

36-Mbit (1M × 36/2M × 18) Pipelined SRAM with NoBL™ Architecture

Features

- Pin compatible and functionally equivalent to ZBT™
- Supports 250-MHz bus operations with zero wait states
 - Available speed grades are 250 and 167 MHz
- Internally self-timed output buffer control to eliminate the need to use asynchronous OE
- Fully registered (inputs and outputs) for pipelined operation
- Byte Write capability
- 2.5-V core power supply
- 2.5-V I/O power supply
- Fast clock-to-output times
 - 2.6 ns (for 250-MHz device)
- Clock Enable ($\overline{\text{CEN}}$) pin to suspend operation
- Synchronous self-timed writes
- CY7C1460SV25 available in JEDEC-standard Pb-free 100-pin TQFP package and non Pb-free 165-ball FBGA package. CY7C1462SV25 available in Pb-free 100-pin TQFP package
- IEEE 1149.1 JTAG-Compatible Boundary Scan
- Burst capability – linear or interleaved burst order
- “ZZ” Sleep Mode option and Stop Clock option

Functional Description

The CY7C1460SV25/CY7C1462SV25 are 2.5 V, 1M × 36/2M × 18 Synchronous pipelined burst SRAMs with No Bus Latency™ (NoBL™) logic, respectively. They are designed to support unlimited true back to back Read/Write operations with no wait states. The CY7C1460SV25/CY7C1462SV25 are equipped with the advanced (NoBL) logic required to enable consecutive Read/Write operations with data being transferred on every clock cycle. This feature dramatically improves the throughput of data in systems that require frequent Write/Read transitions. CY7C1460SV25/CY7C1462SV25 are pin compatible and functionally equivalent to ZBT devices.

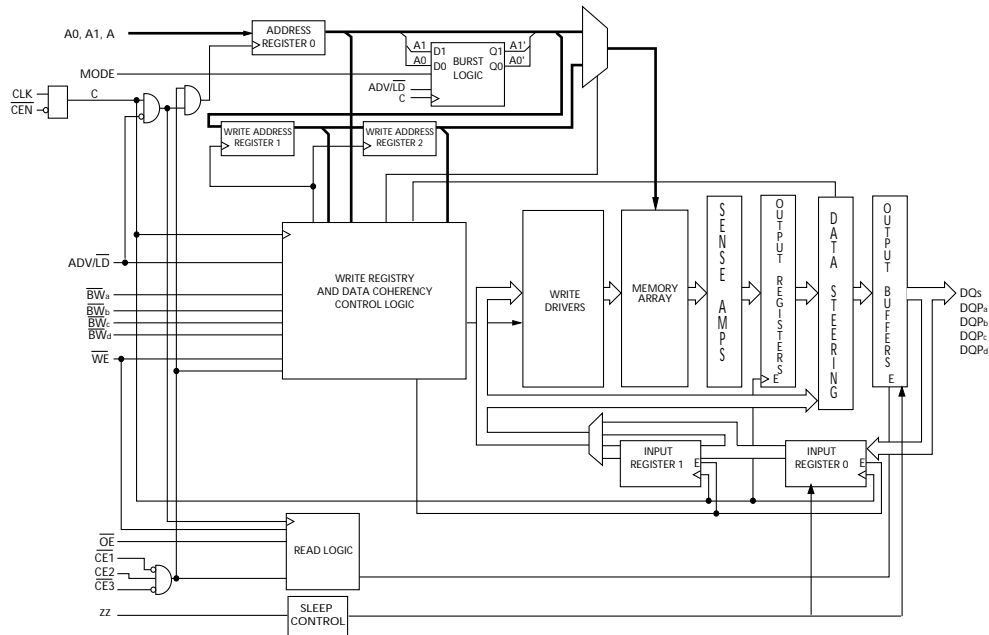
All synchronous inputs pass through input registers controlled by the rising edge of the clock. All data outputs pass through output registers controlled by the rising edge of the clock. The clock input is qualified by the Clock Enable ($\overline{\text{CEN}}$) signal, which when deasserted suspends operation and extends the previous clock cycle. Write operations are controlled by the Byte Write Selects ($\overline{\text{BW}}_a$ – $\overline{\text{BW}}_d$ for CY7C1460SV25 and $\overline{\text{BW}}_a$ – $\overline{\text{BW}}_b$ for CY7C1462SV25) and a Write Enable ($\overline{\text{WE}}$) input. All writes are conducted with on-chip synchronous self-timed write circuitry.

Three synchronous Chip Enables ($\overline{\text{CE}}_1$, $\overline{\text{CE}}_2$, $\overline{\text{CE}}_3$) and an asynchronous Output Enable ($\overline{\text{OE}}$) provide for easy bank selection and output tristate control. To avoid bus contention, the output drivers are synchronously tristated during the data portion of a write sequence.

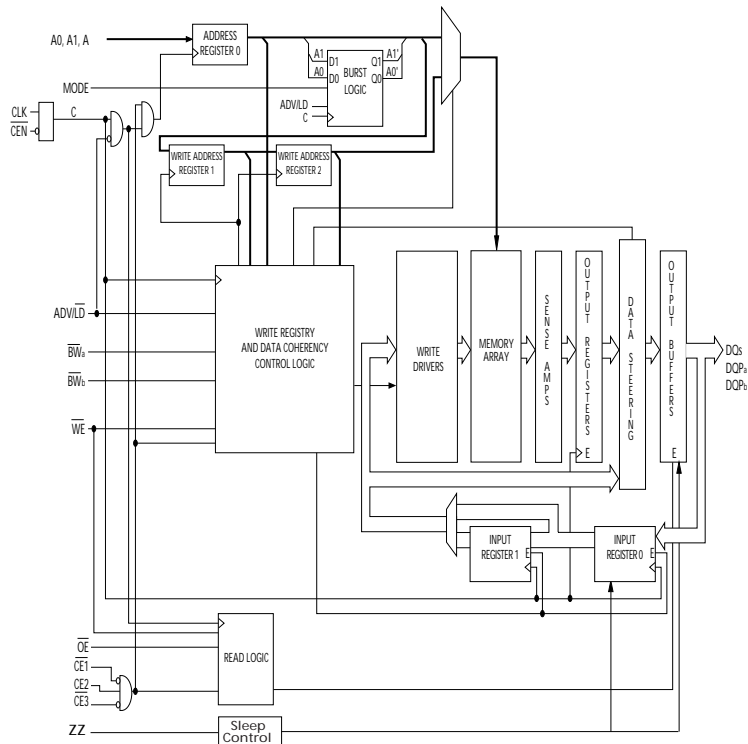
Selection Guide

Description	250 MHz	167 MHz	Unit
Maximum access time	2.6	3.4	ns
Maximum operating current	435	335	mA
Maximum CMOS standby current	120	120	mA

Logic Block Diagram – CY7C1460SV25



Logic Block Diagram – CY7C1462SV25

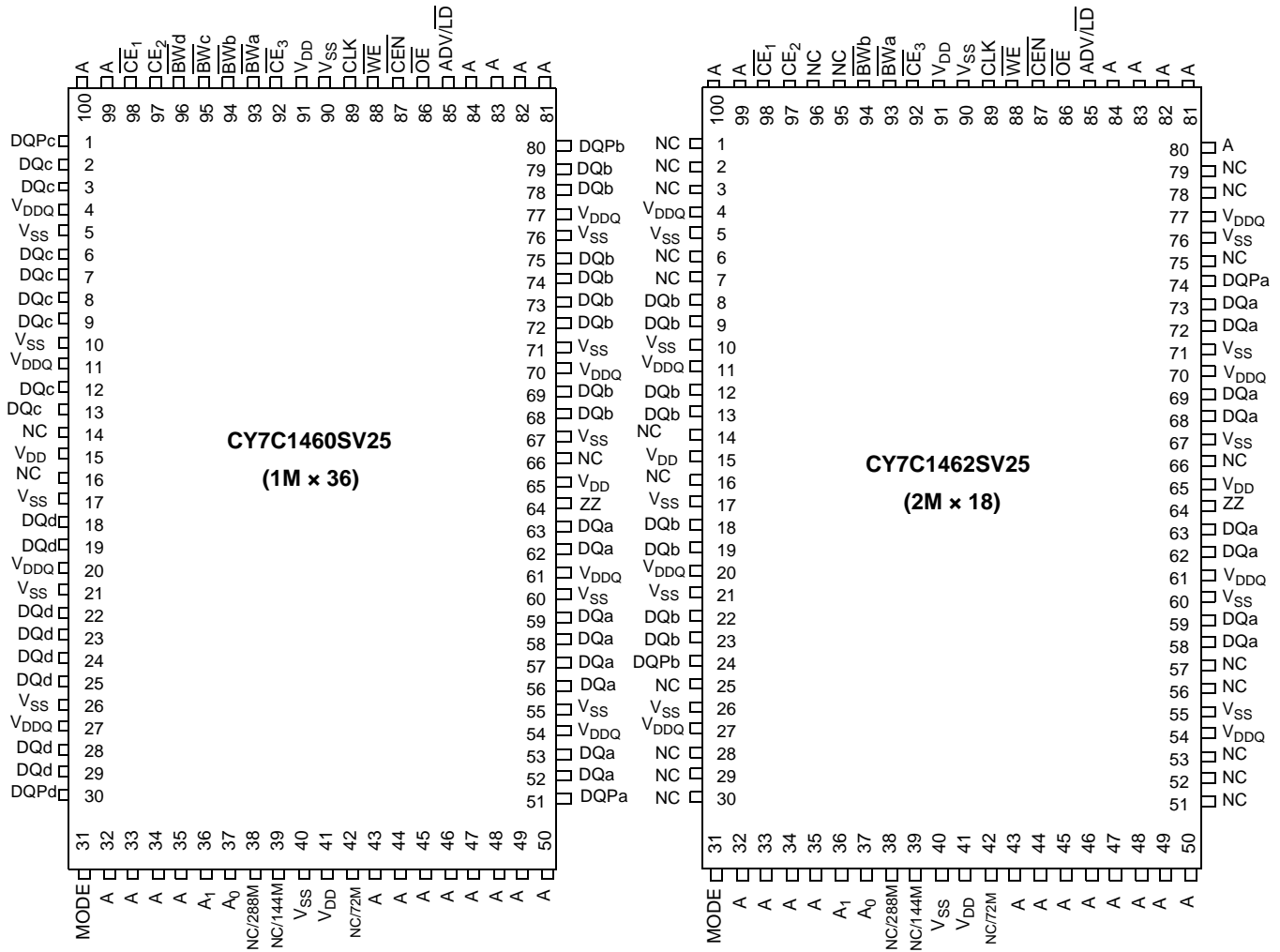


Contents

Pin Configurations	4	Identification Register Definitions	17
Pin Definitions	6	Scan Register Sizes	17
Functional Overview	7	Identification Codes	17
Single Read Accesses	7	Boundary Scan Order	18
Burst Read Accesses	7	Maximum Ratings	19
Single Write Accesses	7	Operating Range	19
Burst Write Accesses	8	Electrical Characteristics	19
Sleep Mode	8	DC Electrical Characteristics	19
Interleaved Burst Address Table	8	Capacitance	20
Linear Burst Address Table	8	Thermal Resistance	20
ZZ Mode Electrical Characteristics	8	AC Test Loads and Waveforms	20
Truth Table	9	Switching Characteristics	21
Partial Write Cycle Description	10	Switching Waveforms	22
IEEE 1149.1 Serial Boundary Scan (JTAG)	11	Ordering Information	25
Disabling the JTAG Feature	11	Ordering Code Definitions	25
Test Access Port (TAP)	11	Package Diagrams	26
PERFORMING A TAP RESET	11	Acronyms	28
TAP REGISTERS	11	Document Conventions	28
TAP Instruction Set	11	Units of Measure	28
TAP Controller State Diagram	13	Document History Page	29
TAP Controller Block Diagram	14	Sales, Solutions, and Legal Information	31
TAP Timing	15	Worldwide Sales and Design Support	31
TAP AC Switching Characteristics	15	Products	31
2.5 V TAP AC Test Conditions	16	PSoC@Solutions	31
2.5 V TAP AC Output Load Equivalent	16	Cypress Developer Community	31
TAP DC Electrical Characteristics and Operating Conditions	16	Technical Support	31

Pin Configurations

Figure 1. 100-pin TQFP (14 × 20 × 1.4 mm) pinout



Pin Configurations (continued)

Figure 2. 165-ball FBGA (15 × 17 × 1.4 mm) pinout

CY7C1460SV25 (1M × 36)

	1	2	3	4	5	6	7	8	9	10	11
A	NC/576M	A	\overline{CE}_1	\overline{BW}_c	\overline{BW}_b	\overline{CE}_3	\overline{CEN}	ADV/ \overline{LD}	A	A	NC
B	NC/1G	A	CE2	\overline{BW}_d	\overline{BW}_a	CLK	\overline{WE}	\overline{OE}	A	A	NC
C	DQP _c	NC	V _{DDQ}	V _{SS}	V _{SS}	V _{SS}	V _{SS}	V _{SS}	V _{DDQ}	NC	DQP _b
D	DQ _c	DQ _c	V _{DDQ}	V _{DD}	V _{SS}	V _{SS}	V _{SS}	V _{DD}	V _{DDQ}	DQ _b	DQ _b
E	DQ _c	DQ _c	V _{DDQ}	V _{DD}	V _{SS}	V _{SS}	V _{SS}	V _{DD}	V _{DDQ}	DQ _b	DQ _b
F	DQ _c	DQ _c	V _{DDQ}	V _{DD}	V _{SS}	V _{SS}	V _{SS}	V _{DD}	V _{DDQ}	DQ _b	DQ _b
G	DQ _c	DQ _c	V _{DDQ}	V _{DD}	V _{SS}	V _{SS}	V _{SS}	V _{DD}	V _{DDQ}	DQ _b	DQ _b
H	NC	NC	NC	V _{DD}	V _{SS}	V _{SS}	V _{SS}	V _{DD}	NC	NC	ZZ
J	DQ _d	DQ _d	V _{DDQ}	V _{DD}	V _{SS}	V _{SS}	V _{SS}	V _{DD}	V _{DDQ}	DQ _a	DQ _a
K	DQ _d	DQ _d	V _{DDQ}	V _{DD}	V _{SS}	V _{SS}	V _{SS}	V _{DD}	V _{DDQ}	DQ _a	DQ _a
L	DQ _d	DQ _d	V _{DDQ}	V _{DD}	V _{SS}	V _{SS}	V _{SS}	V _{DD}	V _{DDQ}	DQ _a	DQ _a
M	DQ _d	DQ _d	V _{DDQ}	V _{DD}	V _{SS}	V _{SS}	V _{SS}	V _{DD}	V _{DDQ}	DQ _a	DQ _a
N	DQP _d	NC	V _{DDQ}	V _{SS}	NC	NC	NC	V _{SS}	V _{DDQ}	NC	DQP _a
P	NC/144M	NC/72M	A	A	TDI	A1	TDO	A	A	A	NC/288M
R	MODE	A	A	A	TMS	A0	TCK	A	A	A	A

Pin Definitions

Pin Name	I/O Type	Pin Description
A ₀ , A ₁ , A	Input-Synchronous	Address Inputs Used to Select One of the Address Locations. Sampled at the rising edge of the CLK.
\overline{BW}_a , \overline{BW}_b , \overline{BW}_c , \overline{BW}_d	Input-Synchronous	Byte Write Select Inputs, Active LOW. Qualified with \overline{WE} to conduct writes to the SRAM. Sampled on the rising edge of CLK. \overline{BW}_a controls DQ _a and DQP _a , \overline{BW}_b controls DQ _b and DQP _b , \overline{BW}_c controls DQ _c and DQP _c , \overline{BW}_d controls DQ _d and DQP _d .
\overline{WE}	Input-Synchronous	Write Enable Input, Active LOW. Sampled on the rising edge of CLK if \overline{CEN} is active LOW. This signal must be asserted LOW to initiate a write sequence.
ADV/LD	Input-Synchronous	Advance/Load Input Used to Advance the On Chip Address Counter or Load a New Address. When HIGH (and \overline{CEN} is asserted LOW) the internal burst counter is advanced. When LOW, a new address can be loaded into the device for an access. After being deselected, ADV/LD should be driven LOW to load a new address.
CLK	Input-Clock	Clock Input. Used to capture all synchronous inputs to the device. CLK is qualified with \overline{CEN} . CLK is only recognized if \overline{CEN} is active LOW.
\overline{CE}_1	Input-Synchronous	Chip Enable 1 Input, Active LOW. Sampled on the rising edge of CLK. Used in conjunction with \overline{CE}_2 and \overline{CE}_3 to select/deselect the device.
\overline{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.
\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 \overline{CE}_2 to select/deselect the device.
\overline{OE}	Input-Asynchronous	Output Enable, Active LOW. Combined with the synchronous logic block inside the device to control the direction of the I/O pins. When LOW, the I/O pins are allowed to behave as outputs. When deasserted HIGH, I/O pins are tristated, and act as input data pins. \overline{OE} is masked during the data portion of a write sequence, during the first clock when emerging from a deselected state and when the device has been deselected.
\overline{CEN}	Input-Synchronous	Clock Enable Input, Active LOW. When asserted LOW the clock signal is recognized by the SRAM. When deasserted HIGH the clock signal is masked. Since deasserting \overline{CEN} does not deselect the device, \overline{CEN} can be used to extend the previous cycle when required.
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 _X during the previous clock rise of the read cycle. The direction of the pins is controlled by \overline{OE} and the internal control logic. When \overline{OE} is asserted LOW, the pins can behave as outputs. When HIGH, DQ _a –DQ _d are placed in a tristate condition. The outputs are automatically tristated during the data portion of a write sequence, during the first clock when emerging from a deselected state, and when the device is deselected, regardless of the state of \overline{OE} .
DQP _a , DQP _b , DQP _c , DQP _d	I/O-Synchronous	Bidirectional Data Parity I/O Lines. Functionally, these signals are identical to DQ _[31:0] . During write sequences, DQP _a is controlled by \overline{BW}_a , DQP _b is controlled by \overline{BW}_b , DQP _c is controlled by \overline{BW}_c , and DQP _d is controlled by \overline{BW}_d .
MODE	Input Strap Pin	Mode Input. Selects the burst order of the device. Tied HIGH selects the interleaved burst order. Pulled LOW selects the linear burst order. MODE should not change states during operation. When left floating MODE defaults HIGH, to an interleaved burst order.
TDO	JTAG serial output Synchronous	Serial data Out to the JTAG Circuit. Delivers data on the negative edge of TCK.
TDI	JTAG serial input Synchronous	Serial data In to the JTAG Circuit. Sampled on the rising edge of TCK.
TMS	Test Mode Select Synchronous	This pin controls the Test Access Port State Machine. Sampled on the rising edge of TCK.

Pin Definitions (continued)

Pin Name	I/O Type	Pin Description
TCK	JTAG-Clock	Clock input to the JTAG Circuitry.
V _{DD}	Power Supply	Power supply inputs to the core of the device.
V _{DDQ}	I/O Power Supply	Power supply for the I/O circuitry.
V _{SS}	Ground	Ground for the device. Should be connected to ground of the system.
NC	N/A	No Connects. This pin is not connected to the die.
NC/72M	N/A	Not connected to the Die. Can be tied to any voltage level.
NC/144M	N/A	Not connected to the Die. Can be tied to any voltage level.
NC/288M	N/A	Not connected to the Die. Can be tied to any voltage level.
NC/576M	N/A	Not connected to the Die. Can be tied to any voltage level.
NC/1G	N/A	Not Connected to the Die. Can be tied to any voltage level.
ZZ	Input-Asynchronous	ZZ “sleep” Input. This active HIGH input places the device in a non time critical “sleep” condition with data integrity preserved. During normal operation, this pin must be LOW or left floating. ZZ pin has an internal pull down.

Functional Overview

The CY7C1460SV25/CY7C1462SV25 are synchronous pipelined Burst NoBL SRAMs designed specifically to eliminate wait states during Write/Read transitions. All synchronous inputs pass through input registers controlled by the rising edge of the clock. The clock signal is qualified with the Clock Enable input signal (CEN). If CEN is HIGH, the clock signal is not recognized and all internal states are maintained. All synchronous operations are qualified with CEN. All data outputs pass through output registers controlled by the rising edge of the clock. Maximum access delay from the clock rise (t_{CO}) is 2.6 ns (250-MHz device).

Accesses can be initiated by asserting all three Chip Enables (\overline{CE}_1 , \overline{CE}_2 , \overline{CE}_3) active at the rising edge of the clock. If Clock Enable (CEN) is active LOW and ADV/LD is asserted LOW, the address presented to the device is latched. The access can either be a read or write operation, depending on the status of the Write Enable (WE). $BW_{[x]}$ can be used to conduct byte write operations.

Write operations are qualified by the Write Enable (\overline{WE}). All writes are simplified with on-chip synchronous self-timed write circuitry.

Three synchronous Chip Enables (\overline{CE}_1 , \overline{CE}_2 , \overline{CE}_3) and an asynchronous Output Enable (\overline{OE}) simplify depth expansion. All operations (Reads, Writes, and Deselects) are pipelined. ADV/LD should be driven LOW after the device has been deselected to load a new address for the next operation.

Single Read Accesses

A read access is initiated when the following conditions are satisfied at clock rise: (1) CEN is asserted LOW, (2) \overline{CE}_1 , \overline{CE}_2 , and \overline{CE}_3 are ALL asserted active, (3) the Write Enable input signal \overline{WE} is deasserted HIGH, and (4) ADV/LD is asserted LOW. The address presented to the address inputs is latched into the Address Register and presented to the memory core and control logic. The control logic determines that a read access is in progress and allows the requested data to propagate to the

input of the output register. At the rising edge of the next clock the requested data is allowed to propagate through the output register and on to the data bus within 2.6 ns (250-MHz device) provided OE is active LOW. After the first clock of the read access the output buffers are controlled by \overline{OE} and the internal control logic. \overline{OE} must be driven LOW for the device to drive out the requested data. During the second clock, a subsequent operation (Read/Write/Deselect) can be initiated. Deselecting the device is also pipelined. Therefore, when the SRAM is deselected at clock rise by one of the chip enable signals, its output tristates following the next clock rise.

Burst Read Accesses

The CY7C1460SV25/CY7C1462SV25 have an on-chip burst counter that allows the user the ability to supply a single address and conduct up to four Reads without reasserting the address inputs. ADV/LD must be driven LOW to load a new address into the SRAM, as described in the [Single Read Accesses](#) section. The sequence of the burst counter is determined by the MODE input signal. A LOW input on MODE selects a linear burst mode, a HIGH selects an interleaved burst sequence. Both burst counters use A0 and A1 in the burst sequence, and wraps around when incremented sufficiently. A HIGH input on ADV/LD increments the internal burst counter regardless of the state of chip enables inputs or \overline{WE} . \overline{WE} is latched at the beginning of a burst cycle. Therefore, the type of access (Read or Write) is maintained throughout the burst sequence.

Single Write Accesses

Write access are initiated when the following conditions are satisfied at clock rise: (1) CEN is asserted LOW, (2) \overline{CE}_1 , \overline{CE}_2 , and \overline{CE}_3 are ALL asserted active, and (3) the write signal \overline{WE} is asserted LOW. The address presented to the address inputs is loaded into the Address Register. The write signals are latched into the Control Logic block.

On the subsequent clock rise the data lines are automatically tristated regardless of the state of the \overline{OE} input signal. This allows the external logic to present the data on DQ and DQP ($DQ_{a,b,c,d}/DQP_{a,b,c,d}$ for CY7C1460SV25 and $DQ_{a,b}/DQP_{a,b}$ for

CY7C1462SV25). In addition, the address for the subsequent access (Read/Write/Deselect) is latched into the Address Register (provided the appropriate control signals are asserted).

On the next clock rise, the data presented to DQ and DQP ($DQ_{a,b,c,d}/DQP_{a,b,c,d}$ for CY7C1460SV25 and $DQ_{a,b}/DQP_{a,b}$ for CY7C1462SV25) (or a subset for byte write operations, see Write Cycle Description table for details) inputs is latched into the device and the write is complete.

The data written during the Write operation is controlled by \overline{BW} ($BW_{a,b,c,d}$ for CY7C1460SV25 and $BW_{a,b}$ for CY7C1462SV25) signals. The CY7C1460SV25/CY7C1462SV25 provides byte write capability that is described in the Write Cycle Description table. Asserting the Write Enable input (WE) with the selected Byte Write Select (\overline{BW}) input selectively writes to only the desired bytes. Bytes not selected during a byte write operation remains unaltered. A synchronous self timed write mechanism has been provided to simplify the write operations. Byte write capability has been included to greatly simplify Read/Modify/Write sequences, which can be reduced to simple byte write operations.

Because CY7C1460SV25/CY7C1462SV25 are common I/O devices, data should not be driven into the device while the outputs are active. The Output Enable (\overline{OE}) can be deasserted HIGH before presenting data to the DQ and DQP ($DQ_{a,b,c,d}/DQP_{a,b,c,d}$ for CY7C1460SV25 and $DQ_{a,b}/DQP_{a,b}$ for CY7C1462SV25) inputs. Doing so tristates the output drivers. As a safety precaution, DQ and DQP ($DQ_{a,b,c,d}/DQP_{a,b,c,d}$ for CY7C1460SV25 and $DQ_{a,b}/DQP_{a,b}$ for CY7C1462SV25) are automatically tristated during the data portion of a write cycle, regardless of the state of OE.

Burst Write Accesses

The CY7C1460SV25/CY7C1462SV25 has an on-chip burst counter that allows the user the ability to supply a single address and conduct up to four \overline{WRITE} operations without reasserting the address inputs. $\overline{ADV}/\overline{LD}$ must be driven LOW to load the initial address, as described in the Single Write Access section. When $\overline{ADV}/\overline{LD}$ is driven HIGH on the subsequent clock rise, the chip enables (\overline{CE}_1 , \overline{CE}_2 , and \overline{CE}_3) and WE inputs are ignored and the burst counter is incremented. The correct \overline{BW} ($BW_{a,b,c,d}$ for CY7C1460SV25 and $BW_{a,b}$ for CY7C1462SV25) inputs must be

driven in each cycle of the burst write to write the correct bytes of data.

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 , \overline{CE}_2 , and \overline{CE}_3 , 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 A1:A0	Second Address A1:A0	Third Address A1:A0	Fourth Address A1:A0
00	01	10	11
01	00	11	10
10	11	00	01
11	10	01	00

Linear Burst Address Table

(MODE = GND)

First Address A1:A0	Second Address A1:A0	Third Address A1:A0	Fourth Address A1:A0
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	$ZZ \geq V_{DD} - 0.2 V$	–	100	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

Truth table for CY7C1460SV25/CY7C1462SV25 follows. [1, 2, 3, 4, 5, 6, 7]

Operation	Address Used	\overline{CE}	ZZ	ADV/LD	\overline{WE}	\overline{BW}_x	\overline{OE}	\overline{CEN}	CLK	DQ
Deselect Cycle	None	H	L	L	X	X	X	L	L-H	Tristate
Continue Deselect Cycle	None	X	L	H	X	X	X	L	L-H	Tristate
Read Cycle (Begin Burst)	External	L	L	L	H	X	L	L	L-H	Data Out (Q)
Read Cycle (Continue Burst)	Next	X	L	H	X	X	L	L	L-H	Data Out (Q)
NOP/Dummy Read (Begin Burst)	External	L	L	L	H	X	H	L	L-H	Tristate
Dummy Read (Continue Burst)	Next	X	L	H	X	X	H	L	L-H	Tristate
Write Cycle (Begin Burst)	External	L	L	L	L	L	X	L	L-H	Data In (D)
Write Cycle (Continue Burst)	Next	X	L	H	X	L	X	L	L-H	Data In (D)
NOP/WRITE ABORT (Begin Burst)	None	L	L	L	L	H	X	L	L-H	Tristate
WRITE ABORT (Continue Burst)	Next	X	L	H	X	H	X	L	L-H	Tristate
IGNORE CLOCK EDGE (Stall)	Current	X	L	X	X	X	X	H	L-H	-
Sleep MODE	None	X	H	X	X	X	X	X	X	Tristate

Notes

1. X = "Don't Care", H = Logic HIGH, L = Logic LOW, \overline{CE} stands for ALL Chip Enables active. $\overline{BW}_x = L$ signifies at least one Byte Write Select is active, $\overline{BW}_x = \text{Valid}$ signifies that the desired byte write selects are asserted, see Write Cycle Description table for details.
2. Write is defined by \overline{WE} and \overline{BW}_x . See Write Cycle Description table for details.
3. When a write cycle is detected, all IOs are tristated, even during byte writes.
4. The DQ and DQP pins are controlled by the current cycle and the \overline{OE} signal.
5. $\overline{CEN} = H$ inserts wait states.
6. Device powers up deselected and the IOs in a tristate condition, regardless of \overline{OE} .
7. \overline{OE} is asynchronous and is not sampled with the clock rise. It is masked internally during write cycles. During a read cycle DQ_s and $DQP_x = \text{Three-state}$ when \overline{OE} is inactive or when the device is deselected, and $DQ_s = \text{data}$ when \overline{OE} is active.

Partial Write Cycle Description

Partial Write Cycle Description for CY7C1460SV25/CY7C1462SV25 follows. [8, 9, 10, 11]

Function (CY7C1460SV25)	\overline{WE}	\overline{BW}_d	\overline{BW}_c	\overline{BW}_b	\overline{BW}_a
Read	H	X	X	X	X
Write – No bytes written	L	H	H	H	H
Write Byte a – (DQ _a and DQP _a)	L	H	H	H	L
Write Byte b – (DQ _b and DQP _b)	L	H	H	L	H
Write Bytes b, a	L	H	H	L	L
Write Byte c – (DQ _c and DQP _c)	L	H	L	H	H
Write Bytes c, a	L	H	L	H	L
Write Bytes c, b	L	H	LL	L	H
Write Bytes c, b, a	L	H	L	L	L
Write Byte d – (DQ _d and DQP _d)	L	L	H	H	H
Write Bytes d, a	L	L	H	H	L
Write Bytes d, b	L	L	H	L	H
Write Bytes d, b, a	L	L	H	L	L
Write Bytes d, c	L	L	L	H	H
Write Bytes d, c, a	L	L	L	H	L
Write Bytes d, c, b	L	L	L	L	H
Write All Bytes	L	L	L	L	L

Function (CY7C1462SV25)	\overline{WE}	\overline{BW}_b	\overline{BW}_a
Read	H	X	X
Write – No Bytes Written	L	H	H
Write Byte a – (DQ _a and DQP _a)	L	H	L
Write Byte b – (DQ _b and DQP _b)	L	L	H
Write Both Bytes	L	L	L

Notes

8. X = "Don't Care", H = Logic HIGH, L = Logic LOW, \overline{CE} stands for ALL Chip Enables active. $\overline{BW}_x = L$ signifies at least one Byte Write Select is active, $\overline{BW}_x = \text{Valid}$ signifies that the desired byte write selects are asserted, see Write Cycle Description table for details.
9. Write is defined by \overline{WE} and \overline{BW}_x . See Write Cycle Description table for details.
10. When a write cycle is detected, all IOs are tristated, even during byte writes.
11. Table only lists a partial listing of the byte write combinations. Any combination of \overline{BW}_x is valid. Appropriate write is done based on which byte write is active.

IEEE 1149.1 Serial Boundary Scan (JTAG)

The CY7C1460SV25 incorporates a serial boundary scan test access port (TAP). This part is fully compliant with 1149.1. The TAP operates using JEDEC-standard 2.5 V I/O logic level.

The CY7C1460SV25 contains a TAP controller, instruction register, boundary scan register, bypass register, and ID register.

Disabling the JTAG Feature

It is possible to operate the SRAM without using the JTAG feature. To disable the TAP controller, TCK must be tied LOW(V_{SS}) to prevent clocking of the device. TDI and TMS are internally pulled up and may be unconnected. They may alternately be connected to V_{DD} through a pull up resistor. TDO should be left unconnected. Upon power up, the device comes up in a reset state which does not interfere with the operation of the device.

Test Access Port (TAP)

Test Clock (TCK)

The test clock is used only with the TAP controller. All inputs are captured on the rising edge of TCK. All outputs are driven from the falling edge of TCK.

Test Mode Select (TMS)

The TMS input is used to give commands to the TAP controller and is sampled on the rising edge of TCK. It is allowable to leave this ball unconnected if the TAP is not used. The ball is pulled up internally, resulting in a logic HIGH level.

Test Data In (TDI)

The TDI ball is used to serially input information into the registers and can be connected to the input of any of the registers. The register between TDI and TDO is chosen by the instruction that is loaded into the TAP instruction register. For information on loading the instruction register, see [TAP Controller State Diagram on page 13](#). TDI is internally pulled up and can be unconnected if the TAP is unused in an application. TDI is connected to the most significant bit (MSB) of any register.

Test Data Out (TDO)

The TDO output ball is used to serially clock data out from the registers. The output is active depending upon the current state of the TAP state machine (see [Identification Codes on page 17](#)). The output changes on the falling edge of TCK. TDO is connected to the least significant bit (LSB) of any register.

Performing a TAP Reset

A RESET is performed by forcing TMS HIGH (V_{DD}) for five rising edges of TCK. This RESET does not affect the operation of the SRAM and may be performed while the SRAM is operating.

At power up, the TAP is reset internally to ensure that TDO comes up in a High Z state.

TAP Registers

Registers are connected between the TDI and TDO balls and scan data into and out of the SRAM test circuitry. Only one register can be selected at a time through the instruction register.

Data is serially loaded into the TDI ball on the rising edge of TCK. Data is output on the TDO ball on the falling edge of TCK.

Instruction Register

Three-bit instructions can be serially loaded into the instruction register. This register is loaded when it is placed between the TDI and TDO balls as shown in the [TAP Controller Block Diagram on page 14](#). Upon power up, the instruction register is loaded with the IDCODE instruction. It is also loaded with the IDCODE instruction if the controller is placed in a reset state as described in the previous section.

When the TAP controller is in the Capture IR state, the two least significant bits are loaded with a binary "01" pattern to allow for fault isolation of the board level serial test data path.

Bypass Register

To save time when serially shifting data through registers, it is sometimes advantageous to skip certain chips. The bypass register is a single-bit register that can be placed between the TDI and TDO balls. This shifts data through the SRAM with minimal delay. The bypass register is set LOW (V_{SS}) when the BYPASS instruction is executed.

Boundary Scan Register

The boundary scan register is connected to all the input and bidirectional balls on the SRAM. The length of the Boundary Scan Register for the SRAM in different packages is listed in the Scan Register Sizes table.

The boundary scan register is loaded with the contents of the RAM I/O ring when the TAP controller is in the Capture DR state and is then placed between the TDI and TDO balls when the controller is moved to the Shift DR state. The EXTEST, SAMPLE/PRELOAD and SAMPLE Z instructions can be used to capture the contents of the I/O ring.

The [Boundary Scan Order on page 18](#) show the order in which the bits are connected. Each bit corresponds to one of the bumps on the SRAM package. The MSB of the register is connected to TDI, and the LSB is connected to TDO.

Identification (ID) Register

The ID register is loaded with a vendor specific, 32-bit code during the Capture DR state when the IDCODE command is loaded in the instruction register. The IDCODE is hardwired into the SRAM and can be shifted out when the TAP controller is in the Shift DR state. The ID register has a vendor code and other information described in the [Identification Register Definitions on page 17](#).

TAP Instruction Set

Overview

Eight different instructions are possible with the three-bit instruction register. All combinations are listed in the [Identification Codes on page 17](#). Three of these instructions are listed as RESERVED and should not be used. The other five instructions are described in this section in detail.

Instructions are loaded into the TAP controller during the Shift IR state when the instruction register is placed between TDI and TDO. During this state, instructions are shifted through the instruction register through the TDI and TDO balls. To execute

the instruction after it is shifted in, the TAP controller is moved into the Update IR state.

IDCODE

The IDCODE instruction loads a vendor specific, 32-bit code into the instruction register. It also places the instruction register between the TDI and TDO balls and shifts the IDCODE out of the device when the TAP controller enters the Shift DR state.

The IDCODE instruction is loaded into the instruction register upon power up or whenever the TAP controller is given a test logic reset state.

SAMPLE Z

The SAMPLE Z instruction connects the boundary scan register between the TDI and TDO pins when the TAP controller is in a Shift DR state. The SAMPLE Z command puts the output bus into a High Z state until the next command is given during the "Update IR" state.

SAMPLE/PRELOAD

SAMPLE/PRELOAD is a 1149.1 mandatory instruction. When the SAMPLE/PRELOAD instructions are loaded into the instruction register and the TAP controller is in the Capture DR state, a snapshot of data on the inputs and output pins is captured in the boundary scan register.

The user must be aware that the TAP controller clock can only operate at a frequency up to 20 MHz, while the SRAM clock operates more than an order of magnitude faster. Because there is a large difference in the clock frequencies, it is possible that during the Capture DR state, an input or output undergoes a transition. The TAP may then try to capture a signal while in transition (metastable state). This does not harm the device, but there is no guarantee as to the value that is captured. Repeatable results may not be possible.

To guarantee that the boundary scan register captures the correct value of a signal, the SRAM signal must be stabilized long enough to meet the TAP controller's capture setup plus hold times (t_{CS} and t_{CH}). The SRAM clock input might not be captured correctly if there is no way in a design to stop (or slow) the clock during a SAMPLE/PRELOAD instruction. If this is an issue, it is still possible to capture all other signals and simply ignore the value of the CK and CK# captured in the boundary scan register.

After the data is captured, it is possible to shift out the data by putting the TAP into the Shift DR state. This places the boundary scan register between the TDI and TDO pins.

PRELOAD places an initial data pattern at the latched parallel outputs of the boundary scan register cells prior to the selection of another boundary scan test operation.

The shifting of data for the SAMPLE and PRELOAD phases can occur concurrently when required—that is, while data captured is shifted out, the preloaded data can be shifted in.

BYPASS

When the BYPASS instruction is loaded in the instruction register and the TAP is placed in a Shift DR state, the bypass register is placed between the TDI and TDO pins. The advantage of the BYPASS instruction is that it shortens the boundary scan path when multiple devices are connected together on a board.

EXTEST

The EXTEST instruction drives the preloaded data out through the system output pins. This instruction also connects the boundary scan register for serial access between the TDI and TDO in the shift DR controller state.

EXTEST Output Bus Tristate

IEEE Standard 1149.1 mandates that the TAP controller be able to put the output bus into a tristate mode.

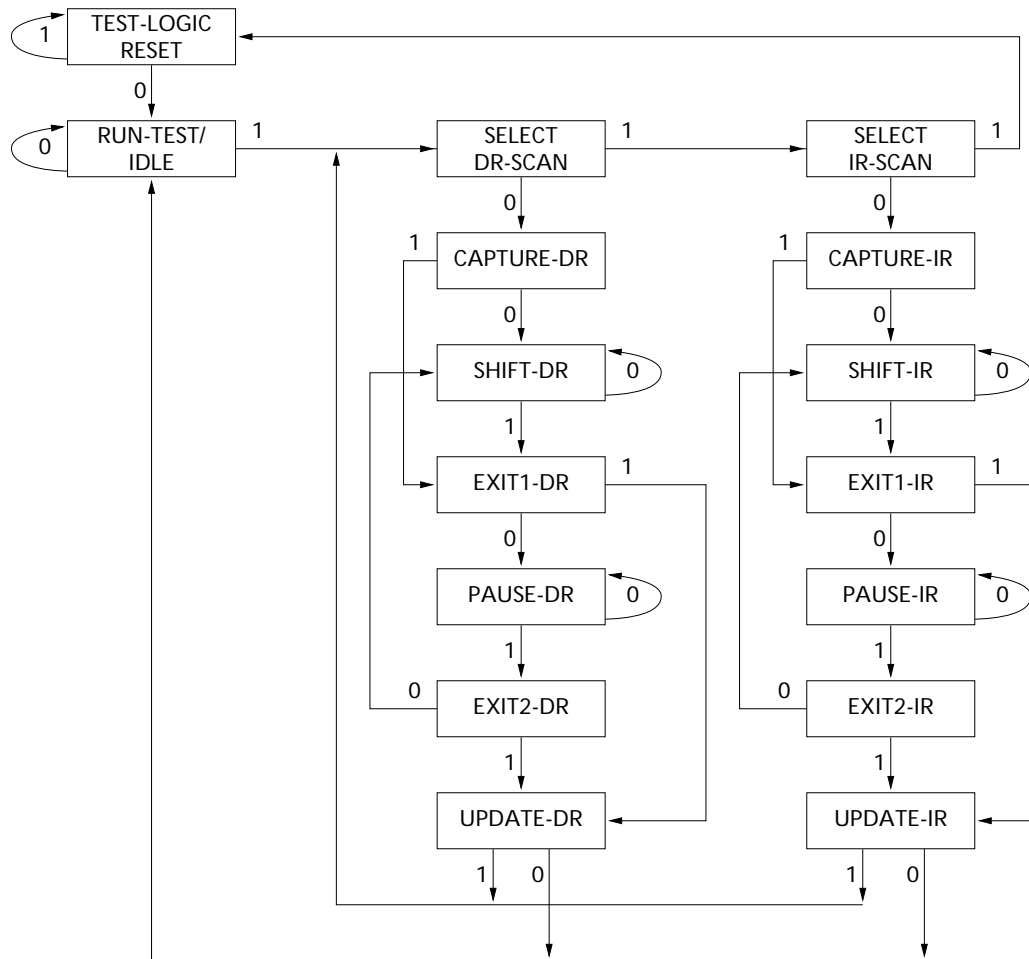
The boundary scan register has a special bit located at bit #89 (for 165-ball FBGA package). When this scan cell, called the "extest output bus tristate," is latched into the preload register during the "Update DR" state in the TAP controller, it directly control the state of the output (Q-bus) pins, when the EXTEST is entered as the current instruction. When HIGH, it enables the output buffers to drive the output bus. When LOW, this bit places the output bus into a High Z condition.

This bit can be set by entering the SAMPLE/PRELOAD or EXTEST command, and then shifting the desired bit into that cell, during the "Shift DR" state. During "Update DR," the value loaded into that shift register cell latches into the preload register. When the EXTEST instruction is entered, this bit directly control the output Q bus pins. Note that this bit is preset HIGH to enable the output when the device is powered up, and also when the TAP controller is in the "Test-Logic-Reset" state.

Reserved

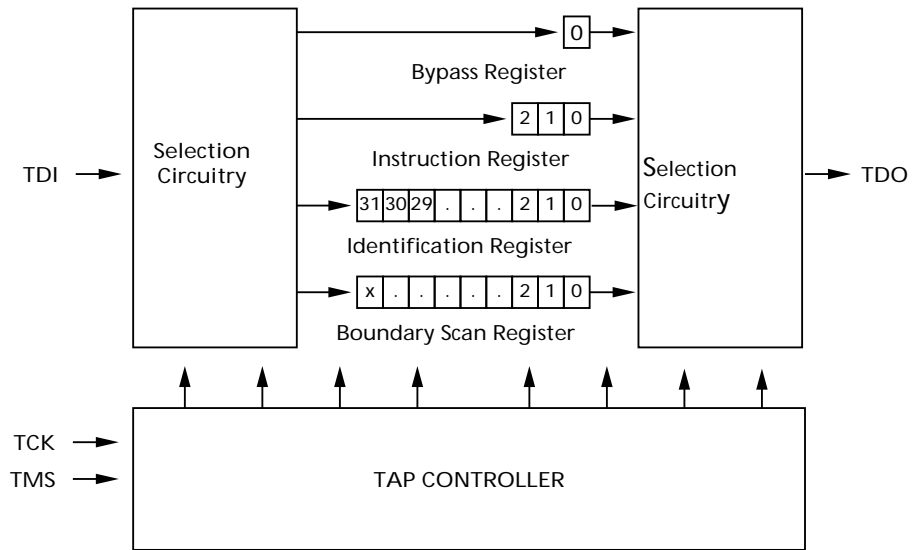
These instructions are not implemented but are reserved for future use. Do not use these instructions.

TAP Controller State Diagram



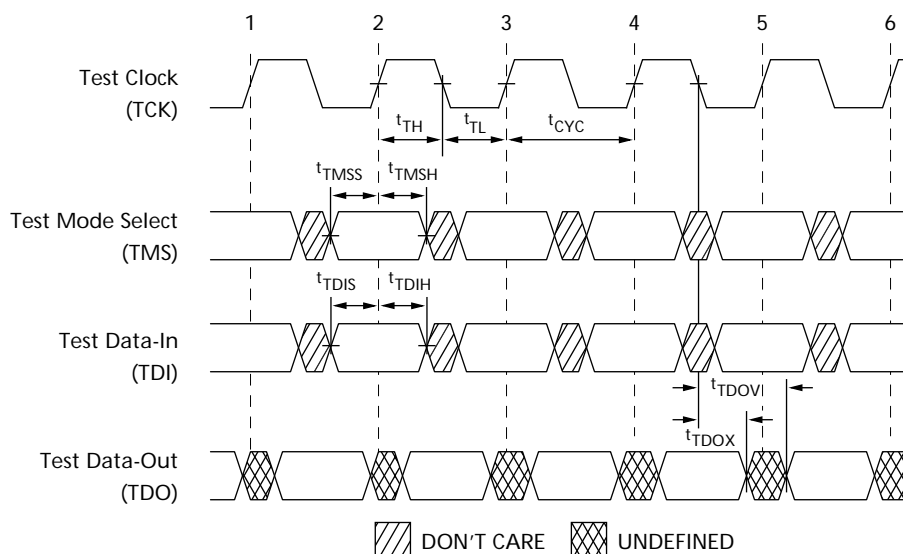
The 0/1 next to each state represents the value of TMS at the rising edge of TCK.

TAP Controller Block Diagram



TAP Timing

Figure 3. TAP Timing



TAP AC Switching Characteristics

Over the Operating Range

Parameter ^[9, 10]	Description	Min	Max	Unit
Clock				
t_{TCYC}	TCK Clock Cycle Time	50	–	ns
t_{TF}	TCK Clock Frequency	–	20	MHz
t_{TH}	TCK Clock HIGH time	20	–	ns
t_{TL}	TCK Clock LOW time	20	–	ns
Output Times				
t_{TDOV}	TCK Clock LOW to TDO Valid	–	10	ns
t_{TDOX}	TCK Clock LOW to TDO Invalid	0	–	ns
Setup Times				
t_{TMSS}	TMS Setup to TCK Clock Rise	5	–	ns
t_{TDIS}	TDI Setup to TCK Clock Rise	5	–	ns
t_{CS}	Capture Setup to TCK Rise	5	–	ns
Hold Times				
t_{TMSH}	TMS Hold after TCK Clock Rise	5	–	ns
t_{TDIH}	TDI Hold after Clock Rise	5	–	ns
t_{CH}	Capture Hold after Clock Rise	5	–	ns

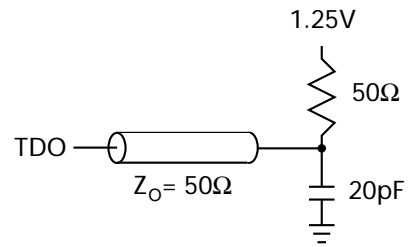
Notes

9. t_{CS} and t_{CH} refer to the setup and hold time requirements of latching data from the boundary scan register.
10. Test conditions are specified using the load in TAP AC test Conditions. $t_R/t_F = 1$ ns.

2.5 V TAP AC Test Conditions

Input pulse levels V_{SS} to 2.5 V
 Input rise and fall time 1 ns
 Input timing reference levels 1.25 V
 Output reference levels 1.25 V
 Test load termination supply voltage 1.25 V

2.5 V TAP AC Output Load Equivalent



TAP DC Electrical Characteristics and Operating Conditions

(0 °C < T_A < +70 °C; $V_{DD} = 2.5 V \pm 0.125 V$ unless otherwise noted)

Parameter ^[11]	Description	Test Conditions		Min	Max	Unit
V_{OH1}	Output HIGH Voltage	$I_{OH} = -1.0 \text{ mA}$	$V_{DDQ} = 2.5 \text{ V}$	1.7	–	V
V_{OH2}	Output HIGH Voltage	$I_{OH} = -100 \mu\text{A}$	$V_{DDQ} = 2.5 \text{ V}$	2.1	–	V
V_{OL1}	Output LOW Voltage	$I_{OL} = 1.0 \text{ mA}$	$V_{DDQ} = 2.5 \text{ V}$	–	0.4	V
V_{OL2}	Output LOW Voltage	$I_{OL} = 100 \mu\text{A}$	$V_{DDQ} = 2.5 \text{ V}$	–	0.2	V
V_{IH}	Input HIGH Voltage		$V_{DDQ} = 2.5 \text{ V}$	1.7	$V_{DD} + 0.3$	V
V_{IL}	Input LOW Voltage		$V_{DDQ} = 2.5 \text{ V}$	–0.3	0.7	V
I_X	Input Load Current	$GND \leq V_I \leq V_{DDQ}$		–5	5	μA

Note

11. All voltages referenced to V_{SS} (GND).

Identification Register Definitions

Instruction Field	CY7C1460SV25 (1M x 36)	Description
Revision Number (31:29)	000	Describes the version number
Device Depth (28:24)	01011	Reserved for Internal Use
Architecture/Memory Type(23:18)	001000	Defines memory type and architecture
Bus Width/Density(17:12)	100111	Defines width and density
Cypress JEDEC ID Code (11:1)	00000110100	Allows unique identification of SRAM vendor
ID Register Presence Indicator (0)	1	Indicates the presence of an ID register

Scan Register Sizes

Register Name	Bit Size (x 36)
Instruction	3
Bypass	1
ID	32
Boundary Scan Order (165-ball FBGA package)	89

Identification Codes

Instruction	Code	Description
EXTEST	000	Captures I/O ring contents. Places the boundary scan register between TDI and TDO. Forces all SRAM outputs to High Z state.
IDCODE	001	Loads the ID register with the vendor ID code and places the register between TDI and TDO. This operation does not affect SRAM operations.
SAMPLE Z	010	Captures I/O ring contents. Places the boundary scan register between TDI and TDO. Forces all SRAM output drivers to a High Z state.
RESERVED	011	Do Not Use: This instruction is reserved for future use.
SAMPLE/PRELOAD	100	Captures I/O ring contents. Places the boundary scan register between TDI and TDO. Does not affect SRAM operation.
RESERVED	101	Do Not Use: This instruction is reserved for future use.
RESERVED	110	Do Not Use: This instruction is reserved for future use.
BYPASS	111	Places the bypass register between TDI and TDO. This operation does not affect SRAM operations.

Boundary Scan Order

165-ball FBGA ^[12]

CY7C1460SV25 (1 M × 36)

Bit#	Ball ID
1	N6
2	N7
3	N10
4	P11
5	P8
6	R8
7	R9
8	P9
9	P10
10	R10
11	R11
12	H11
13	N11
14	M11
15	L11
16	K11
17	J11
18	M10
19	L10
20	K10
21	J10
22	H9
23	H10
24	G11
25	F11

Bit#	Ball ID
26	E11
27	D11
28	G10
29	F10
30	E10
31	D10
32	C11
33	A11
34	B11
35	A10
36	B10
37	A9
38	B9
39	C10
40	A8
41	B8
42	A7
43	B7
44	B6
45	A6
46	B5
47	A5
48	A4
49	B4
50	B3

Bit#	Ball ID
51	A3
52	A2
53	B2
54	C2
55	B1
56	A1
57	C1
58	D1
59	E1
60	F1
61	G1
62	D2
63	E2
64	F2
65	G2
66	H1
67	H3
68	J1
69	K1
70	L1
71	M1
72	J2
73	K2
74	L2
75	M2

Bit#	Ball ID
76	N1
77	N2
78	P1
79	R1
80	R2
81	P3
82	R3
83	P2
84	R4
85	P4
86	N5
87	P6
88	R6
89	Internal

Note

12. Bit# 89 is preset HIGH.

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 +3.6 V

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

DC to Outputs in Tristate -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	2.5 V - 5% / + 5%	1.7 V to V _{DD}

Electrical Characteristics

Over the Operating Range

DC Electrical Characteristics

Over the Operating Range

Parameter ^[14, 15]	Description	Test Conditions	Min	Max	Unit	
V _{DD}	Power Supply Voltage		2.375	2.625	V	
V _{DDQ}	I/O Supply Voltage	for 2.5 V I/O	2.375	V _{DD}	V	
V _{OH}	Output HIGH Voltage	for 2.5 V I/O, I _{OH} = -1.0 mA	2.0	-	V	
V _{OL}	Output LOW Voltage	for 2.5 V I/O, I _{OL} = 1.0 mA	-	0.4	V	
V _{IH}	Input HIGH Voltage ^[14]	for 2.5 V I/O	1.7	V _{DD} + 0.3	V	
V _{IL}	Input LOW Voltage ^[14]	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 = 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} ^[16]	V _{DD} Operating Supply	V _{DD} = Max, I _{OUT} = 0 mA, f = f _{MAX} = 1/t _{CYC}	4-ns cycle, 250 MHz	-	435	mA
			6-ns cycle, 167 MHz	-	335	mA
I _{SB1}	Automatic CE Power down Current – TTL Inputs	Max. V _{DD} , Device Deselected, V _{IN} ≥ V _{IH} or V _{IN} ≤ V _{IL} , f = f _{MAX} = 1/t _{CYC}	All speed grades	-	185	mA
I _{SB2}	Automatic CE Power down Current – CMOS Inputs	Max. V _{DD} , Device Deselected, V _{IN} ≤ 0.3 V or V _{IN} ≥ V _{DDQ} - 0.3 V, f = 0	All speed grades	-	120	mA

Notes

14. Overshoot: V_{IH(AC)} < V_{DD} + 1.5 V (Pulse width less than t_{CYC}/2), undershoot: V_{IL(AC)} > -2V (Pulse width less than t_{CYC}/2).

15. T_{Power-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} ≤ V_{DD}.

16. The operation current is calculated with 50% read cycle and 50% write cycle.

Electrical Characteristics (continued)

Over the Operating Range

DC Electrical Characteristics (continued)

Over the Operating Range

Parameter [14, 15]	Description	Test Conditions	Min	Max	Unit
I_{SB3}	Automatic CE Power down Current – CMOS Inputs	Max. V_{DD} , Device Deselected, $V_{IN} \leq 0.3 V$ or $V_{IN} \geq V_{DDQ} - 0.3 V$, $f = f_{MAX} = 1/t_{CYC}$	–	160	mA
I_{SB4}	Automatic CE Power down Current – TTL Inputs	Max. V_{DD} , Device Deselected, $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$, $f = 0$	–	135	mA

Capacitance

Parameter [17]	Description	Test Conditions	100-pin TQFP Max	165-ball FBGA Max	Unit
C_{IN}	Input capacitance	$T_A = 25\text{ }^\circ\text{C}$, $f = 1\text{ MHz}$, $V_{DD} = 2.5\text{ V}$, $V_{DDQ} = 2.5\text{ V}$	6.5	7	pF
C_{CLK}	Clock input capacitance		3	7	pF
C_{IO}	Input/Output capacitance		5.5	6	pF

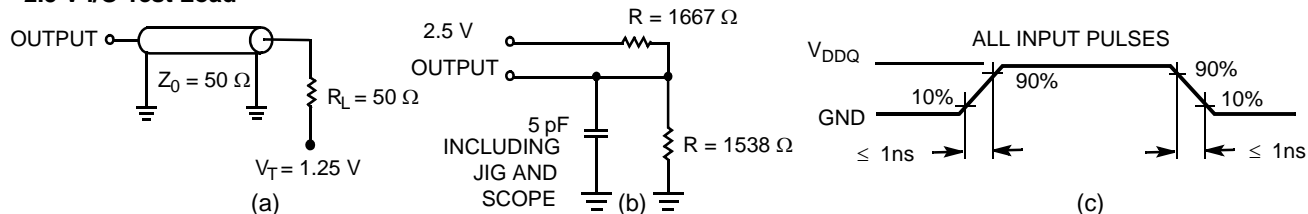
Thermal Resistance

Parameter [17]	Description	Test Conditions	100-pin TQFP Package	165-ball FBGA Package	Unit
Θ_{JA}	Thermal resistance (junction to ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, per EIA/JESD51.	25.21	20.8	$^\circ\text{C/W}$
Θ_{JC}	Thermal resistance (junction to case)		2.58	3.2	$^\circ\text{C/W}$

AC Test Loads and Waveforms

Figure 4. AC Test Loads and Waveforms

2.5 V I/O Test Load



Note

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

Switching Characteristics

Over the Operating Range

Parameter [18, 19]	Description	-250		-167		Unit
		Min	Max	Min	Max	
$t_{Power}^{[20]}$	V_{CC} (typical) to the first access read or write	1	–	1	–	ms
Clock						
t_{CYC}	Clock Cycle Time	4.0	–	6.0	–	ns
F_{MAX}	Maximum Operating Frequency	–	250	–	167	MHz
t_{CH}	Clock HIGH	1.5	–	2.4	–	ns
t_{CL}	Clock LOW	1.5	–	2.4	–	ns
Output Times						
t_{CO}	Data Output Valid After CLK Rise	–	2.6	–	3.4	ns
t_{EOV}	\overline{OE} LOW to Output Valid	–	2.6	–	3.4	ns
t_{DOH}	Data Output Hold After CLK Rise	1.0	–	1.5	–	ns
t_{CHZ}	Clock to High Z [21, 22, 23]	–	2.6	–	3.4	ns
t_{CLZ}	Clock to Low Z [21, 22, 23]	1.0	–	1.5	–	ns
t_{EOHZ}	\overline{OE} HIGH to Output High Z [21, 22, 23]	–	2.6	–	3.4	ns
t_{EOLZ}	\overline{OE} LOW to Output Low Z [21, 22, 23]	0	–	0	–	ns
Setup Times						
t_{AS}	Address Setup Before CLK Rise	1.2	–	1.5	–	ns
t_{DS}	Data Input Setup Before CLK Rise	1.2	–	1.5	–	ns
t_{CENS}	\overline{CEN} Setup Before CLK Rise	1.2	–	1.5	–	ns
t_{WES}	\overline{WE} , \overline{BW}_x Setup Before CLK Rise	1.2	–	1.5	–	ns
t_{ALS}	$\overline{ADV/LD}$ Setup Before CLK Rise	1.2	–	1.5	–	ns
t_{CES}	Chip Select Setup	1.2	–	1.5	–	ns
Hold Times						
t_{AH}	Address Hold After CLK Rise	0.3	–	0.5	–	ns
t_{DH}	Data Input Hold After CLK Rise	0.3	–	0.5	–	ns
t_{CENH}	\overline{CEN} Hold After CLK Rise	0.3	–	0.5	–	ns
t_{WEH}	\overline{WE} , \overline{BW}_x Hold After CLK Rise	0.3	–	0.5	–	ns
t_{ALH}	$\overline{ADV/LD}$ Hold after CLK Rise	0.3	–	0.5	–	ns
t_{CEH}	Chip Select Hold After CLK Rise	0.3	–	0.5	–	ns

Notes

18. Timing reference is 1.25 V when $V_{DDQ} = 2.5$ V.

19. Test conditions shown in (a) of Figure 4 on page 20 unless otherwise noted.

20. This part has a voltage regulator internally; t_{Power} is the time power is supplied above V_{DD} minimum initially, before a Read or Write operation can be initiated.

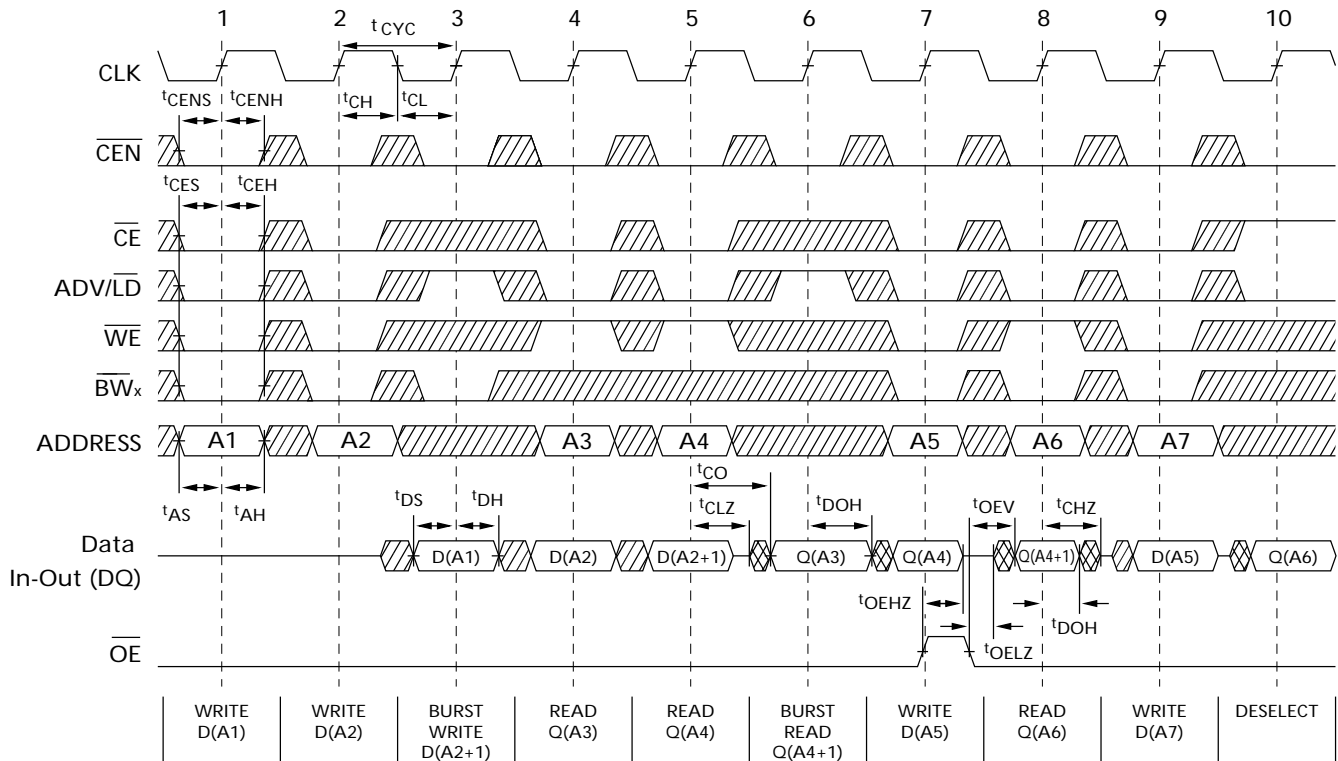
21. t_{CHZ} , t_{CLZ} , t_{EOLZ} , and t_{EOHZ} are specified with AC test conditions shown in (b) of Figure 4 on page 20. Transition is measured ± 200 mV from steady state voltage.

22. At any given voltage and temperature, t_{EOHZ} is less than t_{EOLZ} 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.

23. This parameter is sampled and not 100% tested.

Switching Waveforms

Figure 5. Read/Write/Timing [24, 25, 26]



Notes

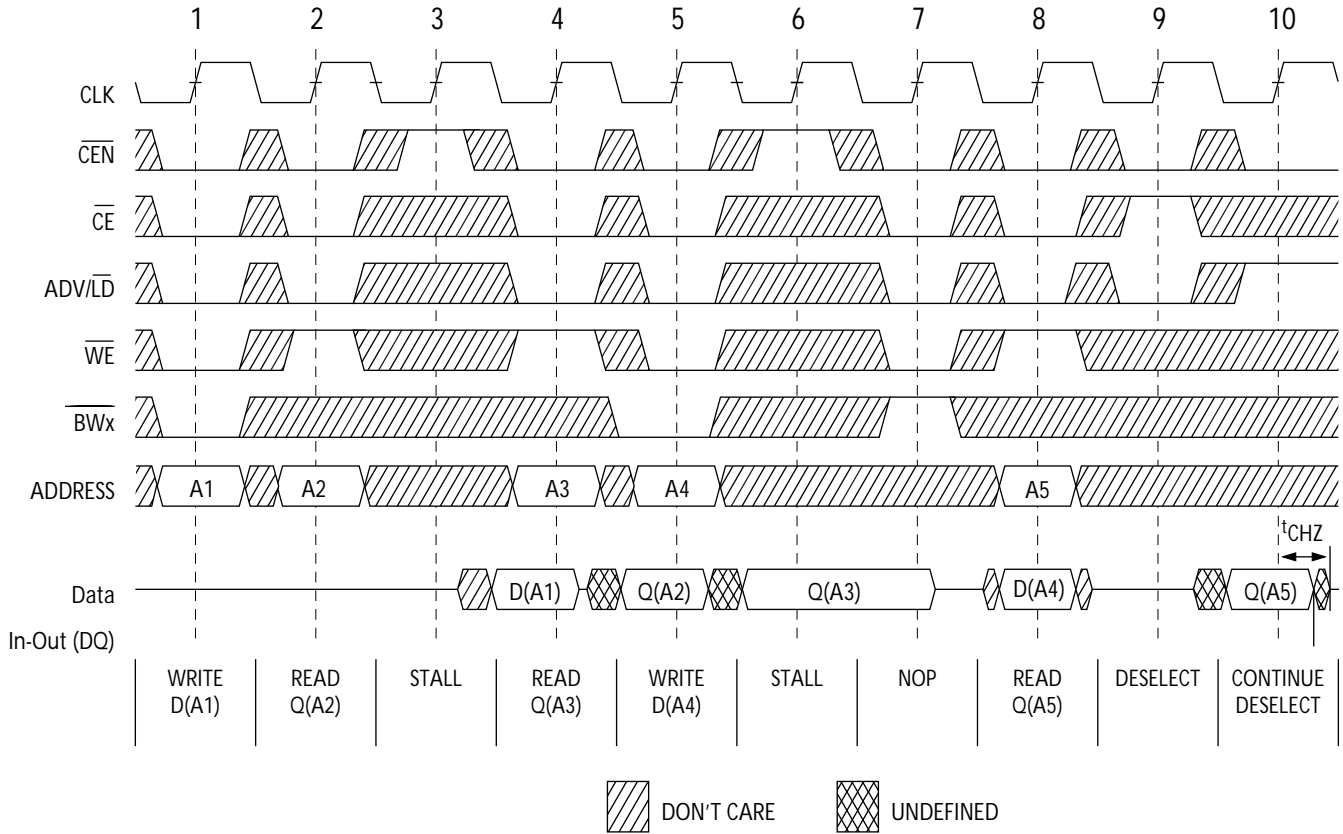
24. For this waveform \overline{ZZ} is tied low.

25. When CE is LOW, \overline{CE}_1 is LOW, \overline{CE}_2 is HIGH and \overline{CE}_3 is LOW. When \overline{CE} is HIGH, \overline{CE}_1 is HIGH or \overline{CE}_2 is LOW or \overline{CE}_3 is HIGH.

26. Order of the Burst sequence is determined by the status of the MODE (0 = Linear, 1 = Interleaved). Burst operations are optional.

Switching Waveforms (continued)

Figure 6. NOP, STALL and DESELECT Cycles [27, 28, 29]

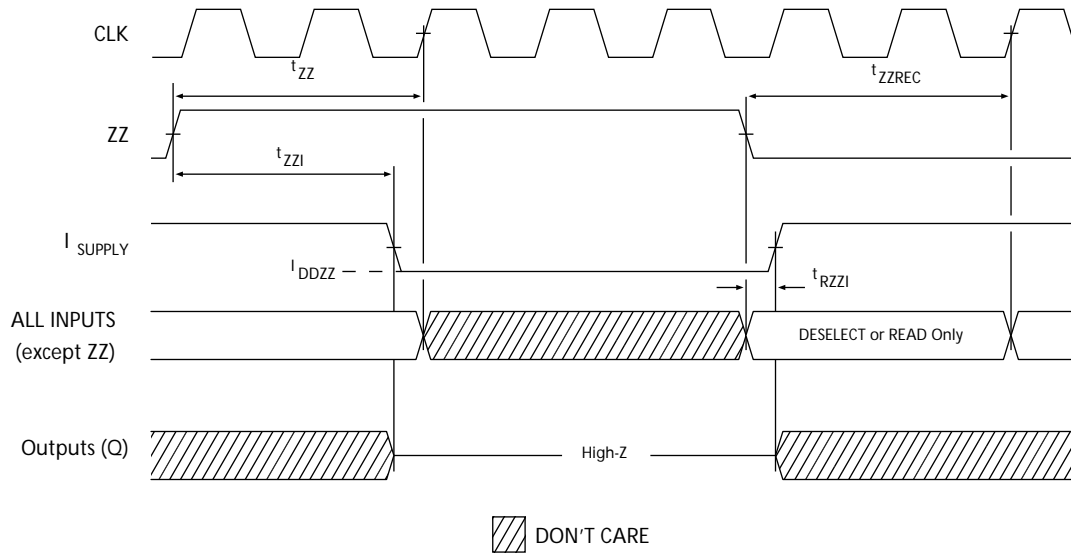


Notes

- 27. For this waveform \overline{ZZ} is tied low.
- 28. When \overline{CE} is LOW, \overline{CE}_1 is LOW, \overline{CE}_2 is HIGH and \overline{CE}_3 is LOW. When \overline{CE} is HIGH, \overline{CE}_1 is HIGH or \overline{CE}_2 is LOW or \overline{CE}_3 is HIGH.
- 29. The IGNORE CLOCK EDGE or STALL cycle (Clock 3) illustrated \overline{CEN} being used to create a pause. A write is not performed during this cycle.

Switching Waveforms (continued)

Figure 7. ZZ Mode Timing [30, 31]



Notes

- 30. Device must be deselected when entering ZZ mode. See cycle description table for all possible signal conditions to deselect the device.
- 31. IOs are in High Z when exiting ZZ sleep mode.

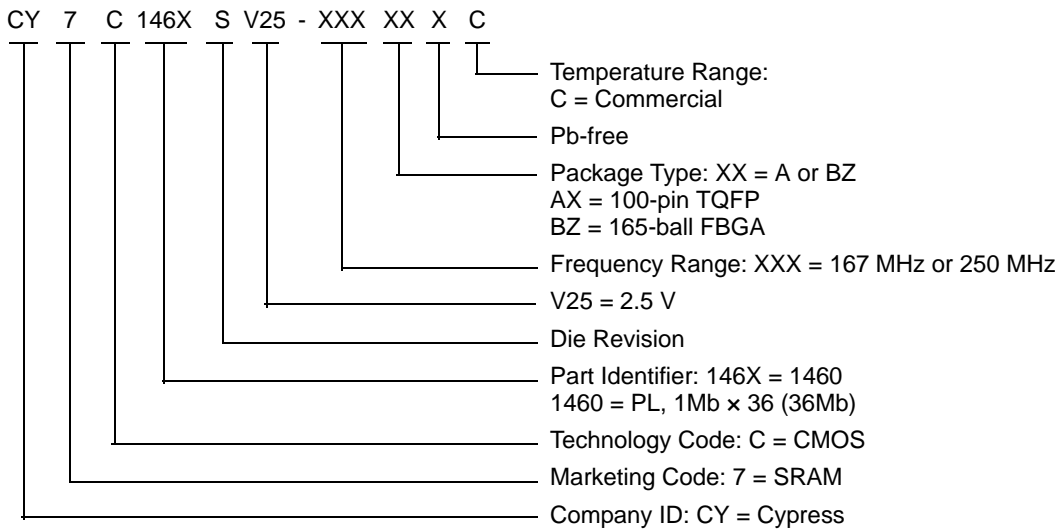
Ordering Information

The following table contains only the parts that are currently available. If you do not see what you are looking for, contact your local sales representative. For more information, visit the Cypress website at www.cypress.com and refer to the product summary page at <http://www.cypress.com/products>

Cypress maintains a worldwide network of offices, solution centers, manufacturer's representatives and distributors. To find the office closest to you, visit us at <http://www.cypress.com/go/datasheet/offices>.

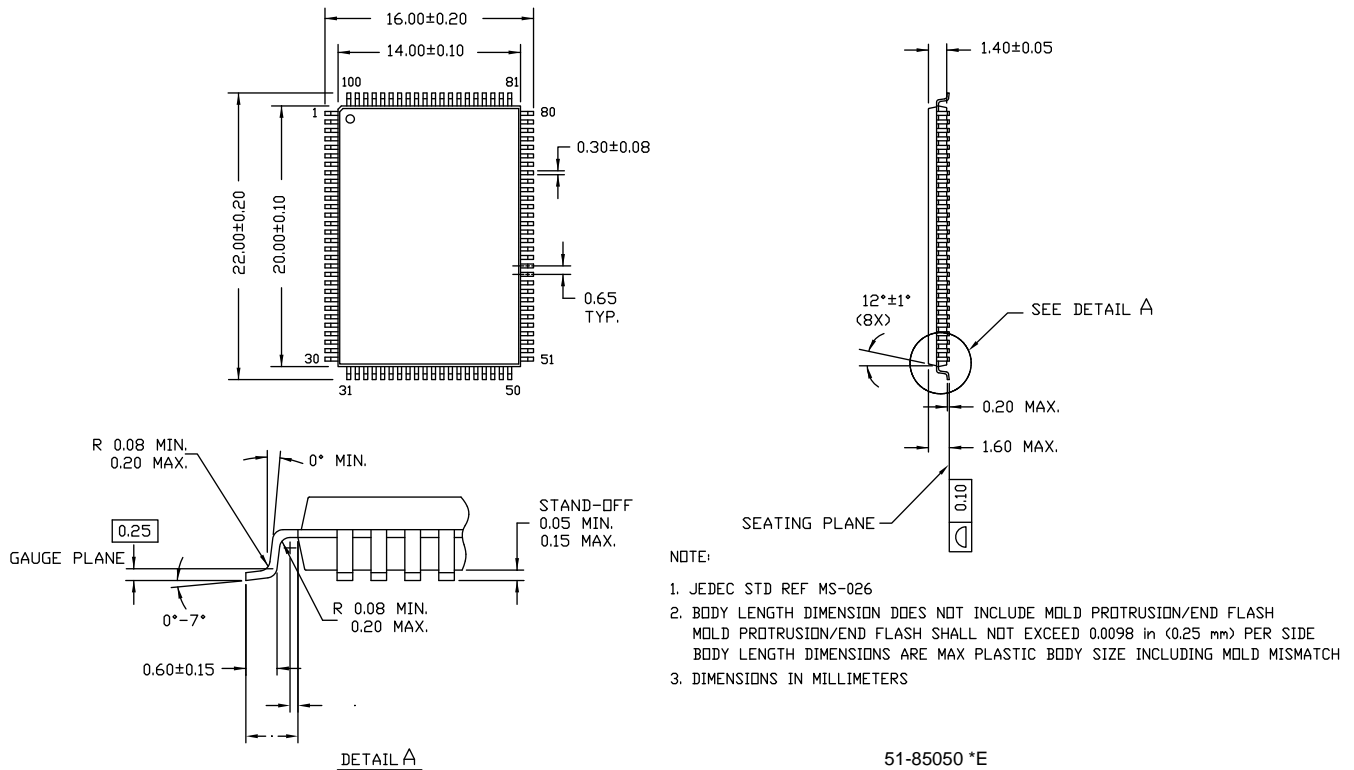
Speed (MHz)	Ordering Code	Package Diagram	Part and Package Type	Operating Range
167	CY7C1460SV25-167AXC	51-85050	100-pin TQFP (14 x 20 x 1.4 mm) Pb-free	Commercial
	CY7C1460SV25-167BZC	51-85195	165-ball FBGA (15 x 17 x 1.4 mm)	
	CY7C1460SV25-167BZXC		165-ball FBGA (15 x 17 x 1.4 mm) Pb-free	
250	CY7C1460SV25-250BZC	51-85195	165-ball FBGA (15 x 17 x 1.4 mm)	Commercial

Ordering Code Definitions



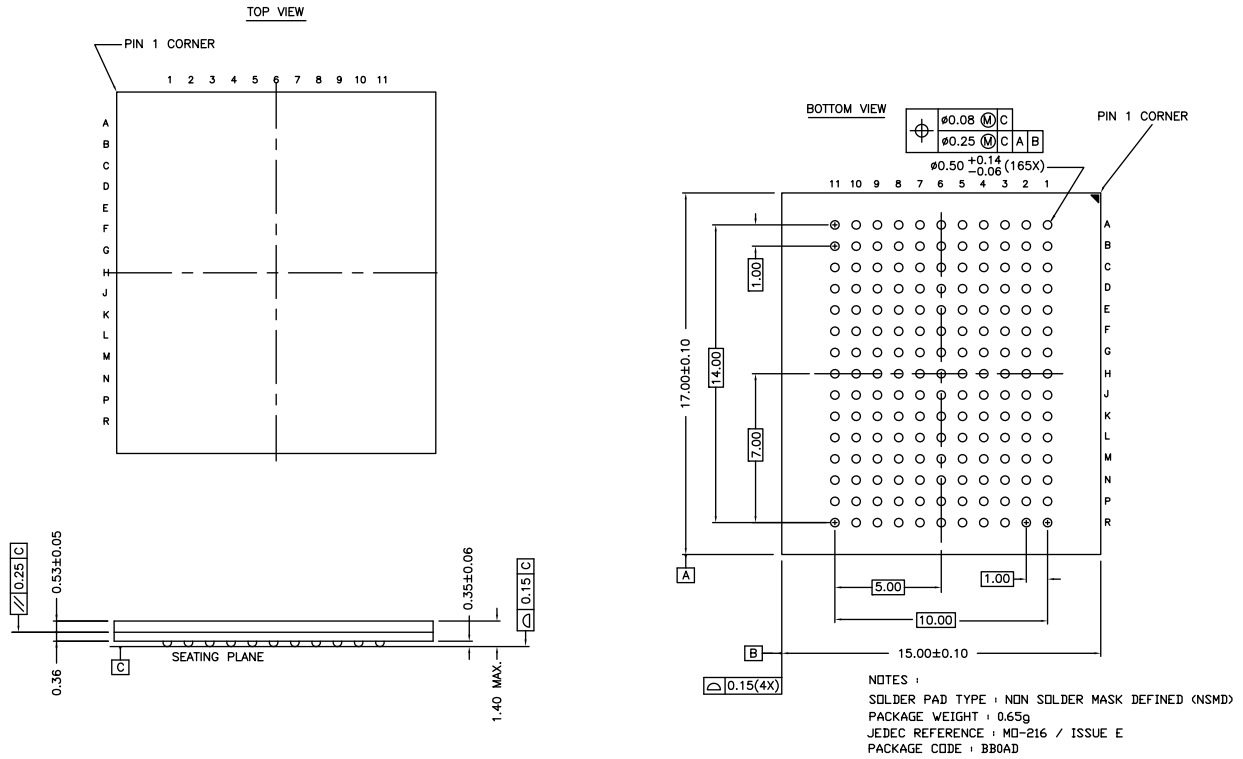
Package Diagrams

Figure 8. 100-pin TQFP (14 × 20 × 1.4 mm) A100RA Package Outline, 51-85050



Package Diagrams (continued)

Figure 9. 165-ball FBGA (15 × 17 × 1.40 mm (0.50 Ball Diameter)) Package Outline, 51-85195



51-85195 *D

Acronyms

Acronym	Description
BGA	Ball Grid Array
CMOS	Complementary Metal Oxide Semiconductor
FBGA	Fine-Pitch Ball Grid Array
I/O	Input/Output
JTAG	Joint Test Action Group
LSB	Least Significant Bit
MSB	Most Significant Bit
\overline{OE}	Output Enable
SRAM	Static Random Access Memory
TAP	Test Access Port
TCK	Test Clock
TMS	Test Mode Select
TDI	Test Data-In
TDO	Test Data-Out
TQFP	Thin Quad Flat Pack
TTL	Transistor-Transistor Logic
\overline{WE}	Write Enable

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	megahertz
μA	microampere
mA	milliampere
mm	millimeter
ms	millisecond
mV	millivolt
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
V	volt
W	watt

Document History Page

Document Title: CY7C1460SV25/CY7C1462SV25, 36-Mbit (1M x 36/2M x 18) Pipelined SRAM with NoBL™ Architecture Document Number: 001-43804				
Rev.	ECN No.	Issue Date	Orig. of Change	Description of Change
**	1897686	See ECN	VKN / AESA	New data sheet.
*A	2082846	See ECN	VKN	Changed status from Preliminary to Final.
*B	2902562	03/31/2010	VKN	Updated Ordering Information (Updated part numbers). Updated Package Diagrams .
*C	2958549	06/22/2010	NJY	Updated Ordering Information (Updated part numbers).
*D	3203729	03/23/2011	NJY	Updated Ordering Information (Updated part numbers) and added Ordering Code Definitions . Updated Package Diagrams . Added Acronyms and Units of Measure . Updated to new template.
*E	3410256	10/18/2011	VIDB	Updated Ordering Information (Removed prune part number CY7C1462SV25-200AXC). Updated Package Diagrams .
*F	3572545	04/04/2012	PRIT	Updated Features (Removed CY7C1464SV25 related information, removed 209-ball FBGA package related information). Updated Functional Description (Removed CY7C1464SV25 related information). Removed Logic Block Diagram – CY7C1464SV25. Updated Pin Configurations (Removed CY7C1464SV25 related information, removed 165-ball FBGA (15 x 17 x 1.4 mm) pinout for CY7C1462SV25). Updated Pin Definitions (Removed CY7C1464SV25 related information). Updated Functional Overview (Removed CY7C1464SV25 related information). Updated Truth Table (Removed CY7C1464SV25 related information). Updated Partial Write Cycle Description (Removed CY7C1464SV25 related information). Updated IEEE 1149.1 Serial Boundary Scan (JTAG) (Removed CY7C1462SV25 and CY7C1464SV25 related information). Updated Identification Register Definitions (Removed CY7C1462SV25 and CY7C1464SV25 related information). Updated Scan Register Sizes (Removed Bit Size (x 18) and Bit Size (x 72) columns, removed 209-ball FBGA package related information). Updated Boundary Scan Order (Removed CY7C1462SV25 related information). Removed Boundary Scan Order (Corresponding to CY7C1464SV25). Updated Operating Range (Removed Industrial Temperature Range). Updated Capacitance (Removed 209-ball FBGA package related information). Updated Thermal Resistance (Removed 209-ball FBGA package related information). Updated Ordering Information . Updated Package Diagrams (Removed 209-ball FBGA package related information).
*G	3849207	12/21/2012	PRIT	Updated Ordering Information (Updated part numbers).
*H	3943327	03/25/2013	PRIT	Removed 200 MHz frequency related information in all instances across the document. Updated Ordering Information (Removed CY7C1462SV25-200AXC as it is a pruned part).

Document History Page (continued)

Document Title: CY7C1460SV25/CY7C1462SV25, 36-Mbit (1M x 36/2M x 18) Pipelined SRAM with NoBL™ Architecture Document Number: 001-43804				
Rev.	ECN No.	Issue Date	Orig. of Change	Description of Change
*I	4953354	10/08/2015	PRIT	Removed 1.8 V I/O related information in all instances across the document. Removed 1.8 V V _{DDQ} related information in all instances across the document. Removed 1.8 V TAP AC Test Conditions. Removed 1.8 V TAP AC Output Load Equivalent. Updated AC Test Loads and Waveforms : Removed "3.3 V I/O Test Load". Updated Package Diagrams : spec 51-85050 – Changed revision from *D to *E. spec 51-85195 – Changed revision from *C to *D.
*J	5211485	04/07/2016	DEVM	Updated to new template. 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

ARM® Cortex® Microcontrollers	cypress.com/arm
Automotive	cypress.com/automotive
Clocks & Buffers	cypress.com/clocks
Interface	cypress.com/interface
Lighting & Power Control	cypress.com/powerpsoc
Memory	cypress.com/memory
PSoC	cypress.com/psoc
Touch Sensing	cypress.com/touch
USB Controllers	cypress.com/usb
Wireless/RF	cypress.com/wireless

PSoC® Solutions

[PSoC 1](#) | [PSoC 3](#) | [PSoC 4](#) | [PSoC 5LP](#)

Cypress Developer Community

[Forums](#) | [Projects](#) | [Video](#) | [Blogs](#) | [Training](#) | [Components](#)

Technical Support

cypress.com/support

© Cypress Semiconductor Corporation, 2008-2016. This document is the property of Cypress Semiconductor Corporation and its subsidiaries, including Spansion LLC ("Cypress"). This document, including any software or firmware included or referenced in this document ("Software"), is owned by Cypress under the intellectual property laws and treaties of the United States and other countries worldwide. Cypress reserves all rights under such laws and treaties and does not, except as specifically stated in this paragraph, grant any license under its patents, copyrights, trademarks, or other intellectual property rights. If the Software is not accompanied by a license agreement and you do not otherwise have a written agreement with Cypress governing the use of the Software, then Cypress hereby grants you a personal, non-exclusive, nontransferable license (without the right to sublicense) (1) under its copyright rights in the Software (a) for Software provided in source code form, to modify and reproduce the Software solely for use with Cypress hardware products, only internally within your organization, and (b) to distribute the Software in binary code form externally to end users (either directly or indirectly through resellers and distributors), solely for use on Cypress hardware product units, and (2) under those claims of Cypress's patents that are infringed by the Software (as provided by Cypress, unmodified) to make, use, distribute, and import the Software solely for use with Cypress hardware products. Any other use, reproduction, modification, translation, or compilation of the Software is prohibited.

TO THE EXTENT PERMITTED BY APPLICABLE LAW, CYPRESS MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS DOCUMENT OR ANY SOFTWARE OR ACCOMPANYING HARDWARE, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. To the extent permitted by applicable law, Cypress reserves the right to make changes to this document without further notice. Cypress does not assume any liability arising out of the application or use of any product or circuit described in this document. Any information provided in this document, including any sample design information or programming code, is provided only for reference purposes. It is the responsibility of the user of this document to properly design, program, and test the functionality and safety of any application made of this information and any resulting product. Cypress products are not designed, intended, or authorized for use as critical components in systems designed or intended for the operation of weapons, weapons systems, nuclear installations, life-support devices or systems, other medical devices or systems (including resuscitation equipment and surgical implants), pollution control or hazardous substances management, or other uses where the failure of the device or system could cause personal injury, death, or property damage ("Unintended Uses"). A critical component is any component of a device or system whose failure to perform can be reasonably expected to cause the failure of the device or system, or to affect its safety or effectiveness. Cypress is not liable, in whole or in part, and you shall and hereby do release Cypress from any claim, damage, or other liability arising from or related to all Unintended Uses of Cypress products. You shall indemnify and hold Cypress harmless from and against all claims, costs, damages, and other liabilities, including claims for personal injury or death, arising from or related to any Unintended Uses of Cypress products.

Cypress, the Cypress logo, Spansion, the Spansion logo, and combinations thereof, PSoC, CapSense, EZ-USB, F-RAM, and Traveo are trademarks or registered trademarks of Cypress in the United States and other countries. For a more complete list of Cypress trademarks, visit cypress.com. Other names and brands may be claimed as property of their respective owners.