CY7C1329H

2-Mbit (64 K × 32) Pipelined Sync SRAM

Features

- Registered inputs and outputs for pipelined operation
- 64 K × 32 common I/O architecture
- 3.3 V core power supply
- 2.5 V/3.3 V I/O operation
- Fast clock-to-output times
  - 3.5 ns (for 166-MHz device)
  - 4.0 ns (for 133-MHz device)
- Provide high-performance 3-1-1-1 access rate
- User-selectable burst counter supporting Intel® Pentium® interleaved or linear burst sequences
- Separate processor and controller address strobes
- Synchronous self-timed write
- Asynchronous output enable
- Offered in JEDEC-standard lead-free 100-pin TQFP package
- "ZZ" Sleep Mode Option

Functional Description

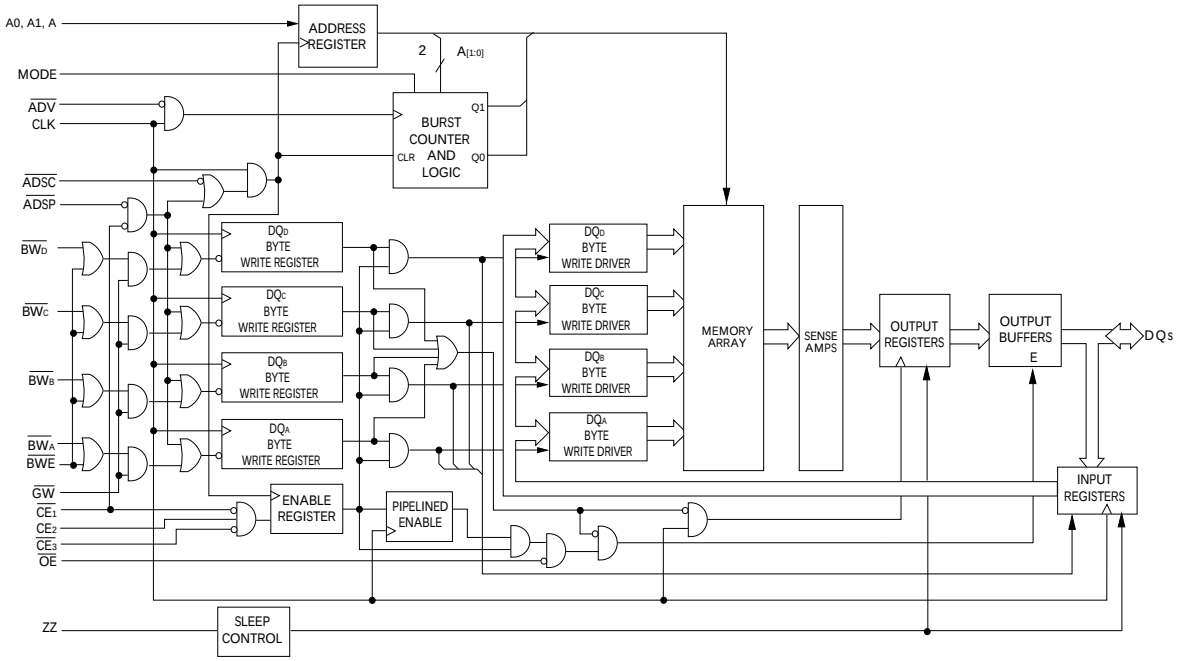
The CY7C1329H[1] SRAM integrates 64 K × 32 SRAM cells with advanced synchronous peripheral circuitry and a two-bit counter for internal burst operation. All synchronous inputs are gated by registers controlled by a positive-edge-triggered Clock Input (CLK). The synchronous inputs include all addresses, all data inputs, address-pipelining Chip Enable ($\overline{CE}_1$), depth-expansion Chip Enables (CE_2 and $\overline{CE}_3$), Burst Control inputs ($\overline{ADSC}$, $\overline{ADSP}$, and $\overline{ADV}$), Write Enables ($\overline{BW}_{[A:D]}$ and $\overline{BWE}$), and Global Write ($\overline{GW}$). Asynchronous inputs include the Output Enable ($\overline{OE}$) and the ZZ pin.

Addresses and chip enables are registered at rising edge of clock when either Address Strobe Processor ($\overline{ADSP}$) or Address Strobe Controller ($\overline{ADSC}$) are active. Subsequent burst addresses can be internally generated as controlled by the Advance pin ($\overline{ADV}$).

Address, data inputs, and write controls are registered on-chip to initiate a self-timed Write cycle. This part supports Byte Write operations (see Pin Descriptions and Truth Table for further details). Write cycles can be one to four bytes wide as controlled by the Byte Write control inputs. $\overline{GW}$ when active LOW causes all bytes to be written.

The CY7C1329H operates from a +3.3 V core power supply while all outputs operate with either a +2.5 V or +3.3 V supply. All inputs and outputs are JEDEC-standard JESD8-5-compatible.

Logic Block Diagram



Note

1. For best-practices recommendations, please refer to the Cypress application note *System Design Guidelines* on www.cypress.com.

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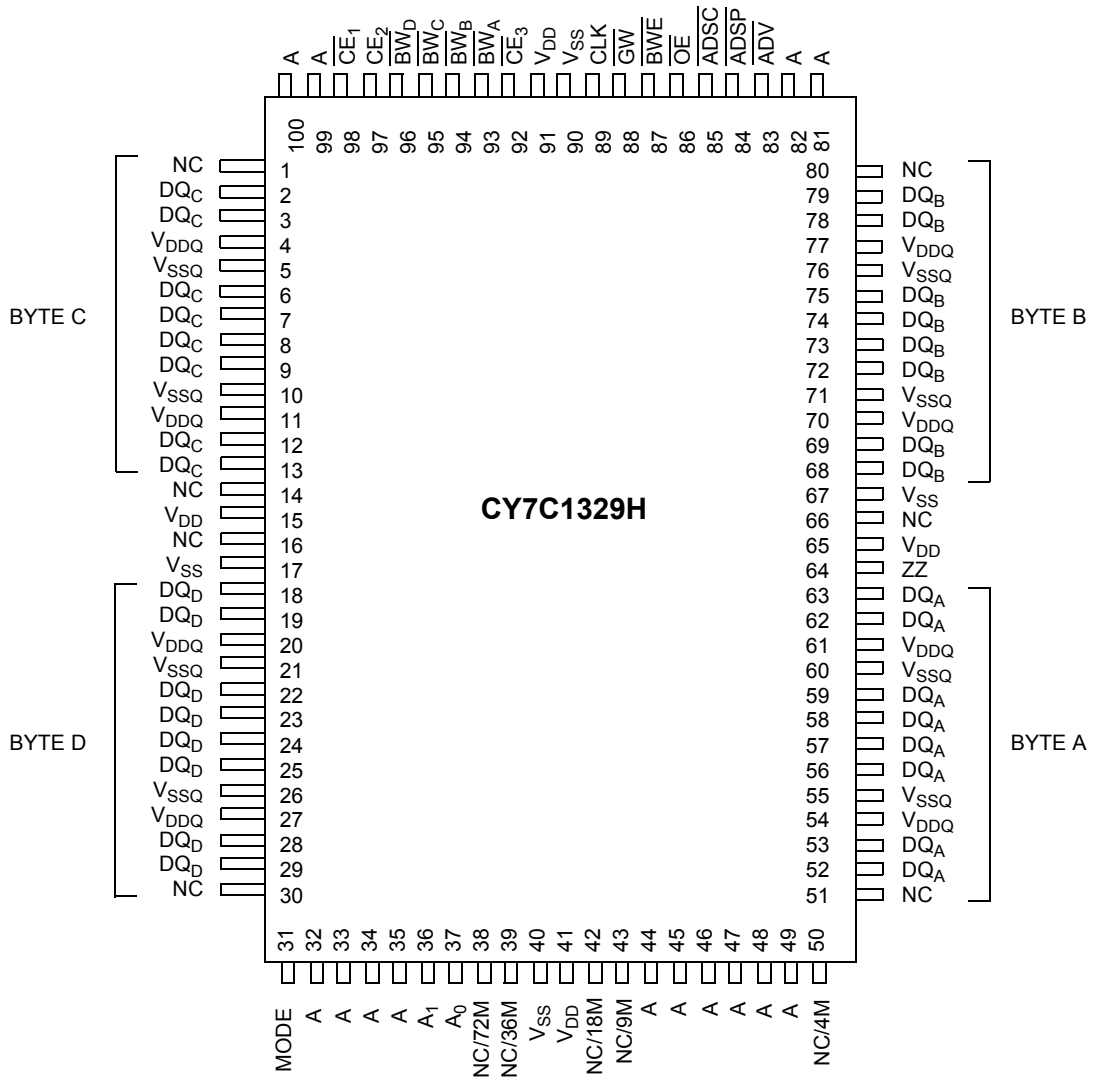
Selection Guide

	166 MHz	133 MHz	Unit
Maximum Access Time	3.5	4.0	ns
Maximum Operating Current	240	225	mA
Maximum CMOS Standby Current	40	40	mA

Pin Configuration

Figure 1. 100-pin TQFP Pinout



[+] Feedback

Pin Definitions

Name	I/O	Description
A_0, A_1, A	Input-Synchronous	**Address Inputs used to select one of the 64K address locations**. Sampled at the rising edge of the CLK if $\overline{ADSP}$ or $\overline{ADSC}$ is active LOW, and $\overline{CE}_1$, CE_2, and $\overline{CE}_3$ are sampled active. A_1, A_0 feed the 2-bit counter.
$\overline{BW}_A$,$\overline{BW}_B$, $\overline{BW}_C$, $\overline{BW}_D$	Input-Synchronous	**Byte Write Select Inputs, active LOW**. Qualified with $\overline{BWE}$ to conduct Byte Writes to the SRAM. Sampled on the rising edge of CLK.
$\overline{GW}$	Input-Synchronous	**Global Write Enable Input, active LOW**. When asserted LOW on the rising edge of CLK, a global Write is conducted (All bytes are written, regardless of the values on $\overline{BW}_{[A:D]}$ and $\overline{BWE}$).
$\overline{BWE}$	Input-Synchronous	**Byte Write Enable Input, active LOW**. Sampled on the rising edge of CLK. This signal must be asserted LOW to conduct a Byte Write.
CLK	Input-Clock	**Clock Input**. Used to capture all synchronous inputs to the device. Also used to increment the burst counter when $\overline{ADV}$ is asserted LOW, during a burst operation.
$\overline{CE}_1$	Input-Synchronous	**Chip Enable 1 Input, active LOW**. Sampled on the rising edge of CLK. Used in conjunction with CE_2 and $\overline{CE}_3$ to select/deselect the device. $\overline{ADSP}$ is ignored if $\overline{CE}_1$ is HIGH. $\overline{CE}_1$ is sampled only when a new external address is loaded.
CE_2	Input-Synchronous	**Chip Enable 2 Input, active HIGH**. Sampled on the rising edge of CLK. Used in conjunction with $\overline{CE}_1$ and $\overline{CE}_3$ to select/deselect the device. CE_2 is sampled only when a new external address is loaded.
$\overline{CE}_3$	Input-Synchronous	**Chip Enable 3 Input, active LOW**. Sampled on the rising edge of CLK. Used in conjunction with $\overline{CE}_1$ and CE_2 to select/deselect the device. Not connected for BGA. Where referenced, $\overline{CE}_3$ is assumed active throughout this document for BGA. $\overline{CE}_3$ is sampled only when a new external address is loaded.
$\overline{OE}$	Input-Asynchronous	**Output Enable, asynchronous input, active LOW**. Controls the direction of the I/O pins. When LOW, the I/O pins behave as outputs. When deasserted HIGH, I/O pins are tri-stated, and act as input data pins. $\overline{OE}$ is masked during the first clock of a Read cycle when emerging from a deselected state.
$\overline{ADV}$	Input-Synchronous	**Advance Input signal, sampled on the rising edge of CLK**, **active LOW**. When asserted, it automatically increments the address in a burst cycle.
$\overline{ADSP}$	Input-Synchronous	**Address Strobe from Processor, sampled on the rising edge of CLK, active LOW**. When asserted LOW, A is captured in the address registers. A_1, A_0 are also loaded into the burst counter. When $\overline{ADSP}$ and $\overline{ADSC}$ are both asserted, only $\overline{ADSP}$ is recognized. $\overline{ASDP}$ is ignored when $\overline{CE}_1$ is deasserted HIGH.
$\overline{ADSC}$	Input-Synchronous	**Address Strobe from Controller, sampled on the rising edge of CLK, active LOW**. When asserted LOW, A is captured in the address registers. A_1, A_0 are also loaded into the burst counter. When $\overline{ADSP}$ and $\overline{ADSC}$ are both asserted, only $\overline{ADSP}$ is recognized.
ZZ	Input-Asynchronous	**ZZ "sleep" Input, active HIGH**. This input, when HIGH places the device in a non-time-critical "sleep" condition with data integrity preserved. For normal operation, this pin has to be LOW or left floating. ZZ pin has an internal pull-down.
DQ_A, DQ_B DQ_C, DQ_D	I/O-Synchronous	**Bidirectional Data I/O lines**. As inputs, they feed into an on-chip data register that is triggered by the rising edge of CLK. As outputs, they deliver the data contained in the memory location specified by "A" during the previous clock rise of the Read cycle. The direction of the pins is controlled by $\overline{OE}$. When $\overline{OE}$ is asserted LOW, the pins behave as outputs. When HIGH, DQ are placed in a tri-state condition.
V_{DD}	Power Supply	**Power supply inputs to the core of the device**.
V_{SS}	Ground	**Ground for the core of the device**.
V_{DDQ}	I/O Power Supply	**Power supply for the I/O circuitry**.
V_{SSQ}	I/O Ground	**Ground for the I/O circuitry**.
MODE	Input-Static	**Selects Burst Order**. When tied to GND selects linear burst sequence. When tied to V_{DD} or left floating selects interleaved burst sequence. This is a strap pin and should remain static during device operation. Mode Pin has an internal pull-up.
NC		**No Connects**. Not internally connected to the die. 4M, 9M, 18M, 72M, 144M, 288M, 576M and 1G are address expansion pins and are not internally connected to the die.

[+] Feedback

Functional Overview

All synchronous inputs pass through input registers controlled by the rising edge of the clock. All data outputs pass through output registers controlled by the rising edge of the clock.

The CY7C1329H supports secondary cache in systems utilizing either a linear or interleaved burst sequence. The interleaved burst order supports Pentium and i486™ processors. The linear burst sequence is suited for processors that utilize a linear burst sequence. The burst order is user selectable, and is determined by sampling the MODE input. Accesses can be initiated with either the Processor Address Strobe ($\overline{ADSP}$) or the Controller Address Strobe ($\overline{ADSC}$). Address advancement through the burst sequence is controlled by the $\overline{ADV}$ input. A two-bit on-chip wraparound burst counter captures the first address in a burst sequence and automatically increments the address for the rest of the burst access.

Byte Write operations are qualified with the Byte Write Enable ($\overline{BWE}$) and Byte Write Select ($\overline{BW}_{[A:D]}$) inputs. A Global Write Enable ($\overline{GW}$) overrides all Byte Write inputs and writes data to all four bytes. All Writes are simplified with on-chip synchronous self-timed Write circuitry.

Three synchronous Chip Selects ($\overline{CE}_1$, CE_2, $\overline{CE}_3$) and an asynchronous Output Enable ($\overline{OE}$) provide for easy bank selection and output tri-state control. $\overline{ADSP}$ is ignored if $\overline{CE}_1$ is HIGH.

Single Read Accesses

This access is initiated when the following conditions are satisfied at clock rise: (1) $\overline{ADSP}$ or $\overline{ADSC}$ is asserted LOW, (2) $\overline{CE}_1$, CE_2, $\overline{CE}_3$ are all asserted active, and (3) the Write signals ($\overline{GW}$, $\overline{BWE}$) are all deasserted HIGH. $\overline{ADSP}$ is ignored if CE1 is HIGH. The address presented to the address inputs (A) is stored into the address advancement logic and the address register while being presented to the memory array. The corresponding data is allowed to propagate to the input of the output registers. At the rising edge of the next clock the data is allowed to propagate through the output register and onto the data bus within t_{CO} if $\overline{OE}$ is active LOW. The only exception occurs when the SRAM is emerging from a deselected state to a selected state, its outputs are always tri-stated during the first cycle of the access. After the first cycle of the access, the outputs are controlled by the $\overline{OE}$ signal. Consecutive single Read cycles are supported. Once the SRAM is deselected at clock rise by the chip select and either $\overline{ADSP}$ or $\overline{ADSC}$ signals, its output will tri-state immediately.

Single Write Accesses Initiated by $\overline{ADSP}$

This access is initiated when both of the following conditions are satisfied at clock rise: (1) $\overline{ADSP}$ is asserted LOW, and (2) $\overline{CE}_1$, CE_2, $\overline{CE}_3$ are all asserted active. The address presented to A is loaded into the address register and the address advancement logic while being delivered to the RAM array. The Write signals ($\overline{GW}$, $\overline{BWE}$, and $\overline{BW}_{[A:D]}$) and $\overline{ADV}$ inputs are ignored during this first cycle.

$\overline{ADSP}$-triggered Write accesses require two clock cycles to complete. If $\overline{GW}$ is asserted LOW on the second clock rise, the data presented to the DQ inputs is written into the corresponding address location in the memory array. If $\overline{GW}$ is HIGH, then the Write operation is controlled by $\overline{BWE}$ and $\overline{BW}_{[A:D]}$ signals. The CY7C1329H provides Byte Write capability that is described in the Write Cycle Descriptions table. Asserting the Byte Write Enable input ($\overline{BWE}$) with the selected Byte Write ($\overline{BW}_{[A:D]}$) input, will selectively write to only the desired bytes. Bytes not selected during a Byte Write operation will remain unaltered. A synchronous self-timed Write mechanism has been provided to simplify the Write operations.

Because the CY7C1329H is a common I/O device, the Output Enable ($\overline{OE}$) must be deasserted HIGH before presenting data to the DQ inputs. Doing so will tri-state the output drivers. As a safety precaution, DQs are automatically tri-stated whenever a Write cycle is detected, regardless of the state of $\overline{OE}$.

Single Write Accesses Initiated by $\overline{ADSC}$

$\overline{ADSC}$ Write accesses are initiated when the following conditions are satisfied: (1) $\overline{ADSC}$ is asserted LOW, (2) $\overline{ADSP}$ is deasserted HIGH, (3) $\overline{CE}_1$, CE_2, $\overline{CE}_3$ are all asserted active, and (4) the appropriate combination of the Write inputs ($\overline{GW}$, $\overline{BWE}$, and $\overline{BW}_{[A:D]}$) are asserted active to conduct a Write to the desired byte(s). $\overline{ADSC}$-triggered Write accesses require a single clock cycle to complete. The address presented to A is loaded into the address register and the address advancement logic while being delivered to the memory array. The $\overline{ADV}$ input is ignored during this cycle. If a global Write is conducted, the data presented to DQ is written into the corresponding address location in the memory core. If a Byte Write is conducted, only the selected bytes are written. Bytes not selected during a Byte Write operation will remain unaltered. A synchronous self-timed Write mechanism has been provided to simplify the Write operations.

Because the CY7C1329H is a common I/O device, the Output Enable ($\overline{OE}$) must be deasserted HIGH before presenting data to the DQ inputs. Doing so will tri-state the output drivers. As a safety precaution, DQs are automatically tri-stated whenever a Write cycle is detected, regardless of the state of $\overline{OE}$.

Burst Sequences

The CY7C1329H provides a two-bit wraparound counter, fed by A_1, A_0, that implements either an interleaved or linear burst sequence. The interleaved burst sequence is designed specifically to support Intel Pentium applications. The linear burst sequence is designed to support processors that follow a linear burst sequence. The burst sequence is user selectable through the MODE input.Asserting $\overline{ADV}$ LOW at clock rise will automatically increment the burst counter to the next address in the burst sequence. Both Read and Write burst operations are supported.

Sleep Mode

The ZZ input pin is an asynchronous input. Asserting ZZ places the SRAM in a power conservation “sleep” mode. Two clock cycles are required to enter into or exit from this “sleep” mode. While in this mode, data integrity is guaranteed. Accesses pending when entering the “sleep” mode are not considered valid nor is the completion of the operation guaranteed. The device must be deselected prior to entering the “sleep” mode. $\overline{CE}_1$, CE_2, $\overline{CE}_3$, $\overline{ADSP}$, and $\overline{ADSC}$ must remain inactive for the duration of t_{ZZREC} after the ZZ input returns LOW.

Interleaved Burst Address Table (MODE = Floating or V_{DD})

First Address A_1, A_0	Second Address A_1, A_0	Third Address A_1, A_0	Fourth Address A_1, A_0
00	01	10	11
01	00	11	10
10	11	00	01
11	10	01	00

Linear Burst Address Table (MODE = GND)

First Address A_1, A_0	Second Address A_1, A_0	Third Address A_1, A_0	Fourth Address A_1, A_0
00	01	10	11
01	10	11	00
10	11	00	01
11	00	01	10

ZZ Mode Electrical Characteristics

Parameter	Description	Test Conditions	Min	Max	Unit
I_{DDZZ}	Sleep mode standby current	$ZZ \geq V_{DD} - 0.2$ V	–	40	mA
t_{ZZS}	Device operation to ZZ	$ZZ \geq V_{DD} - 0.2$ V	–	$2t_{CYC}$	ns
t_{ZZREC}	ZZ recovery time	$ZZ \leq 0.2$ V	$2t_{CYC}$	–	ns
t_{ZZI}	ZZ Active to sleep current	This parameter is sampled	–	$2t_{CYC}$	ns
t_{RZZI}	ZZ Inactive to exit sleep current	This parameter is sampled	0	–	ns

Truth Table [2, 3, 4, 5, 6, 7]

Next Cycle	Address Used	Address Used	$\overline{CE_1}$	CE_2	$\overline{CE_3}$	ZZ	$\overline{ADSP}$	$\overline{ADSC}$	$\overline{ADV}$	$\overline{WRITE}$	$\overline{OE}$
Unselected	None	None	H	X	X	L	X	L	X	X	X
Unselected	None	None	L	L	X	L	L	X	X	X	X
Unselected	None	None	L	X	H	L	L	X	X	X	X
Unselected	None	None	L	L	X	L	H	L	X	X	X
Unselected	None	None	L	X	H	L	H	L	X	X	X
Begin Read	External	None	X	X	X	H	X	X	X	X	X
Begin Read	External	External	L	H	L	L	L	X	X	X	L
Continue Read	Next	External	L	H	L	L	L	X	X	X	H
Continue Read	Next	External	L	H	L	L	H	L	X	L	X
Continue Read	Next	External	L	H	L	L	H	L	X	H	L
Continue Read	Next	External	L	H	L	L	H	L	X	H	H
Suspend Read	Current	Next	X	X	X	L	H	H	L	H	L
Suspend Read	Current										
Suspend Read	Current	Next	X	X	X	L	H	H	L	H	H
Suspend Read	Current	Next	H	X	X	L	X	H	L	H	L
Begin Write	Current	Next	H	X	X	L	X	H	L	H	H
Begin Write	Current	Next	X	X	X	L	H	H	L	L	X
Begin Write	External	Next	H	X	X	L	X	H	L	L	X
Continue Write	Next	Current	X	X	X	L	H	H	H	H	L
Continue Write	Next	Current	X	X	X	L	H	H	H	H	H
Suspend Write	Current	Current	H	X	X	L	X	H	H	H	L
Suspend Write	Current	Current	H	X	X	L	X	H	H	H	H
ZZ “Sleep”	None	Current	X	X	X	L	H	H	H	L	X

Notes

2. X = “Don't Care.” H = Logic HIGH, L = Logic LOW.
3. $\overline{WRITE}$ = L when any one or more Byte Write Enable signals ($\overline{BW_A}$, $\overline{BW_B}$, $\overline{BW_C}$, $\overline{BW_D}$) and $\overline{BWE}$ = L or $\overline{GW}$ = L. $\overline{WRITE}$ = H when all Byte Write Enable signals ($\overline{BW_A}$, BW_B, BW_C, BW_D), BWE, GW = H.
4. The DQ pins are controlled by the current cycle and the $\overline{OE}$ signal. $\overline{OE}$ is asynchronous and is not sampled with the clock.
5. $\overline{CE_1}$, CE_2, and $\overline{CE_3}$ are available only in the TQFP package.
6. The SRAM always initiates a read cycle when ADSP is asserted, regardless of the state of $\overline{GW}$, $\overline{BWE}$, or $\overline{BW_{[A:D]}}$. Writes may occur only on subsequent clocks after the ADSP or with the assertion of ADSC. As a result, $\overline{OE}$ must be driven HIGH prior to the start of the Write cycle to allow the outputs to Tri-State. $\overline{OE}$ is a don't care for the remainder of the Write cycle.
7. $\overline{OE}$ is asynchronous and is not sampled with the clock rise. It is masked internally during Write cycles. During a Read cycle all data bits are Tri-State when $\overline{OE}$ is inactive or when the device is deselected, and all data bits behave as output when $\overline{OE}$ is active (LOW).

[+] Feedback

Truth Table for Read/Write [8, 9]

Function	$\overline{GW}$	$\overline{BWE}$	$\overline{BW_D}$	$\overline{BW_C}$	$\overline{BW_B}$	$\overline{BW_A}$
Read	H	H	X	X	X	X
Read	H	L	H	H	H	H
Write Byte A – DQ_A	H	L	H	H	H	L
Write Byte B – DQ_B	H	L	H	H	L	H
Write Bytes B, A	H	L	H	H	L	L
Write Byte C – DQ_C	H	L	H	L	H	H
Write Bytes C, A	H	L	H	L	H	L
Write Bytes C, B	H	L	H	L	L	H
Write Bytes C, B, A	H	L	H	L	L	L
Write Byte D – DQ_D	H	L	L	H	H	H
Write Bytes D, A	H	L	L	H	H	L
Write Bytes D, B	H	L	L	H	L	H
Write Bytes D, B, A	H	L	L	H	L	L
Write Bytes D, C	H	L	L	L	H	H
Write Bytes D, C, A	H	L	L	L	H	L
Write Bytes D, C, B	H	L	L	L	L	H
Write All Bytes	H	L	L	L	L	L
Write All Bytes	L	X	X	X	X	X

Notes
8. X = "Don't Care." H = Logic HIGH, L = Logic LOW.
9. WRITE = L when any one or more Byte Write Enable signals ($\overline{BW_A}$, $\overline{BW_B}$, $\overline{BW_C}$, $\overline{BW_D}$) and $\overline{BWE}$ = L or $\overline{GW}$ = L. $\overline{WRITE}$ = H when all Byte Write Enable signals ($\overline{BW_A}$, $\overline{BW_B}$, $\overline{BW_C}$, $\overline{BW_D}$), $\overline{BWE}$, $\overline{GW}$ = H.

[+] Feedback

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 on V_{DD} Relative to GND .....–0.5 V to +4.6 V

Supply Voltage on V_{DDQ} Relative to GND .... –0.5 V to +V_{DD}

DC Voltage Applied to Outputs in Tri-State .....–0.5 V to V_{DDQ} + 0.5 V

DC Input Voltage .....–0.5 V to V_{DD} + 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_{DD}	V_{DDQ}
Commercial	0 °C to +70 °C	3.3 V – 5% / + 10%	2.5 V – 5% to V_{DD}
Industrial	–40 °C to +85 °C		

Electrical Characteristics

Over the Operating Range

Parameter [10, 11]	Description	Test Conditions		Min	Max	Unit
V_{DD}	Power Supply Voltage			3.135	3.6	V
V_{DDQ}	I/O Supply Voltage	for 3.3 V I/O		3.135	V_{DD}	V
		for 2.5 V I/O		2.375	2.625	V
V_{OH}	Output HIGH Voltage	for 3.3 V I/O, I_{OH} = –4.0 mA		2.4	–	V
		for 2.5 V I/O, I_{OH} = –1.0 mA		2.0	–	V
V_{OL}	Output LOW Voltage	for 3.3 V I/O, I_{OL} = 8.0 mA		–	0.4	V
		for 2.5 V I/O, I_{OL} = 1.0 mA		–	0.4	V
V_{IH}	Input HIGH Voltage [10]	for 3.3 V I/O		2.0	V_{DD} + 0.3 V	V
		for 2.5 V I/O		1.7	V_{DD} + 0.3 V	V
V_{IL}	Input LOW Voltage [10]	for 3.3 V I/O		–0.3	0.8	V
		for 2.5 V I/O		–0.3	0.7	V
I_X	Input Leakage Current except ZZ and MODE	GND ≤ V_I ≤ V_{DDQ}		–5	5	µA
	Input Current of MODE	Input = V_{SS}		–30	–	µA
		Input = V_{DD}		–	5	µA
	Input Current of ZZ	Input = V_{SS}		–5	–	µA
		Input = V_{DD}		–	30	µA
I_{OZ}	Output Leakage Current	GND ≤ V_I ≤ V_{DDQ}, Output Disabled		–5	5	µA
I_{DD}	V_{DD} Operating Supply Current	V_{DD} = Max, I_{OUT} = 0 mA, f = f_{MAX} = $1/t_{CYC}$	6-ns cycle,166 MHz	–	240	mA
			7.5-ns cycle,133 MHz	–	225	mA
I_{SB1}	Automatic CS Power-down Current—TTL Inputs	V_{DD} = Max, Device Deselected, V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX} = $1/t_{CYC}$	6-ns cycle, 166 MHz	–	100	mA
			7.5-ns cycle,133 MHz	–	90	mA
I_{SB2}	Automatic CS Power-down Current—CMOS Inputs	V_{DD} = Max, Device Deselected, V_{IN} ≤ 0.3 V or V_{IN} ≥ V_{DDQ} – 0.3 V, f = 0	All speeds	–	40	mA

Notes

10. Overshoot: $V_{IH}(AC) < V_{DD} + 1.5$ V (Pulse width less than $t_{CYC}/2$), undershoot: $V_{IL}(AC) > -2$ V (Pulse width less than $t_{CYC}/2$).
11. $T_{Power\text{-}up}$: Assumes a linear ramp from 0 V to V_{DD}(min.) within 200 ms. During this time $V_{IH} < V_{DD}$ and $V_{DDQ} \le V_{DD}$.

[+] Feedback

Electrical Characteristics

Over the Operating Range

Parameter [10, 11]	Description	Test Conditions		Min	Max	Unit
I_{SB3}	Automatic CS Power-down Current—CMOS Inputs	V_{DD} = Max, Device Deselected, or $V_{IN} \le 0.3$ V or $V_{IN} \ge V_{DDQ} - 0.3$ V, f = $f_{MAX} = 1/t_{CYC}$	6-ns cycle, 166 MHz	–	85	mA
			7.5-ns cycle,133 MHz	–	75	mA
I_{SB4}	Automatic CS Power-down Current—TTL Inputs	V_{DD} = Max, Device Deselected, $V_{IN} \ge V_{IH}$ or $V_{IN} \le V_{IL}$, f = 0	All speeds	–	45	mA

Capacitance

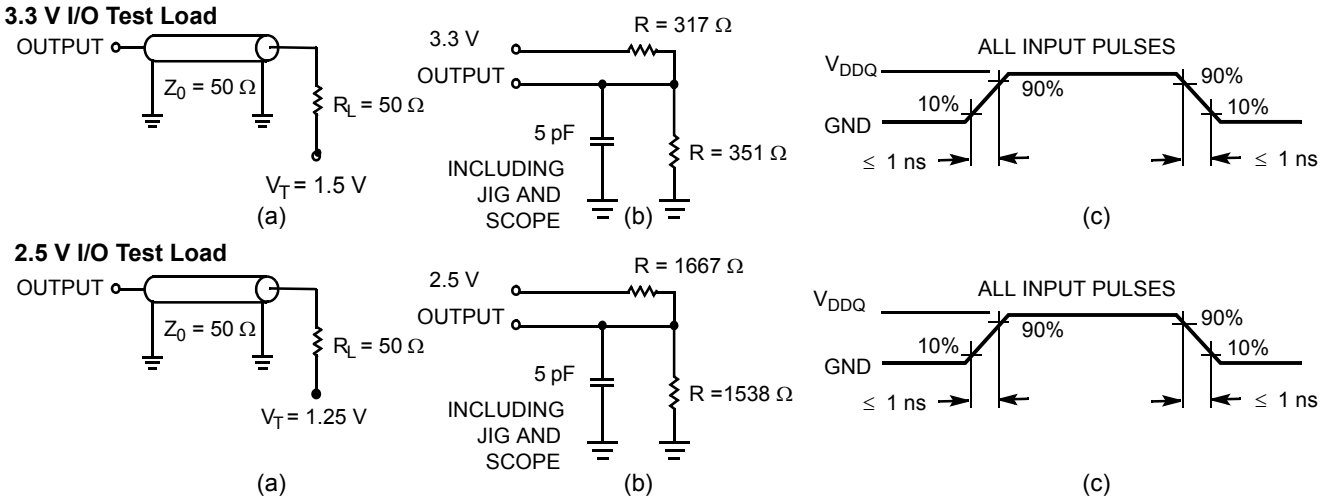
Parameter [12]	Description	Test Conditions	100-pin TQFP Max	Unit
C_{IN}	Input Capacitance	T_A = 25 °C, f = 1 MHz, V_{DD} = 3.3 V, V_{DDQ} = 2.5 V	5	pF
C_{CLK}	Clock Input Capacitance		5	pF
$C_{I/O}$	Input/Output Capacitance		5	pF

Thermal Resistance

Parameter [12]	Description	Test Conditions	100-pin TQFP Package	Unit
Θ_{JA}	Thermal Resistance (Junction to Ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, per EIA/JESD51	30.32	°C/W
Θ_{JC}	Thermal Resistance (Junction to Case)		6.85	°C/W

AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms



Note
12. Tested initially and after any design or process change that may affect these parameters.

[+] Feedback

Switching Characteristics

Over the Operating Range

Parameter [13, 14]	Description	166 MHz		133 MHz		Unit
		Min	Max	Min	Max	
t_{POWER}	V_{DD}(Typical) to the First Access[15]	1	–	1	–	ms
Clock						
t_{CYC}	Clock Cycle Time	6.0	–	7.5	–	ns
t_{CH}	Clock HIGH	2.5	–	3.0	–	ns
t_{CL}	Clock LOW	2.5	–	3.0	–	ns
Output Times						
t_{CO}	Data Output Valid after CLK Rise	–	3.5	–	4.0	ns
t_{DOH}	Data Output Hold after CLK Rise	1.5	–	1.5	–	ns
t_{CLZ}	Clock to Low Z [16, 17, 18]	0	–	0	–	ns
t_{CHZ}	Clock to High Z [16, 17, 18]	–	3.5	–	4.0	ns
t_{OEV}	$\overline{OE}$ LOW to Output Valid	–	3.5	–	4.5	ns
t_{OELZ}	$\overline{OE}$ LOW to Output Low Z [16, 17, 18]	0	–	0	–	ns
t_{OEHZ}	$\overline{OE}$ HIGH to Output High Z [16, 17, 18]	–	3.5	–	4.0	ns
Set-up Times						
t_{AS}	Address Set-up before CLK Rise	1.5	–	1.5	–	ns
t_{ADS}	$\overline{ADSC}$, $\overline{ADSP}$ Set-up before CLK Rise	1.5	–	1.5	–	ns
t_{ADVS}	$\overline{ADV}$ Set-up before CLK Rise	1.5	–	1.5	–	ns
t_{WES}	$\overline{GW}$, $\overline{BWE}$, $\overline{BW}_{[A:D]}$ Set-up before CLK Rise	1.5	–	1.5	–	ns
t_{DS}	Data Input Set-up before CLK Rise	1.5	–	1.5	–	ns
t_{CES}	Chip Enable Set-Up before CLK Rise	1.5	–	1.5	–	ns
Hold Times						
t_{AH}	Address Hold after CLK Rise	0.5	–	0.5	–	ns
t_{ADH}	$\overline{ADSP}$, $\overline{ADSC}$ Hold after CLK Rise	0.5	–	0.5	–	ns
t_{ADVH}	$\overline{ADV}$ Hold after CLK Rise	0.5	–	0.5	–	ns
t_{WEH}	$\overline{GW}$, $\overline{BWE}$, $\overline{BW}_{[A:D]}$ Hold after CLK Rise	0.5	–	0.5	–	ns
t_{DH}	Data Input Hold after CLK Rise	0.5	–	0.5	–	ns
t_{CEH}	Chip Enable Hold after CLK Rise	0.5	–	0.5	–	ns

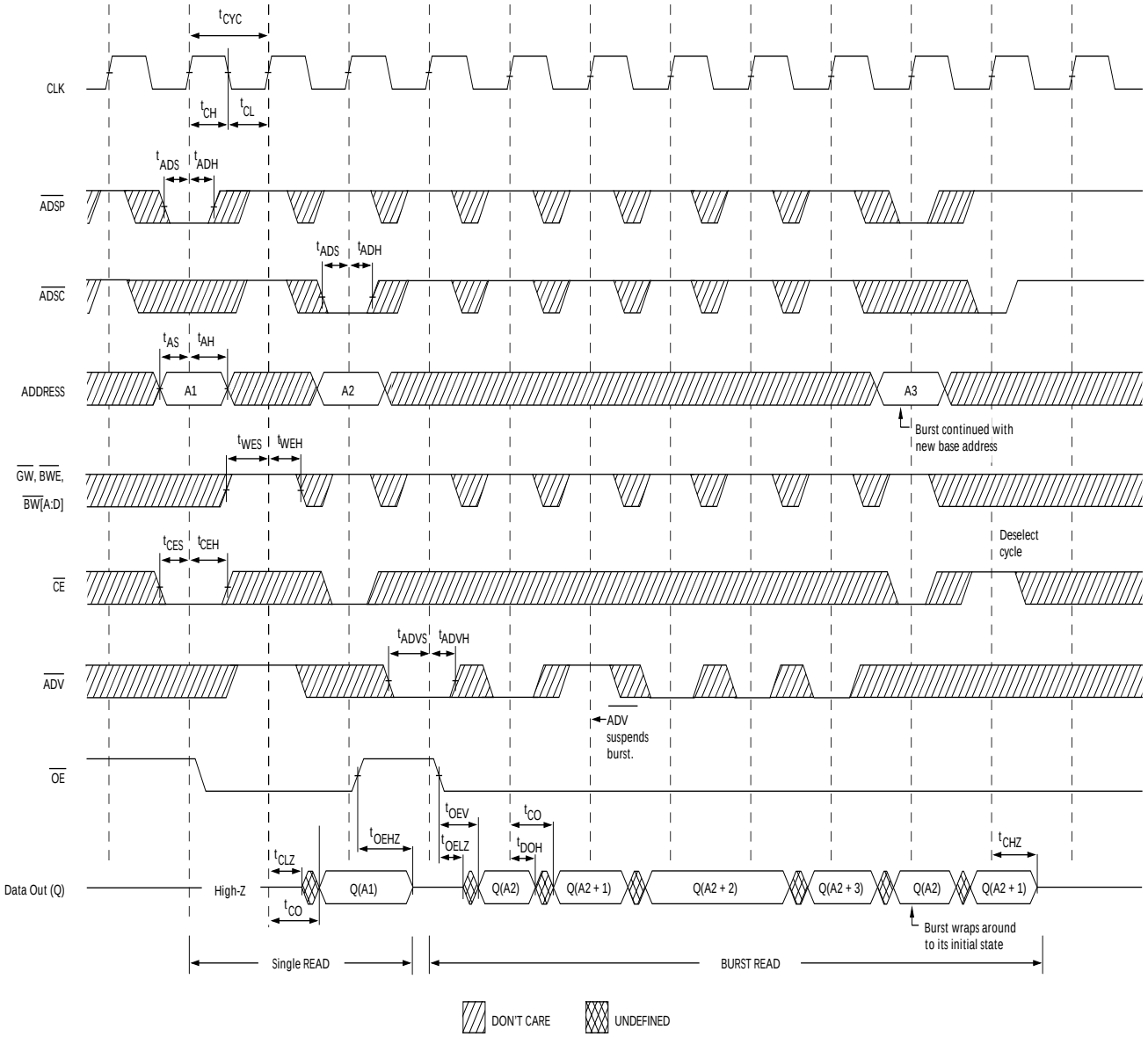
Notes

13. Timing reference level is 1.5 V when V_{DDQ} = 3.3 V and is 1.25 V when V_{DDQ} = 2.5 V.
14. Test conditions shown in (a) ofFigure 2 on page 10 unless otherwise noted.
15. This part has a voltage regulator internally; t_{POWER} is the time that the power needs to be supplied above V_{DD}(minimum) initially before a Read or Write operation can be initiated.
16. t_{CHZ}, t_{CLZ},t_{OELZ}, and t_{OEHZ} are specified with AC test conditions shown in part (b) of Figure 2 on page 10. Transition is measured ± 200 mV from steady-state voltage.
17. At any given voltage and temperature, t_{OEHZ} is less than t_{OELZ} and t_{CHZ} is less than t_{CLZ} to eliminate bus contention between SRAMs when sharing the same data bus. These specifications do not imply a bus contention condition, but reflect parameters guaranteed over worst case user conditions. Device is designed to achieve High Z prior to Low Z under the same system conditions.
18. This parameter is sampled and not 100% tested.

[+] Feedback

Switching Waveforms

Figure 3. Read Cycle Timing [19]

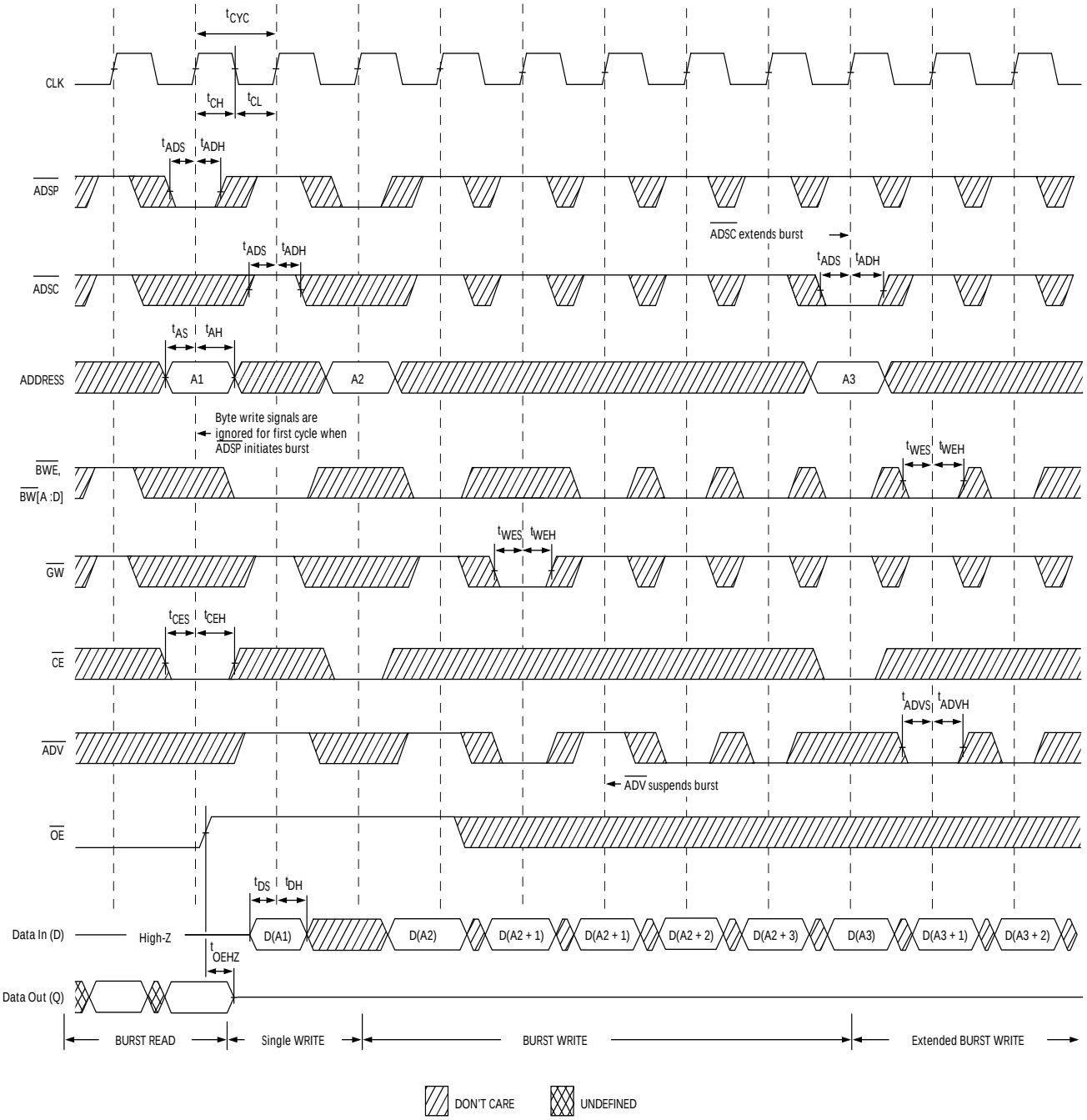


Note
19. On this diagram, when $\overline{CE}$ is LOW, $\overline{CE}_1$ is LOW, CE_2 is HIGH and $\overline{CE}_3$ is LOW. When $\overline{CE}$ is HIGH, $\overline{CE}_1$ is HIGH or CE_2 is LOW or $\overline{CE}_3$ is HIGH.

[+] Feedback

Switching Waveforms (continued)

Figure 4. Write Cycle Timing [20, 21]

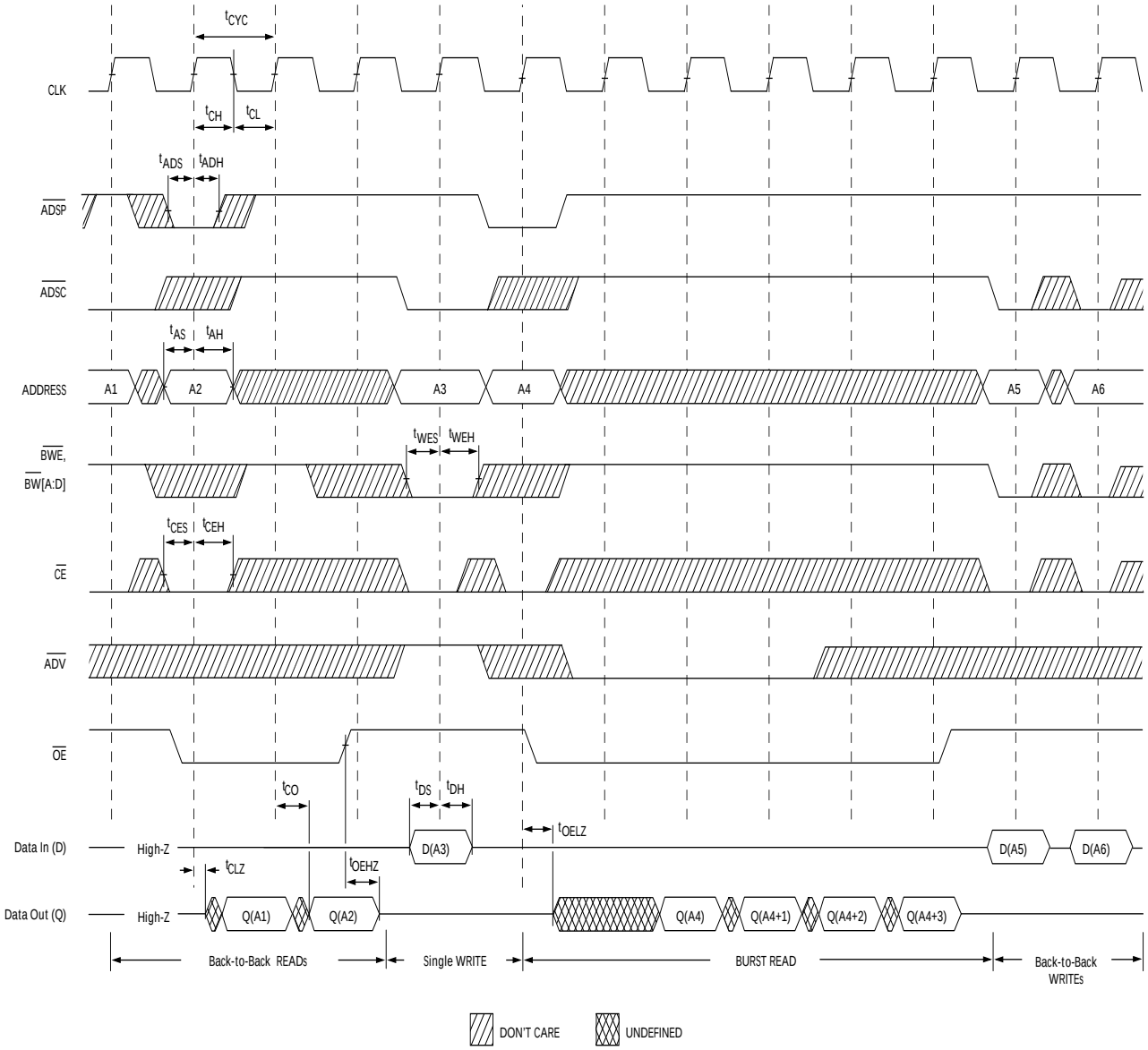


Notes
20. On this diagram, when $\overline{CE}$ is LOW, $\overline{CE}_1$ is LOW, CE_2 is HIGH and $\overline{CE}_3$ is LOW. When $\overline{CE}$ is HIGH, $\overline{CE}_1$ is HIGH or CE_2 is LOW or $\overline{CE}_3$ is HIGH.
21. Full width Write can be initiated by either $\overline{GW}$ LOW; or by $\overline{GW}$ HIGH, $\overline{BWE}$ LOW and $\overline{BW}_{[A : D]}$ LOW.

[+] Feedback

Switching Waveforms (continued)

Figure 5. Read/Write Cycle Timing [22, 23, 24]

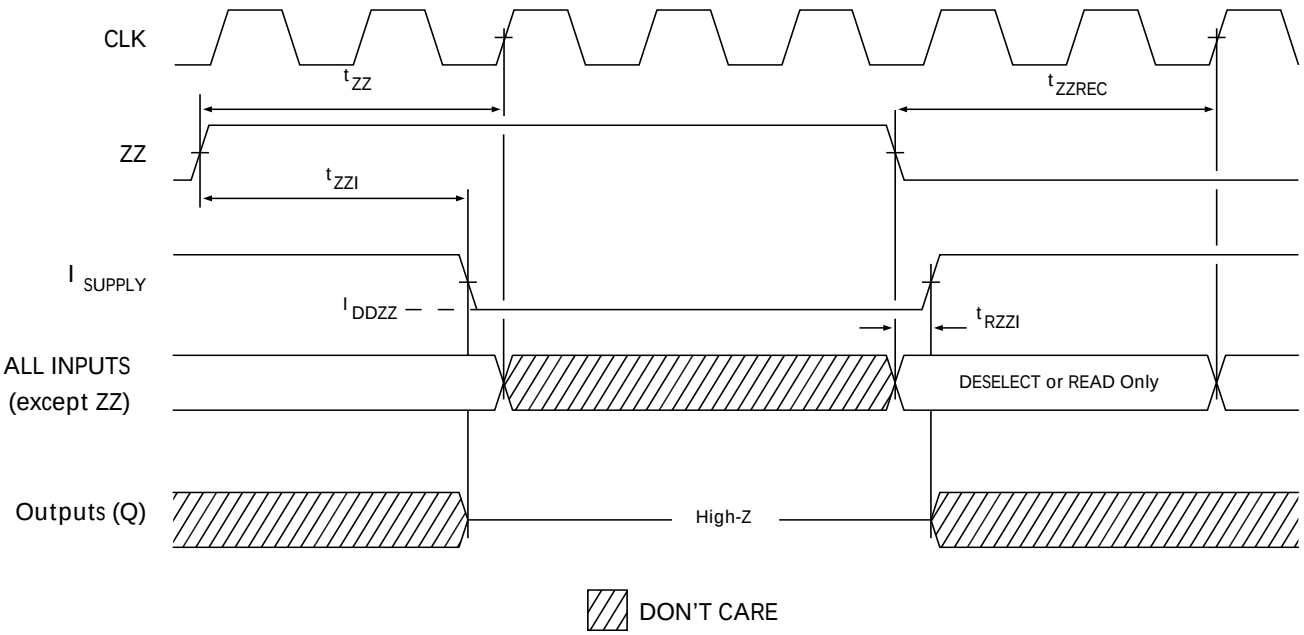


Notes
22. On this diagram, when $\overline{CE}$ is LOW, $\overline{CE}_1$ is LOW, CE_2 is HIGH and $\overline{CE}_3$ is LOW. When $\overline{CE}$ is HIGH, $\overline{CE}_1$ is HIGH or CE_2 is LOW or $\overline{CE}_3$ is HIGH.
23. The data bus (Q) remains in High Z following a Write cycle unless an $\overline{ADSP}$, $\overline{ADSC}$, or $\overline{ADV}$ cycle is performed.
24. $\overline{GW}$ is HIGH.

[+] Feedback

Switching Waveforms (continued)

Figure 6. ZZ Mode Timing [25, 26]



Notes
25. Device must be deselected when entering ZZ mode. See Cycle Descriptions table for all possible signal conditions to deselect the device.
26. DQs are in High Z when exiting ZZ sleep mode.

[+] Feedback

Ordering Information

Cypress offers other versions of this type of product in many different configurations and features. The following table contains only the list of parts that are currently available.
For a complete listing of all options, visit the Cypress website at www.cypress.com and refer to the product summary page at http://www.cypress.com/products or contact your local sales representative.
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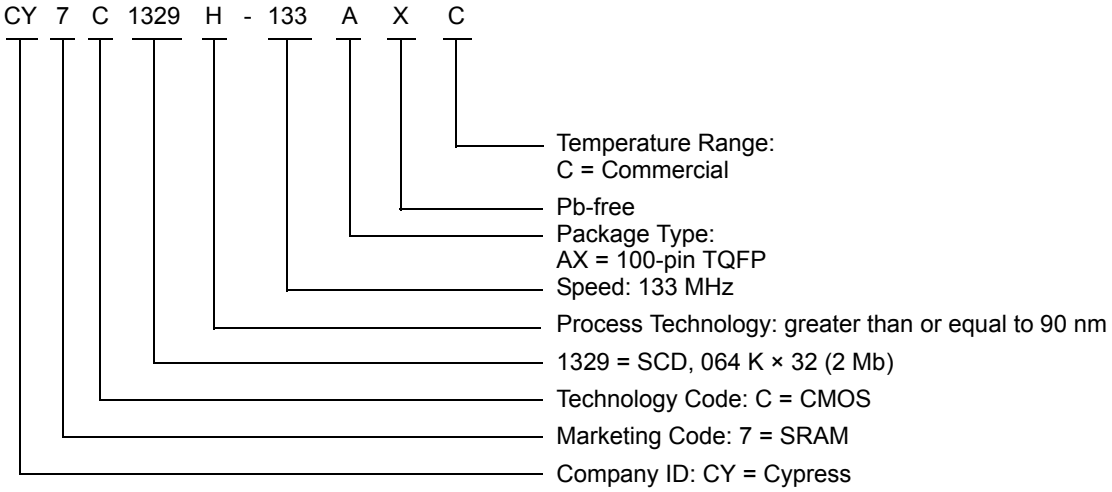
Speed (MHz)	Ordering Code	Package Diagram	Package Type	Operating Range
133	CY7C1329H-133AXC	51-85050	100-pin Thin Quad Flat Pack (14 × 20 × 1.4 mm) Pb-free	Commercial

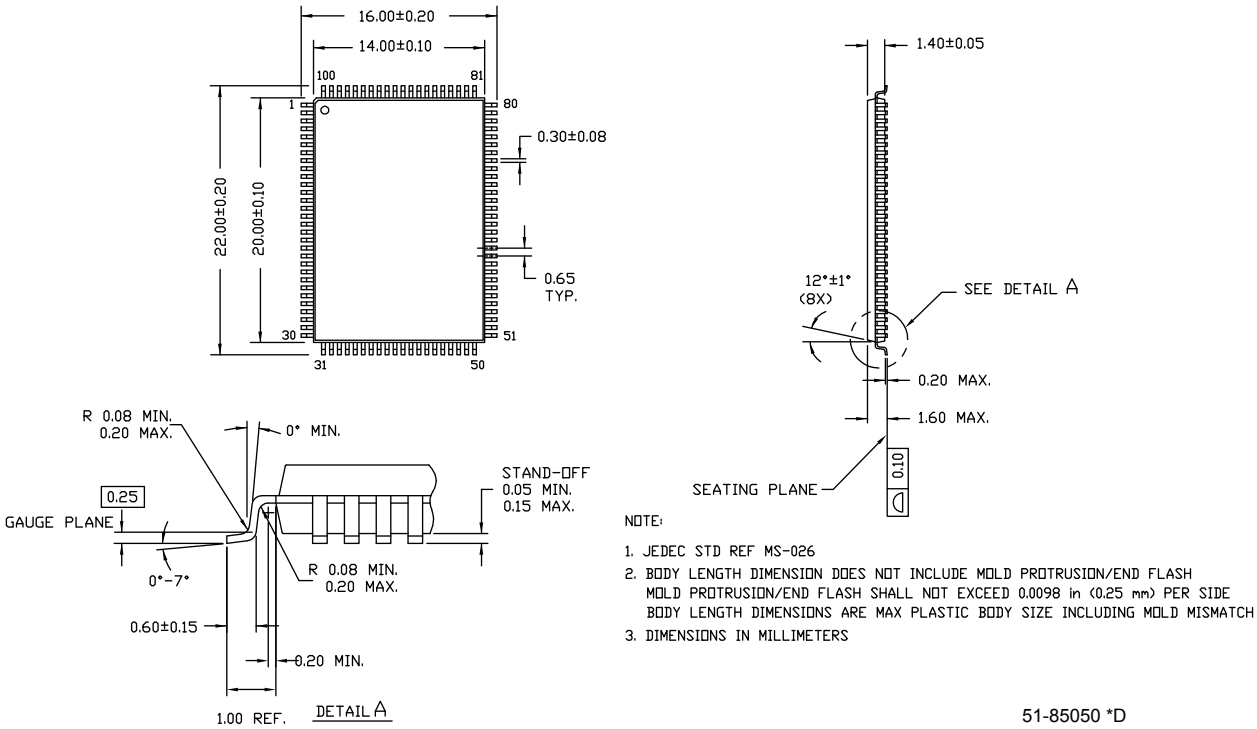
Ordering Code Definitions



[+] Feedback

Package Diagram

Figure 7. 100-pin TQFP (14 × 20 × 1.4 mm) A100RA, 51-85050



[+] Feedback

Acronyms

Acronym	Description
$\overline{CE}$	chip enable
CMOS	complementary metal oxide semiconductor
I/O	input/output
$\overline{OE}$	output enable
SRAM	static random access memory
TQFP	thin quad flat pack
TTL	transistor-transistor logic

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
µA	micro Amperes
µs	micro seconds
mA	milli Amperes
mm	milli meter
ms	milli seconds
mV	milli Volts
mW	milli Watts
MHz	Mega Hertz
ns	nano seconds
%	percent
pF	pico Farad
V	Volts
W	Watts

Document History Page

Document Title: CY7C1329H, 2-Mbit (64 K × 32) Pipelined Sync SRAM Document Number: 38-05673				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	347357	See ECN	PCI	New Data Sheet
*A	424820	See ECN	RXU	Converted from Preliminary to Final. Changed address of Cypress Semiconductor Corporation on Page# 1 from “3901 North First Street” to “198 Champion Court” Changed Three-State to Tri-State. Modified “Input Load” to “Input Leakage Current except ZZ and MODE” in the Electrical Characteristics Table. Modified test condition from $V_{IH} \leq V_{DD}$ to $V_{IH} < V_{DD}$ Replaced Package Name column with Package Diagram in the Ordering Information table. Updated the Ordering Information Table. Replaced Package Diagram of 51-85050 from *A to *B
*B	433014	See ECN	NXR	Included 3.3V I/O option Updated the Ordering Information table.
*C	2896585	03/20/2010	NJY	Removed obsolete part numbers from Ordering Information table and updated package diagrams.
*D	3052882	10/08/2010	NJY	Removed obsolete part numbers from Ordering Information table and added Ordering definitions.
*E	3293640	06/27/2011	NJY	Updated Package Diagram. Added Acronyms and Units of Measure. Updated in new template.

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