE Power-Down Current—TTL Inputs	Max V <sub>CC</sub> , $\overline{CE} \geq V_{IH}$ , V <sub>IN</sub> ≥ V <sub>IH</sub> or V <sub>IN</sub> ≤ V <sub>IL</sub> , f = f <sub>max</sub>	-	10	mA	
I <sub>SB2</sub>	Automatic CE Power-Down Current—CMOS Inputs	Max V <sub>CC</sub> , $\overline{CE} \geq V_{CC} - 0.3 V$ , V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.3 V or V <sub>IN</sub> ≤ 0.3 V, f = 0	-	3	mA	

### Note

- V<sub>IL</sub> (min) = -2.0 V and V<sub>IH</sub> (max) = V<sub>CC</sub> + 1 V for pulse durations of less than 5 ns.
- Please note that the maximum V<sub>OH</sub> limit does not exceed minimum CMOS V<sub>IH</sub> of 3.5 V. If you are interfacing this SRAM with 5 V legacy processors that require a minimum V<sub>IH</sub> of 3.5 V, please refer to Application Note AN6081 for technical details and options you may consider.

## Capacitance

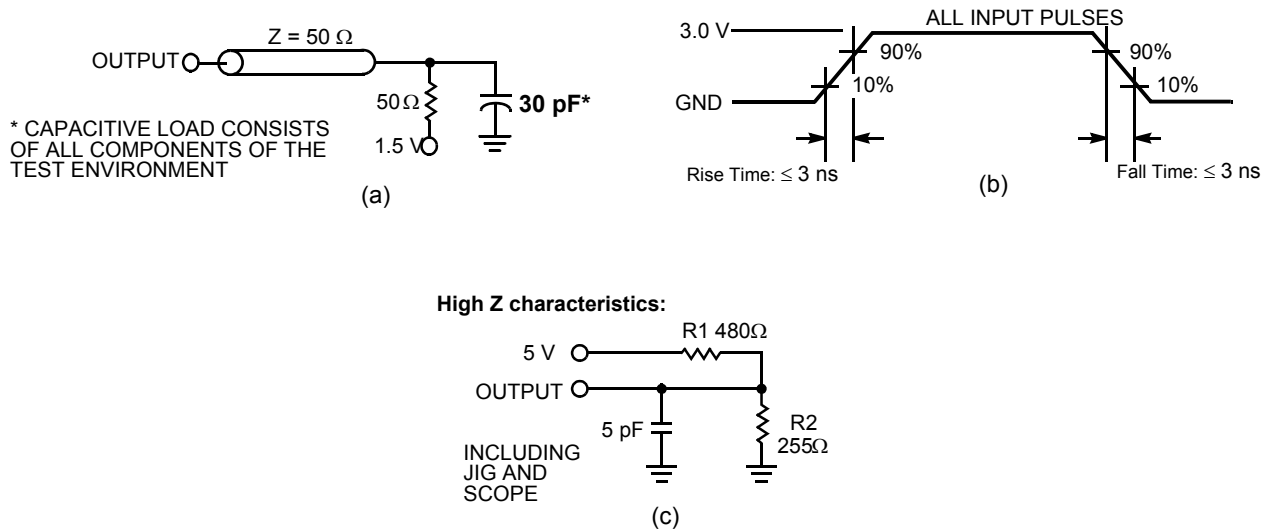
Parameter <sup>[5]</sup>	Description	Test Conditions	Max	Unit
C <sub>IN</sub> : Addresses	Input Capacitance	T <sub>A</sub> = 25 °C, f = 1 MHz, V <sub>CC</sub> = 5.0 V	7	pF
C <sub>IN</sub> : Controls			10	pF
C <sub>OUT</sub>	Output Capacitance		10	pF

## Thermal Resistance

Parameter <sup>[5]</sup>	Description	Test Conditions	300-Mil Wide SOJ	400-Mil Wide SOJ	Unit
Θ <sub>JA</sub>	Thermal Resistance (Junction to Ambient)	Still Air, soldered on a 3 × 4.5 inch, four-layer printed circuit board	59.16	58.76	°C/W
Θ <sub>JC</sub>	Thermal Resistance (Junction to Case)		40.84	40.54	°C/W

## AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms <sup>[6]</sup>



### Notes

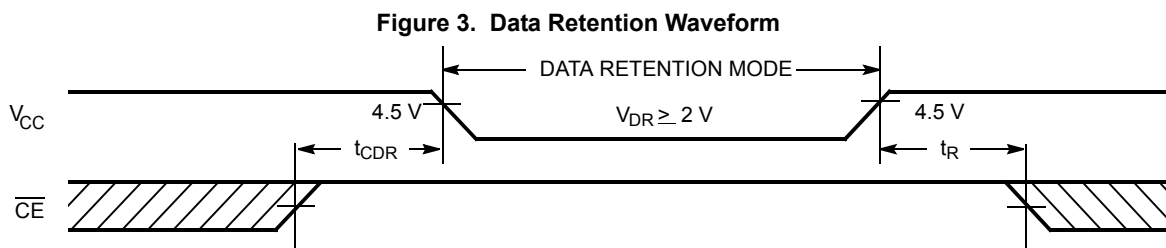
- Tested initially and after any design or process changes that may affect these parameters.
- AC characteristics (except High Z) are tested using the load conditions shown in part (a) of Figure 2. High Z characteristics are tested for all speeds using the test load shown in part (c) of Figure 2.

## 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	$V_{CC} = V_{DR} = 2.0\text{ V}$ , $CE \geq V_{CC} - 0.3\text{ V}$ , $V_{IN} \geq V_{CC} - 0.3\text{ V}$ or $V_{IN} \leq 0.3\text{ V}$	–	3	mA
$t_{CDR}^{[7]}$	Chip Deselect to Data Retention Time		0	–	ns
$t_R^{[8,9]}$	Operation Recovery Time		$t_{RC}$	–	ns

## Data Retention Waveform



### Notes

7. Tested initially and after any design or process changes that may affect these parameters.
8. Full device operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(min)} \geq 50\ \mu\text{s}$  or stable at  $V_{CC(min)} \geq 50\ \mu\text{s}$ .
9.  $t_r \leq 3\text{ ns}$  for all speeds.

## Switching Characteristics

Over the Operating Range <sup>[10]</sup>

Parameter	Description	7C106D-10 7C1006D-10		Unit
		Min	Max	
<b>Read Cycle</b>				
$t_{power}^{[11]}$	$V_{CC}$ (typical) to the first access	100	–	$\mu$ s
$t_{RC}$	Read Cycle Time	10	–	ns
$t_{AA}$	Address to Data Valid	–	10	ns
$t_{OHA}$	Data Hold from Address Change	3	–	ns
$t_{ACE}$	$\overline{CE}$ LOW to Data Valid	–	10	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid	–	5	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low Z	0	–	ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High Z <sup>[12, 13]</sup>	–	5	ns
$t_{LZCE}$	$\overline{CE}$ LOW to Low Z <sup>[13]</sup>	3	–	ns
$t_{HZCE}$	$\overline{CE}$ HIGH to High Z <sup>[12, 13]</sup>	–	5	ns
$t_{PU}^{[14]}$	$\overline{CE}$ LOW to Power-Up	0	–	ns
$t_{PD}^{[14]}$	$\overline{CE}$ HIGH to Power-Down	–	10	ns
<b>Write Cycle</b> <sup>[15, 16]</sup>				
$t_{WC}$	Write Cycle Time	10	–	ns
$t_{SCE}$	$\overline{CE}$ LOW to Write End	7	–	ns
$t_{AW}$	Address Set-Up to Write End	7	–	ns
$t_{HA}$	Address Hold from Write End	0	–	ns
$t_{SA}$	Address Set-Up to Write Start	0	–	ns
$t_{PWE}$	$\overline{WE}$ Pulse Width	7	–	ns
$t_{SD}$	Data Set-Up to Write End	6	–	ns
$t_{HD}$	Data Hold from Write End	0	–	ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[13]</sup>	3	–	ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[12, 13]</sup>	–	5	ns

### Notes

10. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, input pulse levels of 0 to 3.0 V, and output loading of the specified  $I_{OL}/I_{OH}$  and 30-pF load capacitance.
11.  $t_{POWER}$  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.
12.  $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  are specified with a load capacitance of 5 pF as in part (c) of [AC Test Loads and Waveforms](#) on page 5. Transition is measured when the outputs enter a high impedance state.
13. 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.
14. This parameter is guaranteed by design and is not tested.
15. The internal write time of the memory is defined by the overlap of  $\overline{CE}$  and  $\overline{WE}$  LOW.  $\overline{CE}$  and  $\overline{WE}$  must be LOW to initiate a write, and the transition of either of these signals can terminate the write. The input data set-up and hold timing should be referenced to the leading edge of the signal that terminates the write.
16. The minimum write cycle time for Write Cycle No. 3 ( $\overline{WE}$  controlled,  $\overline{OE}$  LOW) is the sum of  $t_{HZWE}$  and  $t_{SD}$ .

## Switching Waveforms

Figure 4. Read Cycle No.1 (Address Transition Controlled) [17, 18]

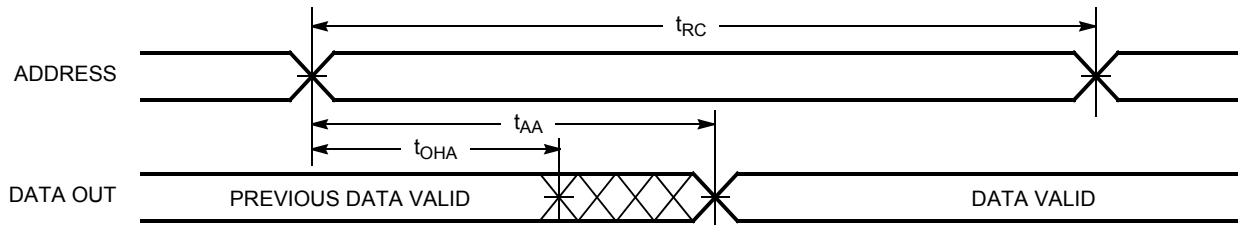
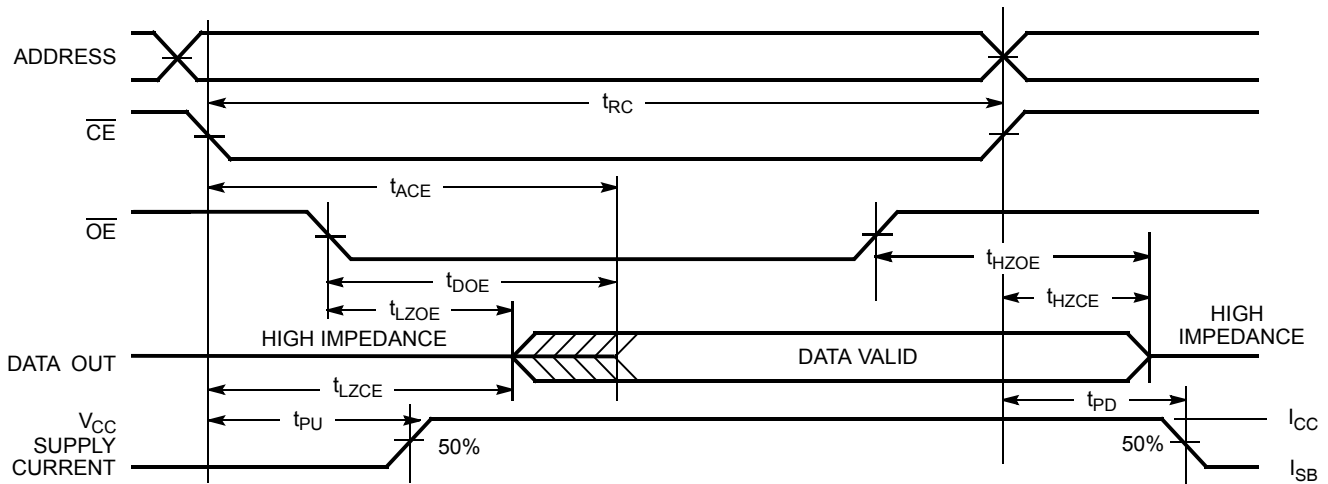


Figure 5. Read Cycle No. 2 ( $\overline{OE}$  Controlled) [18, 19]



### Notes

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



Switching Waveforms (continued)

Figure 6. Write Cycle No. 1 ( $\overline{\text{CE}}$  Controlled) [20, 21]

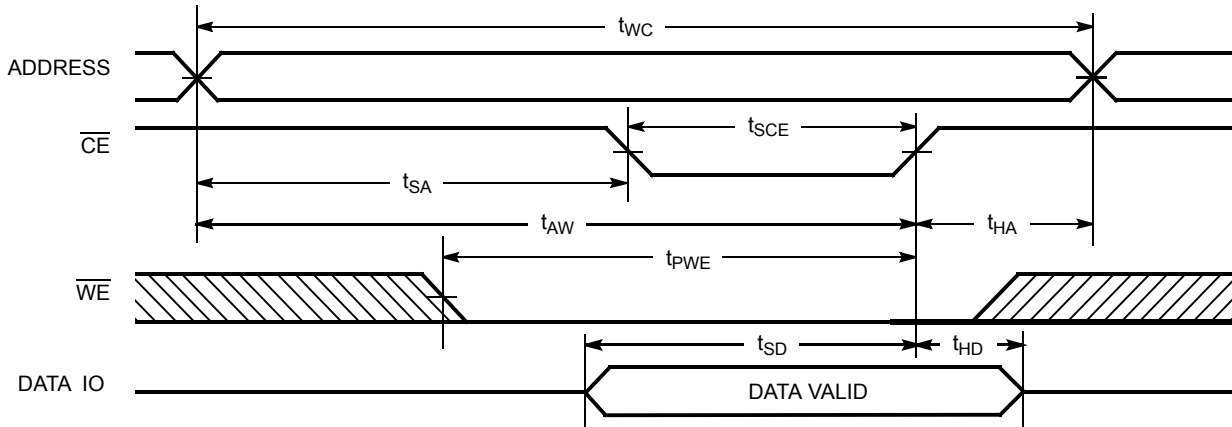
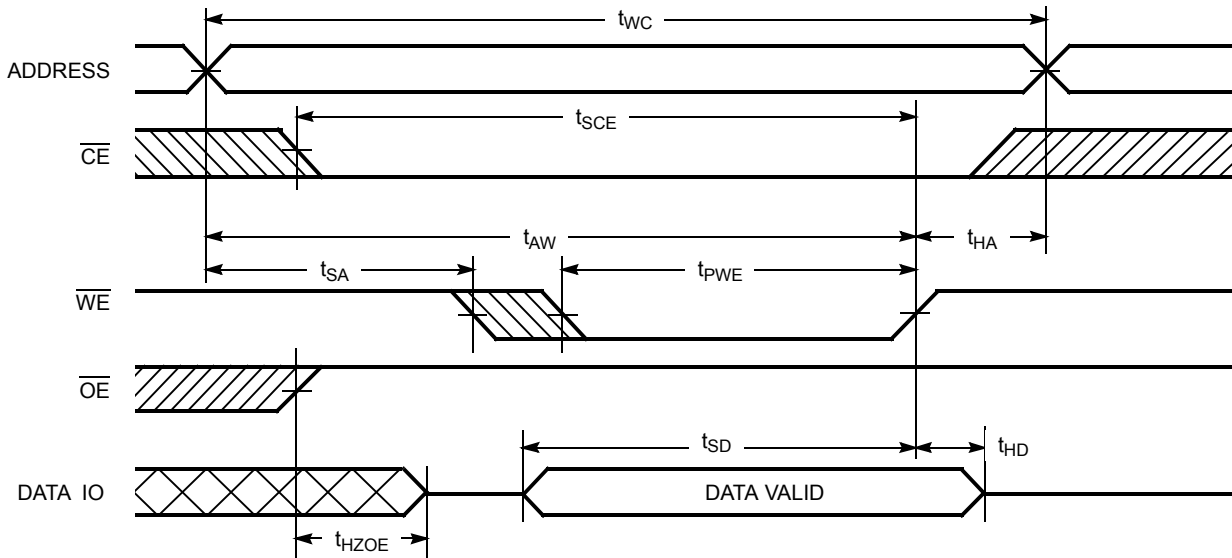


Figure 7. Write Cycle No. 2 ( $\overline{\text{WE}}$  Controlled,  $\overline{\text{OE}}$  HIGH During Write) [20, 21]

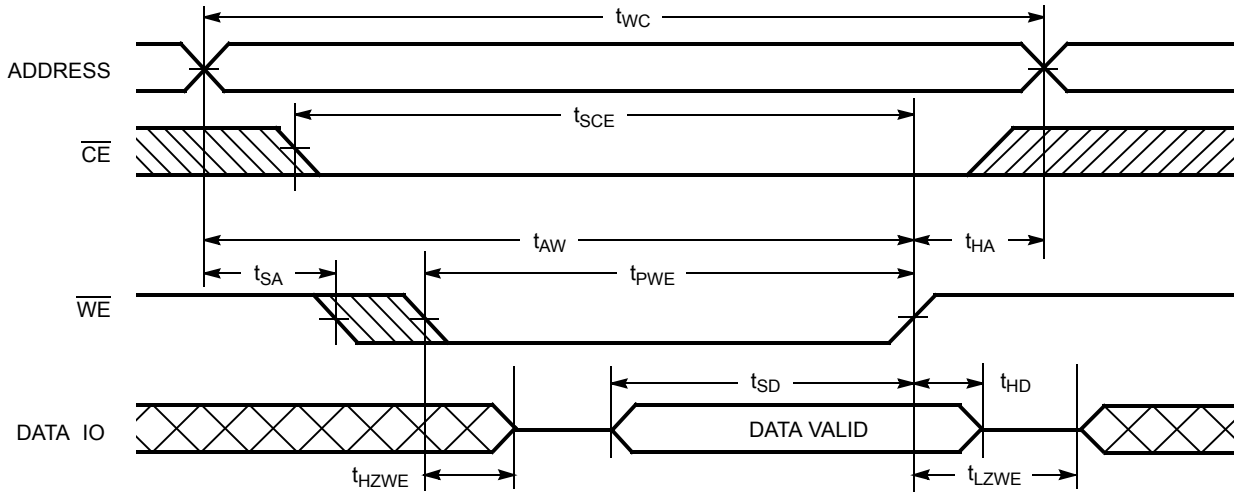


Notes

- 20. If  $\overline{\text{CE}}$  goes HIGH simultaneously with  $\overline{\text{WE}}$  going HIGH, the output remains in a high-impedance state.
- 21. Data IO is high impedance if  $\overline{\text{OE}} = V_{IH}$ .

Switching Waveforms (continued)

Figure 8. Write Cycle No. 3 ( $\overline{WE}$  Controlled,  $\overline{OE}$  LOW) [22, 23]



Notes

- 22. The minimum write cycle time for Write Cycle No. 3 ( $\overline{WE}$  controlled,  $\overline{OE}$  LOW) is the sum of  $t_{HZWE}$  and  $t_{SD}$ .
- 23. Data IO is high impedance if  $\overline{OE} = V_{IH}$ .

### Truth Table

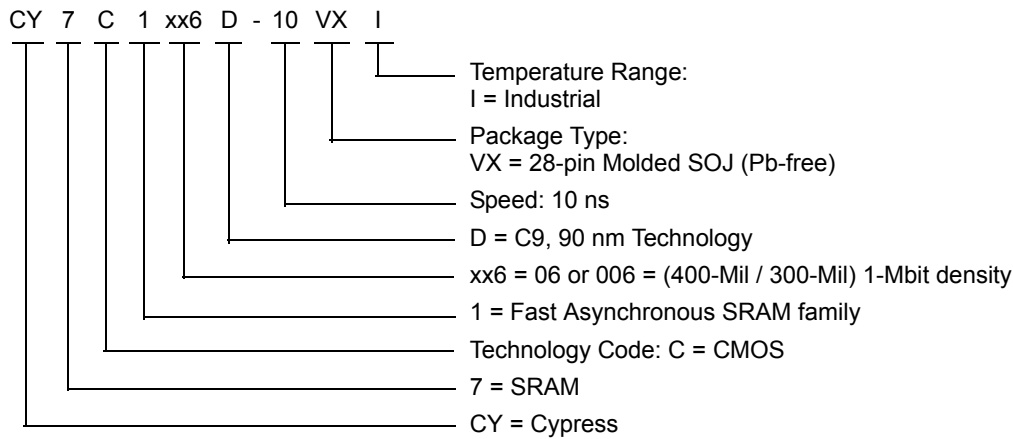
$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	Input/Output	Mode	Power
H	X	X	High Z	Power-Down	Standby ( $I_{SB}$ )
L	L	H	Data Out	Read	Active ( $I_{CC}$ )
L	X	L	Data In	Write	Active ( $I_{CC}$ )
L	H	H	High Z	Selected, Outputs Disabled	Active ( $I_{CC}$ )

### Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
10	CY7C106D-10VXI	51-85032	28-pin (400-Mil) Molded SOJ (Pb-free)	Industrial
	CY7C1006D-10VXI	51-85031	28-pin (300-Mil) Molded SOJ (Pb-free)	

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

### Ordering Code Definitions

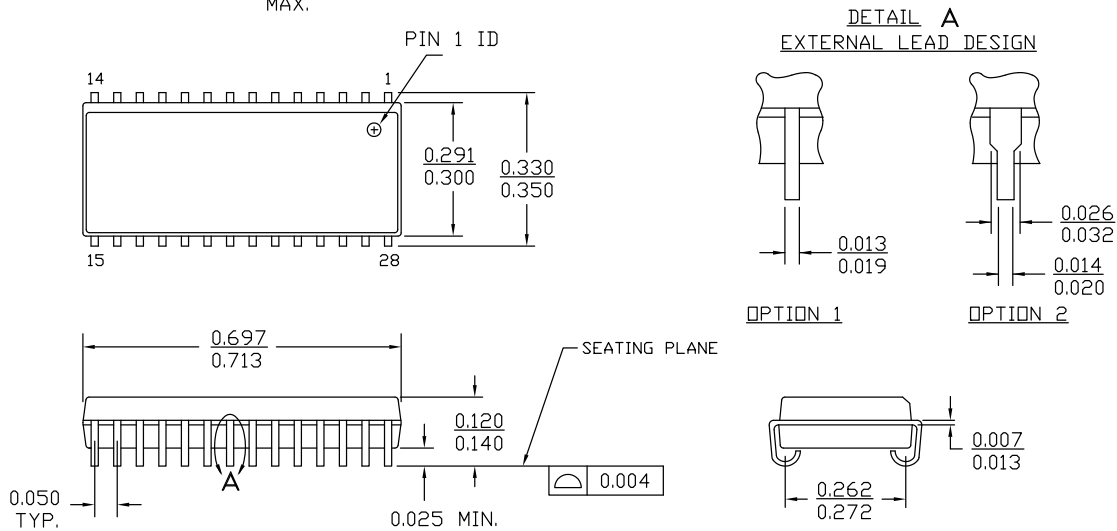


## Package Diagrams

**Figure 9. 28-pin SOJ (300 Mils) V28.3 (Molded SOJ V21) Package Outline, 51-85031**

NOTE :

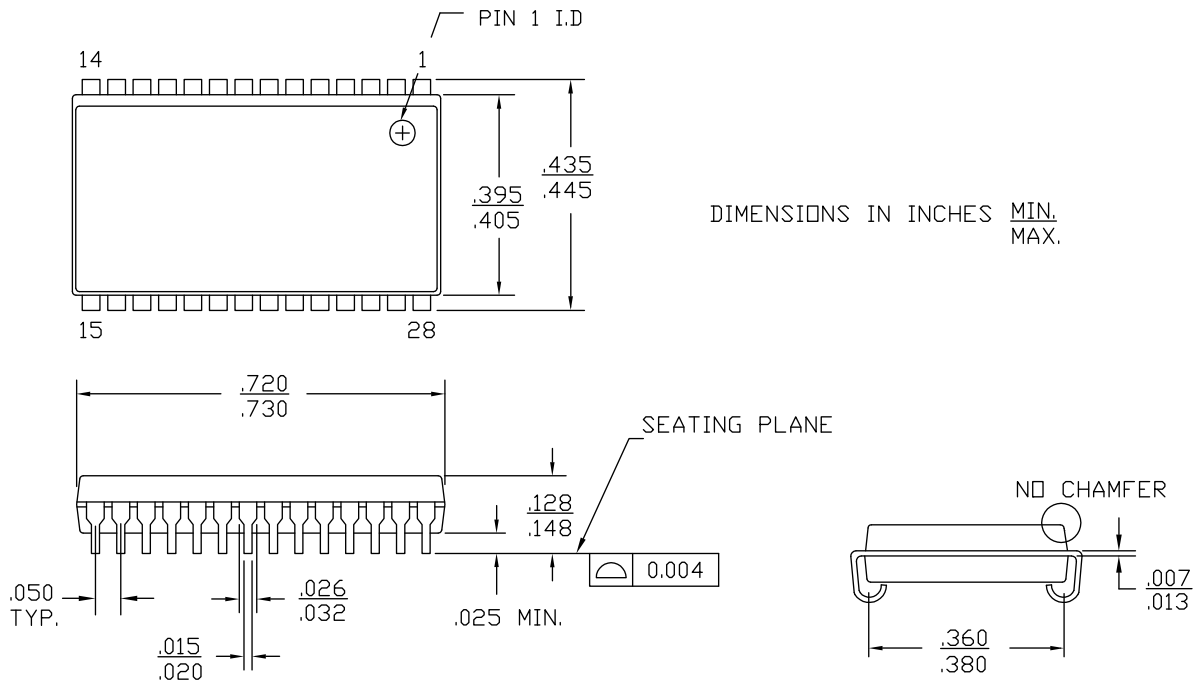
1. JEDEC STD REF MD088
2. BODY LENGTH DIMENSION DOES NOT INCLUDE MOLD PROTRUSION/END FLASH  
MOLD PROTRUSION/END FLASH SHALL NOT EXCEED 0.006 in (0.152 mm) PER SIDE
3. DIMENSIONS IN INCHES MIN.  
MAX.



51-85031 \*E

**Package Diagrams** (continued)

**Figure 10. 28-pin (400 Mils) V28.4 (Molded SOJ V28) Package Outline, 51-85032**



NOTES :

1. PACKAGE WEIGHT : 1.24g
2. JEDEC REFERENCE : MS-027

51-85032 \*E

## Acronyms

Acronym	Description
CE	Chip Enable
CMOS	Complementary Metal-Oxide Semiconductor
I/O	Input/Output
OE	Output Enable
SOJ	Small Outline J-lead
SRAM	Static Random Access Memory
TTL	Transistor-Transistor Logic
WE	Write Enable

## Document Conventions

### Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	megahertz
μA	microampere
μs	microsecond
mA	milliampere
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
V	volt
W	watt

## Document History Page

Document Title: CY7C106D/CY7C1006D, 1-Mbit (256 K × 4) Static RAM				
Document Number: 38-05459				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	201560	See ECN	SWI	Advance information data sheet for C9 IPP
*A	233693	See ECN	RKF	I <sub>CC</sub> , I <sub>SB1</sub> , I <sub>SB2</sub> Specs are modified as per EROS (Spec # 01-2165) Pb-free offering in the 'ordering information'
*B	262950	See ECN	RKF	Added T <sub>power</sub> Spec in Switching Characteristics table Shaded 'Ordering Information'
*C	See ECN	See ECN	RKF	Reduced Speed bins to -10 and -12 ns
*D	560995	See ECN	VKN	Converted from Preliminary to Final Removed Commercial Operating range Removed 12 ns speed bin Added I <sub>CC</sub> values for the frequencies 83MHz, 66MHz and 40MHz Updated Thermal Resistance table Updated Ordering Information table Changed Overshoot spec from V <sub>CC</sub> +2V to V <sub>CC</sub> +1V in footnote #3
*E	802877	See ECN	VKN	Changed I <sub>CC</sub> spec from 60 mA to 80 mA for 100MHz, 55 mA to 72 mA for 83MHz, 45 mA to 58 mA for 66MHz, 30 mA to 37 mA for 40MHz
*F	2898399	03/24/2010	AJU	Updated Package Diagrams
*G	3104943	12/08/2010	AJU	Added <a href="#">Ordering Code Definitions</a> .
*H	3244490	04/29/2011	PRAS	Updated <a href="#">Package Diagrams</a> . Added <a href="#">Acronyms</a> and <a href="#">Units of Measure</a> . Updated in new template.
*I	4033580	06/19/2013	MEMJ	Updated <a href="#">Functional Description</a> .  Updated <a href="#">Electrical Characteristics</a> : Added one more Test Condition "I <sub>OH</sub> = -0.1 mA" for V <sub>OH</sub> parameter and added maximum value corresponding to that Test Condition. Added Note 4 and referred the same note in maximum value for V <sub>OH</sub> parameter corresponding to Test Condition "I <sub>OH</sub> = -0.1 mA".  Updated <a href="#">Package Diagrams</a> : spec 51-85031 – Changed revision from *D to *E.

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