

Features

- Pin- and function-compatible with CY7C1020B
- High speed
 - $t_{AA} = 10 \text{ ns}$
- Low active power
 - $I_{CC} = 80 \text{ mA @ } 10 \text{ ns}$
- Low complementary metal oxide semiconductor (CMOS) standby power
 - $I_{SB2} = 3 \text{ mA}$
- 2.0 V data retention
- Automatic power-down when deselected
- CMOS for optimum speed/power
- Independent control of upper and lower bits
- Available in Pb-free 44-pin 400-Mil wide Molded SOJ and 44-pin thin small outline package (TSOP) II packages

Functional Description

The CY7C1020D ^[1] is a high-performance CMOS static RAM organized as 32,768 words by 16 bits. This device has an automatic power-down feature that significantly reduces power consumption when deselected. The input and output pins (IO_0 through IO_{15}) are placed in a high-impedance state when:

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

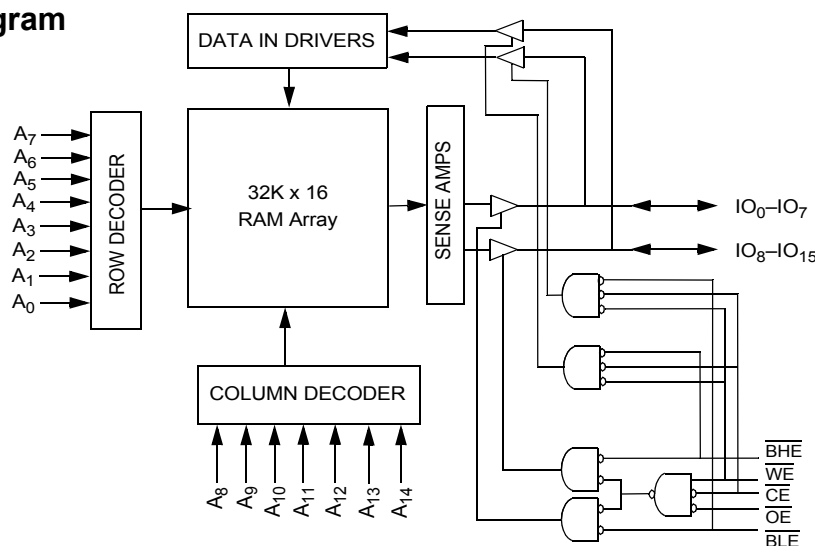
Write to the device by taking Chip Enable ($\overline{CE}$) and Write Enable ($\overline{WE}$) inputs LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from IO pins (IO_0 through IO_7), is written into the location specified on the address pins (A_0 through A_{14}). If Byte High Enable ($\overline{BHE}$) is LOW, then data from IO pins (IO_8 through IO_{15}) is written into the location specified on the address pins (A_0 through A_{14}).

Reading from the device by taking Chip Enable ($\overline{CE}$) and Output Enable ($\overline{OE}$) LOW while forcing the Write Enable ($\overline{WE}$) HIGH. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from the memory location specified by the address pins appears on IO_0 to IO_7 . If Byte High Enable ($\overline{BHE}$) is LOW, then data from memory appears on IO_8 to IO_{15} . See the "Truth Table" on page 11 for a complete description of read and write modes.

The CY7C1020D device is suitable for interfacing with processors that have TTL I/P levels. It is not suitable for processors that require CMOS I/P levels. Please see [Electrical Characteristics on page 4](#) for more details and suggested alternatives.

For a complete list of related documentation, [click here](#).

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.

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Pin Configurations

Figure 1. 44-pin SOJ/TSOP II pinout (Top View) ^[2]

NC	1	44	A ₅
A ₃	2	43	A ₆
A ₂	3	42	A ₇
A ₁	4	41	OE
A ₀	5	40	BHE
CE	6	39	BLE
IO ₀	7	38	IO ₁₅
IO ₁	8	37	IO ₁₄
IO ₂	9	36	IO ₁₃
IO ₃	10	35	IO ₁₂
V _{CC}	11	34	V _{SS}
V _{SS}	12	33	V _{CC}
IO ₄	13	32	IO ₁₁
IO ₅	14	31	IO ₁₀
IO ₆	15	30	IO ₉
IO ₇	16	29	IO ₈
WE	17	28	NC
A ₄	18	27	A ₈
A ₁₄	19	26	A ₉
A ₁₃	20	25	A ₁₀
A ₁₂	21	24	A ₁₁
NC	22	23	NC

Selection Guide

Description	-10 (Industrial)	Unit
Maximum access time	10	ns
Maximum operating current	80	mA
Maximum CMOS standby current	3	mA

Note

- 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_{CC} to Relative GND ^[3] -0.5 V to +6.0 V

DC voltage applied to outputs in High Z State ^[3] -0.5 V to $V_{CC} + 0.5$ V

DC input voltage ^[3] -0.5 V to $V_{CC} + 0.5$ 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_{CC}	Speed
Industrial	-40 °C to +85 °C	5 V ± 0.5 V	10 ns

Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions		-10 (Industrial)		Unit
				Min	Max	
V _{OH}	Output HIGH voltage	I _{OH} = −4.0 mA		2.4	–	V
		I _{OH} = −0.1 mA		–	3.4 ^[4]	
V _{OL}	Output LOW voltage	I _{OL} = 8.0 mA		–	0.4	V
V _{IH}	Input HIGH voltage	–		2.2	V _{CC} + 0.5	V
V _{IL}	Input LOW voltage ^[3]	–		−0.5	0.8	V
I _{IX}	Input load current	GND ≤ V _I ≤ V _{CC}		−1	+1	μA
I _{OZ}	Output leakage current	GND ≤ V _I ≤ V _{CC} , output disabled		−1	+1	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	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	mA
I _{SB2}	Automatic CE Power-Down current – CMOS inputs	Max V _{CC} , $\overline{CE} \geq V_{CC} - 0.3$ V, V _{IN} ≥ V _{CC} − 0.3 V, or V _{IN} ≤ 0.3 V, f = 0		–	3	mA

Note

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

4. Please note that the maximum V_{OH} limit does not exceed minimum CMOS V_{IH} of 3.5V. If you are interfacing this SRAM with 5V legacy processors that require a minimum V_{IH} of 3.5V, please refer to Application Note [AN6081](#) for technical details and options you may consider.

Capacitance

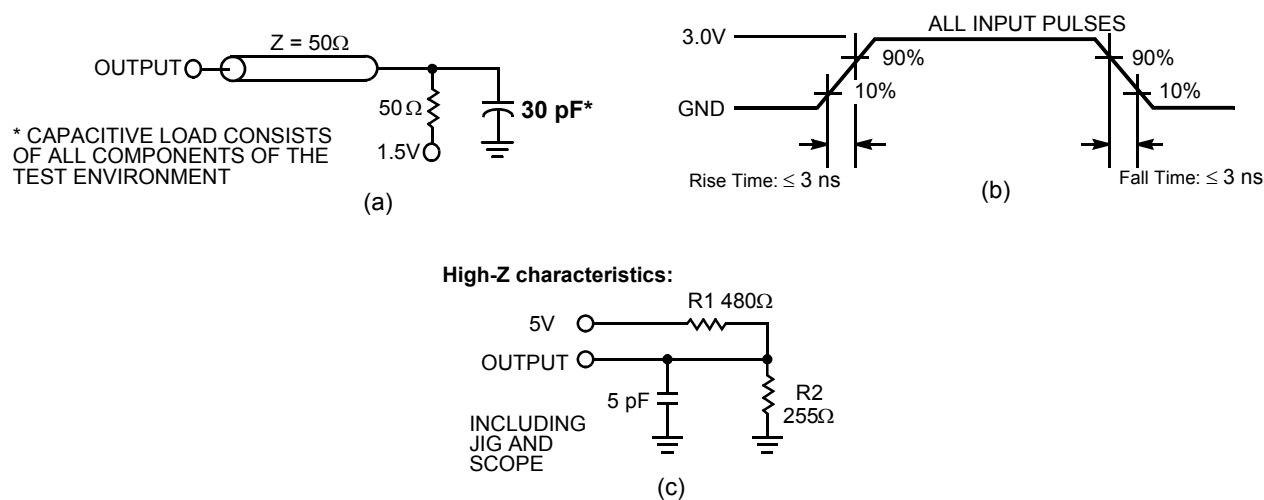
Parameter ^[5]	Description	Test Conditions	Max	Unit
C_{IN}	Input capacitance	$T_A = 25^\circ\text{C}$, $f = 1\text{ MHz}$, $V_{CC} = 5.0\text{ V}$	8	pF
C_{OUT}	Output capacitance		8	pF

Thermal Resistance

Parameter ^[5]	Description	Test Conditions	SOJ	TSOP II	Unit
Θ_{JA}	Thermal resistance (junction to ambient)	Still Air, soldered on a 3×4.5 inch, four-layer printed circuit board	59.52	53.91	$^\circ\text{C/W}$
Θ_{JC}	Thermal resistance (junction to case)		36.75	21.24	$^\circ\text{C/W}$

AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms ^[6]



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 2 (a). High-Z characteristics are tested for all speeds using the test load shown in Figure 2 (c).

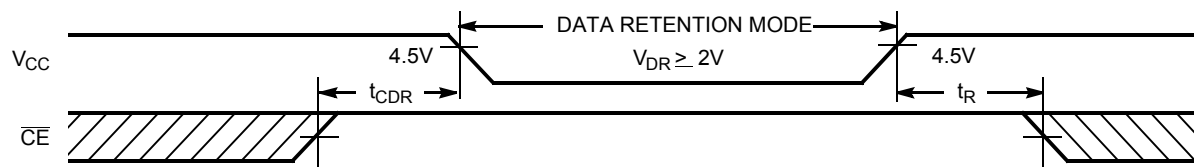
Data Retention Characteristics

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	$V_{CC} = V_{DR} = 2.0\text{ V}$, $\overline{CE} \geq V_{CC} - 0.3\text{ V}$, $V_{IN} \geq V_{CC} - 0.3\text{ V}$ or $V_{IN} \leq 0.3\text{ V}$	–	3	mA
$t_{CDR}^{[7]}$	Chip deselect to data retention time	–	0	–	ns
$t_R^{[8]}$	Operation recovery time	–	t_{RC}	–	ns

Data Retention Waveform

Figure 3. 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 $V_{CC(min)} \geq 50\text{ }\mu\text{s}$ or stable at $V_{CC(min)} \geq 50\text{ }\mu\text{s}$.

Switching Characteristics

Over the Operating Range

Parameter ^[9]	Description	-10 (Industrial)		Unit
		Min	Max	
Read Cycle				
t _{power} ^[10]	V _{CC} (typical) to the first access	100	–	μs
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}	$\overline{\text{CE}}$ LOW to data valid	–	10	ns
t _{DOE}	$\overline{\text{OE}}$ LOW to data valid	–	5	ns
t _{LZOE}	$\overline{\text{OE}}$ LOW to Low Z ^[12]	0		ns
t _{HZOE}	$\overline{\text{OE}}$ HIGH to High Z ^[11, 12]	–	5	ns
t _{LZCE}	$\overline{\text{CE}}$ LOW to Low Z ^[12]	3	–	ns
t _{HZCE}	$\overline{\text{CE}}$ HIGH to High Z ^[11, 12]	–	5	ns
t _{PU} ^[13]	$\overline{\text{CE}}$ LOW to power-up	0	–	ns
t _{PD} ^[13]	$\overline{\text{CE}}$ HIGH to power-down	–	10	ns
t _{DBE}	Byte enable to data valid		5	ns
t _{LZBE}	Byte enable to Low Z	0	–	ns
t _{HZBE}	Byte disable to High Z	–	5	ns
Write Cycle ^[14, 15]				
t _{WC}	Write cycle time	10	–	ns
t _{SCE}	$\overline{\text{CE}}$ 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}	$\overline{\text{WE}}$ 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}	$\overline{\text{WE}}$ HIGH to Low Z ^[12]	3	–	ns
t _{HZWE}	$\overline{\text{WE}}$ LOW to High Z ^[11, 12]	–	5	ns
t _{BW}	Byte enable to end of write	7	–	ns

Notes

9. Test conditions assume signal transition time of 3 ns or less, 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.
10. 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.
11. t_{HZOE} , t_{HZBE} , t_{HZCE} , and t_{HZWE} are specified with a load capacitance of 5 pF as in part (c) of Figure 2 on page 5. Transition is measured when the outputs enter a high impedance state.
12. 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.
13. This parameter is guaranteed by design and is not tested.
14. The internal write time of the memory is defined by the overlap of $\overline{\text{CE}}$ LOW, $\overline{\text{WE}}$ LOW and $\overline{\text{BHE}}/\overline{\text{BLE}}$ LOW. $\overline{\text{CE}}$, $\overline{\text{WE}}$ and $\overline{\text{BHE}}/\overline{\text{BLE}}$ must be LOW to initiate a write and the transition 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.
15. The minimum write cycle time for Write Cycle No. 3 ($\overline{\text{WE}}$ controlled, $\overline{\text{OE}}$ LOW) should be equal to the sum of t_{HZWE} and t_{SD} .

Switching Waveforms

Figure 4. Read Cycle No.1 (Address Transition Controlled) [16, 17]

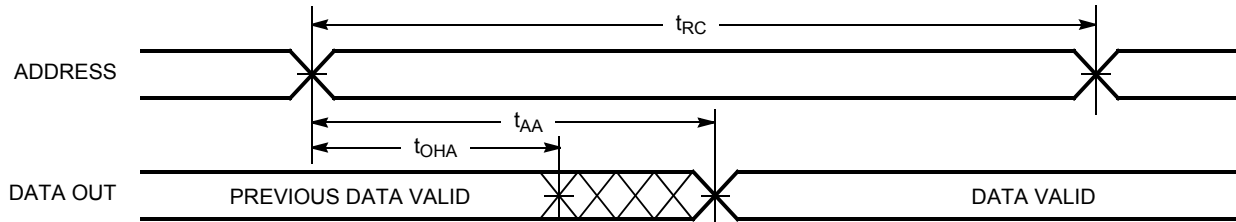
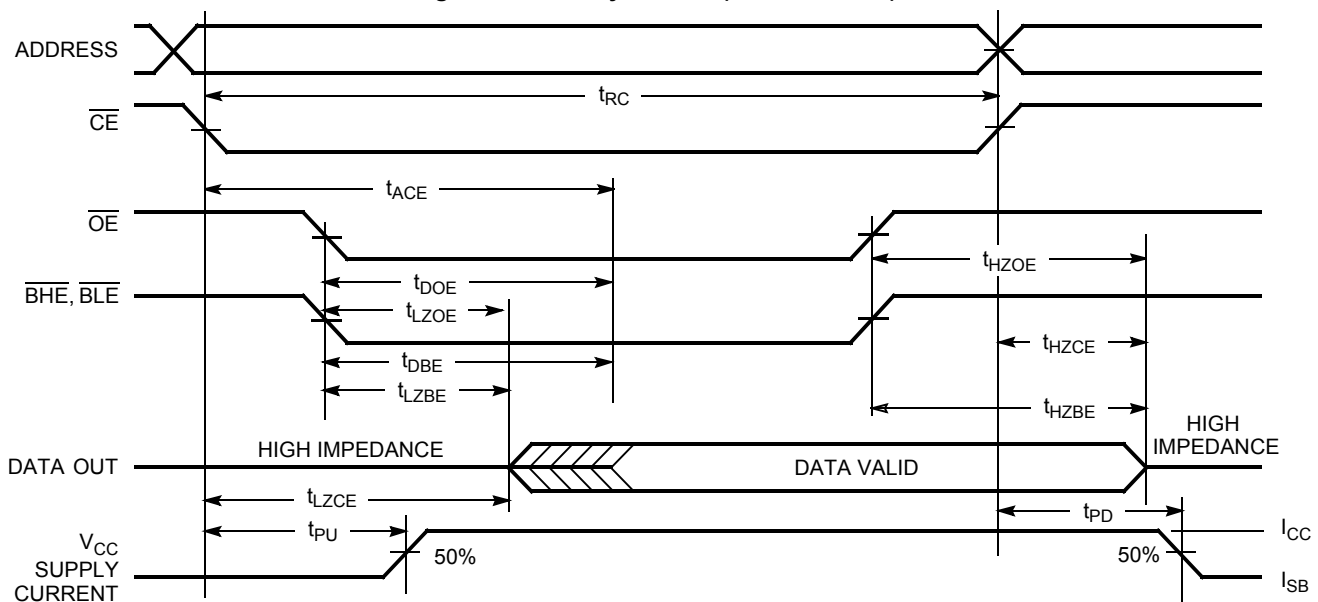
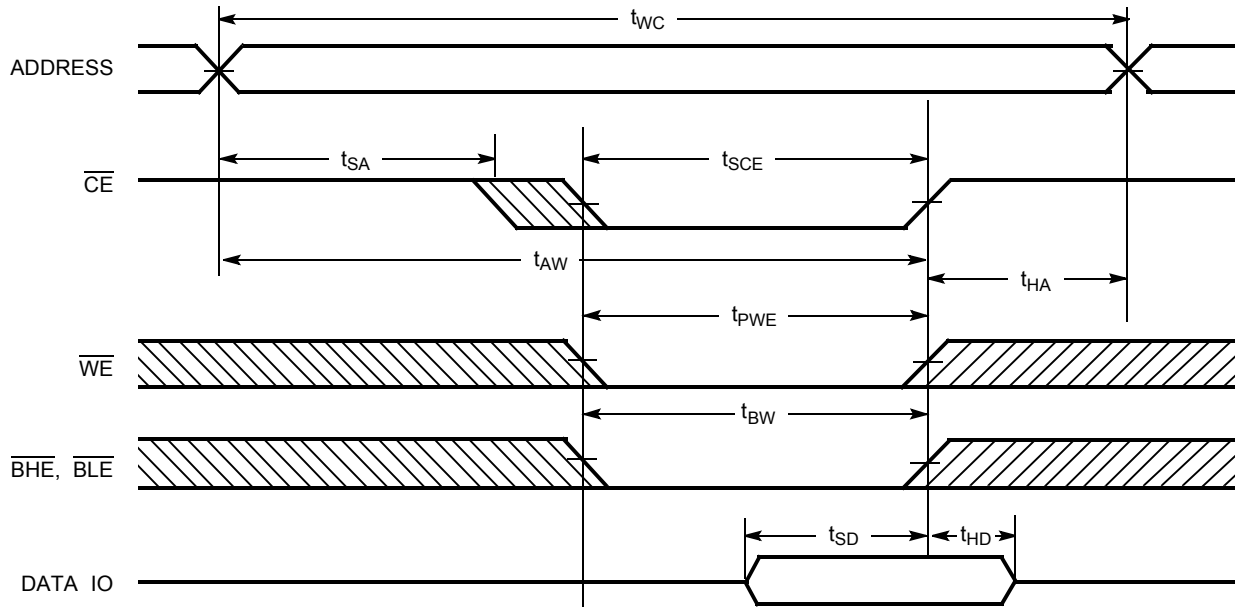
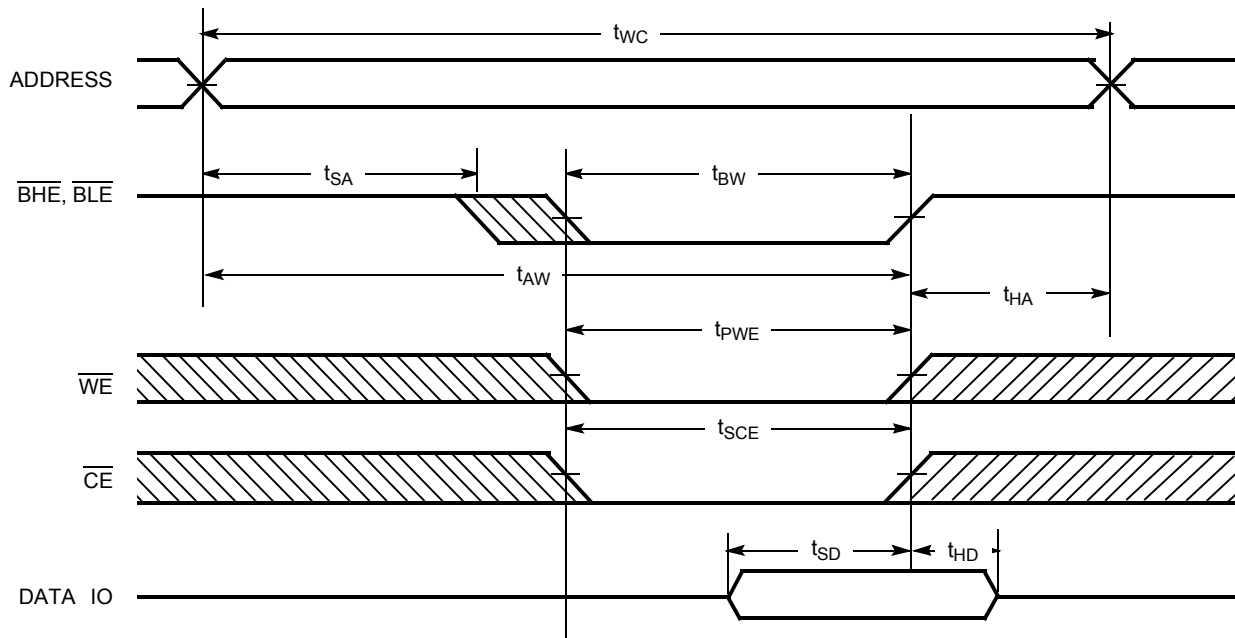


Figure 5. Read Cycle No.2 ($\overline{OE}$ Controlled) [17, 18]



Notes

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

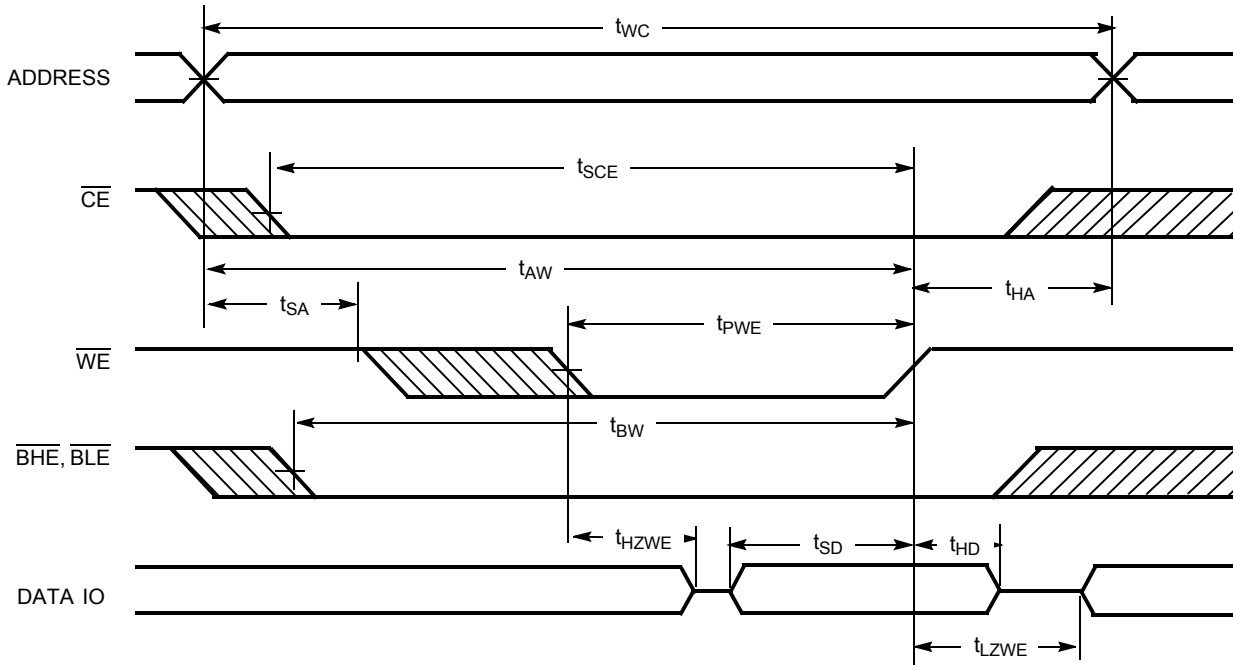
Switching Waveforms(continued)
Figure 6. Write Cycle No. 1 ($\overline{\text{CE}}$ Controlled) [19, 20]

Figure 7. Write Cycle No. 2 ($\overline{\text{BLE}}$ or $\overline{\text{BHE}}$ Controlled) [19, 20]

Notes

19. Data IO is high impedance if $\overline{\text{OE}}$ or $\overline{\text{BHE}}$ and/or $\overline{\text{BLE}} = V_{IH}$.

20. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\overline{\text{WE}}$ going HIGH, the output remains in a high-impedance state.

Switching Waveforms(continued)

Figure 8. Write Cycle No. 3 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ LOW) [21, 22]



Notes

21. The minimum write cycle time for Write Cycle No. 3 ($\overline{\text{WE}}$ controlled, $\overline{\text{OE}}$ LOW) should be equal to the sum of t_{HZWE} and t_{SD} .
 22. If $\overline{\text{CE}}$ goes HIGH simultaneously with $\overline{\text{WE}}$ going HIGH, the output remains in a high-impedance state.

Truth Table

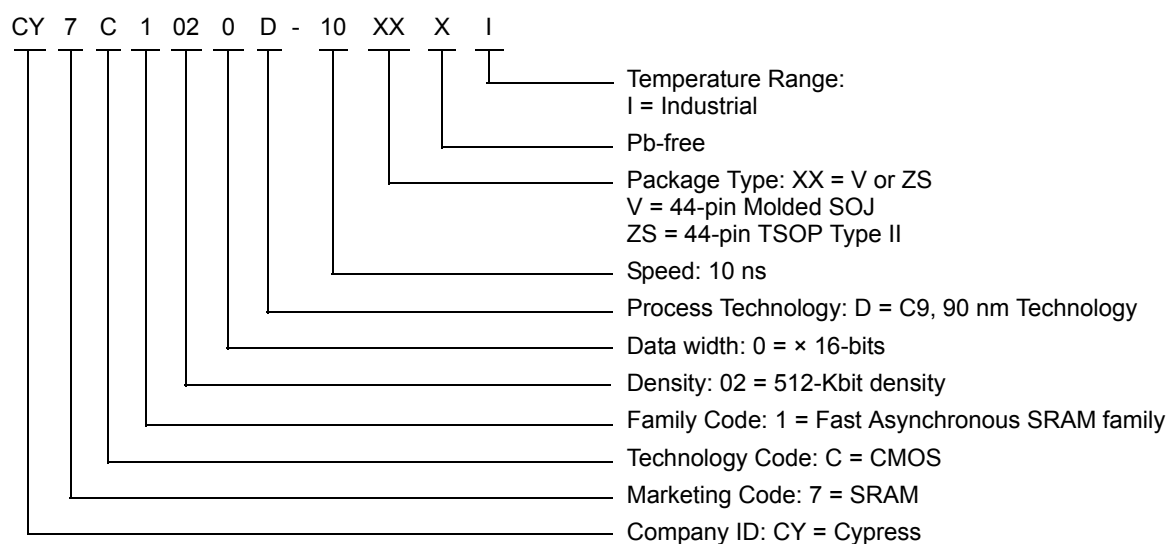
$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	IO_0-IO_7	IO_8-IO_{15}	Mode	Power
H	X	X	X	X	High Z	High Z	Power-down	Standby (I_{SB})
L	L	H	L	L	Data out	Data out	Read – All bits	Active (I_{CC})
			L	H	Data out	High Z	Read – Lower bits only	Active (I_{CC})
			H	L	High Z	Data out	Read – Upper bits only	Active (I_{CC})
L	X	L	L	L	Data in	Data in	Write – All bits	Active (I_{CC})
			L	H	Data in	High Z	Write – Lower bits only	Active (I_{CC})
			H	L	High Z	Data in	Write – Upper bits only	Active (I_{CC})
L	H	H	X	X	High Z	High Z	Selected, outputs disabled	Active (I_{CC})
L	X	X	H	H	High Z	High Z	selected, outputs disabled	Active (I_{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
10	CY7C1020D-10VXI	51-85082	44-pin SOJ (400 Mils) Pb-free	Industrial
	CY7C1020D-10ZSXI	51-85087	44-pin TSOP (Type II) Pb-free	

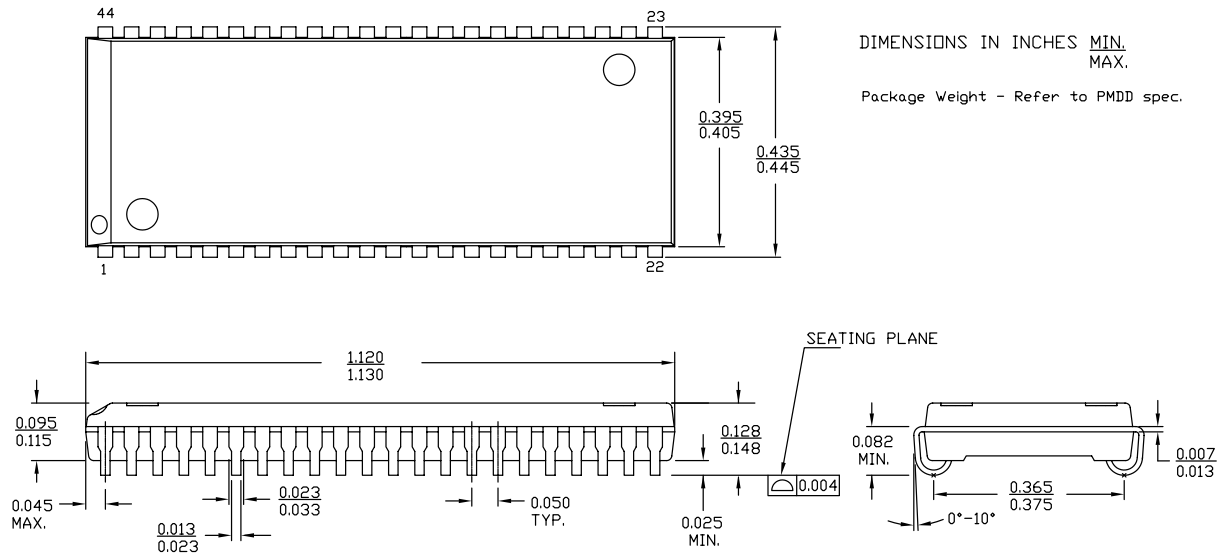
Please contact your local Cypress sales representative for availability of these parts.

Ordering Code Definitions



Package Diagrams

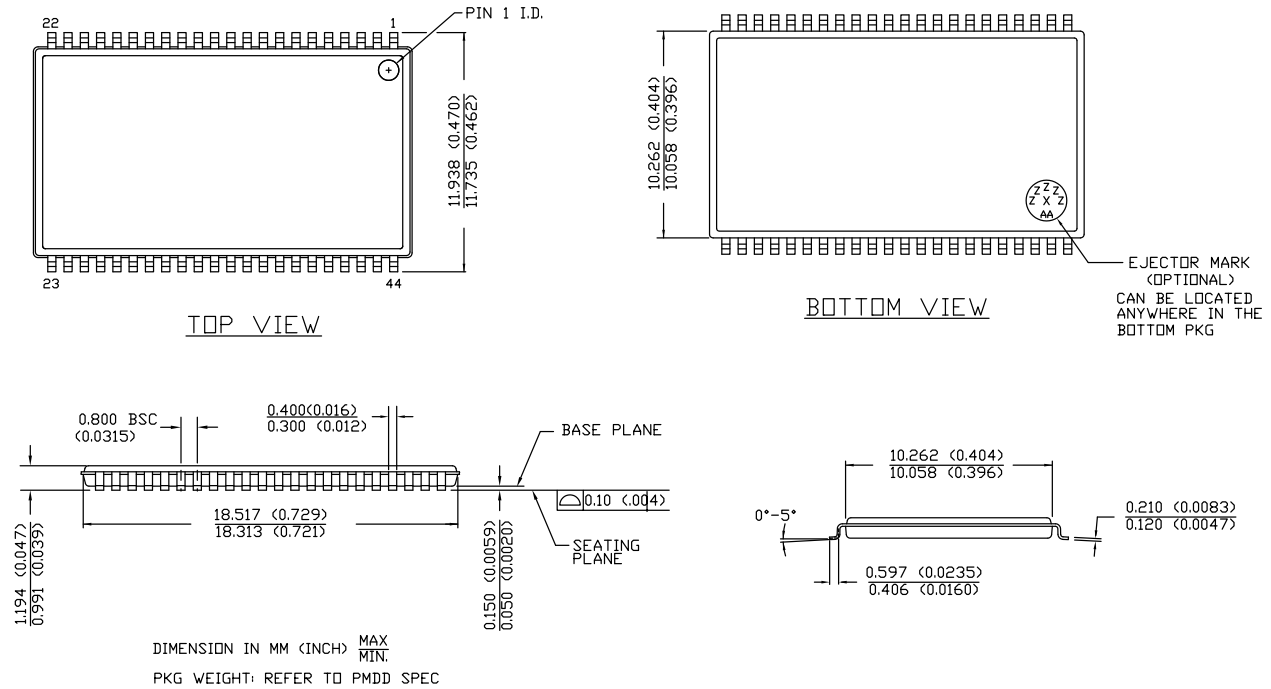
Figure 9. 44-pin SOJ (400 Mils) V44.4 Package Outline, 51-85082



51-85082 *E

Package Diagrams(continued)

Figure 10. 44-pin TSOP Z44-II Package Outline, 51-85087



51-85087 *E

Acronyms

Acronym	Description
BGA	Ball Grid Array
CMOS	Complementary Metal Oxide Semiconductor
FBGA	Fine-Pitch Ball Grid Array
I/O	Input/Output
SRAM	Static Random Access Memory
TSOP	Thin Small Outline Package
TTL	Transistor-Transistor Logic

Document Conventions

Units of Measure

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

Document History Page

Document Title: CY7C1020D, 512-Kbit (32 K × 16) Static RAM Document Number: 38-05463				
Rev.	ECN No.	Issue Date	Orig. of Change	Description of Change
**	201560	See ECN	SWI	Advance Data sheet for C9 IPP
*A	233695	See ECN	RKF	1) DC parameters modified as per EROS (Spec # 01-0216) 2) Pb-free Offering in the 'Ordering Information'
*B	263769	See ECN	RKF	1) Corrected pin #18 on SOJ/TSOPII Pinout (Page #1) from A ₁₅ to A ₄ 2) Changed IO ₁ - IO ₁₆ to IO ₀ - IO ₁₅ on the Pin-out diagram 3) Added T _{power} Spec in Switching Characteristics Table 4) Added Data Retention Characteristics Table and Waveforms 5) Shaded 'Ordering Information'
*C	307594	See ECN	RKF	Reduced Speed bins to -10, -12 and -15 ns
*D	560995	See ECN	VKN	Converted from Preliminary to Final Removed Commercial Operating range Removed 12 ns speed bin Added I _{CC} values for the frequencies 83MHz, 66MHz and 40MHz Updated Thermal Resistance table Updated Ordering Information Table Changed Overshoot spec from V _{CC} +2V to V _{CC} +1V in footnote #3
*E	802877	See ECN	VKN	Changed I _{CC} specs 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	3109992	12/14/2010	AJU	Added Ordering Code Definitions . Updated Package Diagrams .
*G	3219056	04/07/2011	PRAS	Added TOC Added Acronyms and Units of Measure table. Updated Datasheet as per template.
*H	4033925	06/19/2013	MEMJ	Updated Functional Description . Updated Electrical Characteristics : Added one more Test Condition "I _{OH} = -0.1mA" for V _{OH} parameter and added maximum value corresponding to that Test Condition. Added Note 4 and referred the same note in maximum value for V _{OH} parameter corresponding to Test Condition "I _{OH} = -0.1mA". Updated Package Diagrams : spec 51-85082 – Changed revision from *C to *E. spec 51-85087 – Changed revision from *C to *E.
*I	4385769	05/21/2014	MEMJ	No technical updates. Completing Sunset Review.
*J	4576526	11/21/2014	MEMJ	Added related documentation hyperlink in page 1.

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