

512 K (32 K x 16) Static RAM

Features

- Pin-and function-compatible with CY7C1020CV33
- High speed
 - $t_{AA} = 10 \text{ ns}$
- Low active power
 - $I_{CC} = 60 \text{ mA @ } 10 \text{ ns}$
- Low 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 TSOP II packages

Functional Description

The CY7C1020DV33 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.

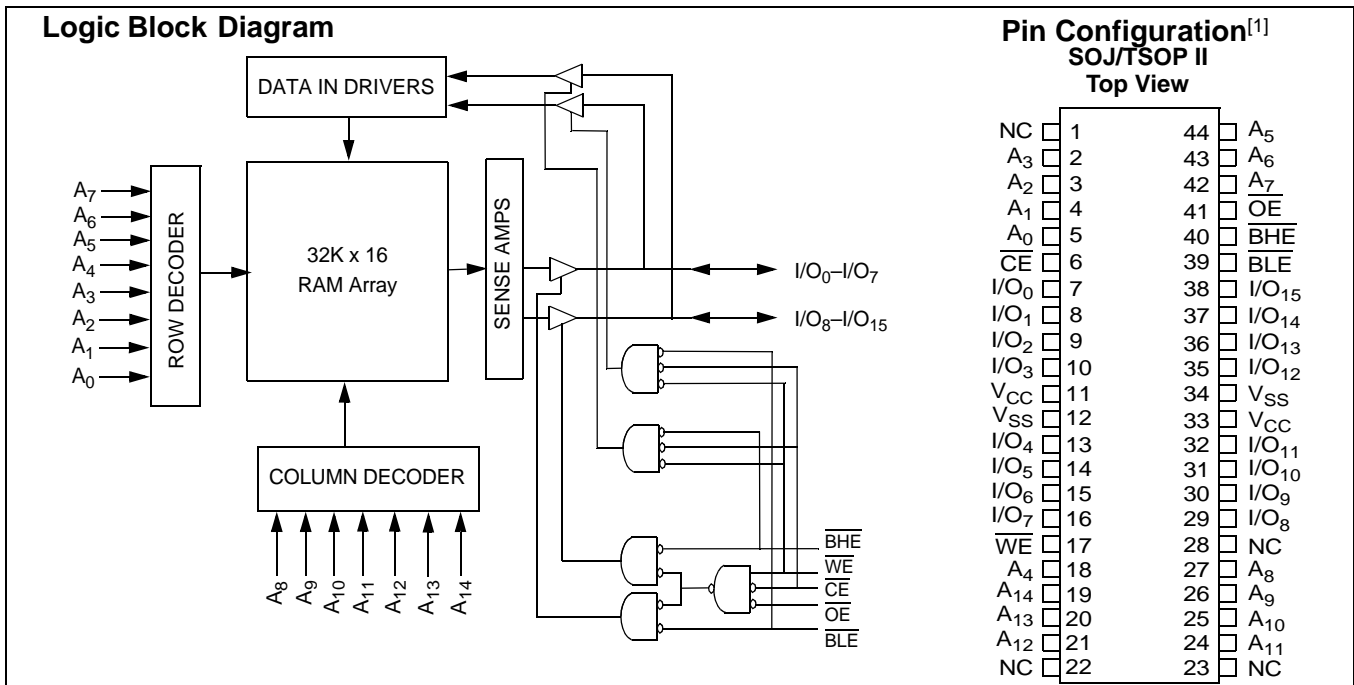
Writing to the device is accomplished by taking chip enable (\overline{CE}) and write enable (\overline{WE}) inputs LOW. If byte low enable (\overline{BLE}) is LOW, then data from I/O pins (I/O_0 through I/O_7), is written into the location specified on the address pins (A_0 through A_{14}). If byte high enable (\overline{BHE}) is LOW, then data from I/O pins (I/O_8 through I/O_{15}) is written into the location specified on the address pins (A_0 through A_{14}).

Reading from the device is accomplished 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 will appear on I/O_0 to I/O_7 . If byte high enable (\overline{BHE}) is LOW, then data from memory will appear on I/O_8 to I/O_{15} . See the truth table at the back of this data sheet for a complete description of read and write modes.

The input/output pins (I/O_0 through I/O_{15}) are placed in a high-impedance state when the device is deselected (\overline{CE} HIGH), the outputs are disabled (\overline{OE} HIGH), the \overline{BHE} and \overline{BLE} are disabled (\overline{BHE} , \overline{BLE} HIGH), or during a write operation (\overline{CE} LOW, and \overline{WE} LOW).

The CY7C1020DV33 is available in Pb-free 44-pin 400-Mil wide Molded SOJ and 44-pin TSOP II packages.

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



Notes

1. NC pins are not connected on the die.

Selection Guide

	-10 (Industrial)	Unit
Maximum access time	10	ns
Maximum operating current	60	mA
Maximum CMOS standby current	3	mA

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, 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] ...	-0.5 V to +4.6 V
DC voltage applied to outputs in High-Z State ^[2]	-0.5 V to $V_{CC} + 0.5$ V

DC input voltage ^[2]	-0.5 V to $V_{CC} + 0.5$ V
Current into outputs (LOW)	20 mA
Static discharge voltage	> 2001 V (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	3.3 V ± 0.3 V	10 ns

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	-10 (Industrial)		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		2.0	$V_{CC} + 0.3$	V
V_{IL}	Input LOW voltage ^[2]		-0.3	0.8	V
I_{IX}	Input Load current	$GND \leq V_I \leq V_{CC}$	-1	+1	μA
I_{OZ}	Output leakage current	$GND \leq V_I \leq V_{CC}$, Output Disabled	-1	+1	μA
I_{CC}	V_{CC} operating supply current	$V_{CC} = \text{Max.}, I_{OUT} = 0 \text{ mA}, f = f_{MAX} = 1/t_{RC}$	100 MHz	60	mA
			83 MHz	55	mA
			66 MHz	45	mA
			40 MHz	30	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	mA
I_{SB2}	Automatic 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 $V_{IN} \leq 0.3 \text{ V}$, $f = 0$		3	mA

Notes

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

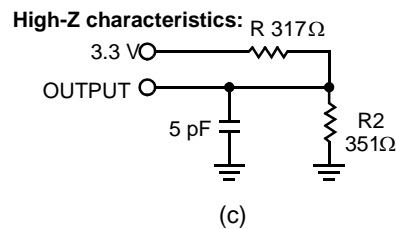
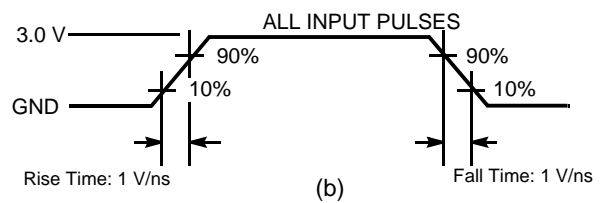
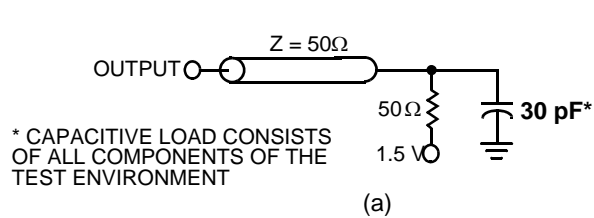
Capacitance^[3]

Parameter	Description	Test Conditions	Max.	Unit
C _{IN}	Input capacitance	T _A = 25°C, f = 1 MHz, V _{CC} = 3.3 V	8	pF
C _{OUT}	Output capacitance		8	pF

Thermal Resistance^[3]

Parameter	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	°C/W
Θ _{JC}	Thermal resistance (Junction to Case)		36.75	21.24	°C/W

AC Test Loads and Waveforms^[4]



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	-10 (Industrial)		Unit
		Min.	Max.	
Read Cycle				
$t_{power}^{[6]}$	V_{CC} (typical) to the first access	100		μ 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 ^[7]	0		ns
t_{HZOE}	\overline{OE} HIGH to High-Z ^[7, 8]		5	ns
t_{LZCE}	\overline{CE} LOW to Low-Z ^[7]	3		ns
t_{HZCE}	\overline{CE} HIGH to High-Z ^[7, 8]		5	ns
$t_{PU}^{[9]}$	\overline{CE} LOW to Power-up	0		ns
$t_{PD}^{[9]}$	\overline{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^[10, 11]				
t_{WC}	Write cycle time	10		ns
t_{SCE}	\overline{CE} LOW to write end	8		ns
t_{AW}	Address set-up to write end	8		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	5		ns
t_{HD}	Data hold from write end	0		ns
t_{LZWE}	\overline{WE} HIGH to Low-Z ^[7]	3		ns
t_{HZWE}	\overline{WE} LOW to High-Z ^[7, 8]		5	ns
t_{BW}	Byte enable to end of write	7		ns

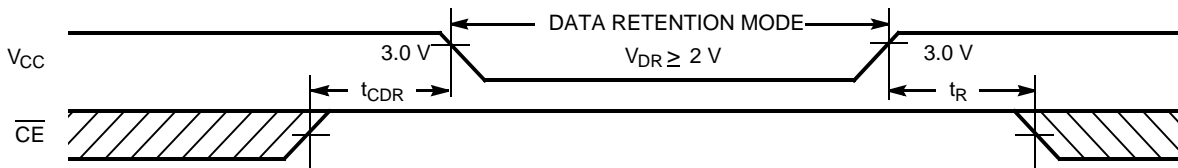
Notes

5. 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.
6. 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
7. t_{HZOE} , t_{HZBE} , t_{HZCE} , and t_{HZWE} are specified with a load capacitance of 5 pF as in (c) of AC Test Loads. Transition is measured when the outputs enter a high impedance state.
8. 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.
9. This parameter is guaranteed by design and is not tested.
10. The internal Write time of the memory is defined by the overlap of \overline{CE} LOW, \overline{WE} LOW and $\overline{BHE}/\overline{BLE}$ LOW. \overline{CE} , \overline{WE} and $\overline{BHE}/\overline{BLE}$ 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.
11. The minimum write cycle time for Write Cycle 3 (WE controlled, \overline{OE} LOW) is the sum of t_{HZWE} and t_{SD} .

Data Retention Characteristics (Over the Operating Range)

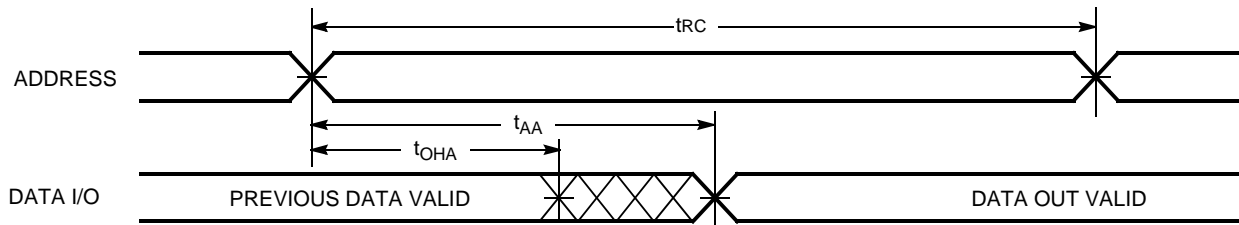
Parameter	Description	Conditions	Min.	Max.	Unit
V_{DR}	V_{CC}		2.0		V
I_{CCDR}	Data retention current	$V_{CC} = V_{DR} = 2.0\text{ V}$, $\overline{CE} \geq V_{CC} - 0.3\text{ V}$, $V_{IN} \geq V_{CC} - 0.3\text{ V}$ or $V_{IN} \leq 0.3\text{ V}$		3	mA
$t_{CDR}^{[3]}$	Chip deselect to data retention time		0		ns
$t_R^{[12]}$	Operation recovery time		t_{RC}		ns

Data Retention Waveform

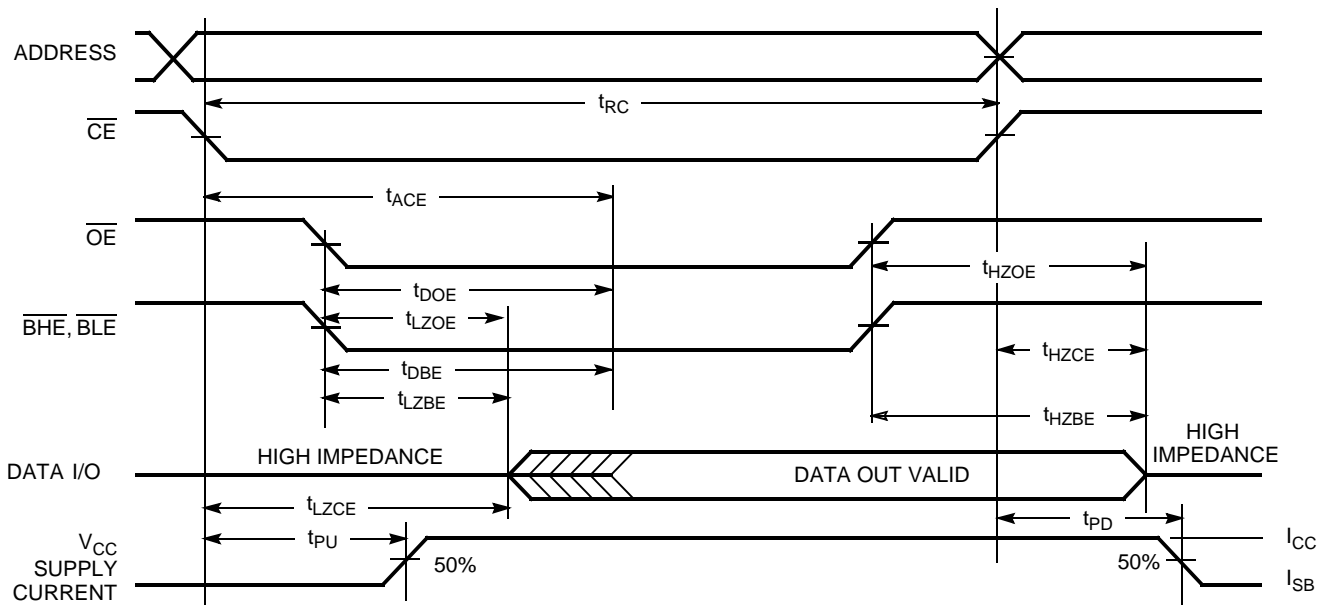


Switching Waveforms

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



Read Cycle No. 2 (OE Controlled)^[14, 15]

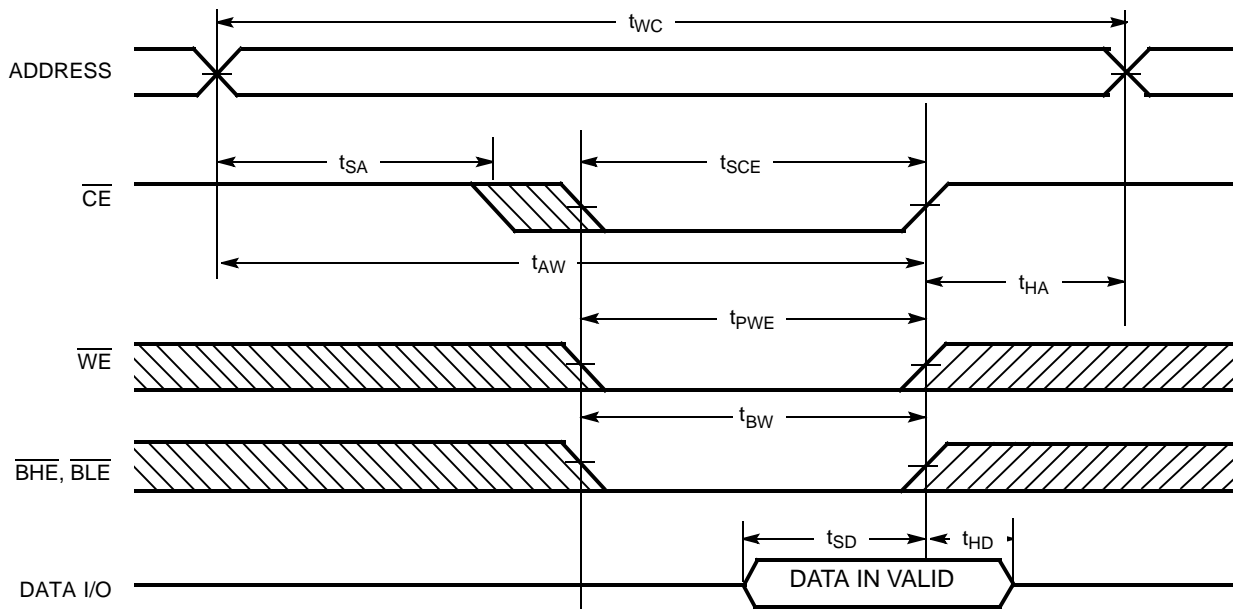


Notes:

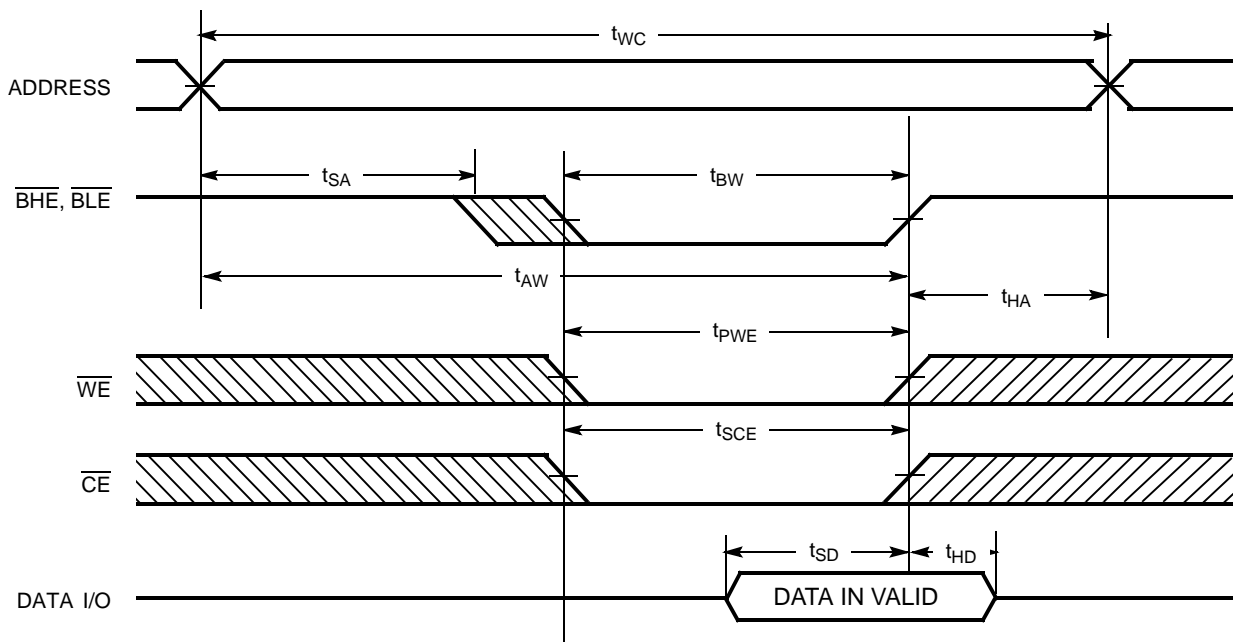
- 12. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min)}$ $\geq 50\ \mu\text{s}$ or stable at $V_{CC(min)}$ $\geq 50\ \mu\text{s}$.
- 13. Device is continuously selected. \overline{OE} , \overline{CE} , \overline{BHE} and/or $\overline{BLE} = V_{IL}$.
- 14. \overline{WE} is 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)^[16, 17]



Write Cycle No. 2 ($\overline{\text{BLE}}$ or $\overline{\text{BHE}}$ Controlled)



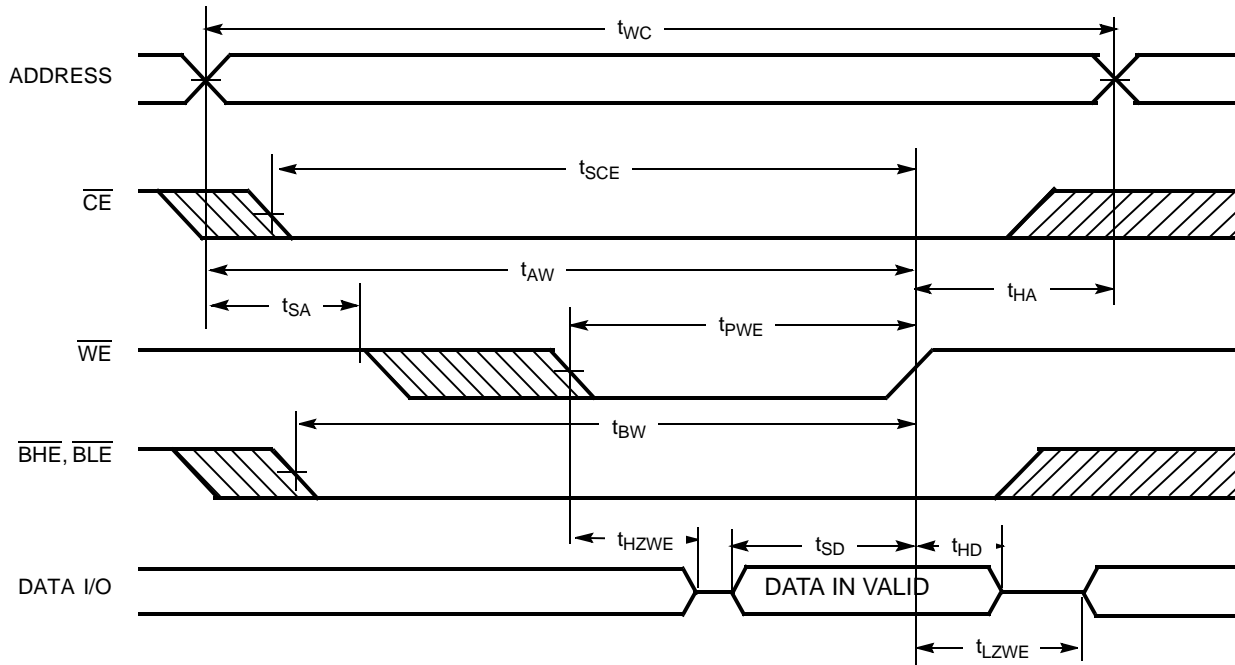
Notes:

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

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

Switching Waveforms (continued)

Write Cycle No. 3 (\overline{WE} Controlled, \overline{OE} LOW)



Truth Table

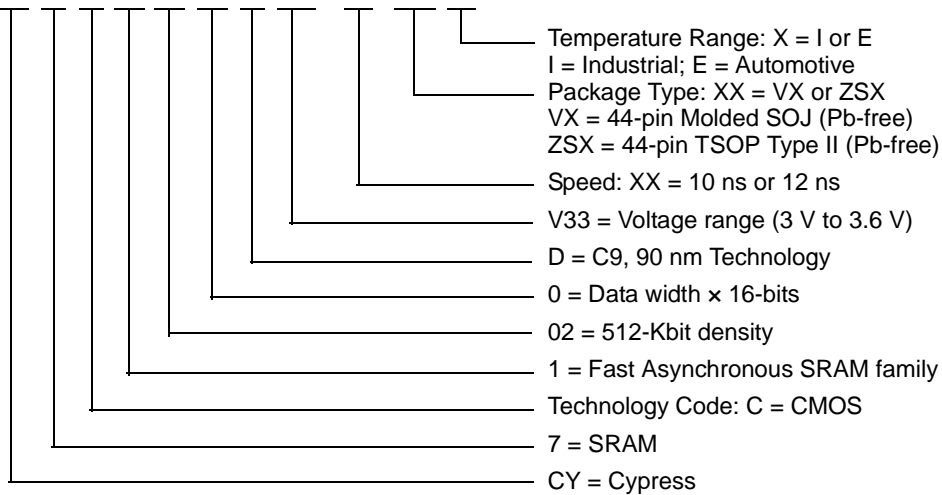
\overline{CE}	\overline{OE}	\overline{WE}	\overline{BLE}	\overline{BHE}	I/O ₀ -I/O ₇	I/O ₈ -I/O ₁₅	Mode	Power
H	X	X	X	X	High-Z	High-Z	Power-down	Standby (I_{SB})
L	L	H	L	L	Data Out	Data Out	Read—All bits	Active (I_{CC})
			L	H	Data Out	High-Z	Read—Lower bits only	Active (I_{CC})
			H	L	High-Z	Data Out	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 Name	Package Type	Operating Range
10	CY7C1020DV33-10ZSXI	51-85087	44-pin TSOP Type II (Pb-free)	Industrial

Ordering Code Definitions

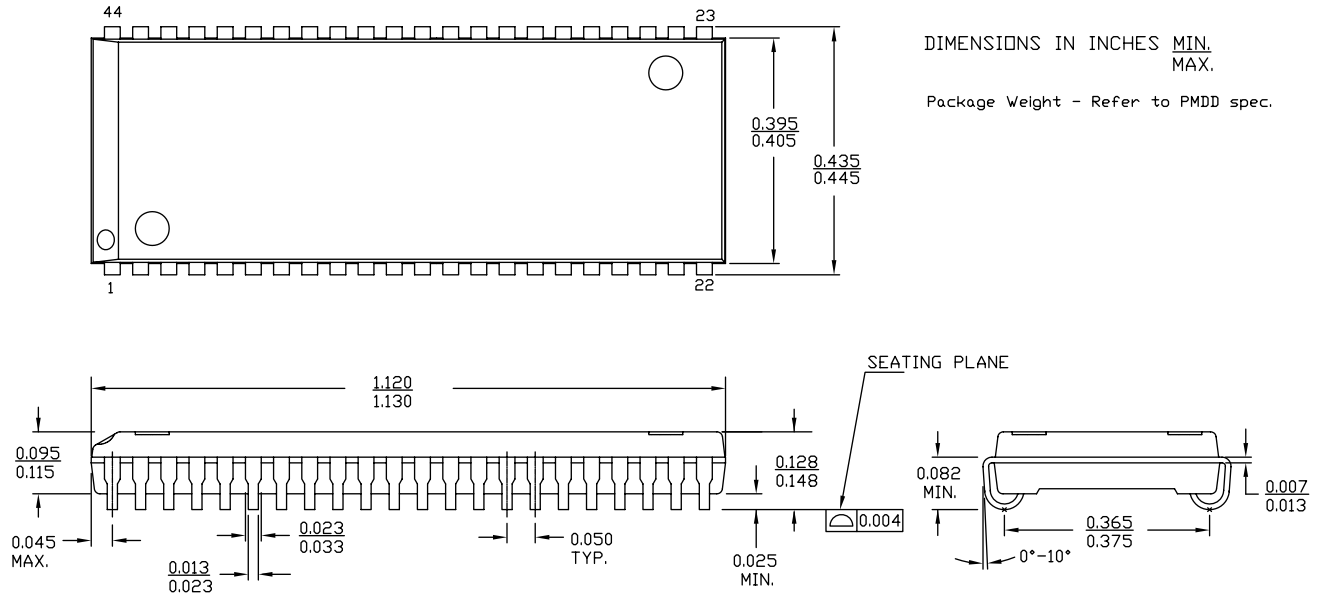
CY 7 C 1 02 0 D V33 - XX XX X



Shaded areas contain advance information. Please contact your local Cypress sales representative for availability of these parts.

Package Diagrams

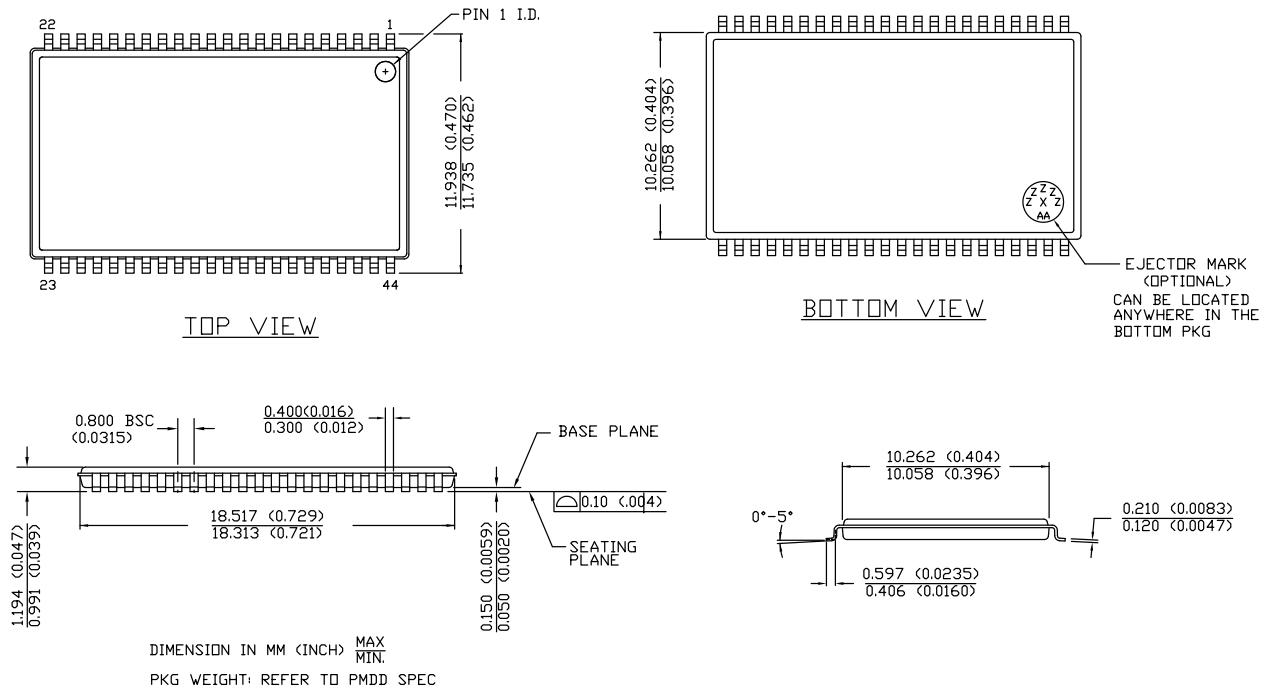
Figure 1. 44-pin (400-Mil) Molded SOJ (51-85082)



51-85082 *E

Package Diagrams (continued)

Figure 2. 44-Pin Thin Small Outline Package Type II (51-85087)



51-85087 *E

Acronyms

Acronym	Description
$\overline{\text{BHE}}$	byte high enable
$\overline{\text{BLE}}$	byte low enable
$\overline{\text{CE}}$	chip enable
CMOS	complementary metal oxide semiconductor
I/O	input/output
$\overline{\text{OE}}$	output enable
SRAM	static random access memory
TSOP	thin small outline package
$\overline{\text{WE}}$	write enable

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degrees Celsius
μA	microamperes
mA	milliamperes
MHz	megahertz
ns	nanoseconds
pF	picofarads
V	volts
Ω	ohms
W	watts

Document History Page

Document Title: CY7C1020DV33, 512 K (32 K x 16) Static RAM				
Document Number: 38-05461				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	201560	See ECN	SWI	Advance Information data sheet for C9 IPP
*A	233695	See ECN	RKF	DC parameters modified as per EROS (Spec # 01-02165) Pb-free Offering in Ordering Information
*B	262950	See ECN	RKF	Changed I/O ₁ – I/O ₁₆ to I/O ₀ – I/O ₁₅ Added Data Retention Characteristics table Added T _{power} spec in Switching Characteristics table Added 44-SOJ package diagram Shaded Ordering Information
*C	307596	See ECN	RKF	Reduced Speed bins to –8 and –10 ns
*D	560995	See ECN	VKN	Converted from Preliminary to Final Removed Commercial operating range Removed 8 ns speed bin Added Automotive information 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} +2 V to V _{CC} +1 V in footnote #4
*E	2898399	03/24/2010	AJU	Updated Package Diagrams
*F	3109992	12/14/2010	AJU	Added Ordering Code Definitions .
*G	3424450	10/28/2011	TAVA	Updated footnotes Updated Selection Guide , Operating Range , Electrical Characteristics Over the Operating Range , Switching Characteristics Over the Operating Range ^[5] , Data Retention Characteristics (Over the Operating Range) , Switching Waveforms , and Ordering Information . Updated Package Diagrams Added Acronyms , and Document Conventions
*H	3861347	01/08/2013	TAVA	Updated Ordering Information (Updated part numbers). Updated Package Diagrams : spec 51-85082 – Changed revision from *D to *E. spec 51-85087 – Changed revision from *D to *E.
*I	4574311	11/19/2014	TAVA	Added related documentation hyperlink in page 1. Added note 11 in Switching Characteristics Over the Operating Range ^[5] . Added note reference in the Switching Characteristics table.

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