



THIS SPEC IS OBSOLETE

Spec No: 001-06366

Spec Title: CY7C1261V18/CY7C1276V18/CY7C1263V18/
CY7C1265V18, 36-Mbit QDR™-II+ SRAM 4-Word
Burst Ar-chitecture (2.5 Cycle Read Latency)

Sunset Owner: Jayasree Nayar (NJY)

Replaced by: None

36-Mbit QDR™-II+ SRAM 4-Word Burst Architecture (2.5 Cycle Read Latency)

Features

- Separate independent read and write data ports
 - Supports concurrent transactions
- 300 MHz to 400 MHz clock for high bandwidth
- 4-Word Burst for reducing address bus frequency
- Double Data Rate (DDR) interfaces on both read and write ports (data transferred at 800 MHz) at 400 MHz
- Read latency of 2.5 clock cycles
- Two input clocks (K and \bar{K}) for precise DDR timing
 - SRAM uses rising edges only
- Echo clocks (CQ and \bar{CQ}) simplify data capture in high speed systems
- Single multiplexed address input bus latches address inputs for both read and write ports
- Separate Port Selects for depth expansion
- Data valid pin (QVLD) to indicate valid data on the output
- Synchronous internally self-timed writes
- Available in x8, x9, x18, and x36 configurations
- Full data coherency providing most current data
- Core $V_{DD} = 1.8V \pm 0.1V$; IO $V_{DDQ} = 1.4V$ to V_{DD} ^[1]
- HSTL inputs and variable drive HSTL output buffers
- Available in 165-ball FBGA package (15 x 17 x 1.4 mm)
- Offered in both Pb-free and non Pb-free packages
- JTAG 1149.1 compatible test access port
- Delay Lock Loop (DLL) for accurate data placement

Configurations

With Read Cycle Latency of 2.5 cycles:

- CY7C1261V18 – 4M x 8
- CY7C1276V18 – 4M x 9
- CY7C1263V18 – 2M x 18
- CY7C1265V18 – 1M x 36

Functional Description

The CY7C1261V18, CY7C1276V18, CY7C1263V18, and CY7C1265V18 are 1.8V Synchronous Pipelined SRAMs, equipped with Quad Data Rate-II+ (QDR-II+) architecture. QDR-II+ architecture consists of two separate ports to access the memory array. The read port has dedicated data outputs to support read operations and the write port has dedicated data inputs to support write operations. QDR-II+ architecture has separate data inputs and data outputs to completely eliminate the need to “turn around” the data bus required with common IO devices. Each port is accessed through a common address bus. Addresses for read and write addresses are latched on alternate rising edges of the input (K) clock. Accesses to the QDR-II+ read and write ports are completely independent of one another. To maximize data throughput, both read and write ports are equipped with Double Data Rate (DDR) interfaces. Each address location is associated with four 8-bit words (CY7C1261V18), 9-bit words (CY7C1276V18), 18-bit words (CY7C1263V18), or 36-bit words (CY7C1265V18) that burst sequentially into or out of the device. Because data can be transferred into and out of the device on every rising edge of both input clocks (K and \bar{K}), memory bandwidth is maximized while simplifying system design by eliminating bus “turn-arounds”.

Depth expansion is accomplished with Port Selects for each port. Port selects enable each port to operate independently.

All synchronous inputs pass through input registers controlled by the K or \bar{K} input clocks. All data outputs pass through output registers controlled by the K or \bar{K} input clocks. Writes are conducted with on-chip synchronous self-timed write circuitry.

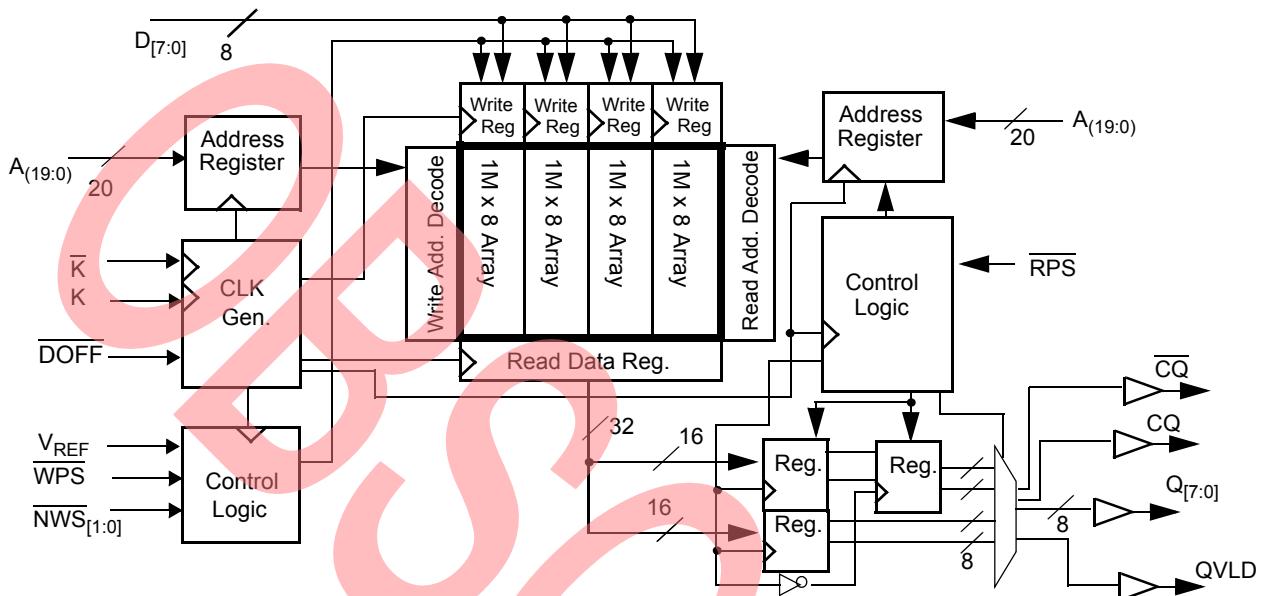
Selection Guide

| Description | 400 MHz | 375 MHz | 333 MHz | 300 MHz | Unit |
|-----------------------------|---------|---------|---------|---------|------|
| Maximum Operating Frequency | 400 | 375 | 333 | 300 | MHz |
| Maximum Operating Current | 1330 | 1240 | 1120 | 1040 | mA |

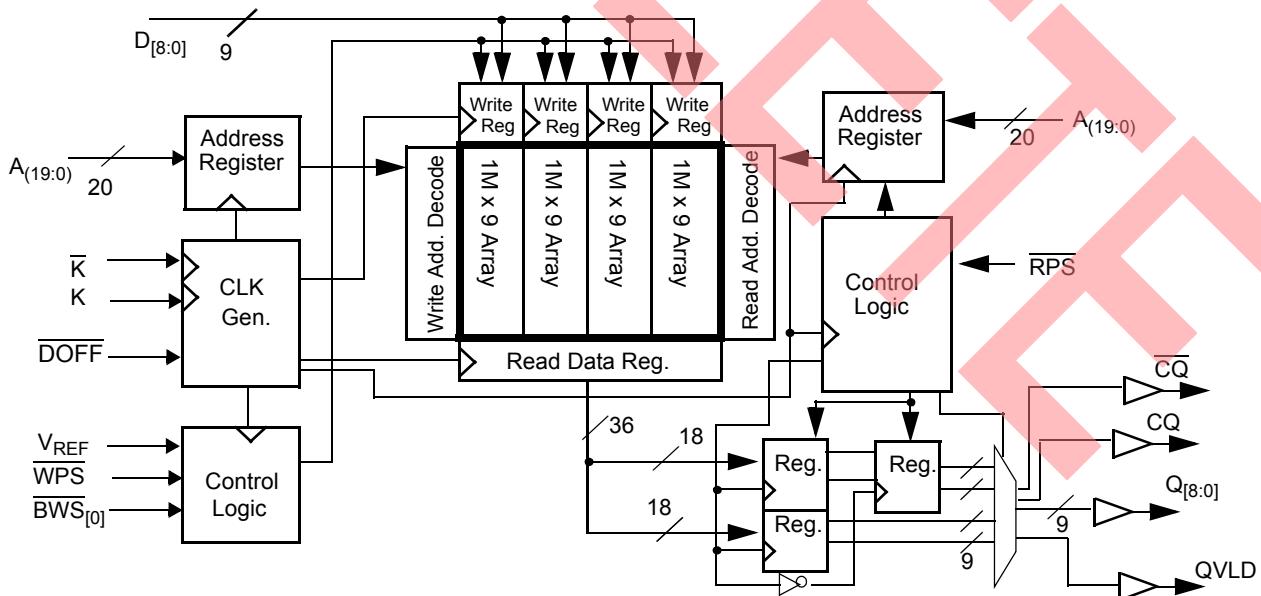
Note

1. The QDR consortium specification for V_{DDQ} is $1.5V \pm 0.1V$. The Cypress QDR devices exceed the QDR consortium specification and are capable of supporting $V_{DDQ} = 1.4V$ to V_{DD} .

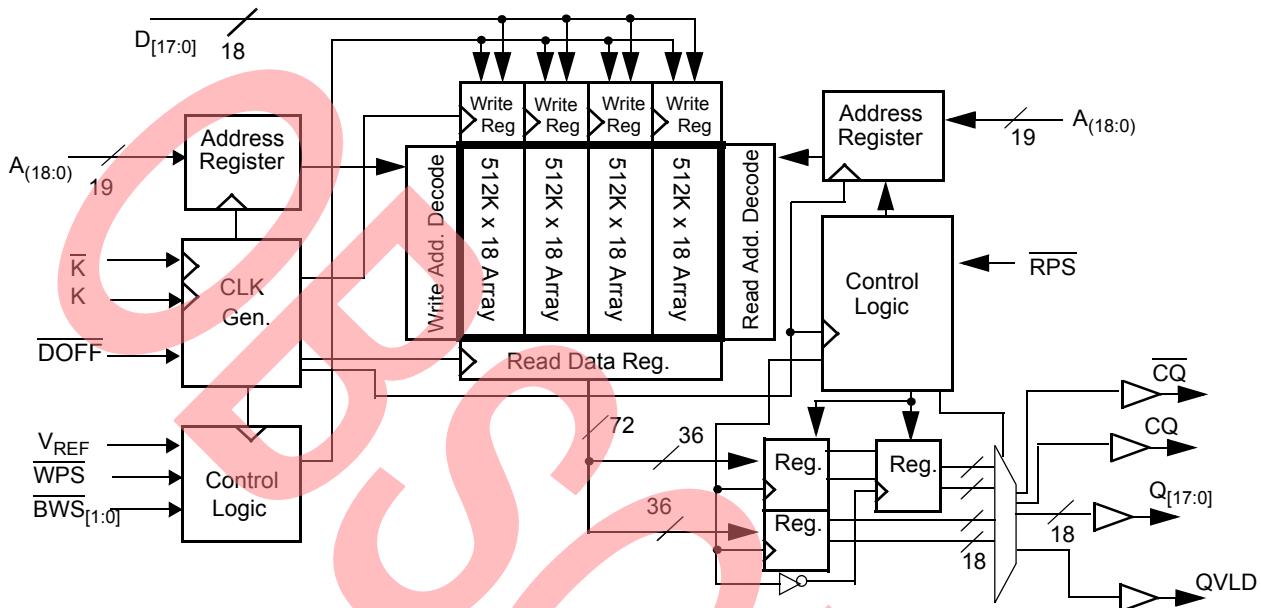
Logic Block Diagram (CY7C1261V18)



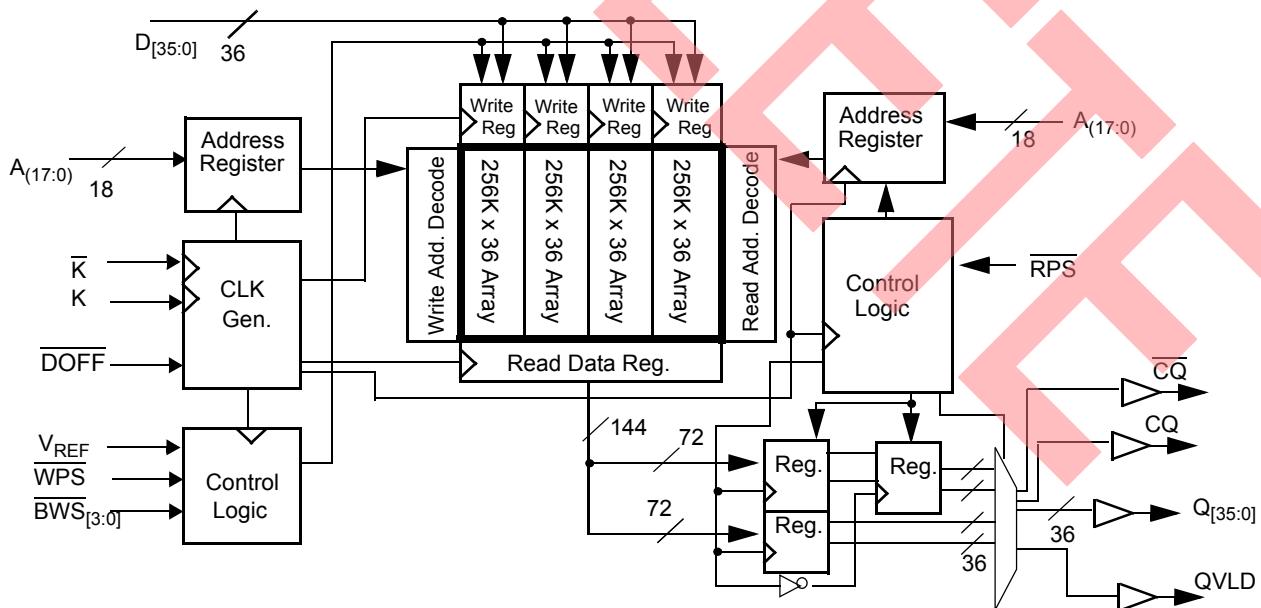
Logic Block Diagram (CY7C1276V18)



Logic Block Diagram (CY7C1263V18)



Logic Block Diagram (CY7C1265V18)



Pin Configurations

165-Ball FBGA (15 x 17 x 1.4 mm) Pinout

CY7C1261V18 (4M x 8)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|-------------|------------------------|------------------------|------------------------|------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|-----|
| A | <u>CQ</u> | NC/72M | A | <u>WPS</u> | <u>NWS₁</u> | <u>K</u> | NC/144M | <u>RPS</u> | A | A | CQ |
| B | NC | NC | NC | A | NC/288M | K | <u>NWS₀</u> | A | NC | NC | Q3 |
| C | NC | NC | NC | <u>V_{SS}</u> | A | NC | A | <u>V_{SS}</u> | NC | NC | D3 |
| D | NC | D4 | NC | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | NC | NC | NC |
| E | NC | NC | Q4 | <u>V_{DDQ}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{DDQ}</u> | NC | D2 | Q2 |
| F | NC | NC | NC | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | NC | NC | NC |
| G | NC | D5 | Q5 | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | NC | NC | NC |
| H | <u>DOFF</u> | <u>V_{REF}</u> | <u>V_{DDQ}</u> | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | <u>V_{DDQ}</u> | <u>V_{REF}</u> | ZQ |
| J | NC | NC | NC | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | NC | Q1 | D1 |
| K | NC | NC | NC | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | NC | NC | NC |
| L | NC | Q6 | D6 | <u>V_{DDQ}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{DDQ}</u> | NC | NC | Q0 |
| M | NC | NC | NC | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | NC | NC | D0 |
| N | NC | D7 | NC | <u>V_{SS}</u> | A | A | A | <u>V_{SS}</u> | NC | NC | NC |
| P | NC | NC | Q7 | A | A | QVLD | A | A | NC | NC | NC |
| R | TDO | TCK | A | A | A | NC | A | A | A | TMS | TDI |

CY7C1276V18 (4M x 9)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|-------------|------------------------|------------------------|------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|-----|
| A | <u>CQ</u> | NC/72M | A | <u>WPS</u> | NC | <u>K</u> | NC/144M | <u>RPS</u> | A | A | CQ |
| B | NC | NC | NC | A | NC/288M | K | <u>BWS₀</u> | A | NC | NC | Q4 |
| C | NC | NC | NC | <u>V_{SS}</u> | A | NC | A | <u>V_{SS}</u> | NC | NC | D4 |
| D | NC | D5 | NC | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | NC | NC | NC |
| E | NC | NC | Q5 | <u>V_{DDQ}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{DDQ}</u> | NC | D3 | Q3 |
| F | NC | NC | NC | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | NC | NC | NC |
| G | NC | D6 | Q6 | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | NC | NC | NC |
| H | <u>DOFF</u> | <u>V_{REF}</u> | <u>V_{DDQ}</u> | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | <u>V_{DDQ}</u> | <u>V_{REF}</u> | ZQ |
| J | NC | NC | NC | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | NC | Q2 | D2 |
| K | NC | NC | NC | <u>V_{DDQ}</u> | <u>V_{DD}</u> | <u>V_{SS}</u> | <u>V_{DD}</u> | <u>V_{DDQ}</u> | NC | NC | NC |
| L | NC | Q7 | D7 | <u>V_{DDQ}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{DDQ}</u> | NC | NC | Q1 |
| M | NC | NC | NC | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | <u>V_{SS}</u> | NC | NC | D1 |
| N | NC | D8 | NC | <u>V_{SS}</u> | A | A | A | <u>V_{SS}</u> | NC | NC | NC |
| P | NC | NC | Q8 | A | A | QVLD | A | A | NC | D0 | Q0 |
| R | TDO | TCK | A | A | A | NC | A | A | A | TMS | TDI |

Pin Configurations (continued)

165-Ball FBGA (15 x 17 x 1.4 mm) Pinout
CY7C1263V18 (2M x 18)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|----------|-------------------|-----------|-----------|------------------|--------------------|----------------|--------------------|------------------|-----------|-----------|-----------|
| A | \overline{CQ} | NC/144M | A | \overline{WPS} | \overline{BWS}_1 | \overline{K} | NC/288M | \overline{RPS} | A | NC/72M | CQ |
| B | NC | Q9 | D9 | A | NC | K | \overline{BWS}_0 | A | NC | NC | Q8 |
| C | NC | NC | D10 | V_{SS} | A | NC | A | V_{SS} | NC | Q7 | D8 |
| D | NC | D11 | Q10 | V_{SS} | V_{SS} | V_{SS} | V_{SS} | V_{SS} | NC | NC | D7 |
| E | NC | NC | Q11 | V_{DDQ} | V_{SS} | V_{SS} | V_{SS} | V_{DDQ} | NC | D6 | Q6 |
| F | NC | Q12 | D12 | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | NC | NC | Q5 |
| G | NC | D13 | Q13 | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | NC | NC | D5 |
| H | \overline{DOFF} | V_{REF} | V_{DDQ} | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | V_{DDQ} | V_{REF} | ZQ |
| J | NC | NC | D14 | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | NC | Q4 | D4 |
| K | NC | NC | Q14 | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | NC | D3 | Q3 |
| L | NC | Q15 | D15 | V_{DDQ} | V_{SS} | V_{SS} | V_{SS} | V_{DDQ} | NC | NC | Q2 |
| M | NC | NC | D16 | V_{SS} | V_{SS} | V_{SS} | V_{SS} | V_{SS} | NC | Q1 | D2 |
| N | NC | D17 | Q16 | V_{SS} | A | A | A | V_{SS} | NC | NC | D1 |
| P | NC | NC | Q17 | A | A | QVLD | A | A | NC | D0 | Q0 |
| R | TDO | TCK | A | A | A | NC | A | A | A | TMS | TDI |

CY7C1265V18 (1M x 36)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|----------|-------------------|-----------|-----------|------------------|--------------------|----------------|--------------------|------------------|-----------|-----------|-----------|
| A | \overline{CQ} | NC/288M | NC/72M | \overline{WPS} | \overline{BWS}_2 | \overline{K} | \overline{BWS}_1 | \overline{RPS} | A | NC/144M | CQ |
| B | Q27 | Q18 | D18 | A | \overline{BWS}_3 | K | \overline{BWS}_0 | A | D17 | Q17 | Q8 |
| C | D27 | Q28 | D19 | V_{SS} | A | NC | A | V_{SS} | D16 | Q7 | D8 |
| D | D28 | D20 | Q19 | V_{SS} | V_{SS} | V_{SS} | V_{SS} | V_{SS} | Q16 | D15 | D7 |
| E | Q29 | D29 | Q20 | V_{DDQ} | V_{SS} | V_{SS} | V_{SS} | V_{DDQ} | Q15 | D6 | Q6 |
| F | Q30 | Q21 | D21 | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | D14 | Q14 | Q5 |
| G | D30 | D22 | Q22 | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | Q13 | D13 | D5 |
| H | \overline{DOFF} | V_{REF} | V_{DDQ} | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | V_{DDQ} | V_{REF} | ZQ |
| J | D31 | Q31 | D23 | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | D12 | Q4 | D4 |
| K | Q32 | D32 | Q23 | V_{DDQ} | V_{DD} | V_{SS} | V_{DD} | V_{DDQ} | Q12 | D3 | Q3 |
| L | Q33 | Q24 | D24 | V_{DDQ} | V_{SS} | V_{SS} | V_{SS} | V_{DDQ} | D11 | Q11 | Q2 |
| M | D33 | Q34 | D25 | V_{SS} | V_{SS} | V_{SS} | V_{SS} | V_{SS} | D10 | Q1 | D2 |
| N | D34 | D26 | Q25 | V_{SS} | A | A | A | V_{SS} | Q10 | D9 | D1 |
| P | Q35 | D35 | Q26 | A | A | QVLD | A | A | Q9 | D0 | Q0 |
| R | TDO | TCK | A | A | A | NC | A | A | A | TMS | TDI |

Pin Definitions

| Pin Name | IO | Pin Description |
|--|------------------------|--|
| D _[x:0] | Input-Synchronous | Data Input Signals. Sampled on the rising edge of K and \bar{K} clocks during valid write operations. CY7C1261V18 – D _[7:0] CY7C1276V18 – D _[8:0] CY7C1263V18 – D _[17:0] CY7C1265V18 – D _[35:0] |
| WPS | Input-Synchronous | Write Port Select, Active LOW. Sampled on the rising edge of the K clock. When asserted active, a write operation is initiated. Deasserting deselects the write port. Deselecting the write port causes D _[x:0] to be ignored. |
| NWS ₀ , NWS ₁ , | Input-Synchronous | Nibble Write Select 0, 1, Active LOW (CY7C1261V18 Only). Sampled on the rising edge of the K and \bar{K} clocks when write operations are active. Used to <u>select</u> which nibble is written into the device during the current portion of the write operations. NWS ₀ controls D _[3:0] and NWS ₁ controls D _[7:4] . All the Nibble Write Selects are sampled on the same edge as the data. The corresponding nibble of data is ignored by deselecting a nibble write select and is not written into the device. |
| BWS ₀ , BWS ₁ , BWS ₂ , BWS ₃ | Input-Synchronous | Byte Write Select 0, 1, 2, and 3, Active LOW. Sampled on the rising edge of the K and \bar{K} clocks during write operations. Used to select which byte is written into the device during the current portion of the Write operations. Bytes not written remain unaltered. CY7C1276V18 – BWS ₀ controls D _[8:0] CY7C1263V18 – BWS ₀ controls D _[8:0] and BWS ₁ controls D _[17:9] . CY7C1265V18 – BWS ₀ controls D _[8:0] , BWS ₁ controls D _[17:9] , BWS ₂ controls D _[26:18] , and BWS ₃ controls D _[35:27] . All the Byte Write Selects are sampled on the same edge as the data. Deselecting a Byte Write Select causes the corresponding byte of data to be ignored and not written into the device. |
| A | Input-Synchronous | Address Inputs. Sampled on the rising edge of the K clock during active read and write operations. These address inputs are multiplexed for both read and write operations. Internally, the device is organized as 4M x 8 (4 arrays each of 1M x 8) for CY7C1261V18, 4M x 9 (4 arrays each of 1M x 9) for CY7C1276V18, 2M x 18 (4 arrays each of 512K x 18) for CY7C1263V18 and 1M x 36 (4 arrays each of 256K x 36) for CY7C1265V18. Therefore, only 20 address inputs are needed to access the entire memory array of CY7C1261V18 and CY7C1276V18, 19 address inputs for CY7C1263V18 and 18 address inputs for CY7C1265V18. These inputs are ignored when the appropriate port is deselected. |
| Q _[x:0] | Outputs-Synchronous | Data Output Signals. These pins drive out the requested data during a read operation. Valid data is driven out on the rising edge of both the K and \bar{K} clocks during read operations. When the read port is deselected, Q _[x:0] are automatically tri-stated. CY7C1261V18 – Q _[7:0] CY7C1276V18 – Q _[8:0] CY7C1263V18 – Q _[17:0] CY7C1265V18 – Q _[35:0] |
| RPS | Input-Synchronous | Read Port Select, Active LOW. Sampled on the rising edge of Positive Input Clock (K). When active, a read operation is initiated. Deasserting causes the read port to be deselected. When deselected, the pending access is allowed to complete and the output drivers are automatically tri-stated following the next rising edge of the K clock. Each read access consists of a burst of four sequential transfers. |
| QVLD | Valid Output Indicator | Valid Output Indicator. The Q Valid indicates valid output data. QVLD is edge aligned with CQ and CQ. |
| K | Input-Clock | Positive Input Clock Input. The rising edge of K is used to capture synchronous inputs to the device and to drive out data through Q _[x:0] when in single clock mode. All accesses are initiated on the rising edge of K. |
| \bar{K} | Input-Clock | Negative Input Clock Input. \bar{K} is used to capture synchronous inputs being presented to the device and to drive out data through Q _[x:0] when in single clock mode. |

Pin Definitions (continued)

| Pin Name | IO | Pin Description |
|-----------|-----------------|--|
| CQ | Echo Clock | Synchronous Echo Clock Outputs. This is a free running clock and is synchronized to the input clock (K) of the QDR-II+. The timing for the echo clocks is shown in Switching Characteristics on page 24 . |
| CQ | Echo Clock | Synchronous Echo Clock Outputs. This is a free running clock and is synchronized to the input clock (K) of the QDR-II+. The timing for the echo clocks is shown in Switching Characteristics on page 24 . |
| ZQ | Input | Output Impedance Matching Input. This input is used to tune the device outputs to the system data bus impedance. CQ, CQ, and $Q_{[x:0]}$ output impedance are set to $0.2 \times R_Q$, where R_Q is a resistor connected between ZQ and ground. Alternatively, this pin can be connected directly to V_{DDQ} , which enables the minimum impedance mode. This pin cannot be connected directly to GND or left unconnected. |
| DOFF | Input | DLL Turn Off, Active LOW. Connecting this pin to ground turns off the DLL inside the device. The timing in the DLL turned off operation is different from that listed in this data sheet. For normal operation, this pin can be connected to a pull up through a 10 Kohm or less pull up resistor. The device behaves in QDR-I mode when the DLL is turned off. In this mode, the device can be operated at a frequency of up to 167 MHz with QDR-I timing. |
| TDO | Output | TDO for JTAG. |
| TCK | Input | TCK Pin for JTAG. |
| TDI | Input | TDI Pin for JTAG. |
| TMS | Input | TMS Pin for JTAG. |
| NC | N/A | Not Connected to the Die. Can be tied to any voltage level. |
| 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. |
| V_{REF} | Input-Reference | Reference Voltage Input. Static input used to set the reference level for HSTL inputs, outputs, and AC measurement points. |
| V_{DD} | Power Supply | Power Supply Inputs to the Core of the Device. |
| V_{SS} | Ground | Ground for the Device. |
| V_{DDQ} | Power Supply | Power Supply Inputs for the Outputs of the Device. |

Functional Overview

The CY7C1261V18, CY7C1276V18, CY7C1263V18, and CY7C1265V18 are synchronous pipelined Burst SRAMs equipped with a read port and a write port. The read port is dedicated to read operations and the write port is dedicated to write operations. Data flows into the SRAM through the write port and out through the read port. These devices multiplex the address inputs to minimize the number of address pins required. By having separate read and write ports, the QDR-II+ completely eliminates the need to “turn around” the data bus and avoids any possible data contention, thereby simplifying system design. Each access consists of four 8-bit data transfers in the case of CY7C1261V18, four 9-bit data transfers in the case of CY7C1276V18, four 18-bit data transfers in the case of CY7C1263V18, and four 36-bit data transfers in the case of CY7C1265V18, in two clock cycles.

Accesses for both ports are initiated on the Positive Input Clock (K). All synchronous input and output timing refer to the rising edge of the Input clocks (K/K).

All synchronous data inputs ($D_{[x:0]}$) inputs pass through input registers controlled by the input clocks (K and \bar{K}). All synchronous data outputs ($Q_{[x:0]}$) outputs pass through output registers controlled by the rising edge of the Input clocks (K and \bar{K}).

All synchronous control (RPS , WPS , $BWS_{[x:0]}$) inputs pass through input registers controlled by the rising edge of the input clocks (K/K).

CY7C1263V18 is described in the following sections. The same basic descriptions apply to CY7C1261V18, CY7C1276V18, and CY7C1265V18.

Read Operations

The CY7C1263V18 is organized internally as 4 arrays of $512K \times 18$. Accesses are completed in a burst of four sequential 18-bit data words. Read operations are initiated by asserting RPS active at the rising edge of the Positive Input Clock (K). The addresses presented to address inputs are stored in the Read address register. Following the next two K clock rising edges, the corresponding lowest order 18-bit word of data is driven onto the $Q_{[17:0]}$ using K as the output timing reference. On the subsequent rising edge of K the next 18-bit data word is driven onto the $Q_{[17:0]}$. This process continues until all four 18-bit data words have been driven out onto $Q_{[17:0]}$. The requested data is valid 0.45 ns from the rising edge of the Input clock (K or \bar{K}). To maintain the internal logic, each read access must be allowed to complete. Each read access consists of four 18-bit data words and takes two clock cycles to complete. Therefore, read accesses to the device cannot be initiated on two consecutive K clock rises. The internal logic of the device ignores the second read request. Read accesses can be initiated on every other K clock rise. Doing so pipelines the data flow such that data is transferred out of the device on every rising edge of the input clocks (K and \bar{K}).

When the read port is deselected, the CY7C1263V18 completes the pending read transactions. Synchronous internal circuitry automatically tri-states the outputs following the next rising edge of the negative Input Clock (\bar{K}). This enables a seamless transition between devices without the insertion of wait states in a depth expanded memory.

Write Operations

Write operations are initiated by asserting WPS active at the rising edge of the Positive Input Clock (K). On the following K clock rise, the data presented to $D_{[17:0]}$ is latched and stored into the lower 18-bit Write Data register, provided $BWS_{[1:0]}$ are both asserted active. On the subsequent rising edge of the Negative Input Clock (\bar{K}), the information presented to $D_{[17:0]}$ is also stored into the Write Data register, provided $BWS_{[1:0]}$ are both asserted active. This process continues for one more cycle until four 18-bit words (a total of 72 bits) of data are stored in the SRAM. The 72 bits of data are then written into the memory array at the specified location. Therefore, write accesses to the device cannot be initiated on two consecutive K clock rises. The internal logic of the device ignores the second write request. Write accesses can be initiated on every other rising edge of the Positive Input Clock (K). Doing so pipelines the data flow such that 18 bits of data can be transferred into the device on every rising edge of the input clocks (K and \bar{K}). When deselected, the write port ignores all inputs after the pending write operations have been completed.

Byte Write Operations

Byte write operations are supported by the CY7C1263V18. A write operation is initiated as described in the [Write Operations section](#). The bytes that are written are determined by BWS_0 and BWS_1 , which are sampled with each set of 18-bit data words. Asserting the appropriate Byte Write Select input during the data portion of a write latches the data being presented and written into the device. Deasserting the Byte Write Select input during the data portion of a write enables the data stored in the device for that byte to remain unaltered. This feature can be used to simplify read/modify/write operations to a byte write operation.

Concurrent Transactions

The read and write ports on the CY7C1263V18 operate completely independently of one another. Because each port latches the address inputs on different clock edges, the user can read or write to any location, regardless of the transaction on the other port. If the ports access the same location when a read follows a write in successive clock cycles, the SRAM delivers the most recent information associated with the specified address location. This includes forwarding data from a write cycle that was initiated on the previous K clock rise.

Read accesses and write access must be scheduled such that one transaction is initiated on any clock cycle. If both ports are selected on the same K clock rise, the arbitration depends on the previous state of the SRAM. If both ports are deselected, the read port takes priority. If a read was initiated on the previous cycle, the Write port assumes priority (because read operations cannot be initiated on consecutive cycles). If a write was initiated on the previous cycle, the read port assumes priority (because write operations cannot be initiated on consecutive cycles). Therefore, asserting both port selects active from a deselected state results in alternating read/write operations being initiated, with the first access being a read.

Depth Expansion

The CY7C1263V18 has a Port Select input for each port. This enables easy depth expansion. Both Port Selects are sampled on the rising edge of the Positive Input Clock only (K). Each port select input can deselect the specified port. Deselecting a port does not affect the other port. All pending transactions (read and write) are completed before the device is deselected.

Programmable Impedance

An external resistor, RQ, must be connected between the ZQ pin on the SRAM and V_{SS} to enable the SRAM to adjust its output driver impedance. The value of RQ must be 5X the value of the intended line impedance driven by the SRAM. The allowable range of RQ to guarantee impedance matching with a tolerance of $\pm 15\%$ is between 175Ω and 350Ω , with V_{DDQ} = 1.5V. The output impedance is adjusted every 1024 cycles upon power up to account for drifts in supply voltage and temperature.

Echo Clocks

Echo clocks are provided on the QDR-II+ to simplify data capture on high speed systems. Two echo clocks are generated by the QDR-II+. CQ is referenced with respect to K and CQ is referenced with respect to K̄. These are free running clocks and are synchronized to the input clock of the QDR-II+. The timing for the echo clocks is shown in [Switching Characteristics on page 24](#).

Valid Data Indicator (QVLD)

QVLD is provided on the QDR-II+ to simplify data capture on high speed systems. The QVLD is generated by the QDR-II+ device along with data output. This signal is also edge aligned with the echo clock and follows the timing of any data pin. This signal is asserted half a cycle before valid data arrives.

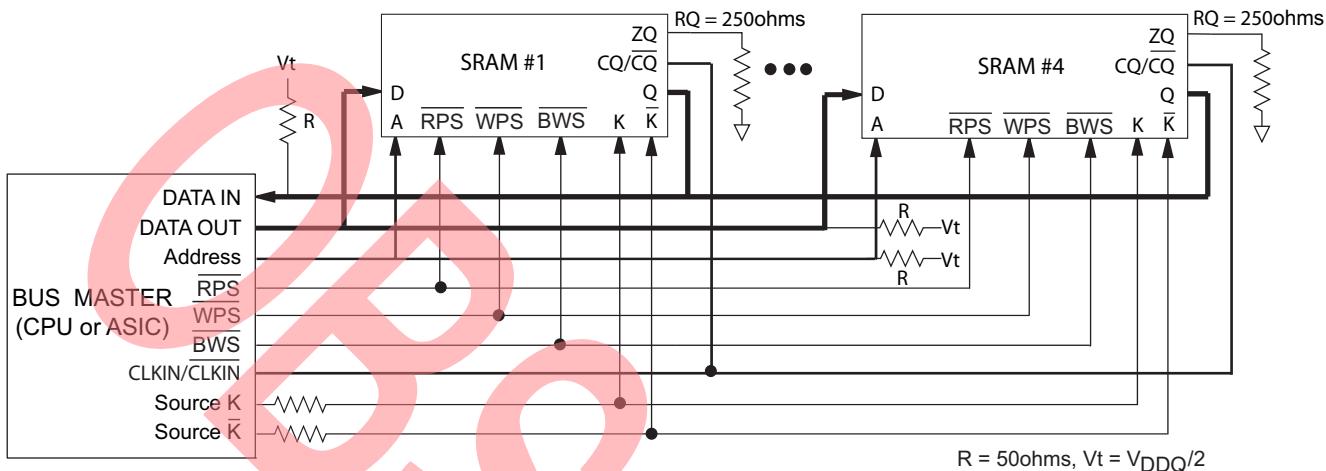
Delay Lock Loop (DLL)

These chips use a DLL that is designed to function between 120 MHz and the specified maximum clock frequency. To disable the DLL, apply ground to the DOFF pin. When the DLL is turned off, the device behaves in QDR-I mode (with 1.0 cycle latency and a longer access time). For more information, refer to the application note, [DLL Considerations in QDRII/DDRII/QDRII+/DDRII+](#). The DLL can also be reset by slowing or stopping the input clocks K and K̄ for a minimum of 30 ns. However, it is not necessary for the DLL to be reset to lock to the frequency you want. During power up, when the DOFF is tied HIGH, the DLL is locked after 2048 cycles of stable clock.

Application Example

Figure 1 shows the use of four QDR-II+ SRAMs in an application.

Figure 1. Application Example



Truth Table

The truth table for the CY7C1261V18, CY7C1276V18, CY7C1263V18, and CY7C1265V18 follows.^[2, 3, 4, 5, 6, 7]

| Operation | K | RPS | WPS | DQ | DQ | DQ | DQ |
|--|---------|------------------|------------------|---------------------|-------------------------|-------------------------|-------------------------|
| Write Cycle: Load address on the rising edge of K; input write data on two consecutive K and K̄ rising edges. | L-H | H ^[8] | L ^[9] | D(A) at K(t + 1) ↑ | D(A + 1) at K̄(t + 1) ↑ | D(A + 2) at K(t + 2) ↑ | D(A + 3) at K̄(t + 2) ↑ |
| Read Cycle: (2.5 cycle Latency) Load address on the rising edge of K; wait two and half cycle; read data on two consecutive K and K̄ rising edges. | L-H | L ^[9] | X | Q(A) at K̄(t + 2) ↑ | Q(A + 1) at K(t + 3) ↑ | Q(A + 2) at K̄(t + 3) ↑ | Q(A + 3) at K(t + 4) ↑ |
| NOP: No Operation | L-H | H | H | D = X Q = High-Z | D = X Q = High-Z | D = X Q = High-Z | D = X Q = High-Z |
| Standby: Clock Stopped | Stopped | X | X | Previous State | Previous State | Previous State | Previous State |

Notes

2. X = "Don't Care," H = Logic HIGH, L = Logic LOW, ↑ represents rising edge.
3. Device powers up deselected with the outputs in a tri-state condition.
4. "A" represents address location latched by the devices when transaction was initiated. A + 1, A + 2, and A + 3 represent the address sequence in the burst.
5. "t" represents the cycle at which a read/write operation is started. t + 1, t + 2, t + 3 and t + 4 are the first, second, third, and fourth clock cycles, respectively, succeeding the "t" clock cycle.
6. Data inputs are registered at K and K̄ rising edges. Data outputs are delivered on K and K̄ rising edges.
7. Cypress recommends that K = K̄ = HIGH when clock is stopped. This is not essential, but permits most rapid restart by overcoming transmission line charging symmetrically.
8. If this signal was LOW to initiate the previous cycle, this signal becomes a "Don't Care" for this operation.
9. This signal was HIGH on previous K clock rise. Initiating consecutive read or write operations on consecutive K clock rises is not permitted. The device ignores the second read or write request.

Write Cycle Descriptions

The write cycle descriptions table for CY7C1261V18 and CY7C1263V18 follows.^[2, 10]

| BWS₀/ NWS₀ | BWS₁/ NWS₁ | K | \bar{K} | Comments |
|---|---|----------|-----------------------------|---|
| L | L | L-H | — | During the data portion of a write sequence: CY7C1261V18 – both nibbles (D _[7:0]) are written into the device. CY7C1263V18 – both bytes (D _[17:0]) are written into the device. |
| L | L | — | L-H | During the data portion of a write sequence: CY7C1261V18 – both nibbles (D _[7:0]) are written into the device. CY7C1263V18 – both bytes (D _[17:0]) are written into the device. |
| L | H | L-H | — | During the data portion of a write sequence: CY7C1261V18 – only the lower nibble (D _[3:0]) is written into the device, D _[7:4] remains unaltered. CY7C1263V18 – only the lower byte (D _[8:0]) is written into the device, D _[17:9] remains unaltered. |
| L | H | — | L-H | During the data portion of a write sequence: CY7C1261V18 – only the lower nibble (D _[3:0]) is written into the device, D _[7:4] remains unaltered. CY7C1263V18 – only the lower byte (D _[8:0]) is written into the device, D _[17:9] remains unaltered. |
| H | L | L-H | — | During the data portion of a write sequence: CY7C1261V18 – only the upper nibble (D _[7:4]) is written into the device, D _[3:0] remains unaltered. CY7C1263V18 – only the upper byte (D _[17:9]) is written into the device, D _[8:0] remains unaltered. |
| H | L | — | L-H | During the data portion of a write sequence: CY7C1261V18 – only the upper nibble (D _[7:4]) is written into the device, D _[3:0] remains unaltered. CY7C1263V18 – only the upper byte (D _[17:9]) is written into the device, D _[8:0] remains unaltered. |
| H | H | L-H | — | No data is written into the devices during this portion of a write operation. |
| H | H | — | L-H | No data is written into the devices during this portion of a write operation. |

Write Cycle Descriptions

The write cycle descriptions table for CY7C1276V18 follows.^[2, 10]

| BWS₀ | K | \bar{K} | Comments |
|------------------------|----------|-----------------------------|--|
| L | L-H | — | During the data portion of a write sequence, the single byte (D _[8:0]) is written into the device. |
| L | — | L-H | During the data portion of a write sequence, the single byte (D _[8:0]) is written into the device. |
| H | L-H | — | No data is written into the device during this portion of a write operation. |
| H | — | L-H | No data is written into the device during this portion of a write operation. |

Note

10. Assumes a write cycle was initiated per the [Write Cycle Descriptions](#) table. NWS₀, NWS₁, BWS₀, BWS₁, BWS₂, and BWS₃ can be altered on different portions of a write cycle, as long as the setup and hold requirements are met.

Write Cycle Descriptions

The write cycle descriptions table for CY7C1265V18 follows.^[2, 10]

| BWS₀ | BWS₁ | BWS₂ | BWS₃ | K | \bar{K} | Comments |
|------------------------|------------------------|------------------------|------------------------|----------|-----------------------------|---|
| L | L | L | L | L-H | – | During the data portion of a write sequence, all four bytes ($D_{[35:0]}$) are written into the device. |
| L | L | L | L | – | L-H | During the data portion of a write sequence, all four bytes ($D_{[35:0]}$) are written into the device. |
| L | H | H | H | L-H | – | During the data portion of a write sequence, only the lower byte ($D_{[8:0]}$) is written into the device. $D_{[35:9]}$ remains unaltered. |
| L | H | H | H | – | L-H | During the data portion of a write sequence, only the lower byte ($D_{[8:0]}$) is written into the device. $D_{[35:9]}$ remains unaltered. |
| H | L | H | H | L-H | – | During the data portion of a write sequence, only the byte ($D_{[17:9]}$) is written into the device. $D_{[8:0]}$ and $D_{[35:18]}$ remain unaltered. |
| H | L | H | H | – | L-H | During the data portion of a write sequence, only the byte ($D_{[17:9]}$) is written into the device. $D_{[8:0]}$ and $D_{[35:18]}$ remain unaltered. |
| H | H | L | H | L-H | – | During the data portion of a write sequence, only the byte ($D_{[26:18]}$) is written into the device. $D_{[17:0]}$ and $D_{[35:27]}$ remain unaltered. |
| H | H | L | H | – | L-H | During the data portion of a write sequence, only the byte ($D_{[26:18]}$) is written into the device. $D_{[17:0]}$ and $D_{[35:27]}$ remain unaltered. |
| H | H | H | L | L-H | – | During the data portion of a write sequence, only the byte ($D_{[35:27]}$) is written into the device. $D_{[26:0]}$ remains unaltered. |
| H | H | H | L | – | L-H | During the data portion of a write sequence, only the byte ($D_{[35:27]}$) is written into the device. $D_{[26:0]}$ remains unaltered. |
| H | H | H | H | L-H | – | No data is written into the device during this portion of a write operation. |
| H | H | H | H | – | L-H | No data is written into the device during this portion of a write operation. |

IEEE 1149.1 Serial Boundary Scan (JTAG)

These SRAMs incorporate a serial boundary scan test access port (TAP) in the FBGA package. This part is fully compliant with IEEE Standard #1149.1-2001. The TAP operates using JEDEC standard 1.8V IO logic levels.

Disabling the JTAG Feature

It is possible to operate the SRAM without using the JTAG feature. To disable the TAP controller, tie TCK LOW (V_{SS}) to prevent device clocking. TDI and TMS are internally pulled up and may be unconnected. They may alternatively be connected to V_{DD} through a pull up resistor. TDO must 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 – Test Clock

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

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

Test Data-In (TDI)

The TDI pin 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 the [TAP Controller State Diagram on page 15](#). 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) on any register.

Test Data-Out (TDO)

The TDO output pin is used to serially clock data-out from the registers. Whether the output is active depends on the current state of the TAP state machine (see [Instruction Codes on page 19](#)). 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 pins and scans data into and out of the SRAM test circuitry. Only one register can be selected at a time through the instruction registers. Data is serially loaded into the TDI pin on the rising edge of TCK. Data is output on the TDO pin 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 pins as shown in [TAP Controller Block Diagram on page 16](#). 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 enable fault isolation of the board level serial test 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 TDI and TDO pins. 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 of the input and output pins on the SRAM. Several no connect (NC) pins are also included in the scan register to reserve pins for higher density devices.

The boundary scan register is loaded with the contents of the RAM input and output ring when the TAP controller is in the Capture-DR state and is then placed between the TDI and TDO pins 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 input and output ring.

[Boundary Scan Order on page 20](#) shows 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 [Identification Register Definitions on page 19](#).

TAP Instruction Set

Eight different instructions are possible with the three-bit instruction register. All combinations are listed in [Instruction Codes on page 19](#). Three of these instructions are listed as RESERVED and must 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 pins. To execute the instruction after it is shifted in, the TAP controller must be 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 pins 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 in 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 issued 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.

Be aware that the TAP controller clock can only operate at a frequency up to 20 MHz, although 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 may undergo 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 before 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 TRI-STATE

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

The boundary scan register has a special bit located at bit #108. When this scan cell, called the "extest output bus tri-state," is latched into the preload register during the Update-DR state in the TAP controller, it directly controls 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.

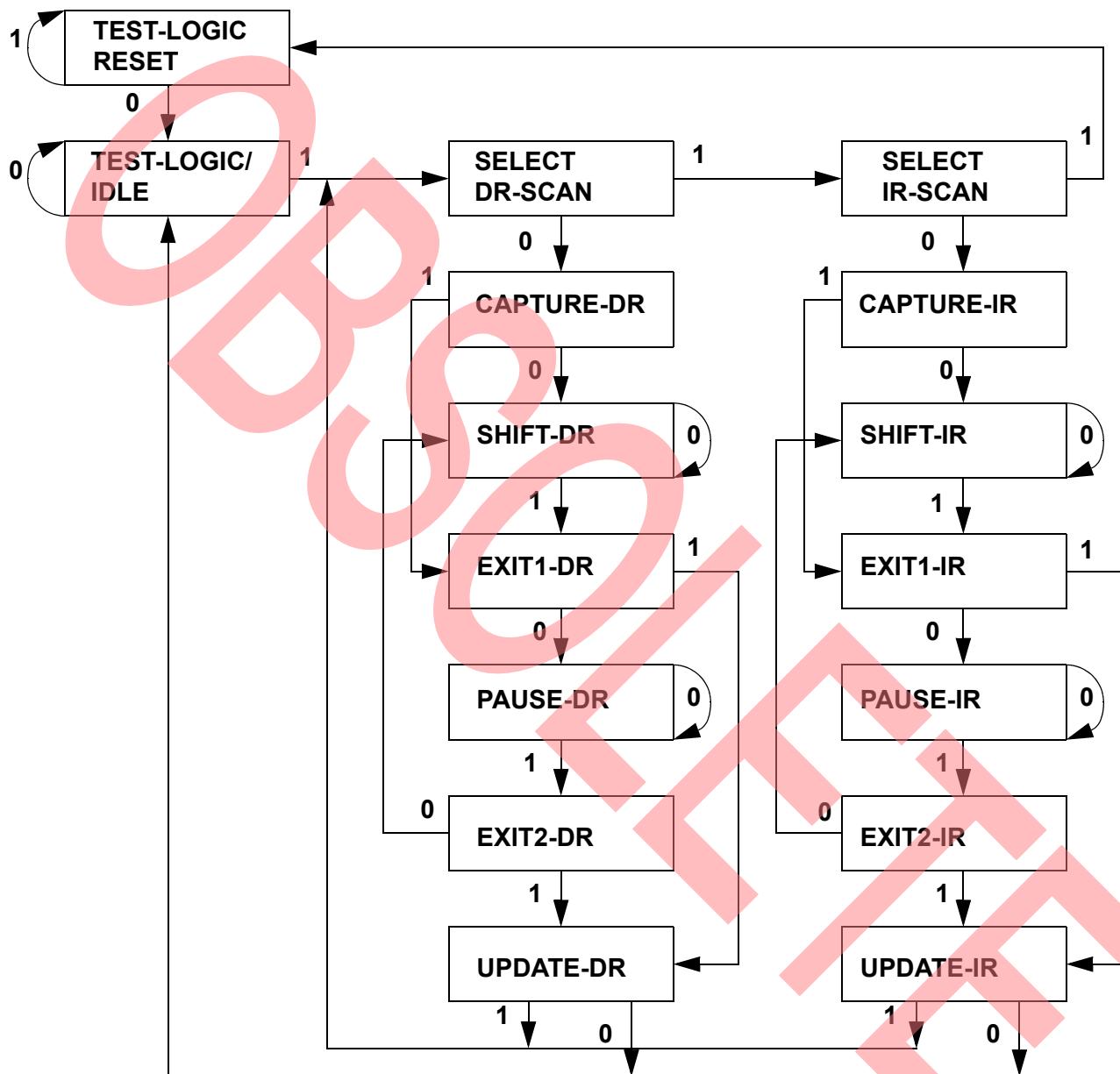
This bit can be set by entering the SAMPLE/PRELOAD or EXTEST command, and then shifting the desired bit into that cell, during the Shift-DR state. During Update-DR, the value loaded into that shift register cell latches into the preload register. When the EXTEST instruction is entered, this bit directly controls 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

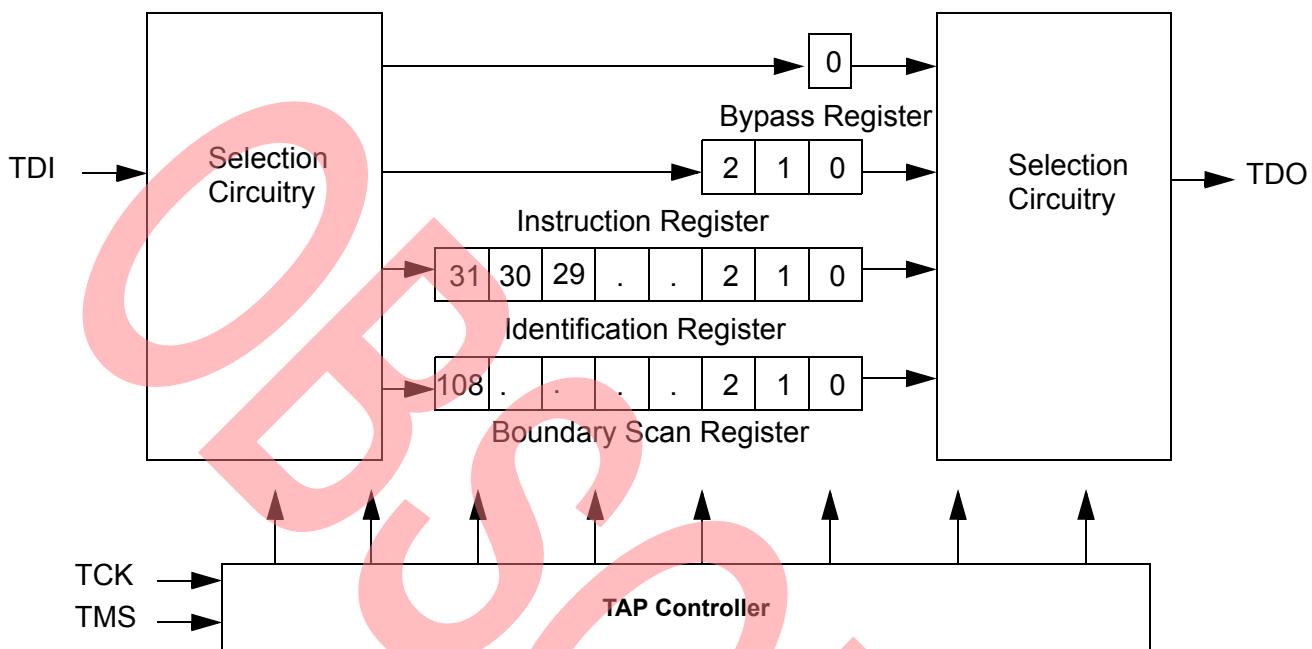
The state diagram for the TAP Controller follows.^[11]



Note

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

TAP Controller Block Diagram



TAP Electrical Characteristics

Over the Operating Range^[12, 13, 14]

| Parameter | Description | Test Conditions | Min | Max | Unit |
|-----------|-------------------------------|-----------------------------|--------------|----------------|---------------|
| V_{OH1} | Output HIGH Voltage | $I_{OH} = -2.0 \text{ mA}$ | 1.4 | | V |
| V_{OH2} | Output HIGH Voltage | $I_{OH} = -100 \mu\text{A}$ | 1.6 | | V |
| V_{OL1} | Output LOW Voltage | $I_{OL} = 2.0 \text{ mA}$ | | 0.4 | V |
| V_{OL2} | Output LOW Voltage | $I_{OL} = 100 \mu\text{A}$ | | 0.2 | V |
| V_{IH} | Input HIGH Voltage | | $0.65V_{DD}$ | $V_{DD} + 0.3$ | V |
| V_{IL} | Input LOW Voltage | | -0.3 | $0.35V_{DD}$ | V |
| I_x | Input and Output Load Current | $GND \leq V_I \leq V_{DD}$ | -5 | 5 | μA |

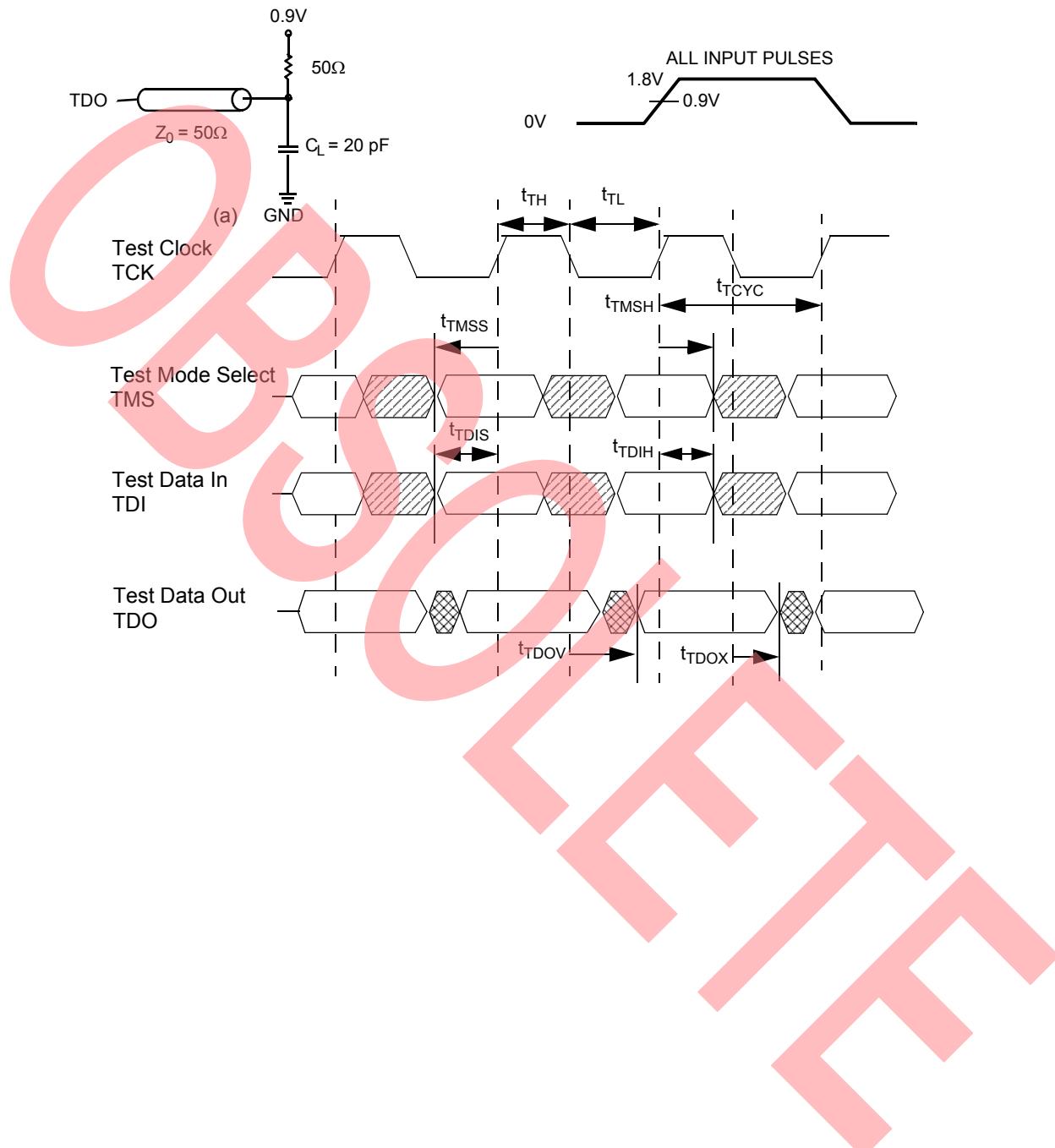
Notes

12. These characteristics apply to the TAP inputs (TMS, TCK, TDI and TDO). Parallel load levels are specified in [Electrical Characteristics on page 22](#).
13. Overshoot: $V_{IH}(\text{AC}) \leq V_{DDQ} + 0.3\text{V}$ (pulse width less than $t_{Cyc}/2$). Undershoot: $V_{IL}(\text{AC}) \geq -0.3\text{V}$ (pulse width less than $t_{Cyc}/2$).
14. All voltage refer to Ground.

TAP AC Switching Characteristics

Over the Operating Range^[15, 16]

| Parameter | Description | Min | Max | Unit |
|---------------------|-------------------------------|-----|-----|------|
| t_{TCYC} | TCK Clock Cycle Time | 50 | | ns |
| t_{TF} | TCK Clock Frequency | | 20 | MHz |
| t_{TH} | TCK Clock HIGH | 20 | | ns |
| t_{TL} | TCK Clock LOW | 20 | | 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 |
| Output Times | | | | |
| t_{TDOV} | TCK Clock LOW to TDO Valid | | 10 | ns |
| t_{TDOX} | TCK Clock LOW to TDO Invalid | 0 | | ns |

TAP Timing and Test Conditions^[16]

Notes

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

Identification Register Definitions

| Instruction Field | Value | | | | Description |
|---------------------------|-------------------|-------------------|-------------------|-------------------|---|
| | CY7C1261V18 | CY7C1276V18 | CY7C1263V18 | CY7C1265V18 | |
| Revision Number (31:29) | 000 | 000 | 000 | 000 | Version number. |
| Cypress Device ID (28:12) | 11010010001000111 | 11010010001001111 | 11010010001010111 | 11010010001100111 | Defines the type of SRAM. |
| Cypress JEDEC ID (11:1) | 00000110100 | 00000110100 | 00000110100 | 00000110100 | Enables unique identification of SRAM vendor. |
| ID Register Presence (0) | 1 | 1 | 1 | 1 | Indicates the presence of an ID register. |

Scan Register Sizes

| Register Name | Bit Size |
|---------------|----------|
| Instruction | 3 |
| Bypass | 1 |
| ID | 32 |
| Boundary Scan | 109 |

Instruction Codes

| Instruction | Code | Description |
|----------------|------|--|
| EXTEST | 000 | Captures the input/output ring contents. |
| 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 operation. |
| SAMPLE Z | 010 | Captures the input and output 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 the input/output ring contents. Places the boundary scan register between TDI and TDO. Does not affect the 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 operation. |

Boundary Scan Order

| Bit # | Bump ID |
|-------|---------|
| 0 | 6R |
| 1 | 6P |
| 2 | 6N |
| 3 | 7P |
| 4 | 7N |
| 5 | 7R |
| 6 | 8R |
| 7 | 8P |
| 8 | 9R |
| 9 | 11P |
| 10 | 10P |
| 11 | 10N |
| 12 | 9P |
| 13 | 10M |
| 14 | 11N |
| 15 | 9M |
| 16 | 9N |
| 17 | 11L |
| 18 | 11M |
| 19 | 9L |
| 20 | 10L |
| 21 | 11K |
| 22 | 10K |
| 23 | 9J |
| 24 | 9K |
| 25 | 10J |
| 26 | 11J |
| 27 | 11H |

| Bit # | Bump ID |
|-------|---------|
| 28 | 10G |
| 29 | 9G |
| 30 | 11F |
| 31 | 11G |
| 32 | 9F |
| 33 | 10F |
| 34 | 11E |
| 35 | 10E |
| 36 | 10D |
| 37 | 9E |
| 38 | 10C |
| 39 | 11D |
| 40 | 9C |
| 41 | 9D |
| 42 | 11B |
| 43 | 11C |
| 44 | 9B |
| 45 | 10B |
| 46 | 11A |
| 47 | 10A |
| 48 | 9A |
| 49 | 8B |
| 50 | 7C |
| 51 | 6C |
| 52 | 8A |
| 53 | 7A |
| 54 | 7B |
| 55 | 6B |

| Bit # | Bump ID |
|-------|---------|
| 56 | 6A |
| 57 | 5B |
| 58 | 5A |
| 59 | 4A |
| 60 | 5C |
| 61 | 4B |
| 62 | 3A |
| 63 | 2A |
| 64 | 1A |
| 65 | 2B |
| 66 | 3B |
| 67 | 1C |
| 68 | 1B |
| 69 | 3D |
| 70 | 3C |
| 71 | 1D |
| 72 | 2C |
| 73 | 3E |
| 74 | 2D |
| 75 | 2E |
| 76 | 1E |
| 77 | 2F |
| 78 | 3F |
| 79 | 1G |
| 80 | 1F |
| 81 | 3G |
| 82 | 2G |
| 83 | 1H |

| Bit # | Bump ID |
|-------|----------|
| 84 | 1J |
| 85 | 2J |
| 86 | 3K |
| 87 | 3J |
| 88 | 2K |
| 89 | 1K |
| 90 | 2L |
| 91 | 3L |
| 92 | 1M |
| 93 | 1L |
| 94 | 3N |
| 95 | 3M |
| 96 | 1N |
| 97 | 2M |
| 98 | 3P |
| 99 | 2N |
| 100 | 2P |
| 101 | 1P |
| 102 | 3R |
| 103 | 4R |
| 104 | 4P |
| 105 | 5P |
| 106 | 5N |
| 107 | 5R |
| 108 | Internal |
| | |
| | |
| | |
| | |

Power Up Sequence in QDR-II+ SRAM

QDR-II+ SRAMs must be powered up and initialized in a predefined manner to prevent undefined operations. During power up, when the DOFF is tied HIGH, the DLL is locked after 2048 cycles of stable clock.

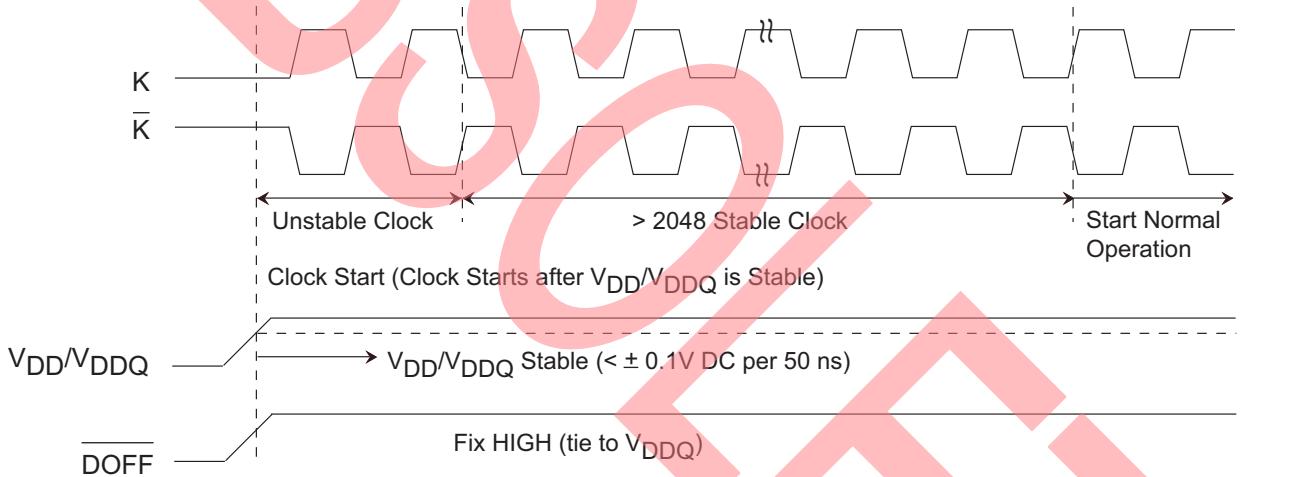
Power Up Sequence

- Apply power with $\overline{\text{DOFF}}$ tied HIGH (All other inputs can be HIGH or LOW)
 - Apply V_{DD} before V_{DDQ}
 - Apply V_{DDQ} before V_{REF} or at the same time as V_{REF}
- Provide stable power and clock (K , \overline{K}) for 2048 cycles to lock the DLL

DLL Constraints

- DLL uses K clock as its synchronizing input. The input must have low phase jitter, which is specified as $t_{KC\text{ Var}}$
- The DLL functions at frequencies down to 120 MHz.
- If the input clock is unstable and the DLL is enabled, then the DLL may lock onto an incorrect frequency, causing unstable SRAM behavior. To avoid this, provide 2048 cycles stable clock to relock to the clock frequency you want.

Figure 2. Power Up Waveforms



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 | | -0.5V to + 2.9V |
| Supply Voltage on V_{DDQ} Relative to GND | | -0.5V to + V_{DD} |
| DC Applied to Outputs in High-Z | | -0.5V to $V_{DDQ} + 0.3V$ |
| DC Input Voltage ^[13] | | -0.5V to $V_{DD} + 0.3V$ |

| | |
|---|---------|
| Current into Outputs (LOW)..... | 20 mA |
| Static Discharge Voltage (MIL-STD-883, M. 3015).... | >2001V |
| Latch Up Current | >200 mA |

Electrical Characteristics

Over the Operating Range^[14]

DC Electrical Characteristics

| Parameter | Description | Test Conditions | Min | Typ | Max | Unit |
|--------------------------|---|--|--------------------|------|--------------------|------|
| V_{DD} | Power Supply Voltage | | 1.7 | 1.8 | 1.9 | V |
| V_{DDQ} | IO Supply Voltage | | 1.4 | 1.5 | V_{DD} | V |
| V_{OH} | Output HIGH Voltage | Note 18 | $V_{DDQ}/2 - 0.12$ | | $V_{DDQ}/2 + 0.12$ | V |
| V_{OL} | Output LOW Voltage | Note 19 | $V_{DDQ}/2 - 0.12$ | | $V_{DDQ}/2 + 0.12$ | V |
| $V_{OH(LOW)}$ | Output HIGH Voltage | $I_{OH} = -0.1$ mA, Nominal Impedance | $V_{DDQ} - 0.2$ | | V_{DDQ} | V |
| $V_{OL(LOW)}$ | Output LOW Voltage | $I_{OL} = 0.1$ mA, Nominal Impedance | V_{SS} | | 0.2 | V |
| V_{IH} | Input HIGH Voltage | | $V_{REF} + 0.1$ | | $V_{DDQ} + 0.15$ | V |
| V_{IL} | Input LOW Voltage | | -0.15 | | $V_{REF} - 0.1$ | V |
| I_X | Input Leakage Current | $GND \leq V_I \leq V_{DDQ}$ | -2 | | 2 | µA |
| I_{OZ} | Output Leakage Current | $GND \leq V_I \leq V_{DDQ}$, Output Disabled | -2 | | 2 | µA |
| V_{REF} | Input Reference Voltage ^[20] | Typical Value = 0.75V | 0.68 | 0.75 | 0.95 | V |
| I_{DD} ^[21] | V_{DD} Operating Supply | $V_{DD} = \text{Max.}$, $I_{OUT} = 0$ mA, $f = f_{MAX} = 1/t_{CYC}$ | 300 MHz | | 1040 | mA |
| | | | 333 MHz | | 1120 | mA |
| | | | 375 MHz | | 1240 | mA |
| | | | 400 MHz | | 1330 | mA |
| I_{SB1} | Automatic Power Down Current | Max. V_{DD} , Both Ports Deselected, $V_{IN} \geq V_{IH}$ or $V_{IN} \leq V_{IL}$ $f = f_{MAX} = 1/t_{CYC}$, Inputs Static | 300 MHz | | 280 | mA |
| | | | 333 MHz | | 300 | mA |
| | | | 375 MHz | | 310 | mA |
| | | | 400 MHz | | 320 | mA |

AC Electrical Characteristics

Over the Operating Range^[13]

| Parameter | Description | Test Conditions | Min | Typ. | Max | Unit |
|-----------|--------------------|-----------------|-----------------|------|------------------|------|
| V_{IH} | Input HIGH Voltage | | $V_{REF} + 0.2$ | - | $V_{DDQ} + 0.24$ | V |
| V_{IL} | Input LOW Voltage | | -0.24 | - | $V_{REF} - 0.2$ | V |

Notes

17. Power up: assumes a linear ramp from 0V to V_{DD} (min) within 200 ms. During this time $V_{IH} < V_{DD}$ and $V_{DDQ} \leq V_{DD}$.
18. Outputs are impedance controlled. $I_{OH} = -(V_{DDQ}/2)/(RQ/5)$ for values of $175\Omega \leq RQ \leq 350\Omega$.
19. Outputs are impedance controlled. $I_{OL} = (V_{DDQ}/2)/(RQ/5)$ for values of $175\Omega \leq RQ \leq 350\Omega$.
20. V_{REF} (min) = 0.68V or $0.46V_{DDQ}$, whichever is larger, V_{REF} (max) = 0.95V or $0.54V_{DDQ}$, whichever is smaller.
21. The operation current is calculated with 50% read cycle and 50% write cycle.

Capacitance

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

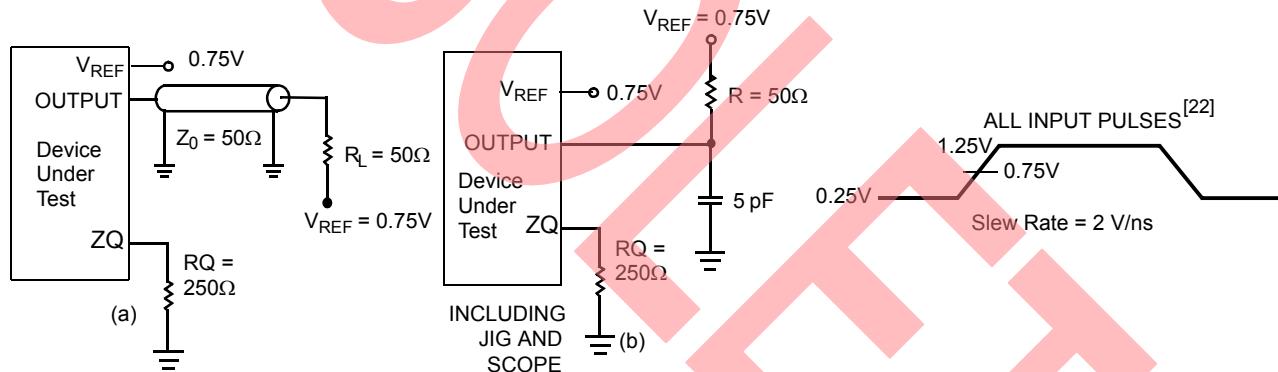
| Parameter | Description | Test Conditions | Max | Unit |
|-----------|-------------------------|---|-----|------|
| C_{IN} | Input Capacitance | $T_A = 25^\circ\text{C}$, $f = 1 \text{ MHz}$, | 5 | pF |
| C_{CLK} | Clock Input Capacitance | $V_{DD} = 1.8\text{V}$ $V_{DDQ} = 1.5\text{V}$ | 4 | pF |
| C_O | Output Capacitance | | 5 | pF |

Thermal Resistance

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

| Parameter | Description | Test Conditions | 165 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. | 16.25 | $^\circ\text{C/W}$ |
| Θ_{JC} | Thermal Resistance (Junction to Case) | | 2.91 | $^\circ\text{C/W}$ |

Figure 3. AC Test Loads and Waveforms



Note

22. Unless otherwise noted, test conditions assume signal transition time of 2V/ns, timing reference levels of 0.75V, $V_{REF} = 0.75\text{V}$, $RQ = 250\Omega$, $V_{DDQ} = 1.5\text{V}$, input pulse levels of 0.25V to 1.25V, and output loading of the specified I_{OL}/I_{OH} and load capacitance shown in (a) of [AC Test Loads and Waveforms](#).

Switching Characteristics

 Over the Operating Range^[22, 23]

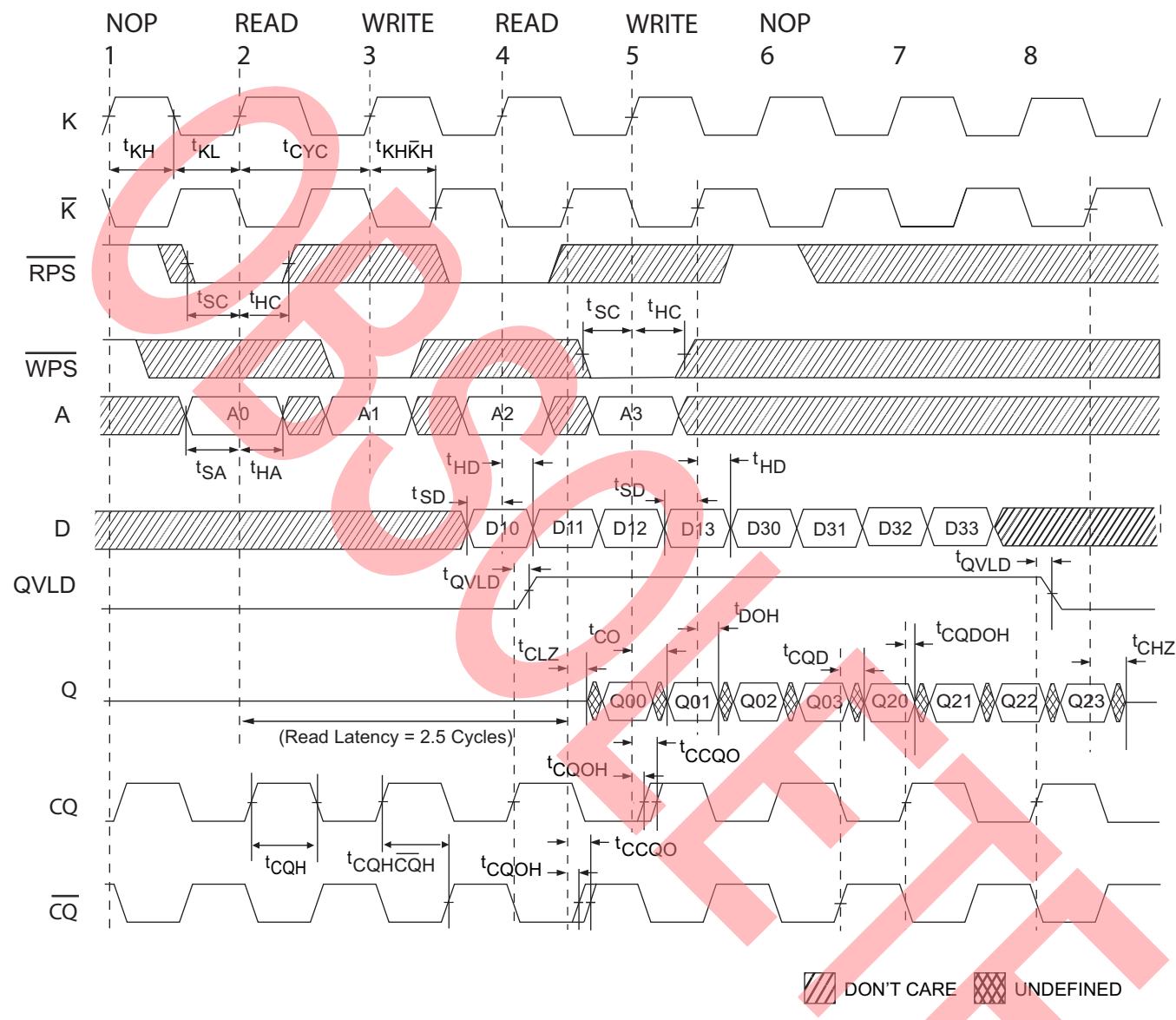
| Cypress Parameter | Consortium Parameter | Description | 400 MHz | | 375 MHz | | 333 MHz | | 300 MHz | | Unit |
|---------------------|----------------------|---|---------|------|---------|------|---------|------|---------|------|-----------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| t_{POWER} | | V_{DD} (Typical) to the First Access ^[24] | 1 | — | 1 | — | 1 | — | 1 | — | ms |
| t_{CYC} | t_{KHKH} | K Clock Cycle Time | 2.50 | 8.4 | 2.66 | 8.4 | 3.0 | 8.4 | 3.3 | 8.4 | ns |
| t_{KH} | t_{KHKL} | Input Clock (K/K) HIGH | 0.4 | — | 0.4 | — | 0.4 | — | 0.4 | — | t_{CYC} |
| t_{KL} | t_{KLKH} | Input Clock (K/K) LOW | 0.4 | — | 0.4 | — | 0.4 | — | 0.4 | — | t_{CYC} |
| t_{KHKH} | t_{KHKH} | K Clock Rise to K Clock Rise (rising edge to rising edge) | 1.06 | — | 1.13 | — | 1.28 | — | 1.40 | — | ns |
| Setup Times | | | | | | | | | | | |
| t_{SA} | t_{AVKH} | Address Setup to K Clock Rise | 0.4 | — | 0.4 | — | 0.4 | — | 0.4 | — | ns |
| t_{SC} | t_{IVKH} | Control Setup to K Clock Rise (RPS, WPS) | 0.4 | — | 0.4 | — | 0.4 | — | 0.4 | — | ns |
| t_{SCDDR} | t_{IVKH} | Double Data Rate Control Setup to Clock (K, K) Rise (BWS ₀ , BWS ₁ , BWS ₂ , BWS ₃) | 0.28 | — | 0.28 | — | 0.28 | — | 0.28 | — | ns |
| t_{SD} | t_{DVKH} | D _[x:0] Setup to Clock (K/K) Rise | 0.28 | — | 0.28 | — | 0.28 | — | 0.28 | — | ns |
| Hold Times | | | | | | | | | | | |
| t_{HA} | t_{KHAX} | Address Hold after K Clock Rise | 0.4 | — | 0.4 | — | 0.4 | — | 0.4 | — | ns |
| t_{HC} | t_{KHIX} | Control Hold after K Clock Rise (RPS, WPS) | 0.4 | — | 0.4 | — | 0.4 | — | 0.4 | — | ns |
| t_{HCDDR} | t_{KHIX} | Double Data Rate Control Hold after Clock (K/K) Rise (BWS ₀ , BWS ₁ , BWS ₂ , BWS ₃) | 0.28 | — | 0.28 | — | 0.28 | — | 0.28 | — | ns |
| t_{HD} | t_{KHDX} | D _[x:0] Hold after Clock (K/K) Rise | 0.28 | — | 0.28 | — | 0.28 | — | 0.28 | — | ns |
| Output Times | | | | | | | | | | | |
| t_{CO} | t_{CHQV} | K/K Clock Rise to Data Valid | — | 0.45 | — | 0.45 | — | 0.45 | — | 0.45 | ns |
| t_{DOH} | t_{CHQX} | Data Output Hold after Output K/K Clock Rise (Active to Active) | -0.45 | — | -0.45 | — | -0.45 | — | -0.45 | — | ns |
| t_{CCQO} | t_{CHCQV} | K/K Clock Rise to Echo Clock Valid | — | 0.45 | — | 0.45 | — | 0.45 | — | 0.45 | ns |
| t_{CQOH} | t_{CHCQX} | Echo Clock Hold after K/K Clock Rise | -0.45 | — | -0.45 | — | -0.45 | — | -0.45 | — | ns |
| t_{CQD} | t_{CQHQV} | Echo Clock High to Data Valid | — | 0.2 | — | 0.2 | — | 0.2 | — | 0.2 | ns |
| t_{CQDOH} | t_{CQHQX} | Echo Clock High to Data Invalid | -0.2 | — | -0.2 | — | -0.2 | — | -0.2 | — | ns |
| t_{CQH} | t_{CQHCQL} | Output Clock (CQ/CQ) HIGH ^[25] | 0.81 | — | 0.88 | — | 1.03 | — | 1.15 | — | ns |
| t_{CQHCQH} | t_{CQHCQH} | CQ Clock Rise to CQ Clock Rise ^[25] (rising edge to rising edge) | 0.81 | — | 0.88 | — | 1.03 | — | 1.15 | — | ns |
| t_{CHZ} | t_{CHQZ} | Clock (K/K) Rise to High-Z (Active to High-Z) ^[26, 27] | — | 0.45 | — | 0.45 | — | 0.45 | — | 0.45 | ns |
| t_{CLZ} | t_{CHQX1} | Clock (K/K) Rise to Low-Z ^[26, 27] | -0.45 | — | -0.45 | — | -0.45 | — | -0.45 | — | ns |
| t_{QVLD} | $t_{CQHQVLD}$ | Echo Clock High to QVLD Valid ^[28] | -0.20 | 0.20 | -0.20 | 0.20 | -0.20 | 0.20 | -0.20 | 0.20 | ns |
| DLL Timing | | | | | | | | | | | |
| $t_{KC Var}$ | $t_{KC Var}$ | Clock Phase Jitter | — | 0.20 | — | 0.20 | — | 0.20 | — | 0.20 | ns |
| $t_{KC lock}$ | $t_{KC lock}$ | DLL Lock Time (K) | 2048 | — | 2048 | — | 2048 | — | 2048 | — | Cycles |
| $t_{KC Reset}$ | $t_{KC Reset}$ | K Static to DLL Reset ^[29] | 30 | — | 30 | — | 30 | — | 30 | — | ns |

Notes

23. When a part with a maximum frequency above 300 MHz is operating at a lower clock frequency, it requires the input timings of the frequency range in which it is being operated and outputs data with the output timings of that frequency range.
24. This part has an internal voltage regulator; t_{POWER} is the time that the power must be supplied above V_{DD} minimum initially before a read or write operation can be initiated.
25. These parameters are extrapolated from the input timing parameters ($t_{KHKH} = 250$ ps, where 250 ps is the internal jitter. An input jitter of 200 ps ($t_{KC Var}$) is already included in the t_{KHKH}). These parameters are only guaranteed by design and are not tested in production.
26. t_{CHZ} , t_{CLZ} are specified with a load capacitance of 5 pF as in part (b) of [AC Test Loads and Waveforms on page 23](#). Transition is measured ± 100 mV from steady-state voltage.
27. At any voltage and temperature t_{CHZ} is less than t_{CLZ} and t_{CHZ} less than t_{CO} .
28. t_{QVLD} spec is applicable for both rising and falling edges of QVLD signal.
29. Hold to $>V_{IH}$ or $<V_{IL}$.

Switching Waveforms

Figure 4. Read/Write/Deselect Sequence Waveform for 2.5 Cycle Read Latency^[30, 31, 32]



Notes

30. Q00 refers to output from address A0. Q01 refers to output from the next internal burst address following A0, that is, A0+1.

31. Outputs are disabled (High-Z) one clock cycle after a NOP.

32. In this example, if address A2 = A1, then data Q20 = D10 and Q21 = D11. Write data is forwarded immediately as read results. This note applies to the whole diagram.

Ordering Information

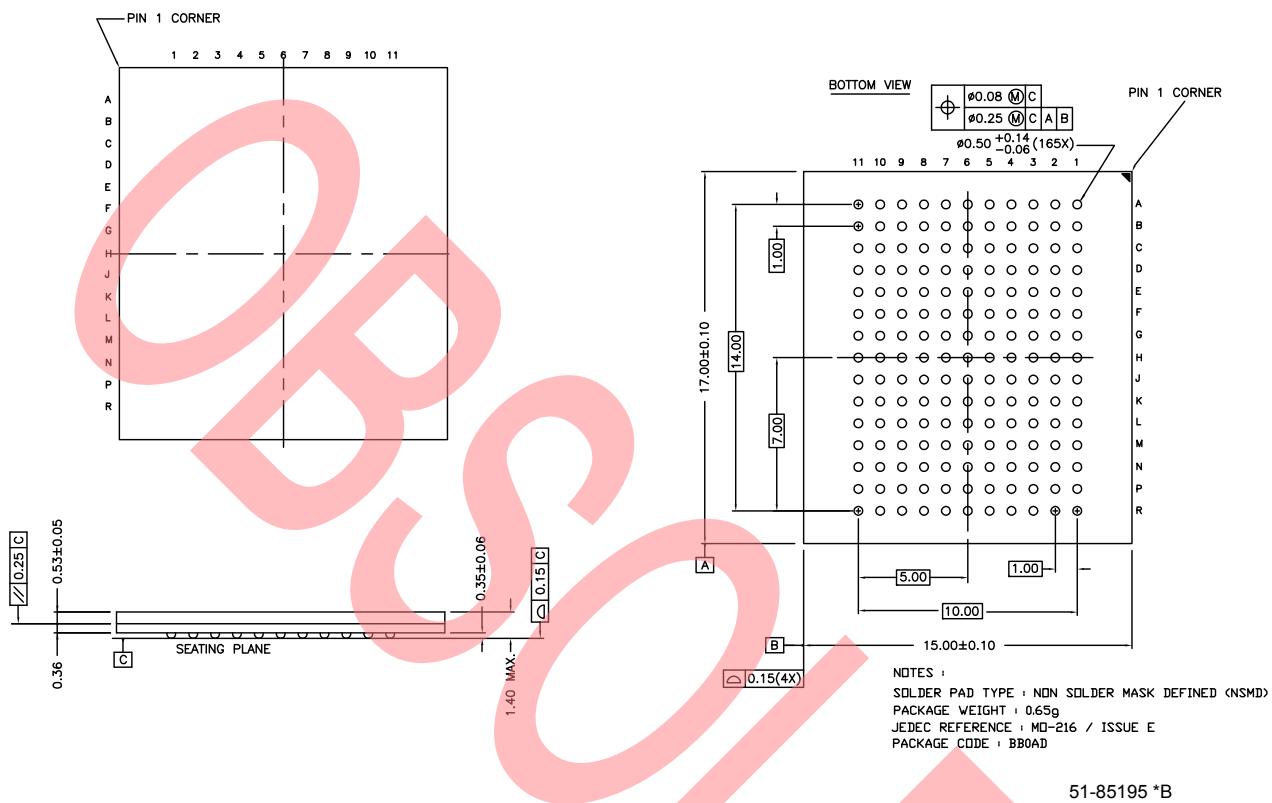
Cypress offers other versions of this type of product in many different configurations and features. The below table contains only the list of parts that are currently available. For a complete listing of all options, visit the Cypress website at www.cypress.com and refer to the product summary page at <http://www.cypress.com/products> or contact your local sales representative. 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 | Package Type | Operating Range |
|-------------|---------------------|-----------------|--|-----------------|
| 400 | CY7C1263V18-400BZC | 51-85195 | 165-Ball Fine Pitch Ball Grid Array (15 x 17 x 1.4 mm) | Commercial |
| | CY7C1265V18-400BZC | | | |
| | CY7C1263V18-400BZXC | 51-85195 | 165-Ball Fine Pitch Ball Grid Array (15 x 17 x 1.4 mm) Pb-Free | |
| | CY7C1265V18-400BZXC | | | |

BSI OFF

Package Diagram

Figure 5. 165-Ball FBGA (15 x 17 x 1.40 mm), 51-85195



Document History Page

| Document Title: CY7C1261V18/CY7C1276V18/CY7C1263V18/CY7C1265V18, 36-Mbit QDR™-II+ SRAM 4-Word Burst Architecture (2.5 Cycle Read Latency) Document Number: 001-06366 | | | | |
|---|---------|-----------------|-----------------|---|
| REV. | ECN NO. | SUBMISSION DATE | ORIG. OF CHANGE | DESCRIPTION OF CHANGE |
| ** | 425689 | See ECN | NXR | New Data Sheet |
| *A | 461639 | See ECN | NXR | Revised the MPNs from CY7C1256AV18 to CY7C1276V18 CY7C1263AV18 to CY7C1263V18 CY7C1265AV18 to CY7C1265V18 Changed t_{TH} and t_{TL} from 40 ns to 20 ns, changed t_{TMSS} , t_{TDIS} , t_{CS} , t_{TMSH} , t_{TDIH} , t_{CH} from 10 ns to 5 ns and changed t_{TDOV} from 20 ns to 10 ns in TAP AC Switching Characteristics table Modified Power-Up waveform |
| *B | 497628 | See ECN | NXR | Changed the V_{DDQ} operating voltage to 1.4V to V_{DD} in the Features section, in Operating Range table and in the DC Electrical Characteristics table Added foot note in page# 1 Changed the Maximum rating of Ambient Temperature with Power Applied from -10°C to $+85^{\circ}\text{C}$ to -55°C to $+125^{\circ}\text{C}$ Changed V_{REF} (Max.) spec from 0.85V to 0.95V in the DC Electrical Characteristics table and in the note below the table Updated note# 20 to specify Overshoot and Undershoot Spec Updated Θ_{JA} and Θ_{JC} values Removed x9 part and its related information Updated footnote #25 |
| *C | 1072841 | See ECN | VKN/KKVTMP | Converted from preliminary to final Added x8 and x9 parts Changed I_{DD} values from 1050 mA to 1330 mA for 400 MHz, 950 mA to 1240 mA for 375 MHz, 850 mA to 1120 mA for 333 MHz, 800 mA to 1040 mA for 300 MHz Changed I_{SB} values from 325 mA to 320 mA for 400 MHz, 300 mA to 310 mA for 375 MHz, 275 mA to 300 mA for 333 MHz, 250 mA to 280 mA for 300 MHz Changed t_{CYC} max spec to 8.4 ns for all speed bins Changed Θ_{JA} value from 12.43°C/W to 16.25°C/W Updated Ordering Information table |
| *D | 2198506 | See ECN | VKN/AESA | Added footnote# 21 related to I_{DD} |
| *E | 2560835 | 09/02/08 | VKN/PYRS | Corrected typo in the "Configurations" section on page# 1 |
| *F | 2902738 | 03/31/2010 | NJY | Removed inactive parts from Ordering information table; Updated package diagram. |
| *G | 3086116 | 11/15/2010 | NJY | Obsolete document. |

© Cypress Semiconductor Corporation, 2006-2010. The information contained herein is subject to change without notice. Cypress Semiconductor Corporation assumes no responsibility for the use of any circuitry other than circuitry embodied in a Cypress product. Nor does it convey or imply any license under patent or other rights. Cypress products are not warranted nor intended to be used for medical, life support, life saving, critical control or safety applications, unless pursuant to an express written agreement with Cypress. Furthermore, Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress products in life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

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

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

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