



**THE DATASHEET OF  
CY7C192-15VXCT**



# 64 K × 4 Static RAM with Separate IO

## Features

- High speed
  - 15 ns
- CMOS for optimum speed/power
- Low active power
  - 860 mW
- Low standby power
  - 55 mW
- TTL-compatible inputs and outputs
- Automatic power down when deselected
- Available in Pb-free 28-pin Molded SOJ package

## Functional Description

The CY7C192 is a high performance CMOS static RAM organized as 65,536 × 4 bits with separate IO. Easy memory expansion is provided by active LOW Chip Enable ( $\overline{CE}$ ) and tri-state drivers. It has an automatic power down feature that reduces power consumption by 75% when deselected.

Writing to the device is accomplished when the Chip Enable ( $\overline{CE}$ ) and Write Enable ( $\overline{WE}$ ) inputs are both LOW.

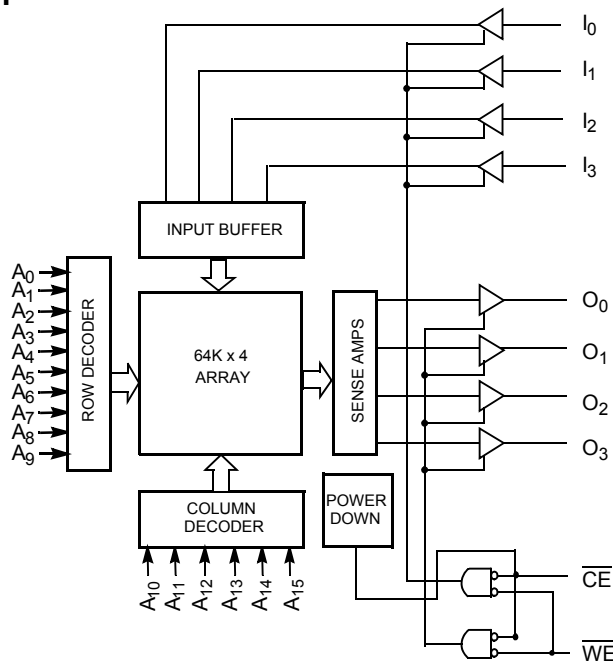
Data on the four input pins ( $I_0$  through  $I_3$ ) is written into the memory location specified on the address pins ( $A_0$  through  $A_{15}$ ).

Reading the device is accomplished by taking the Chip Enable ( $\overline{CE}$ ) LOW while the Write Enable ( $\overline{WE}$ ) remains HIGH. Under these conditions, the contents of the memory location specified on the address pins appears on the four data output pins.

The output pins stay in high impedance state when Write Enable ( $\overline{WE}$ ) is LOW or Chip Enable ( $\overline{CE}$ ) is HIGH.

A die coat ensures alpha immunity.

## Logic Block Diagram

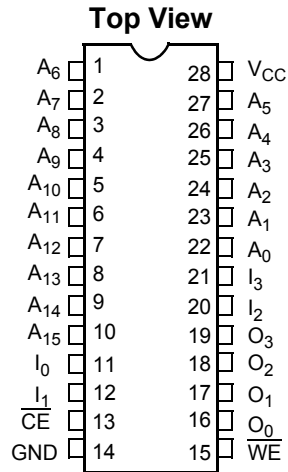


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## Pin Configurations

Figure 1. 28-pin Molded SOJ pinout



## Selection Guide

Description	-15	Unit
Maximum Access Time	15	ns
Maximum Operating Current	145	mA
Maximum CMOS Standby Current	10	mA

**Maximum Ratings**

Exceeding maximum ratings may shorten the useful life of the device. User guidelines are not tested.

- Storage Temperature ..... -65 °C to +150 °C
- Ambient Temperature with Power Applied ..... -55 °C to +125 °C
- Supply Voltage to Ground Potential ..... -0.5 V to +7.0 V
- DC Voltage Applied to Outputs in High Z State <sup>[1]</sup> ..... -0.5 V to V<sub>CC</sub> + 0.5 V

- DC Input Voltage<sup>[1]</sup> ..... -0.5 V to V<sub>CC</sub> + 0.5 V
- Output Current into Outputs (LOW) ..... 20 mA
- Static Discharge Voltage (per MIL-STD-883, Method 3015) ..... > 900 V
- Latch-Up Current ..... > 200 mA

**Operating Range**

Range	Ambient Temperature <sup>[2]</sup>	V <sub>CC</sub>
Commercial	0 °C to +70 °C	5 V ± 10%

**Electrical Characteristics**

Over the Operating Range

Parameter	Description	Test Conditions	-15		Unit
			Min	Max	
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = -4.0 mA	2.4	-	V
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = 8.0 mA	-	0.4	V
V <sub>IH</sub>	Input HIGH Voltage		2.2	V <sub>CC</sub> + 0.3	V
V <sub>IL</sub>	Input LOW Voltage <sup>[1]</sup>		-0.5	0.8	V
I <sub>IX</sub>	Input Leakage Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	-5	+5	μA
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> , Output Disabled	-5	+5	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>	-	145	mA
I <sub>SB1</sub>	Automatic $\overline{CE}$ 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>	-	30	mA
I <sub>SB2</sub>	Automatic $\overline{CE}$ 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	-	10	mA

**Capacitance**

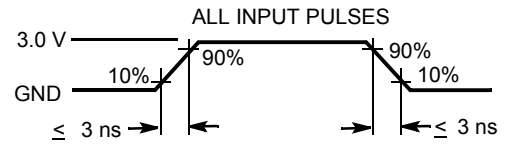
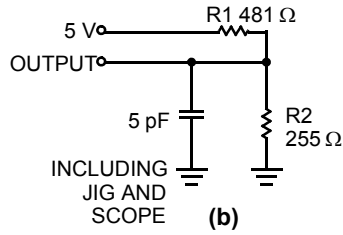
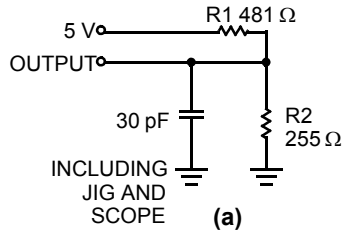
Parameter	Description	Test Conditions	Max	Unit
C <sub>IN</sub> <sup>[3]</sup>	Input Capacitance	T <sub>A</sub> = 25 °C, f = 1 MHz, V <sub>CC</sub> = 5.0 V	8	pF
C <sub>OUT</sub> <sup>[3]</sup>	Output Capacitance		10	pF

**Notes**

1. Minimum voltage is equal to -2.0 V for pulse durations of less than 20 ns.
2. T<sub>A</sub> is the case temperature.
3. Tested initially and after any design or process changes that may affect these parameters.

## AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms



Equivalent to: THÉVENIN EQUIVALENT  
 $167\ \Omega$   
 OUTPUT  $1.73\ \text{V}$

## Switching Characteristics

Over the Operating Range

Parameter <sup>[4]</sup>	Description	-15		Unit
		Min	Max	
<b>Read Cycle</b>				
$t_{RC}$	Read Cycle Time	15	–	ns
$t_{AA}$	Address to Data Valid	–	15	ns
$t_{OHA}$	Output Hold from Address Change	3	–	ns
$t_{ACE}$	$\overline{CE}$ LOW to Data Valid	–	15	ns
$t_{LZCE}$	$\overline{CE}$ LOW to Low Z <sup>[5]</sup>	3	–	ns
$t_{HZCE}$	$\overline{CE}$ HIGH to High Z <sup>[5, 6]</sup>	–	7	ns
$t_{PU}$	$\overline{CE}$ LOW to Power Up	0	–	ns
$t_{PD}$	$\overline{CE}$ HIGH to Power Down	–	15	ns
<b>Write Cycle <sup>[7]</sup></b>				
$t_{WC}$	Write Cycle Time	15	–	ns
$t_{SCE}$	$\overline{CE}$ LOW to Write End	10	–	ns
$t_{AW}$	Address Setup to Write End	10	–	ns
$t_{HA}$	Address Hold from Write End	0	–	ns
$t_{SA}$	Address Setup to Write Start	0	–	ns
$t_{PWE}$	$\overline{WE}$ Pulse Width	9	–	ns
$t_{SD}$	Data Setup to Write End	9	–	ns
$t_{HD}$	Data Hold from Write End	0	–	ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low Z <sup>[5]</sup>	3	–	ns
$t_{HZWE}$	$\overline{WE}$ LOW to High Z <sup>[5, 6]</sup>	–	7	ns

### Notes

- 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.
- At any temperature and voltage condition,  $t_{HZCE}$  is less than  $t_{LZCE}$ ,  $t_{HZWE}$  is less than  $t_{LZWE}$  for any given device. These parameters are guaranteed by design and not 100% tested.
- $t_{HZCE}$  and  $t_{HZWE}$  are specified with  $C_L = 5$  pF as in part (b) of [Figure 2](#). Transition is measured  $\pm 500$  mV from steady-state voltage.
- 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 setup and hold timing must be referenced to the rising edge of the signal that terminates the write.

Switching Waveforms

Figure 3. Read Cycle No. 1 [8, 9]

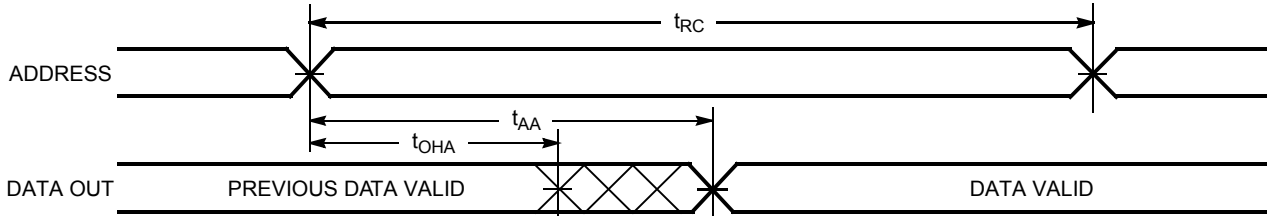


Figure 4. Read Cycle No. 2 [8, 10]

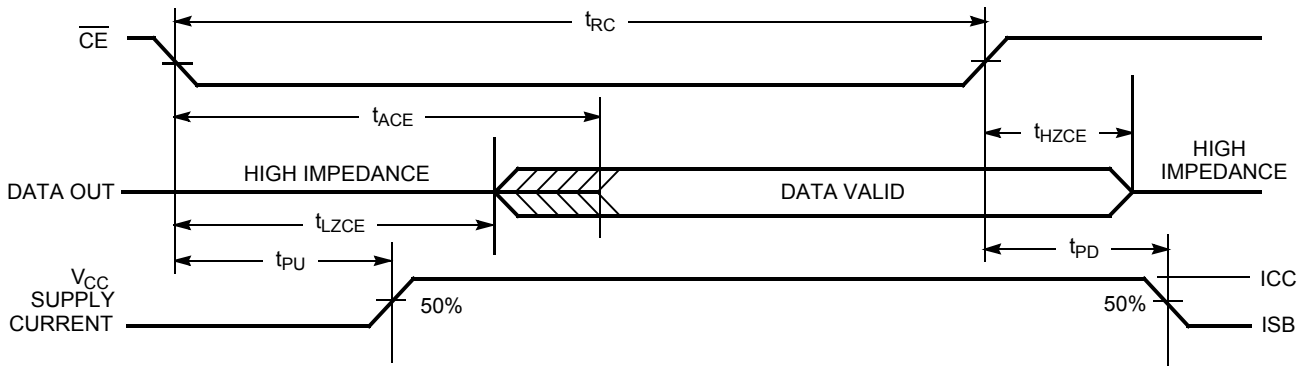
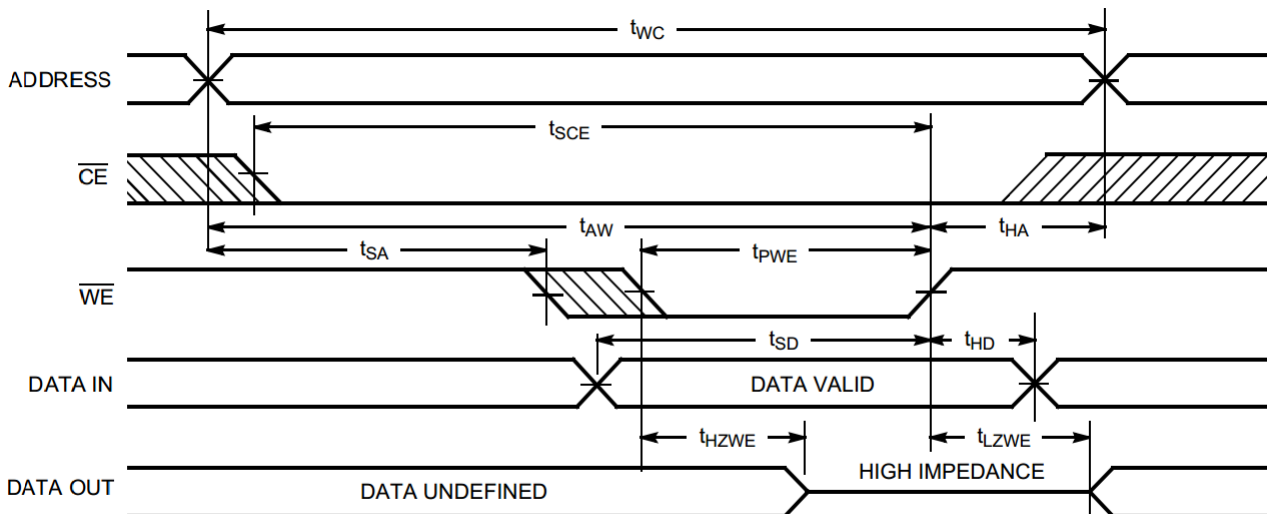


Figure 5. Write Cycle No. 1 ( $\overline{WE}$  Controlled) [11]

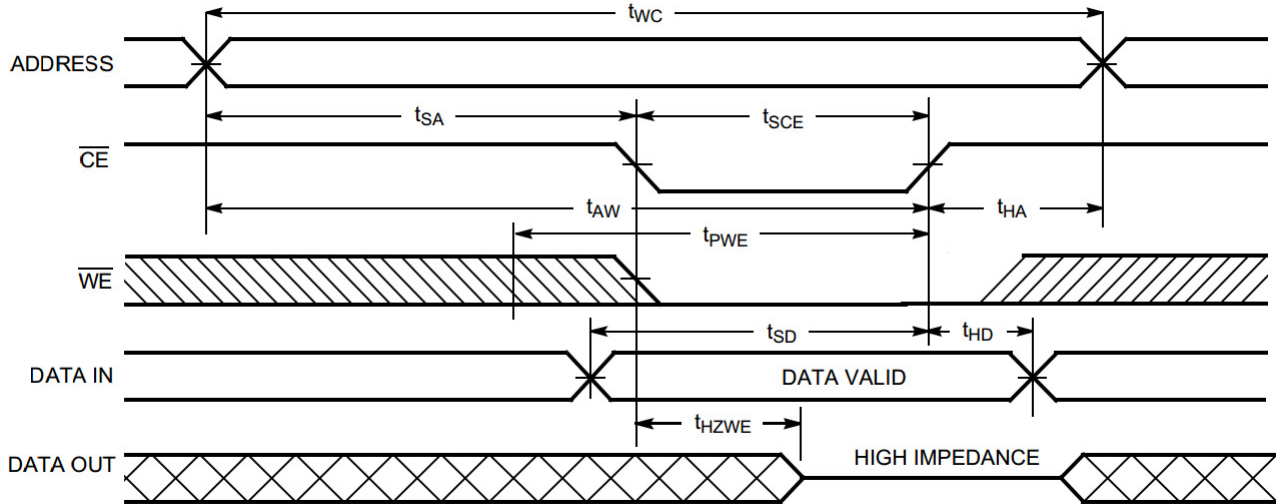


Notes

8.  $\overline{WE}$  is HIGH for read cycle.
9. Device is continuously selected,  $\overline{CE} = V_{IL}$ .
10. Address valid prior to or coincident with  $\overline{CE}$  transition LOW.
11. 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 setup and hold timing must be referenced to the rising edge of the signal that terminates the write.

Switching Waveforms (continued)

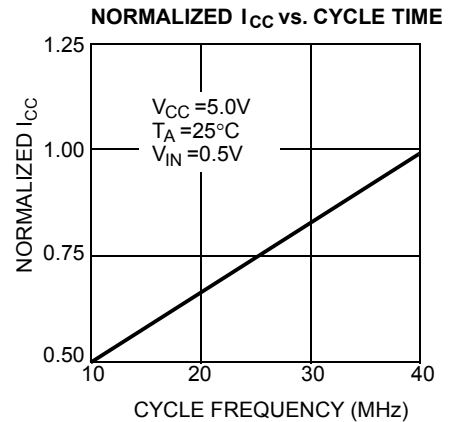
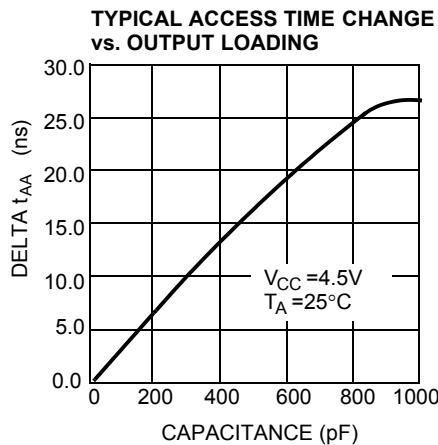
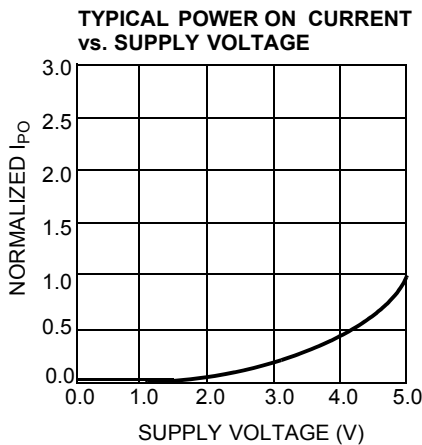
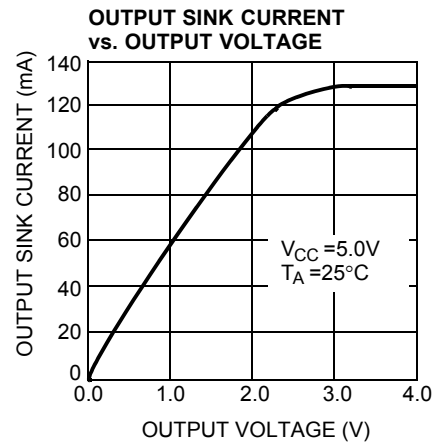
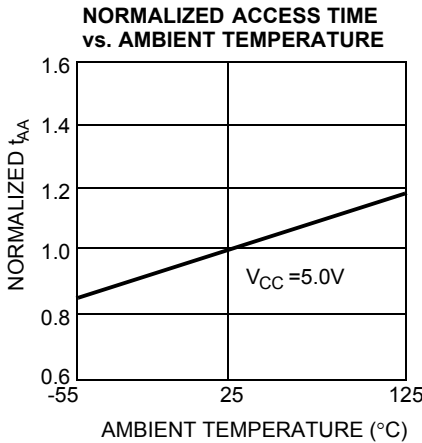
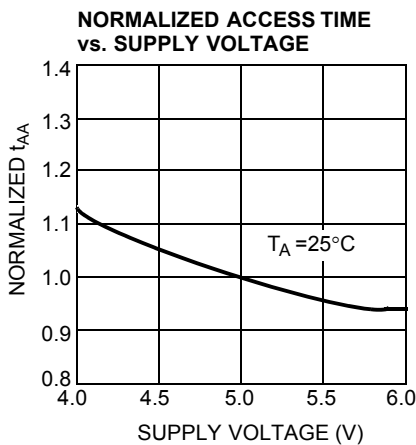
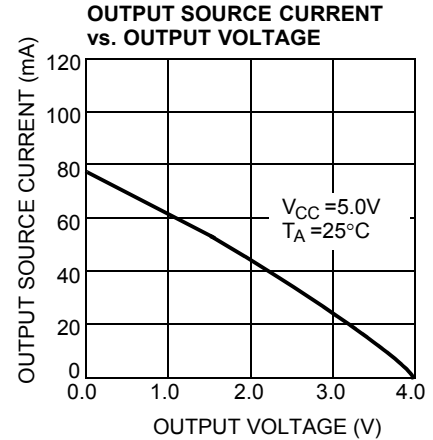
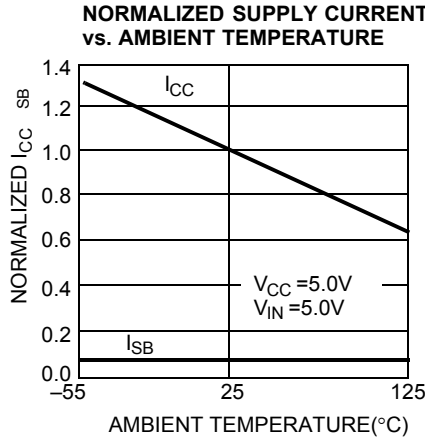
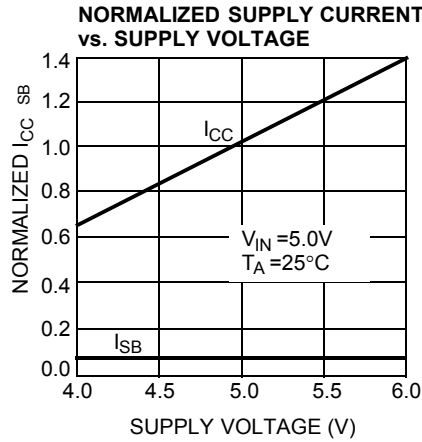
Figure 6. Write Cycle No. 2 ( $\overline{CE}$  Controlled) [12, 13]



Notes

12. 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 setup and hold timing must be referenced to the rising edge of the signal that terminates the write.
13. If  $\overline{CE}$  goes HIGH simultaneously with  $\overline{WE}$  HIGH, the output remains in a high impedance state.

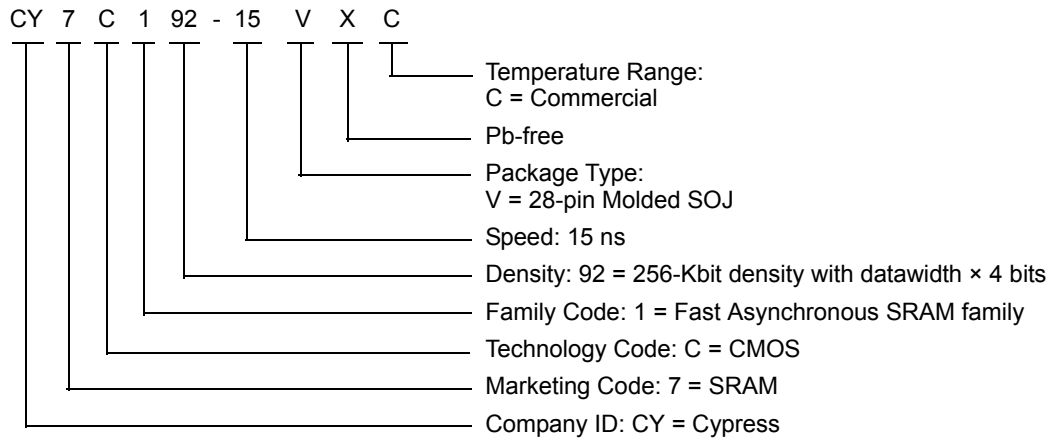
Typical DC and AC Characteristics



## Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
15	CY7C192-15VXC	51-85031	28-pin Molded SOJ (Pb-free)	Commercial

## Ordering Code Definitions

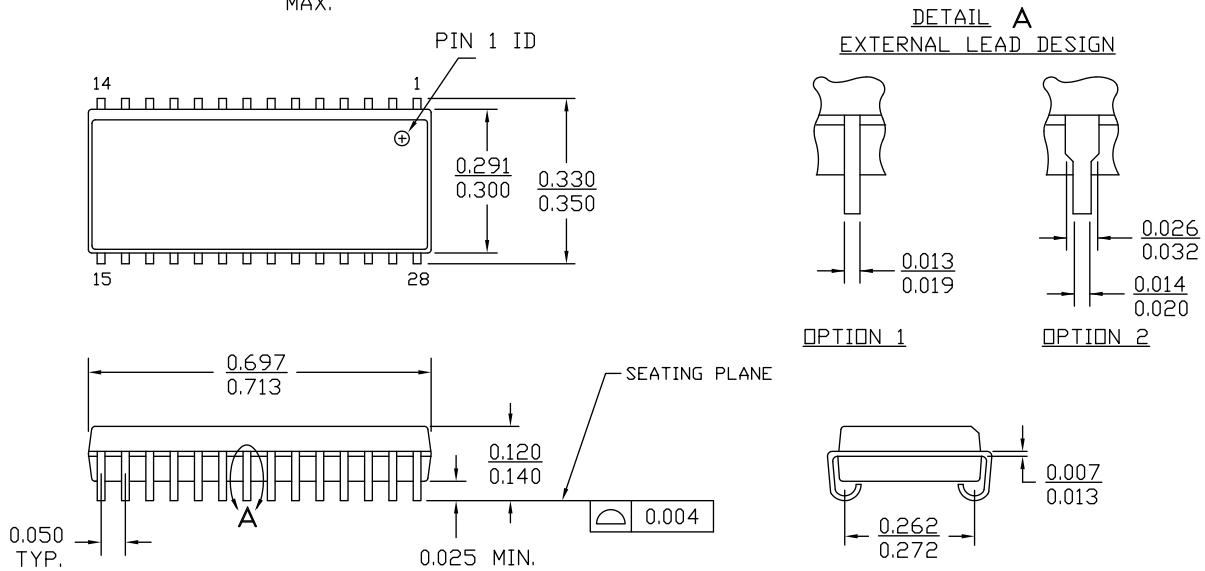


**Package Diagram**

**Figure 7. 28-pin SOJ (300 Mils) V28.3 (Molded SOJ V21) Package Outline, 51-85031**

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 \*E

**Acronyms**

Acronym	Description
CE	Chip Enable
CMOS	Complementary Metal Oxide Semiconductor
I/O	Input/Output
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 Celcius
MHz	megahertz
μA	microampere
mA	milliampere
mm	millimeter
ms	millisecond
mW	milliwatt
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
V	volt
W	watt

Document History Page

Document Title: CY7C192, 64 K × 4 Static RAM with Separate IO				
Document Number: 38-05047				
Rev.	ECN No.	Issue Date	Orig. of Change	Description of Change
**	107149	09/10/01	SZV	Change Spec number from: 38-00076 to 38-05047
*A	359716	See ECN	AJU	Changed Static Discharge Voltage limit in the Maximum Ratings section (page 2) from 2001V to 900V Removed references to CY7C191
*B	419549	See ECN	AJU	Added Pb-free parts to the Ordering Information table and replaced the Package Name column with Package Diagram
*C	492500	See ECN	NXR	Removed 20 ns and 25 ns speed bins Changed the Low active power from 220 mW to 55 mW Changed the description of I <sub>IX</sub> from Input Load Current to Input Leakage Current in DC Electrical Characteristics table Removed I <sub>OS</sub> parameter from DC Electrical Characteristics table Removed 28-Lead (300-Mil) PDIP package from product offering Updated Ordering Information table
*D	2104606	See ECN	VKN/AESA	Removed 12 ns speed bin
*E	2956606	06/18/2010	KAO	Removed inactive part from <a href="#">Ordering Information</a> Updated <a href="#">Package Diagram</a> . Added <a href="#">Sales, Solutions, and Legal Information</a> .
*F	3105329	12/09/2010	AJU	Added <a href="#">Ordering Code Definitions</a> .
*G	3217855	04/06/2011	PRAS	Added <a href="#">Acronyms and Units of Measure</a> . Updated in new template.
*H	3271782	06/01/2011	PRAS	Updated <a href="#">Features</a> .
*I	3974483	04/19/2013	MEMJ	Updated <a href="#">Switching Waveforms</a> (Updated <a href="#">Figure 5</a> , <a href="#">Figure 6</a> ).  Updated <a href="#">Package Diagram</a> : spec 51-85031 – Changed revision from *D to *E.  Completing Sunset Review.

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