

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.

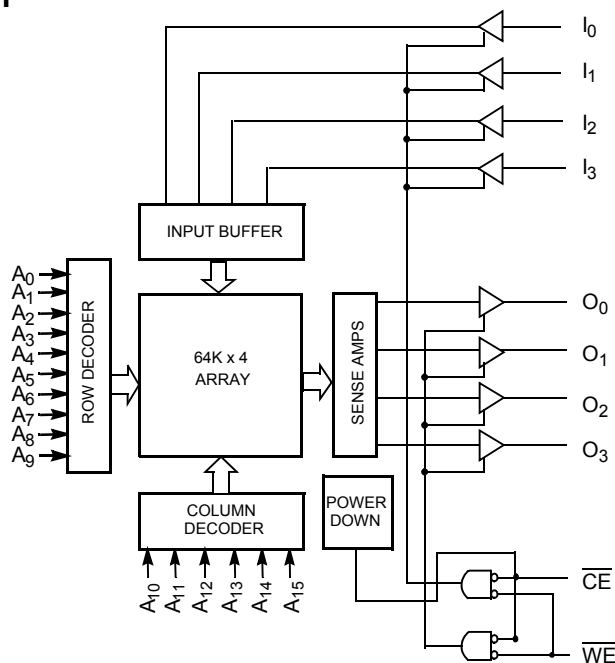
Data on the four input pins (I_0 through I_3) is written into the memory location specified on the address pins (A_0 through A_{15}).

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

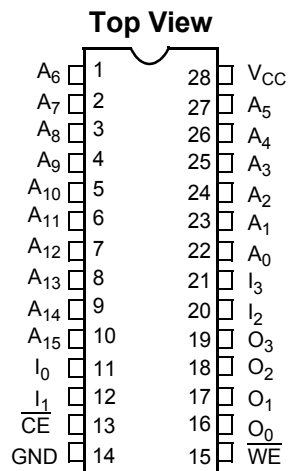


Contents

Pin Configurations	3	Package Diagram	11
Selection Guide	3	Acronyms	12
Maximum Ratings	4	Document Conventions	12
Operating Range	4	Units of Measure	12
Electrical Characteristics	4	Document History Page	13
Capacitance	4	Sales, Solutions, and Legal Information	14
AC Test Loads and Waveforms	5	Worldwide Sales and Design Support	14
Switching Characteristics	6	Products	14
Switching Waveforms	7	PSoC Solutions	14
Typical DC and AC Characteristics	9		
Ordering Information	10		
Ordering Code Definitions	10		

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 ^[1] -0.5 V to $V_{CC} + 0.5$ V

DC Input Voltage^[1] -0.5 V to $V_{CC} + 0.5$ 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 ^[2]	V_{CC}
Commercial	0 °C to +70 °C	5 V ± 10%

Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	-15		Unit
			Min	Max	
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min}, I_{OH} = -4.0 \text{ mA}$	2.4	–	V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min}, I_{OL} = 8.0 \text{ mA}$	–	0.4	V
V_{IH}	Input HIGH Voltage		2.2	$V_{CC} + 0.3$	V
V_{IL}	Input LOW Voltage ^[1]		-0.5	0.8	V
I_{IX}	Input Leakage Current	$GND \leq V_I \leq V_{CC}$	-5	+5	μA
I_{OZ}	Output Leakage Current	$GND \leq V_O \leq V_{CC}$, Output Disabled	-5	+5	μA
I_{CC}	V_{CC} Operating Supply Current	$V_{CC} = \text{Max}, I_{OUT} = 0 \text{ mA}, f = f_{MAX} = 1/t_{RC}$	–	145	mA
I_{SB1}	Automatic \overline{CE} Power Down Current – TTL Inputs	Max V_{CC} , $\overline{CE} \geq V_{IH}$, $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$, $f = f_{MAX}$	–	30	mA
I_{SB2}	Automatic \overline{CE} Power Down Current – CMOS Inputs	Max V_{CC} , $\overline{CE} \geq V_{CC} - 0.3 \text{ V}$, $V_{IN} \geq V_{CC} - 0.3 \text{ V}$ or $V_{IN} \leq 0.3 \text{ V}$, $f = 0$	–	10	mA

Capacitance

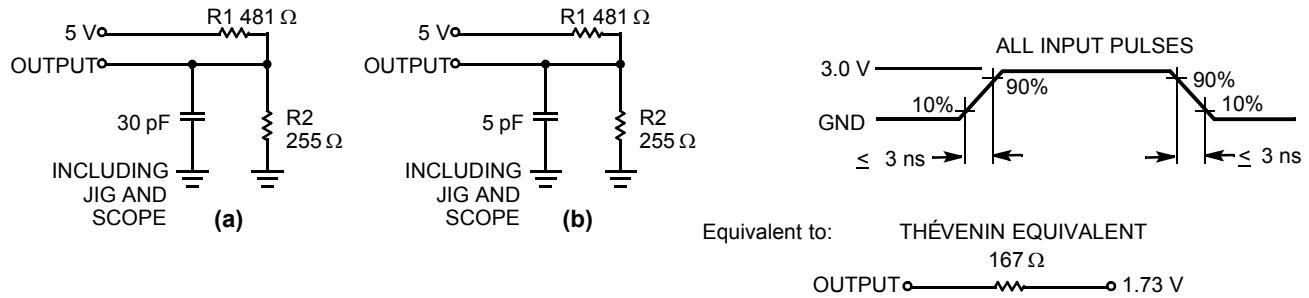
Parameter	Description	Test Conditions	Max	Unit
C_{IN} ^[3]	Input Capacitance	$T_A = 25 \text{ °C}, f = 1 \text{ MHz}, V_{CC} = 5.0 \text{ V}$	8	pF
C_{OUT} ^[3]	Output Capacitance		10	pF

Notes

1. Minimum voltage is equal to -2.0 V for pulse durations of less than 20 ns.
2. T_A 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



Switching Characteristics

Over the Operating Range

Parameter ^[4]	Description	-15		Unit
		Min	Max	
Read Cycle				
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 ^[5]	3	–	ns
t _{HZCE}	\overline{CE} HIGH to High Z ^[5, 6]	–	7	ns
t _{PU}	\overline{CE} LOW to Power Up	0	–	ns
t _{PD}	\overline{CE} HIGH to Power Down	–	15	ns
Write Cycle ^[7]				
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 ^[5]	3	–	ns
t _{HZWE}	\overline{WE} LOW to High Z ^[5, 6]	–	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 ± 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]

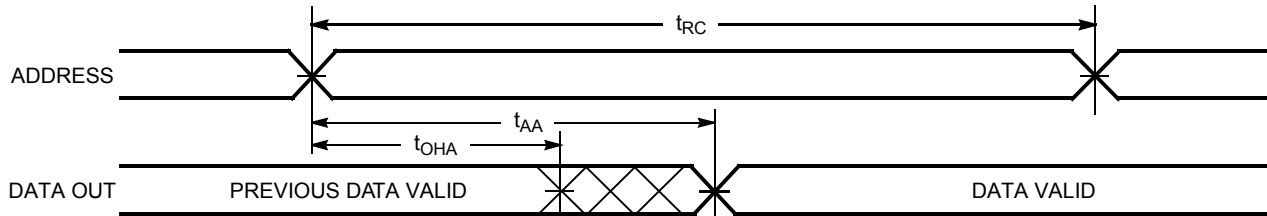


Figure 4. Read Cycle No. 2 [8, 10]

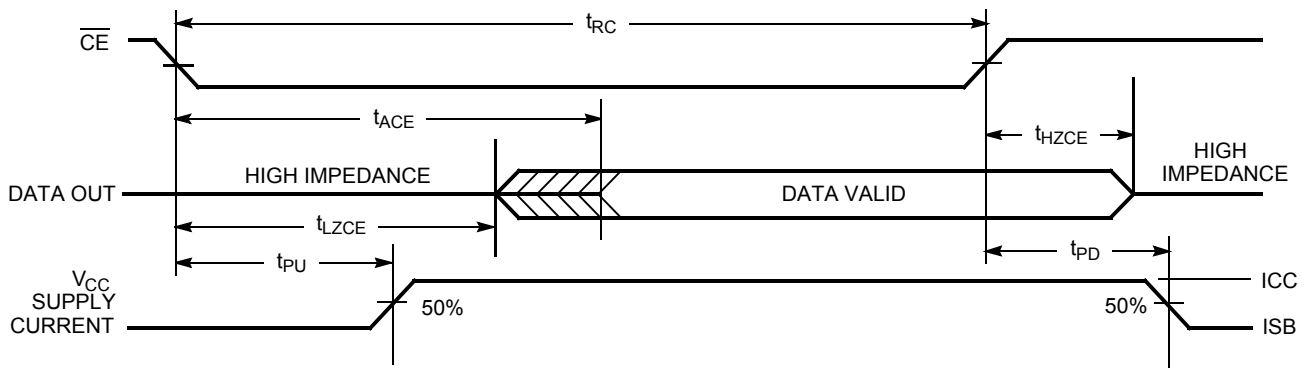
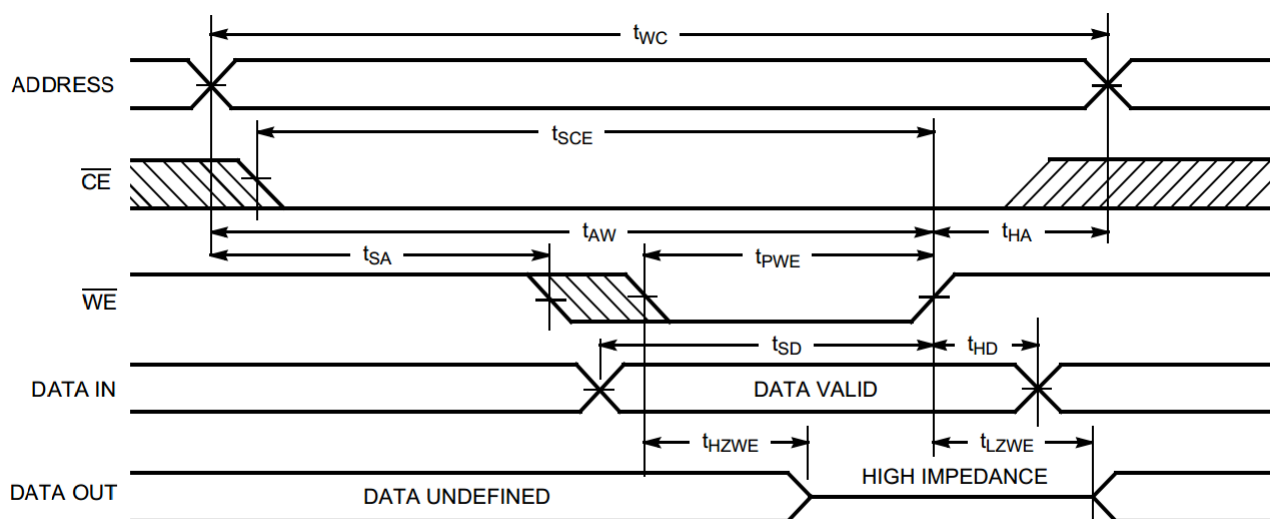


Figure 5. Write Cycle No. 1 (\overline{WE} Controlled) [11]

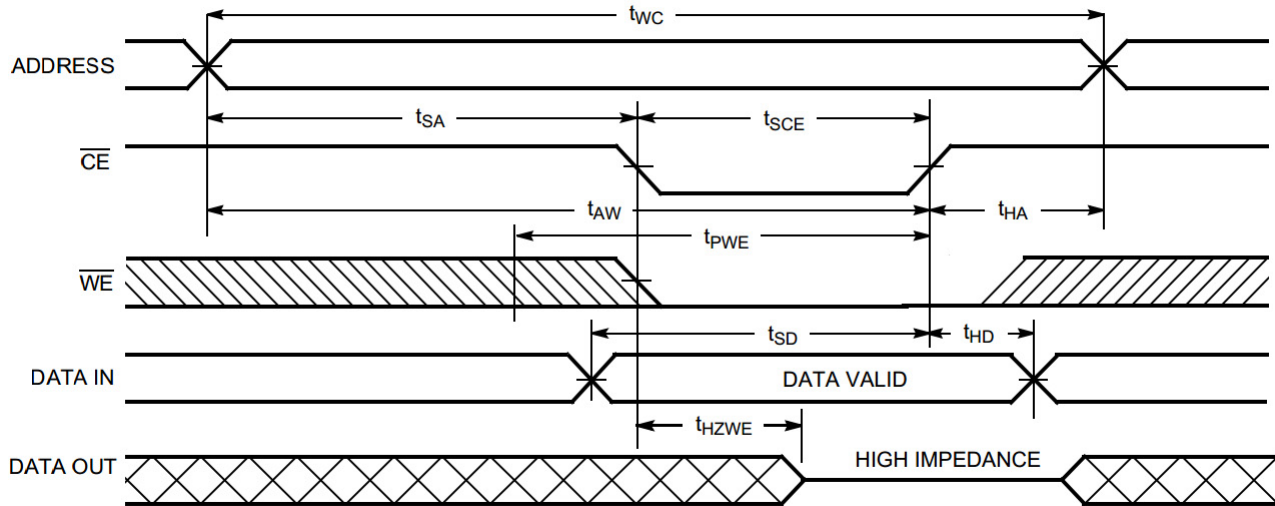


Notes

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)

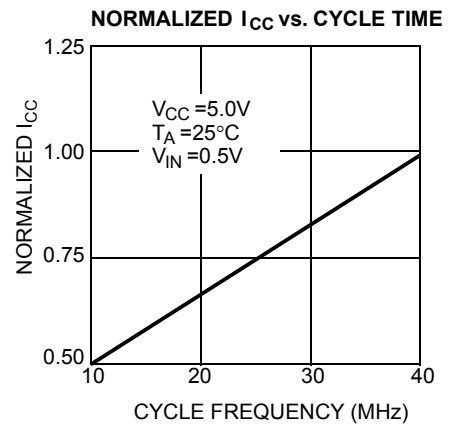
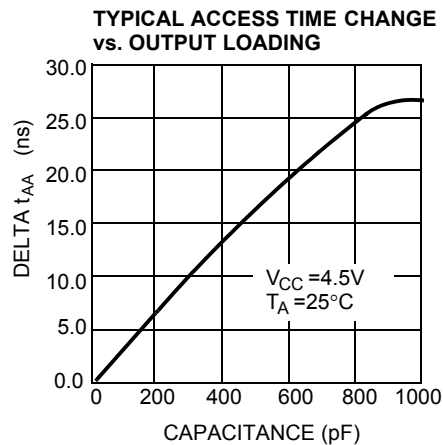
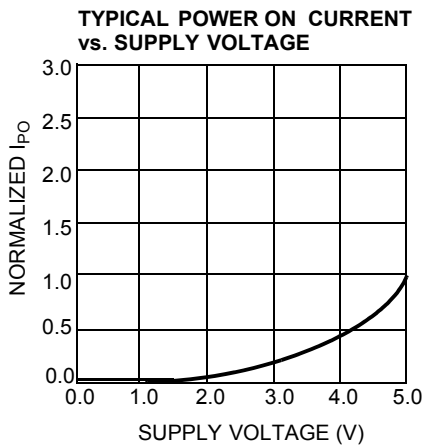
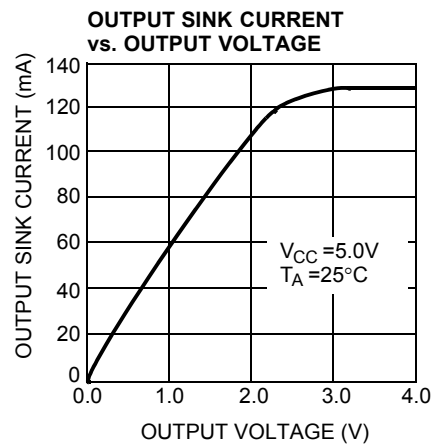
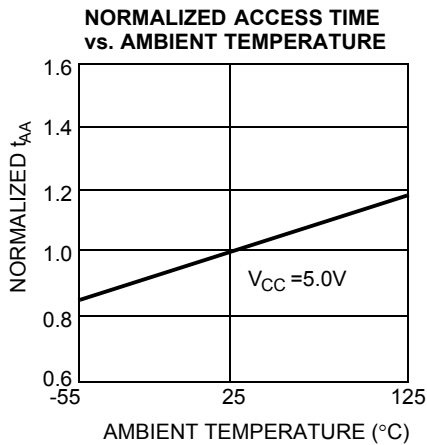
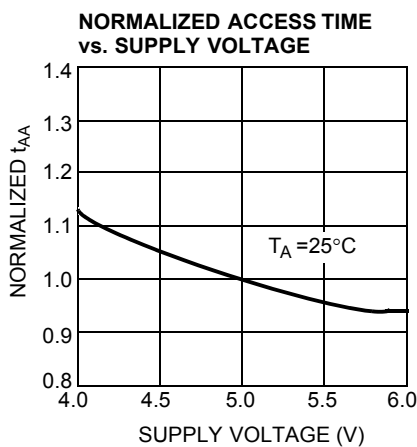
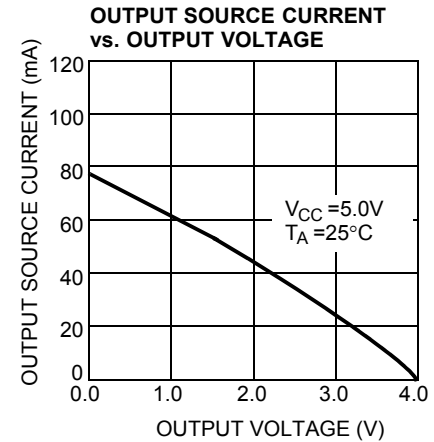
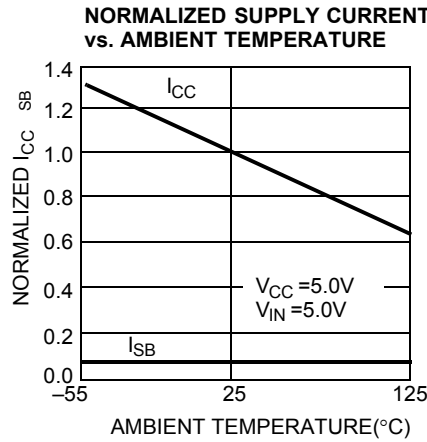
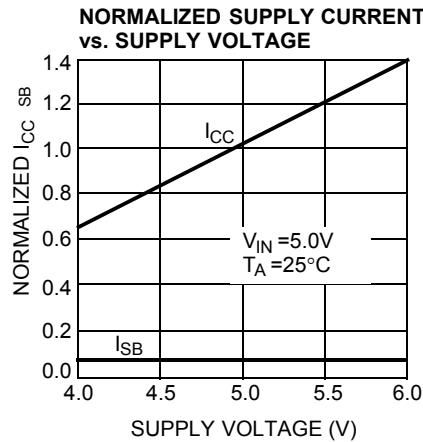
Figure 6. Write Cycle No. 2 ($\overline{\text{CE}}$ Controlled) [12, 13]



Notes

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

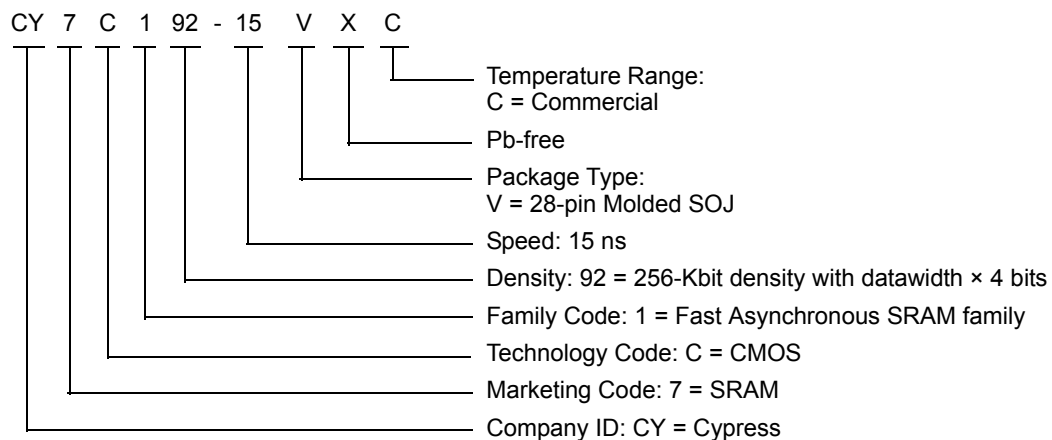
Typical DC and AC Characteristics



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

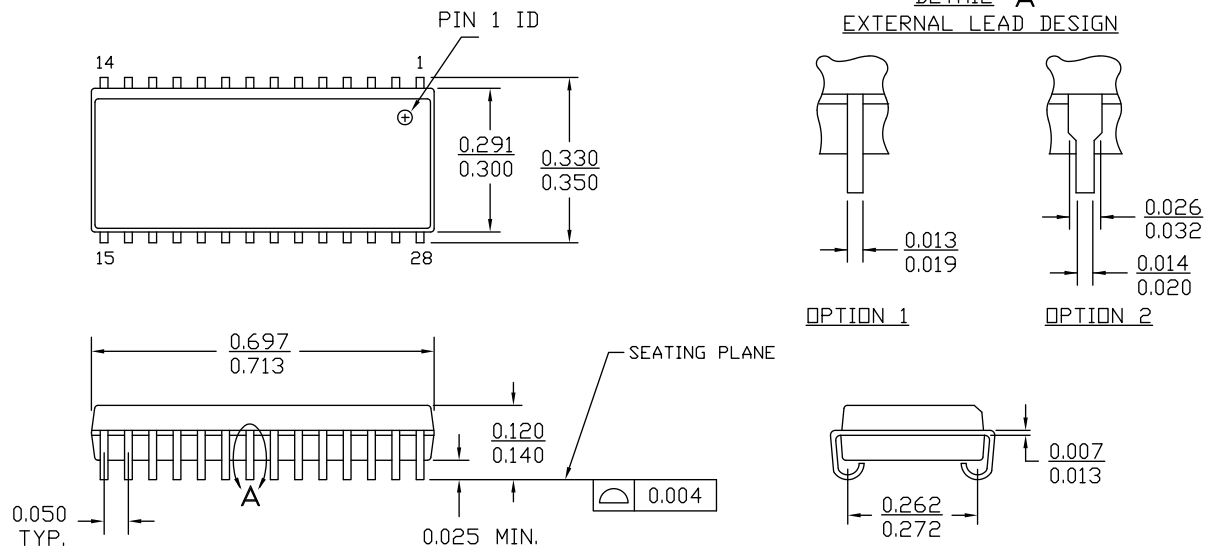


Package Diagram

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_{IX} from Input Load Current to Input Leakage Current in DC Electrical Characteristics table Removed I_{OS} 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 Ordering Information Updated Package Diagram . Added Sales, Solutions, and Legal Information .
*F	3105329	12/09/2010	AJU	Added Ordering Code Definitions .
*G	3217855	04/06/2011	PRAS	Added Acronyms and Units of Measure . Updated in new template.
*H	3271782	06/01/2011	PRAS	Updated Features .
*I	3974483	04/19/2013	MEMJ	Updated Switching Waveforms (Updated Figure 5 , Figure 6). Updated Package Diagram : spec 51-85031 – Changed revision from *D to *E. Completing Sunset Review.

Sales, Solutions, and Legal Information

Worldwide Sales and Design Support

Cypress maintains a worldwide network of offices, solution centers, manufacturer's representatives, and distributors. To find the office closest to you, visit us at [Cypress Locations](#).

Products

Automotive	cypress.com/go/automotive
Clocks & Buffers	cypress.com/go/clocks
Interface	cypress.com/go/interface
Lighting & Power Control	cypress.com/go/powerpsoc cypress.com/go/plc
Memory	cypress.com/go/memory
Optical & Image Sensing	cypress.com/go/image
PSoC	cypress.com/go/psoc
Touch Sensing	cypress.com/go/touch
USB Controllers	cypress.com/go/USB
Wireless/RF	cypress.com/go/wireless

PSoC Solutions

[psoc.cypress.com/solutions](#)

PSoC 1 | PSoC 3 | PSoC 5

© Cypress Semiconductor Corporation, 2001-2013. The information contained herein is subject to change without notice. Cypress Semiconductor Corporation assumes no responsibility for the use of any circuitry other than circuitry embodied in a Cypress product. Nor does it convey or imply any license under patent or other rights. Cypress products are not warranted nor intended to be used for medical, life support, life saving, critical control or safety applications, unless pursuant to an express written agreement with Cypress. Furthermore, Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress products in life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Any Source Code (software and/or firmware) is owned by Cypress Semiconductor Corporation (Cypress) and is protected by and subject to worldwide patent protection (United States and foreign), United States copyright laws and international treaty provisions. Cypress hereby grants to licensee a personal, non-exclusive, non-transferable license to copy, use, modify, create derivative works of, and compile the Cypress Source Code and derivative works for the sole purpose of creating custom software and or firmware in support of licensee product to be used only in conjunction with a Cypress integrated circuit as specified in the applicable agreement. Any reproduction, modification, translation, compilation, or representation of this Source Code except as specified above is prohibited without the express written permission of Cypress.

Disclaimer: CYPRESS MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Cypress reserves the right to make changes without further notice to the materials described herein. Cypress does not assume any liability arising out of the application or use of any product or circuit described herein. Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress' product in a life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Use may be limited by and subject to the applicable Cypress software license agreement.