



CYPRESS



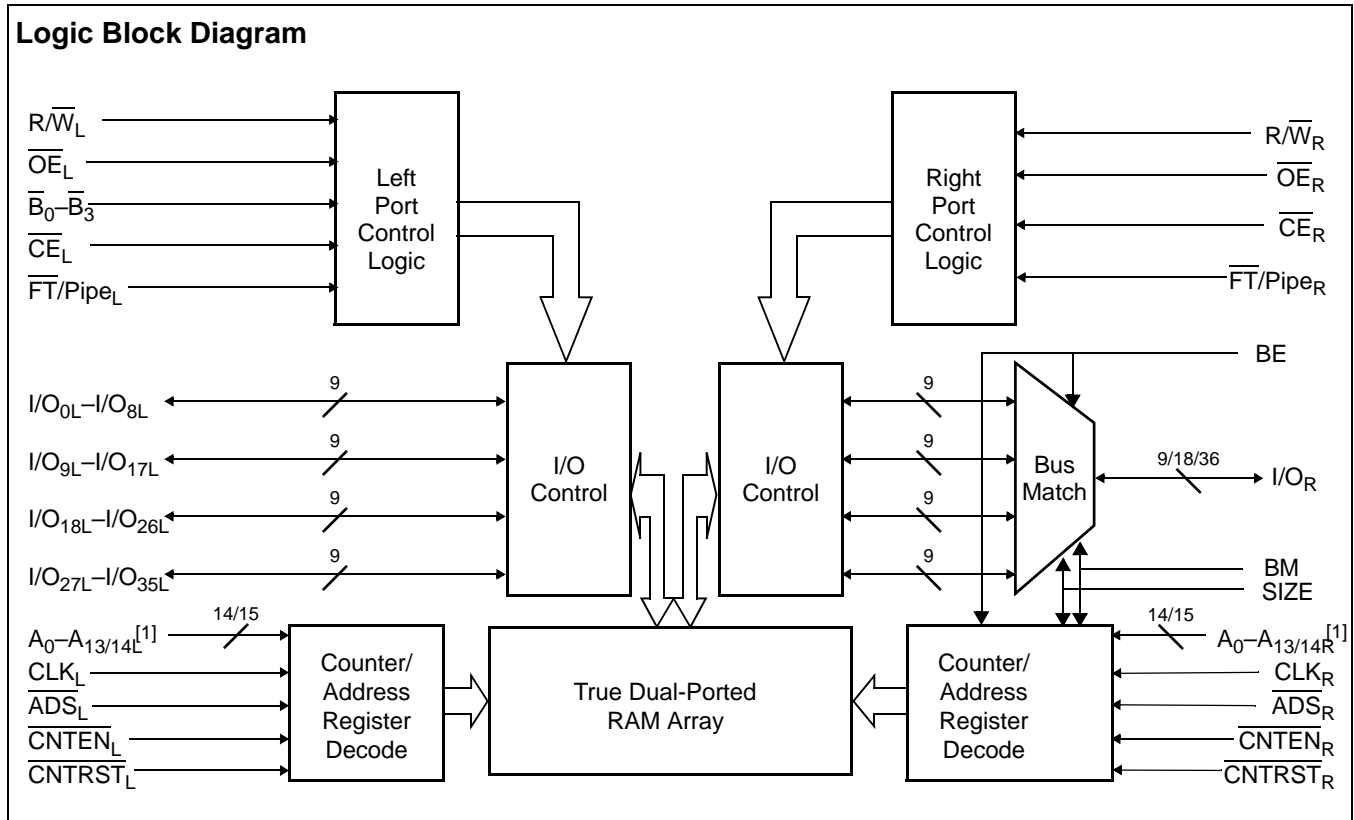
CY7C09569V  
CY7C09579V

# 3.3V 16K/32K x 36 FLEx36™ Synchronous Dual-Port Static RAM

## Features

- True dual-ported memory cells which allow simultaneous access of the same memory location
- Two Flow-Through/Pipelined devices
  - 16K x 36 organization (CY7C09569V)
  - 32K x 36 organization (CY7C09579V)
- 0.25-micron CMOS for optimum speed/power
- Three modes
  - Flow-Through
  - Pipelined
  - Burst
- Bus-Matching Capabilities on Right Port (x36 to x18 or x9)
- Byte-Select Capabilities on Left Port
- 100-MHz Pipelined Operation
- High-speed clock to data access 5/6/8 ns
- 3.3V Low operating power
  - Active = 250 mA (typical)
  - Standby = 10  $\mu$ A (typical)
- Fully synchronous interface for ease of use
- Burst counters increment addresses internally
  - Shorten cycle times
  - Minimize bus noise
  - Supported in Flow-Through and Pipelined modes
- Counter Address Read Back via I/O lines
- Single Chip Enable
- Automatic power-down
- Commercial and Industrial Temperature Ranges
- Compact package
  - 144-Pin TQFP (20 x 20 x 1.4 mm)
  - 144-Pin Pb-Free TQFP (20 x 20 x 1.4 mm)
  - 172-Ball BGA (1.0-mm pitch) (15 x 15 x 0.51 mm)

## Logic Block Diagram



### Note:

1.  $A_0-A_{13}$  for 16K;  $A_0-A_{14}$  for 32K devices.

## Functional Description

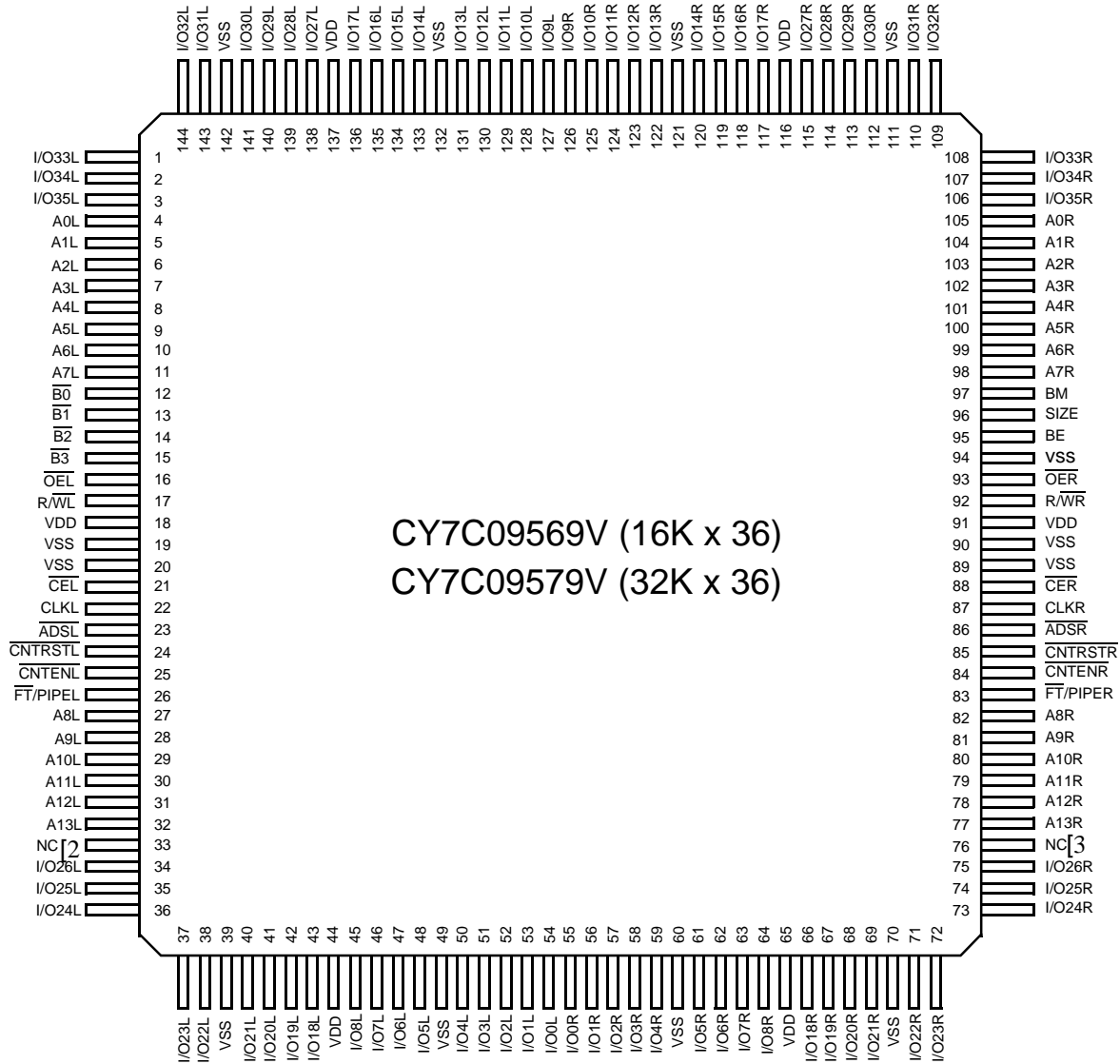
The CY7C09569V and CY7C09579V are high-speed 3.3V synchronous CMOS 16K and 32K x 36 dual-port static RAMs. Two ports are provided, permitting independent, simultaneous access for reads and writes to any location in memory. Registers on control, address, and data lines allow for minimal set-up and hold times. In pipelined output mode, data is registered for decreased cycle time. Clock to data valid  $t_{CD2} = 5$  ns (pipelined). Flow-through mode can also be used to bypass the pipelined output register to eliminate access latency. In flow-through mode data will be available  $t_{CD1} = 12.5$  ns after the address is clocked into the device. Pipelined output or flow-through mode is selected via the FT/Pipe pin.

Each port contains a burst counter on the input address register. The internal write pulse width is independent of the external R/W LOW duration. The internal write pulse is self-timed to allow the shortest possible cycle times.

A HIGH on  $\overline{CE}$  for one clock cycle will power down the internal circuitry to reduce the static power consumption. In the pipelined mode, one cycle is required with  $\overline{CE}$  LOW to reactivate the outputs.

Counter Enable Inputs are provided to stall the operation of the address input and utilize the internal address generated by the internal counter for fast interleaved memory applications. A port's burst counter is loaded with the port's Address Strobe (ADS). When the port's Count Enable ( $\overline{CNTEN}$ ) is asserted, the address counter will increment on each LOW-to-HIGH transition of that port's clock signal. This will read/write one word from/into each successive address location until  $\overline{CNTEN}$  is deasserted. The counter can address the entire memory array and will loop back to the start. Counter Reset ( $\overline{CNTRST}$ ) is used to reset the burst counter.

All parts are available in 144-Pin Thin Quad Plastic Flatpack (TQFP), 144-Pin Pb-Free Thin Quad Plastic Flatpack (TQFP) and 172-Ball Ball Grid Array (BGA) packages.

**Pin Configurations**
**144-Pin Thin Quad Flatpack (TQFP)**
**Top View**

**Notes:**

2. This pin is A14L for CY7C09579V.
3. This pin is A14R for CY7C09579V.

**Pin Configurations** (continued)

**172-Ball Ball Grid Array (BGA)**
**Top View**

|   | 1                     | 2                 | 3                   | 4                    | 5      | 6      | 7      | 8      | 9      | 10     | 11                   | 12                  | 13                | 14                    |
|---|-----------------------|-------------------|---------------------|----------------------|--------|--------|--------|--------|--------|--------|----------------------|---------------------|-------------------|-----------------------|
| A | I/O32L                | I/O30L            | NC                  | VSS                  | I/O13L | VDD    | I/O11L | I/O11R | VDD    | I/O13R | VSS                  | NC                  | I/O30R            | I/O32R                |
| B | A0L                   | I/O33L            | I/O29               | I/O17L               | I/O14L | I/O12L | I/O9L  | I/O9R  | I/O12R | I/O14R | I/O17R               | I/O29R              | I/O33R            | A0R                   |
| C | NC                    | A1L               | I/O31L              | I/O27L               | NC     | I/O15L | I/O10L | I/O10R | I/O15R | NC     | I/O27R               | I/O31R              | A1R               | NC                    |
| D | A2L                   | A3L               | I/O35L              | I/O34L               | I/O28L | I/O16L | VSS    | VSS    | I/O16R | I/O28R | I/O34R               | I/O35R              | A3R               | A2R                   |
| E | A4L                   | A5L               | NC                  | $\overline{B0L}$     | NC     | NC     |        |        | NC     | NC     | BM                   | NC                  | A5R               | A4R                   |
| F | VDD                   | A6L               | A7L                 | $\overline{B1L}$     | NC     |        |        |        |        | NC     | SIZE                 | A7R                 | A6R               | VDD                   |
| G | $\overline{OEL}$      | $\overline{B2L}$  | $\overline{B3L}$    | $\overline{CEL}$     |        |        |        |        |        |        | $\overline{CER}$     | VSS                 | BE                | $\overline{OER}$      |
| H | VSS                   | $\overline{R/WL}$ | A8L                 | CLKL                 |        |        |        |        |        |        | CLKR                 | A8R                 | $\overline{R/WR}$ | VSS                   |
| J | A9L                   | A10L              | VSS                 | $\overline{ADSL}$    | NC     |        |        |        |        | NC     | $\overline{ADSR}$    | VSS                 | A10R              | A9R                   |
| K | A11L                  | A12L              | NC                  | $\overline{CNTRSTL}$ | NC     | NC     |        |        | NC     | NC     | $\overline{CNTRSTR}$ | NC                  | A12R              | A11R                  |
| L | $\overline{FT/PIPEL}$ | A13L              | $\overline{CNTENL}$ | I/O26L               | I/O25L | I/O19L | VSS    | VSS    | I/O19R | I/O25R | I/O26R               | $\overline{CNTENR}$ | A13R              | $\overline{FT/PIPER}$ |
| M | NC                    | NC <sup>[2]</sup> | I/O22L              | I/O18L               | NC     | I/O7L  | I/O2L  | I/O2R  | I/O7R  | NC     | I/O18R               | I/O22R              | NC <sup>[3]</sup> | NC                    |
| N | I/O24L                | I/O20L            | I/O8L               | I/O6L                | I/O5L  | I/O3L  | I/O0L  | I/O0R  | I/3R   | I/O5R  | I/O6R                | I/O8R               | I/O20R            | I/O24R                |
| P | I/O23L                | I/O21L            | NC                  | VSS                  | I/O4L  | VDD    | I/O1L  | I/O1R  | VDD    | I/O4R  | VSS                  | NC                  | I/O21R            | I/O23R                |

## Selection Guide

|   | <b>CY7C09569V<br/>CY7C09579V<br/>-100</b> | <b>CY7C09569V<br/>CY7C09579V<br/>-83</b> | <b>CY7C09569V<br/>CY7C09579V<br/>-67</b> | <b>Unit</b> |
|---|---|--|--|-------------|
| $f_{MAX2}$ (Pipelined)  | 100                                       | 83                                       | 67                                       | MHz         |
| Max. Access Time (Clock to Data, Pipelined)                   | 5   | 6  | 8  | ns          |
| Typical Operating Current $I_{CC}$                            | 250                                       | 240                                      | 230                                      | mA          |
| Typical Standby Current for $I_{SB1}$ (Both Ports TTL Level)  | 30  | 25                                       | 25                                       | mA          |
| Typical Standby Current for $I_{SB3}$ (Both Ports CMOS Level) | 10  | 10                                       | 10                                       | $\mu$ A     |

## Pin Definitions

| <b>Left Port</b>     | <b>Right Port</b>    | <b>Description</b>  |
|----------------------|----------------------|---|
| $A_{0L}-A_{13/14L}$  | $A_{0R}-A_{13/14R}$  | Address Inputs ( $A_0-A_{13}$ for 16K, $A_0-A_{14}$ for 32K devices).   |
| $ADS_L$              | $ADS_R$              | Address Strobe Input. Used as an address qualifier. This signal should be asserted LOW to assert the part using the externally supplied address on Address Pins. To load this address into the Burst Address Counter both ADS and CNTEN have to be LOW. ADS is disabled if CNTRST is asserted LOW |
| $CE_L$               | $CE_R$               | Chip Enable Input.  |
| $CLK_L$              | $CLK_R$              | Clock Signal. This input can be free-running or strobed. Maximum clock input rate is $f_{MAX}$ .  |
| $CNTEN_L$            | $CNTEN_R$            | Counter Enable Input. Asserting this signal <u>LOW</u> increments the burst address counter of its respective port on each rising edge of CLK. CNTEN is disabled if CNTRST is asserted LOW.   |
| $CNTRST_L$           | $CNTRST_R$           | Counter Reset Input. Asserting this signal <u>LOW</u> resets the burst address counter of its respective port to zero. CNTRST is not disabled by asserting ADS or CNTEN.  |
| $I/O_{0L}-I/O_{35L}$ | $I/O_{0R}-I/O_{35R}$ | Data Bus Input/Output.  |
| $OE_L$               | $OE_R$               | Output Enable Input. This signal must be asserted LOW to enable the I/O data pins during read operations.   |
| $R/W_L$              | $R/W_R$              | Read/Write Enable Input. This signal is asserted LOW to write to the dual port memory array. For read operations, assert this pin HIGH.   |
| $FT/PIPE_L$          | $FT/PIPE_R$          | Flow-Through/Pipelined Select Input. For flow-through mode operation, assert this pin LOW. For pipelined mode operation, assert this pin HIGH.  |
| $B_{0L}-B_{3L}$      |                      | Byte Select Inputs. Asserting these signals enable read and write operations to the corresponding bytes of the memory array.  |
|                      | BM, SIZE             | Select Pins for Bus Matching. See Bus Matching for details.   |
|                      | BE                   | Big Endian Pin. See Bus Matching for details.   |
| $V_{SS}$             |                      | Ground Input.   |
| $V_{DD}$             |                      | Power Input.  |



**Maximum Ratings** [4]

(Above which the useful life may be impaired. For user guidelines, not tested.)

- Storage Temperature ..... -65°C to +150°C
- Ambient Temperature with Power Applied.....-55°C to +125°C
- Supply Voltage to Ground Potential ..... -0.5V to +4.6V
- DC Voltage Applied to Outputs in High Z State.....-0.5V to V<sub>DD</sub>+0.5V
- DC Input Voltage..... -0.5V to V<sub>DD</sub>+0.5V<sup>[5]</sup>

- Output Current into Outputs (LOW)..... 20 mA
- Static Discharge Voltage..... >2001V
- Latch-Up Current..... >200 mA

**Operating Range**

| Range      | Ambient Temperature | V <sub>DD</sub> |
|------------|---------------------|-----------------|
| Commercial | 0°C to +70°C        | 3.3V ± 165 mV   |
| Industrial | -40°C to +85°C      | 3.3V ± 165 mV   |

**Electrical Characteristics** Over the Operating Range

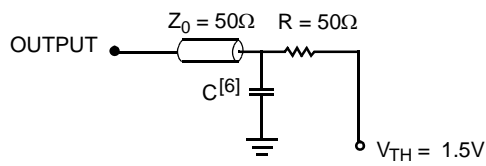
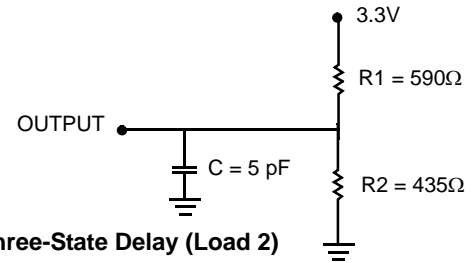
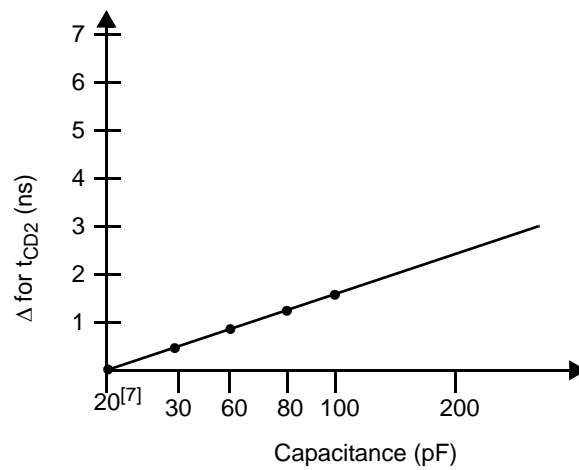
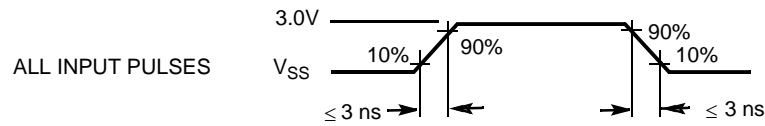
| Parameter        | Description   | CY7C09569V<br>CY7C09579V |      |      |      |      |      |      |      |      | Unit |    |
|------------------|---|--------------------------|------|------|------|------|------|------|------|------|------|----|
|                  |   | -100                     |      |      | -83  |      |      | -67  |      |      |      |    |
|                  |   | Min.                     | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. |      |    |
| V <sub>OH</sub>  | Output HIGH Voltage (V <sub>DD</sub> = Min., I <sub>OH</sub> = -4.0 mA)   | 2.4                      |      |      | 2.4  |      |      | 2.4  |      |      | V    |    |
| V <sub>OL</sub>  | Output LOW Voltage (V <sub>DD</sub> = Min., I <sub>OL</sub> = +4.0 mA)  |                          |      | 0.4  |      |      | 0.4  |      |      | 0.4  | V    |    |
| V <sub>IH</sub>  | Input HIGH Voltage  | 2.0                      |      |      | 2.0  |      |      | 2.0  |      |      | V    |    |
| V <sub>IL</sub>  | Input LOW Voltage   |                          |      | 0.8  |      |      | 0.8  |      |      | 0.8  | V    |    |
| I <sub>OZ</sub>  | Output Leakage Current  | -10                      |      | 10   | -10  |      | 10   | -10  |      | 10   | µA   |    |
| I <sub>CC</sub>  | Operating Current (V <sub>DD</sub> = Max., I <sub>OUT</sub> = 0 mA) Outputs Disabled                              | Commercial               |      | 250  | 385  |      | 240  | 360  |      | 230  | 340  | mA |
|                  |   | Industrial               |      |      |      |      | 270  | 385  |      |      |      | mA |
| I <sub>SB1</sub> | Standby Current (Both Ports TTL Level) CE <sub>L</sub> & CE <sub>R</sub> ≥ V <sub>IH</sub> , f = f <sub>MAX</sub> | Commercial               |      | 30   | 75   |      | 25   | 70   |      | 25   | 65   | mA |
|                  |   | Industrial               |      |      |      |      | 35   | 85   |      |      |      | mA |
| I <sub>SB2</sub> | Standby Current (One Port TTL Level) CE <sub>L</sub>   CE <sub>R</sub> ≥ V <sub>IH</sub> , f = f <sub>MAX</sub>   | Commercial               |      | 170  | 220  |      | 160  | 210  |      | 150  | 200  | mA |
|                  |   | Industrial               |      |      |      |      | 170  | 235  |      |      |      | mA |
| I <sub>SB3</sub> | Standby Current (Both Ports CMOS Level) CE <sub>L</sub> & CE <sub>R</sub> ≥ V <sub>DD</sub> - 0.2V, f = 0         | Commercial               |      | 0.01 | 1    |      | 0.01 | 1    |      | 0.01 | 1    | mA |
|                  |   | Industrial               |      |      |      |      | 0.01 | 1    |      |      |      | mA |
| I <sub>SB4</sub> | Standby Current (One Port CMOS Level) CE <sub>L</sub>   CE <sub>R</sub> ≥ V <sub>IH</sub> , f = f <sub>MAX</sub>  | Commercial               |      | 150  | 200  |      | 140  | 190  |      | 130  | 180  | mA |
|                  |   | Industrial               |      |      |      |      | 150  | 200  |      |      |      | mA |

**Capacitance**

| Parameter        | Description        | Test Conditions   | Max. | Unit |
|------------------|--------------------|---|------|------|
| C <sub>IN</sub>  | Input Capacitance  | T <sub>A</sub> = 25°C, f = 1 MHz,<br>V <sub>DD</sub> = 3.3V | 10   | pF   |
| C <sub>OUT</sub> | Output Capacitance |   | 10   | pF   |

**Note:**

- 4. The voltage on any input or I/O pin can not exceed the power pin during power-up.
- 5. Pulse width < 20 ns.

**AC Test Load and Waveforms**

**(a) Normal Load (Load 1)**

**(b) Three-State Delay (Load 2)**

**(b) Load Derating Curve**
**Notes:**

- 6. External AC Test Load Capacitance = 10 pF.
- 7. (Internal I/O pad Capacitance = 10 pF) + AC Test Load.

**Switching Characteristics** Over the Operating Range

| Parameter                           | Description                                   | CY7C09569V<br>CY7C09579V |      |      |      |      |      | Unit |
|-------------------------------------|---|--------------------------|------|------|------|------|------|------|
|                                     |   | -100                     |      | -83  |      | -67  |      |      |
|                                     |   | Min.                     | Max. | Min. | Max. | Min. | Max. |      |
| f <sub>MAX1</sub>                   | f <sub>Max</sub> Flow-Through                 |                          | 67   |      | 45   |      | 40   | MHz  |
| f <sub>MAX2</sub>                   | f <sub>Max</sub> Pipelined                    |                          | 100  |      | 83   |      | 67   | MHz  |
| t <sub>CYC1</sub>                   | Clock Cycle Time - Flow-Through               | 15                       |      | 22   |      | 25   |      | ns   |
| t <sub>CYC2</sub>                   | Clock Cycle Time - Pipelined                  | 10                       |      | 12   |      | 15   |      | ns   |
| t <sub>CH1</sub>                    | Clock HIGH Time - Flow-Through                | 6.5                      |      | 7.5  |      | 8.5  |      | ns   |
| t <sub>CL1</sub>                    | Clock LOW Time - Flow-Through                 | 6.5                      |      | 7.5  |      | 8.5  |      | ns   |
| t <sub>CH2</sub>                    | Clock HIGH Time - Pipelined                   | 4                        |      | 5    |      | 6.5  |      | ns   |
| t <sub>CL2</sub>                    | Clock LOW Time - Pipelined                    | 4                        |      | 5    |      | 6.5  |      | ns   |
| t <sub>R</sub>                      | Clock Rise Time                               |                          | 3    |      | 3    |      | 3    | ns   |
| t <sub>F</sub>                      | Clock Fall Time                               |                          | 3    |      | 3    |      | 3    | ns   |
| t <sub>SA</sub>                     | Address Set-Up Time                           | 3.5                      |      | 4    |      | 4    |      | ns   |
| t <sub>HA</sub>                     | Address Hold Time                             | 0.5                      |      | 0.5  |      | 0.5  |      | ns   |
| t <sub>SB</sub>                     | Byte Select Set-Up Time                       | 3.5                      |      | 4    |      | 4    |      | ns   |
| t <sub>HB</sub>                     | Byte Select Hold Time                         | 0.5                      |      | 0.5  |      | 0.5  |      | ns   |
| t <sub>SC</sub>                     | Chip Enable Set-Up Time                       | 3.5                      |      | 4    |      | 4    |      | ns   |
| t <sub>HC</sub>                     | Chip Enable Hold Time                         | 0.5                      |      | 0.5  |      | 0.5  |      | ns   |
| t <sub>SW</sub>                     | R/W Set-Up Time                               | 3.5                      |      | 4    |      | 4    |      | ns   |
| t <sub>HW</sub>                     | R/W Hold Time                                 | 0.5                      |      | 0.5  |      | 0.5  |      | ns   |
| t <sub>SD</sub>                     | Input Data Set-Up Time                        | 3.5                      |      | 4    |      | 4    |      | ns   |
| t <sub>HD</sub>                     | Input Data Hold Time                          | 0.5                      |      | 0.5  |      | 0.5  |      | ns   |
| t <sub>SAD</sub>                    | ADS Set-Up Time                               | 3.5                      |      | 4    |      | 4    |      | ns   |
| t <sub>HAD</sub>                    | ADS Hold Time                                 | 0.5                      |      | 0.5  |      | 0.5  |      | ns   |
| t <sub>SCN</sub>                    | CNTEN Set-Up Time                             | 3.5                      |      | 4    |      | 4    |      | ns   |
| t <sub>HCN</sub>                    | CNTEN Hold Time                               | 0.5                      |      | 0.5  |      | 0.5  |      | ns   |
| t <sub>SRST</sub>                   | CNTRST Set-Up Time                            | 3.5                      |      | 4    |      | 4    |      | ns   |
| t <sub>HRST</sub>                   | CNTRST Hold Time                              | 0.5                      |      | 0.5  |      | 0.5  |      | ns   |
| t <sub>OE</sub>                     | Output Enable to Data Valid                   |                          | 8    |      | 9    |      | 10   | ns   |
| t <sub>OLZ</sub> <sup>[8, 9]</sup>  | OE to Low Z                                   | 2                        |      | 2    |      | 2    |      | ns   |
| t <sub>OHZ</sub> <sup>[8, 9]</sup>  | OE to High Z                                  | 1                        | 7    | 1    | 7    | 1    | 7    | ns   |
| t <sub>CD1</sub>                    | Clock to Data Valid - Flow-Through            |                          | 12.5 |      | 18   |      | 20   | ns   |
| t <sub>CD2</sub>                    | Clock to Data Valid - Pipelined               |                          | 5    |      | 6    |      | 8    | ns   |
| t <sub>CA1</sub>                    | Clock to Counter Address Valid - Flow-Through |                          | 12.5 |      | 18   |      | 20   | ns   |
| t <sub>CA2</sub>                    | Clock to Counter Address Valid - Pipelined    |                          | 9    |      | 10   |      | 11   | ns   |
| t <sub>DC</sub>                     | Data Output Hold After Clock HIGH             | 2                        |      | 2    |      | 2    |      | ns   |
| t <sub>CKHZ</sub> <sup>[8, 9]</sup> | Clock HIGH to Output High Z                   | 2                        | 6    | 2    | 7    | 2    | 8    | ns   |
| t <sub>CKLZ</sub> <sup>[8, 9]</sup> | Clock HIGH to Output Low Z                    | 2                        |      | 2    |      | 2    |      | ns   |

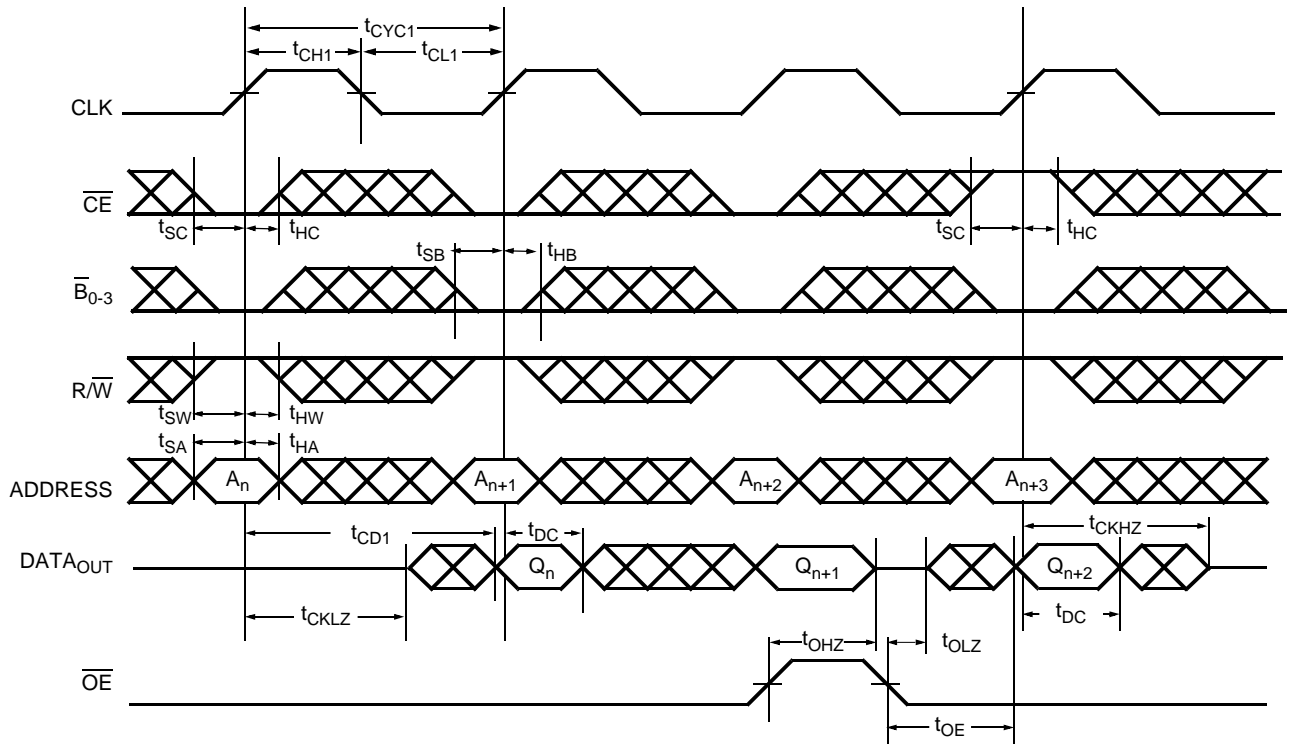
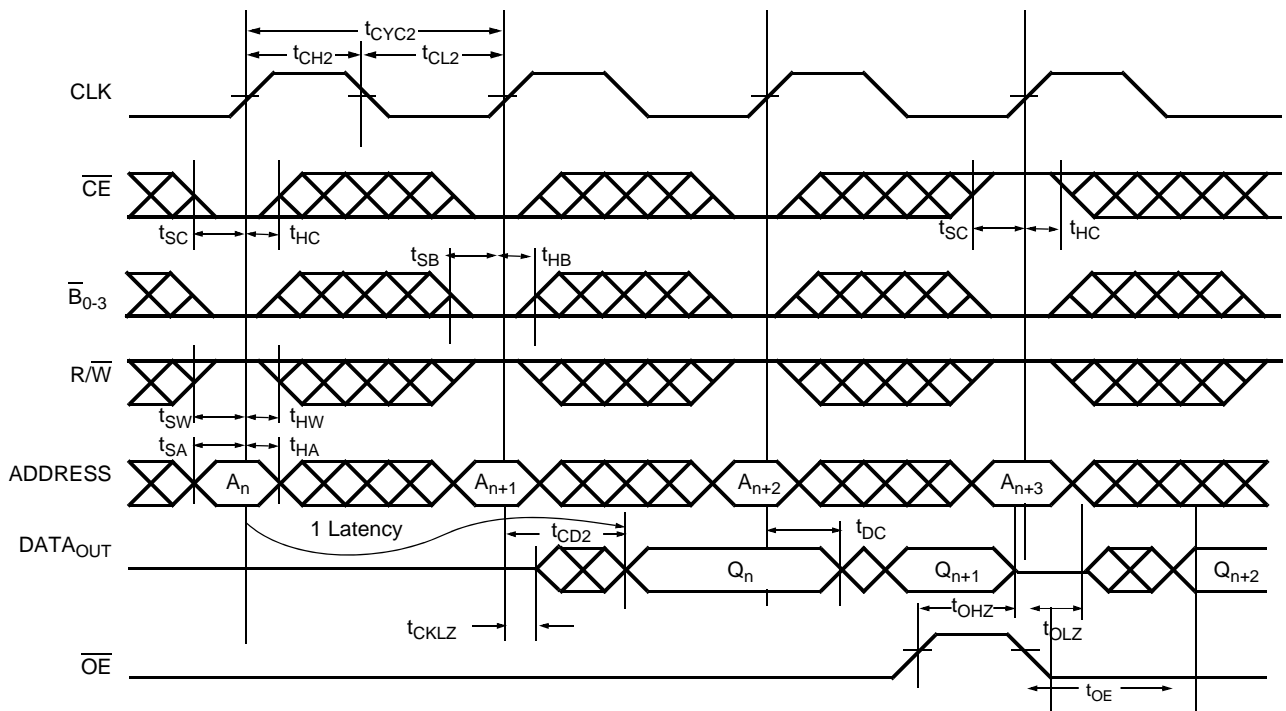
**Notes:**

8. This parameter is guaranteed by design, but it is not production tested.
9. Test conditions used are Load 2.

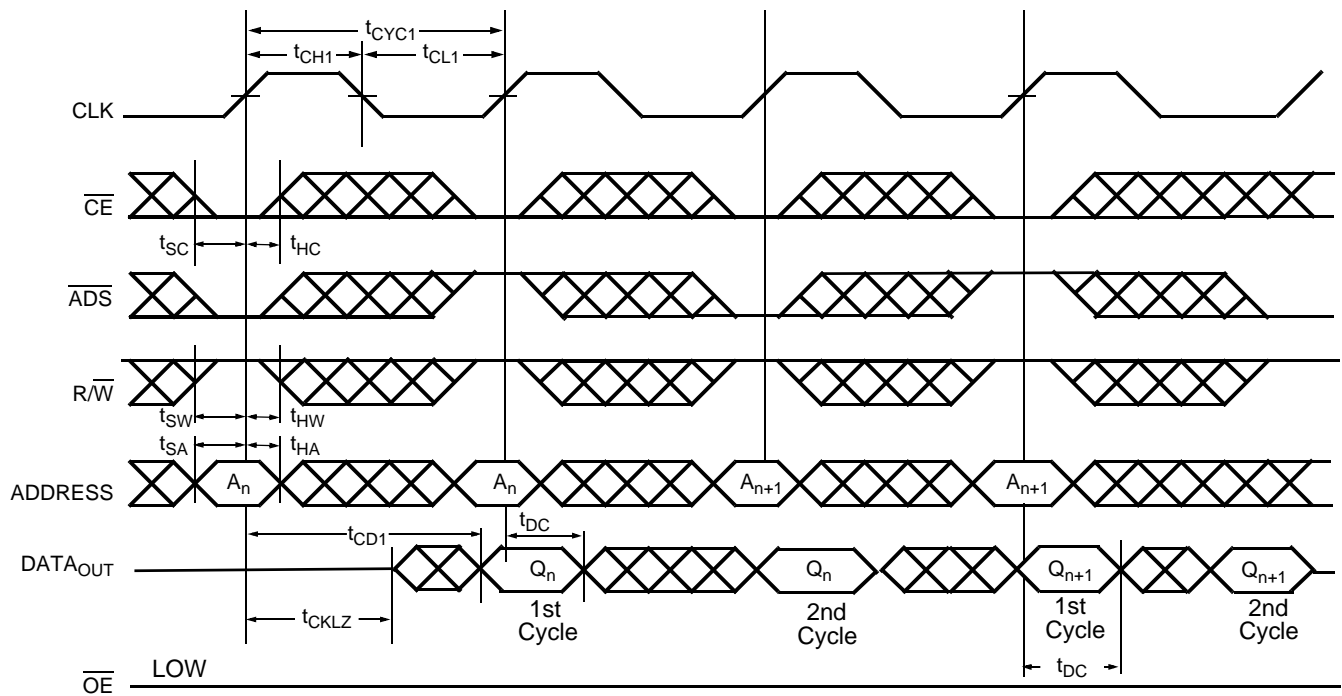
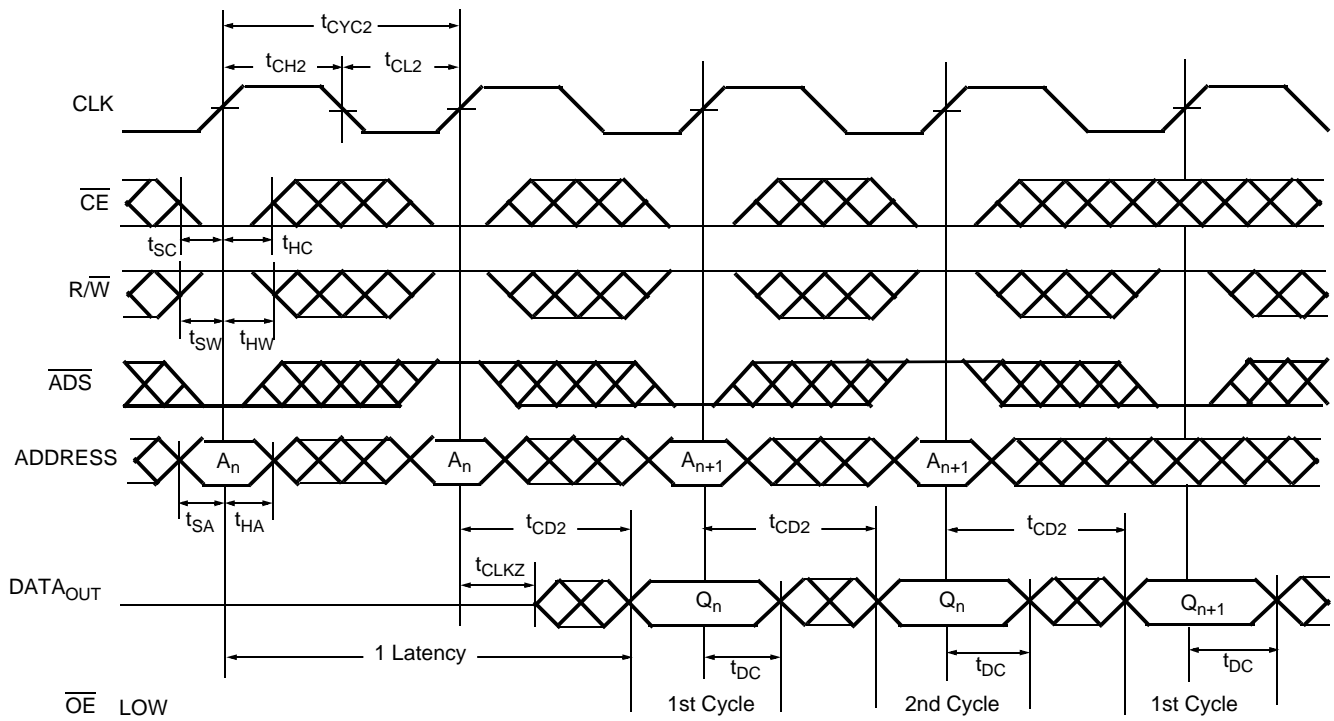


**Switching Characteristics** Over the Operating Range (continued)

| Parameter                  | Description                              | CY7C09569V<br>CY7C09579V |      |      |      |      |      | Unit |
|----------------------------|--|--------------------------|------|------|------|------|------|------|
|                            |  | -100                     |      | -83  |      | -67  |      |      |
|                            |  | Min.                     | Max. | Min. | Max. | Min. | Max. |      |
| <b>Port to Port Delays</b> |  |                          |      |      |      |      |      |      |
| t <sub>CWDD</sub>          | Write Port Clock HIGH to Read Data Delay |                          | 30   |      | 35   |      | 35   | ns   |
| t <sub>CCS</sub>           | Clock to Clock Set-Up Time               |                          | 9    |      | 10   |      | 12   | ns   |

**Switching Waveforms**
**Read Cycle for Flow-Through Output ( $\overline{FT}/PIPE = V_{IL}$ )<sup>[10, 11, 12, 13]</sup>**

**Read Cycle for Pipelined Operation ( $\overline{FT}/PIPE = V_{IH}$ )<sup>[10, 11, 12, 13]</sup>**

**Notes:**

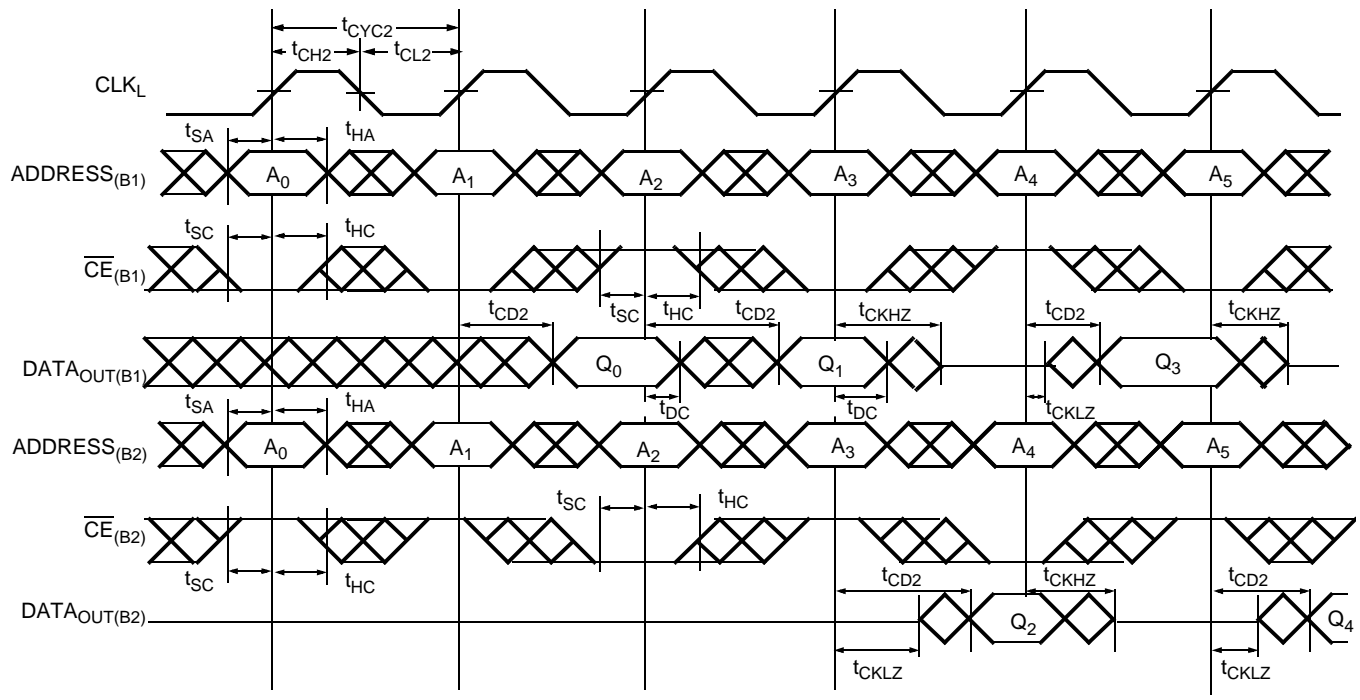
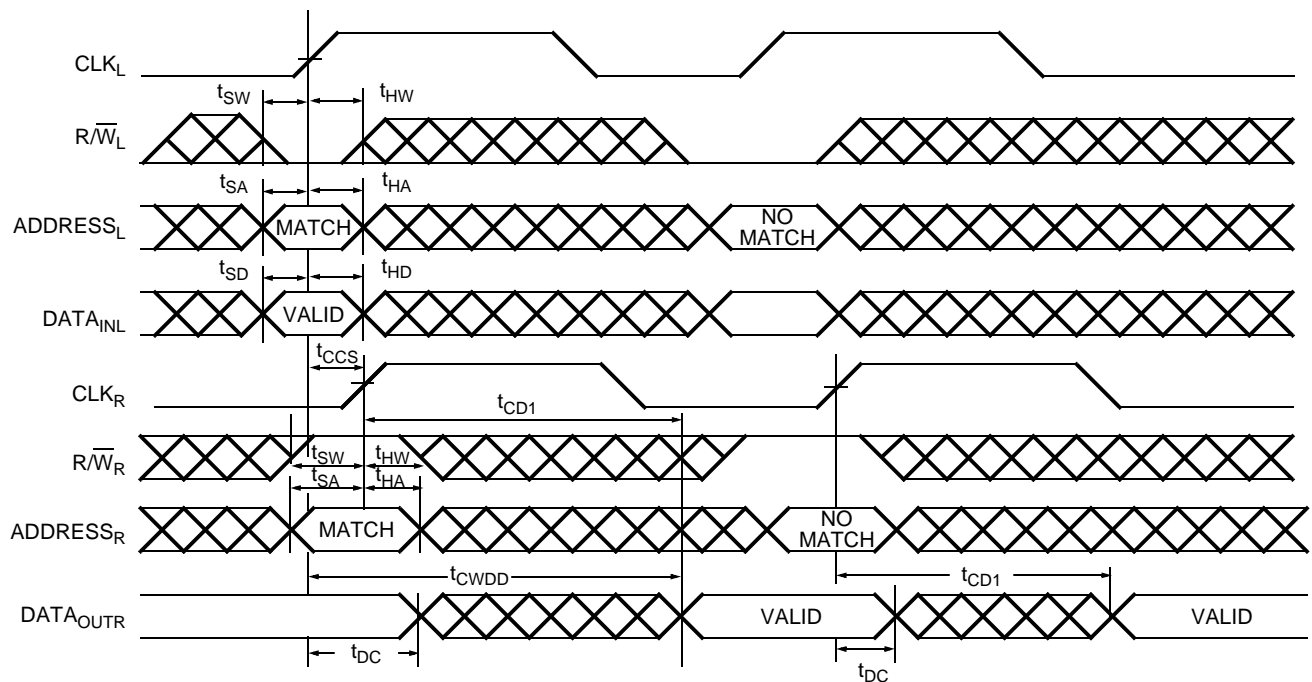
10.  $\overline{OE}$  is asynchronously controlled; all other inputs are synchronous to the rising clock edge.
11.  $ADS = V_{IL}$ ,  $CNTEN = V_{IL}$  and  $CNTRST = V_{IH}$ .
12. The output is disabled (high-impedance state) by  $\overline{CE} = V_{IH}$  following the next rising edge of the clock.
13. Addresses do not have to be accessed sequentially since  $ADS = V_{IL}$  constantly loads the address on the rising edge of the CLK. Numbers are for reference only.

**Switching Waveforms (continued)**
**Bus Match Read Cycle for Flow-Through Output ( $\overline{FT}/\overline{PIPE} = V_{IL}$ )<sup>[10, 12, 14, 15, 16]</sup>**

**Bus Match Read Cycle for Pipelined Operation ( $\overline{FT}/\overline{PIPE} = V_{IH}$ )<sup>[10, 12, 14, 15, 16]</sup>**

**Notes:**

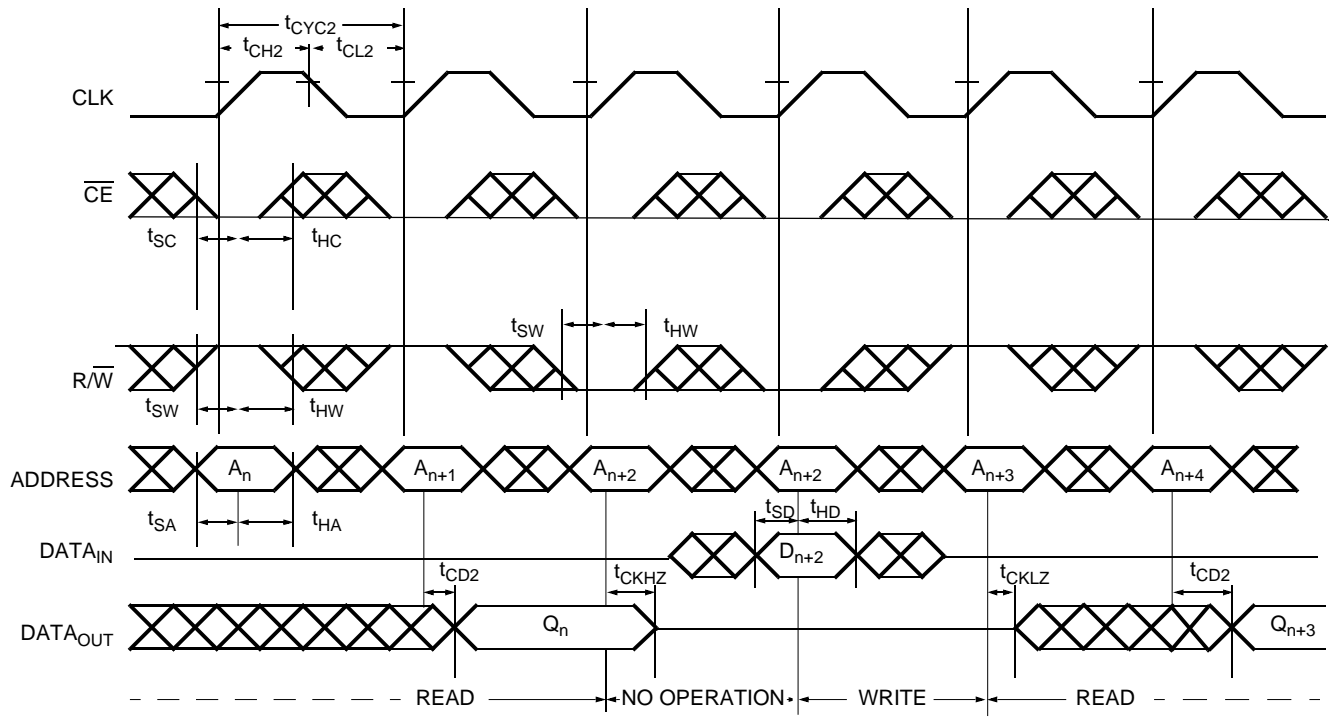
14. Timing shown is for x18 bus matching; x9 bus matching is similar with 4 cycles between address inputs.

15. See table "Right Port Operation" for data output on first and subsequent cycles.

16.  $\overline{CNTEN} = V_{IL}$ . In x9 and x18 Bus Matching Burst Mode operations (Write or Read),  $\overline{ADS}$  can toggle on the rising edge of every clock cycle or it can be at  $V_{IH}$  level all the time except when loading the initial external address (i.e.  $\overline{ADS} = V_{IL}$  only required when reading or writing the first Byte or Word).

**Switching Waveforms (continued)**
**Bank Select Pipelined Read<sup>[17, 18]</sup>**

**Left Port Write to Flow-Through Right Port Read<sup>[18, 19, 20, 21, 22]</sup>**

**Notes:**

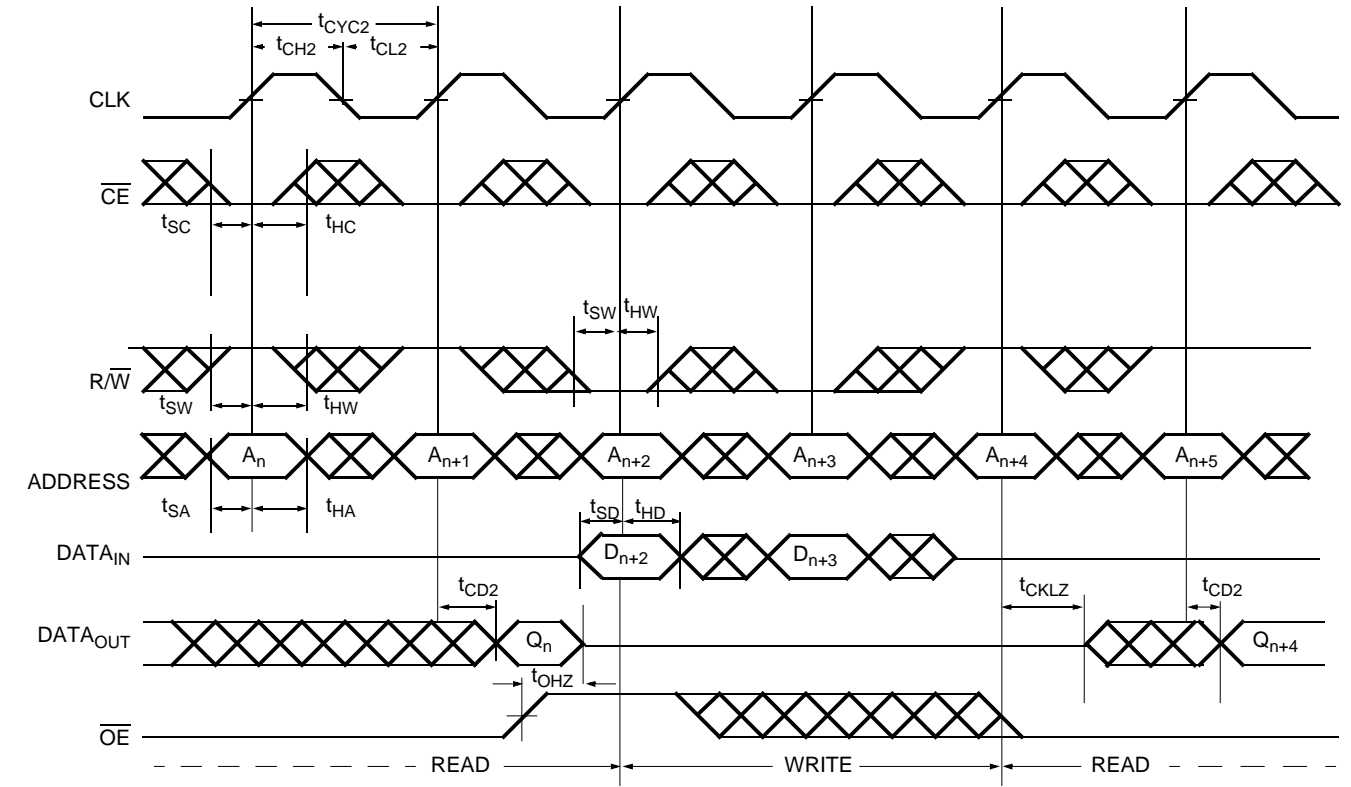
17. In this depth expansion example, B1 represents Bank #1 and B2 is Bank #2; Each Bank consists of one Cypress dual-port device from this data sheet.  
 $ADDRESS_{(B1)} = ADDRESS_{(B2)}$ .
18.  $B0 = B1 = B2 = B3 = BM = SIZE = ADS = CNTEN = V_{IL}$ ;  $CNTRST = V_{IH}$ .
19. The same waveforms apply for a right port write to flow-through left port read.
20.  $\overline{CE} = B0 = B1 = B2 = B3 = ADS = CNTEN = V_{IL}$ ;  $CNTRST = V_{IH}$ .
21.  $OE = V_{IL}$  for the right port, which is being read from.  $OE = V_{IH}$  for the left port, which is being written to.
22. If  $t_{CCS} \leq$  maximum specified, then data from right port READ is not valid until the maximum specified for  $t_{CWDD}$ . If  $t_{CCS} >$  maximum specified, then data is not valid until  $t_{CCS} + t_{CD1}$  ( $t_{CWDD}$  does not apply in this case).

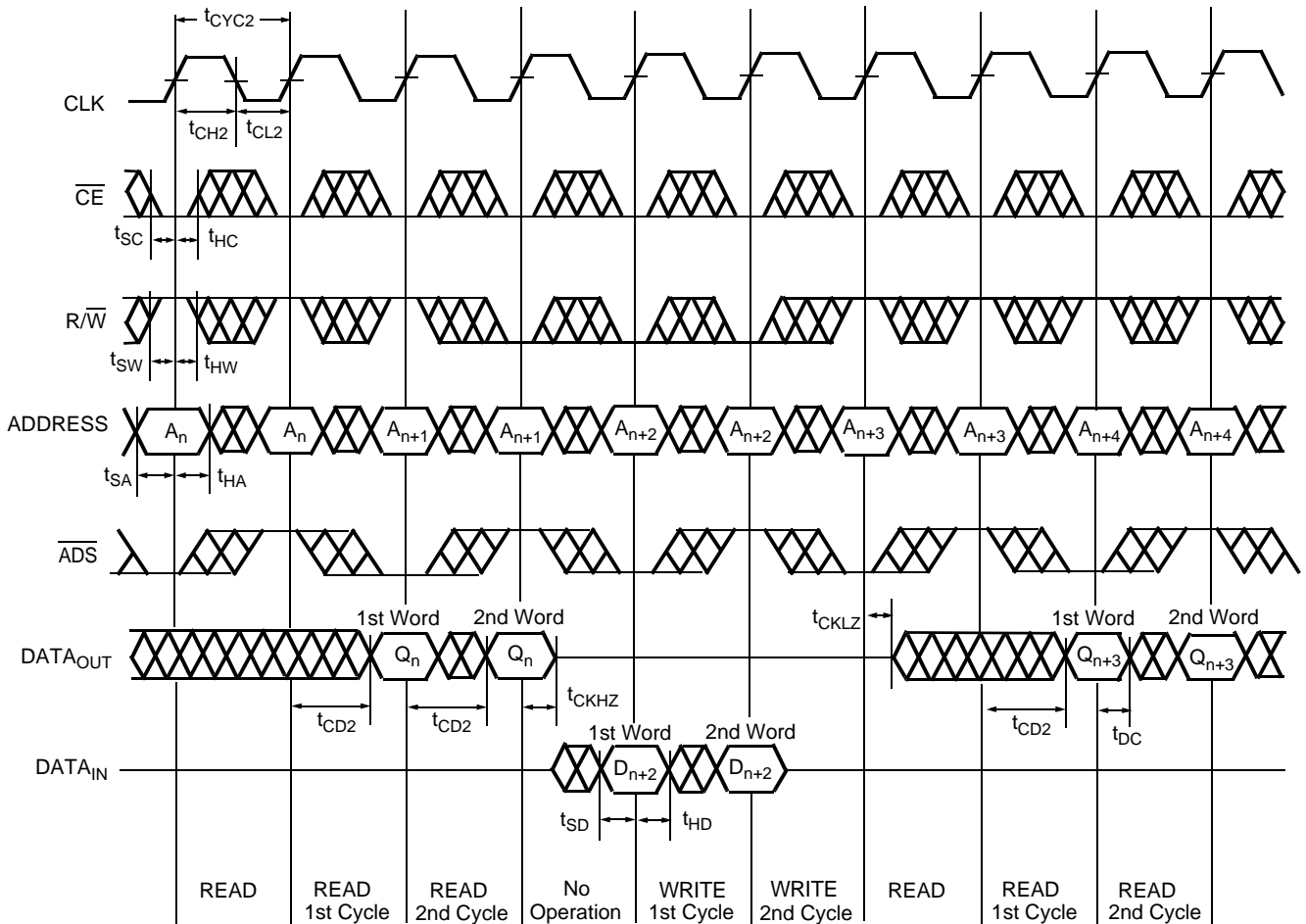
**Switching Waveforms (continued)**
**Pipelined Read-to-Write-to-Read ( $\overline{OE} = V_{IL}$ )<sup>[13, 23, 24, 25]</sup>**

**Notes:**

23. Output state (HIGH, LOW, or High-Impedance) is determined by the previous cycle control signals.

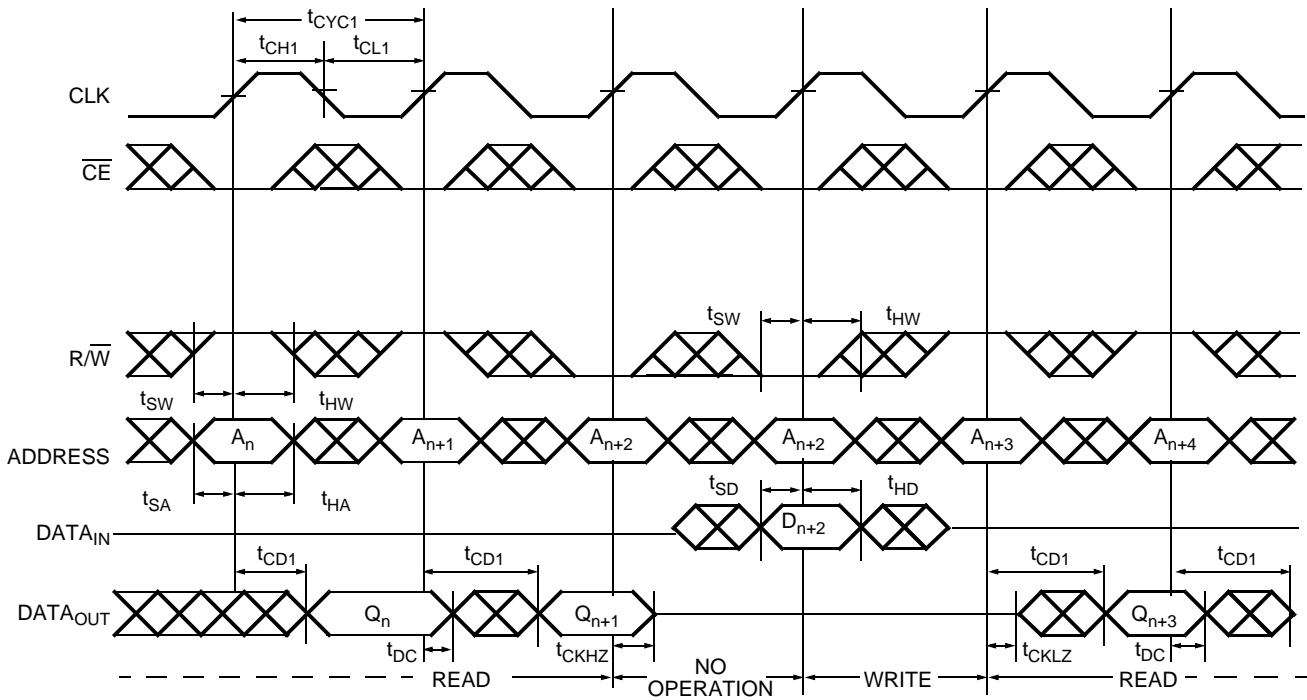
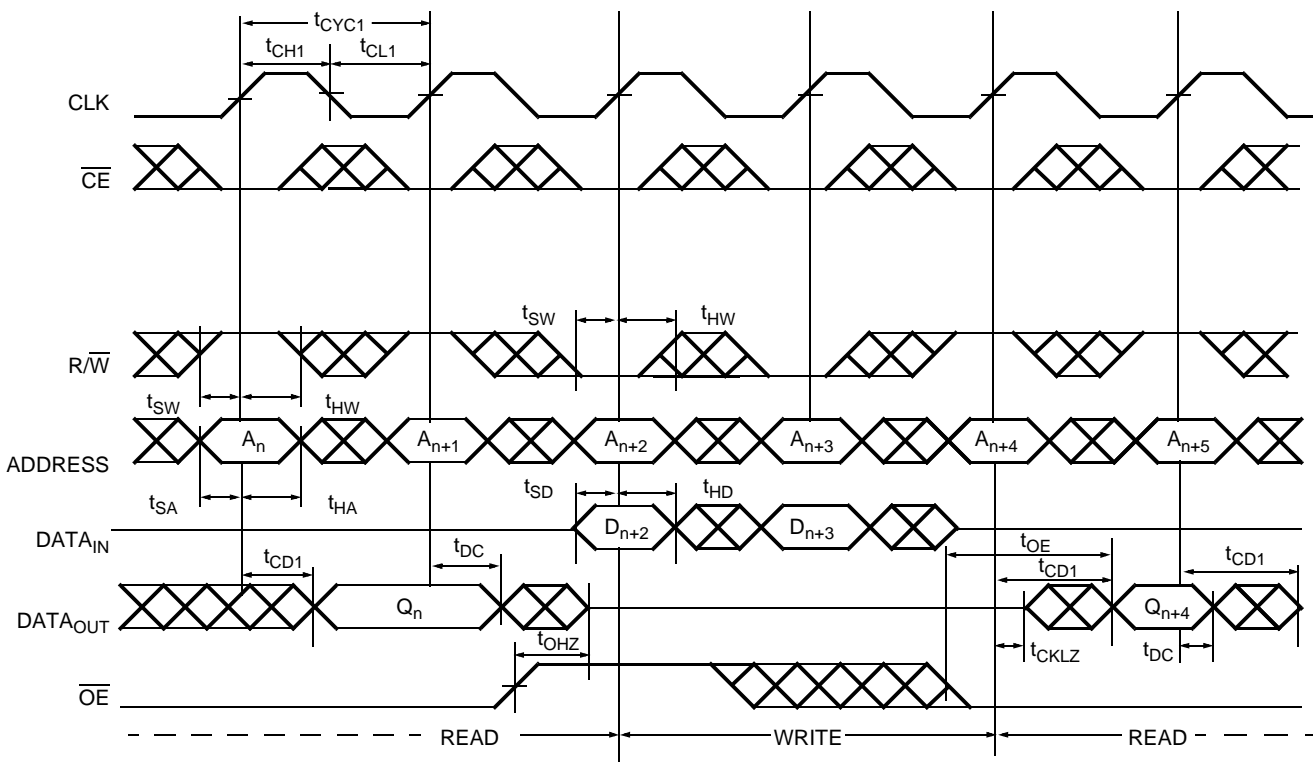
24.  $\overline{CE} = \overline{ADS} = \overline{CNTEN} = V_{IL}$ ;  $\overline{CNTST} = V_{IH}$ .

25. During "No Operation," data in memory at the selected address may be corrupted and should be rewritten to ensure data integrity.

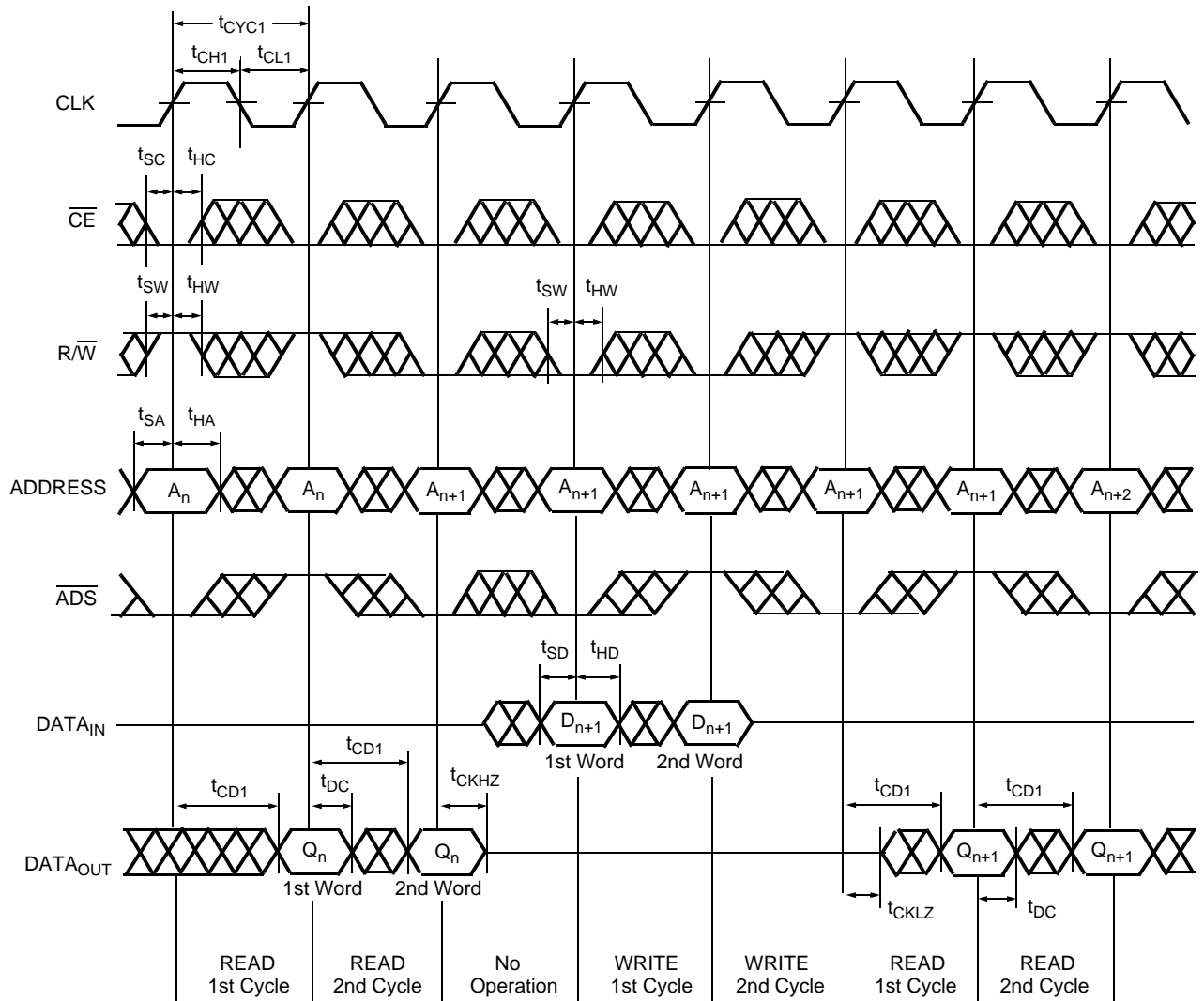
**Switching Waveforms (continued)**
**Pipelined Read-to-Write-to-Read ( $\overline{OE}$  Controlled)**<sup>[11, 23, 24, 25]</sup>


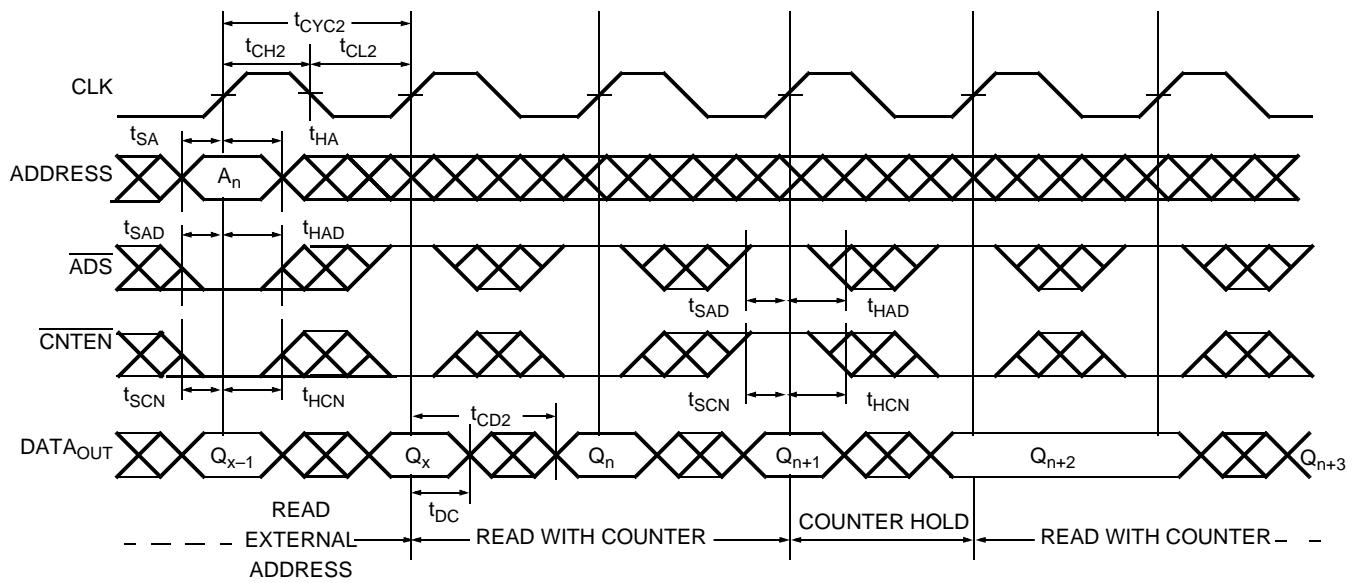
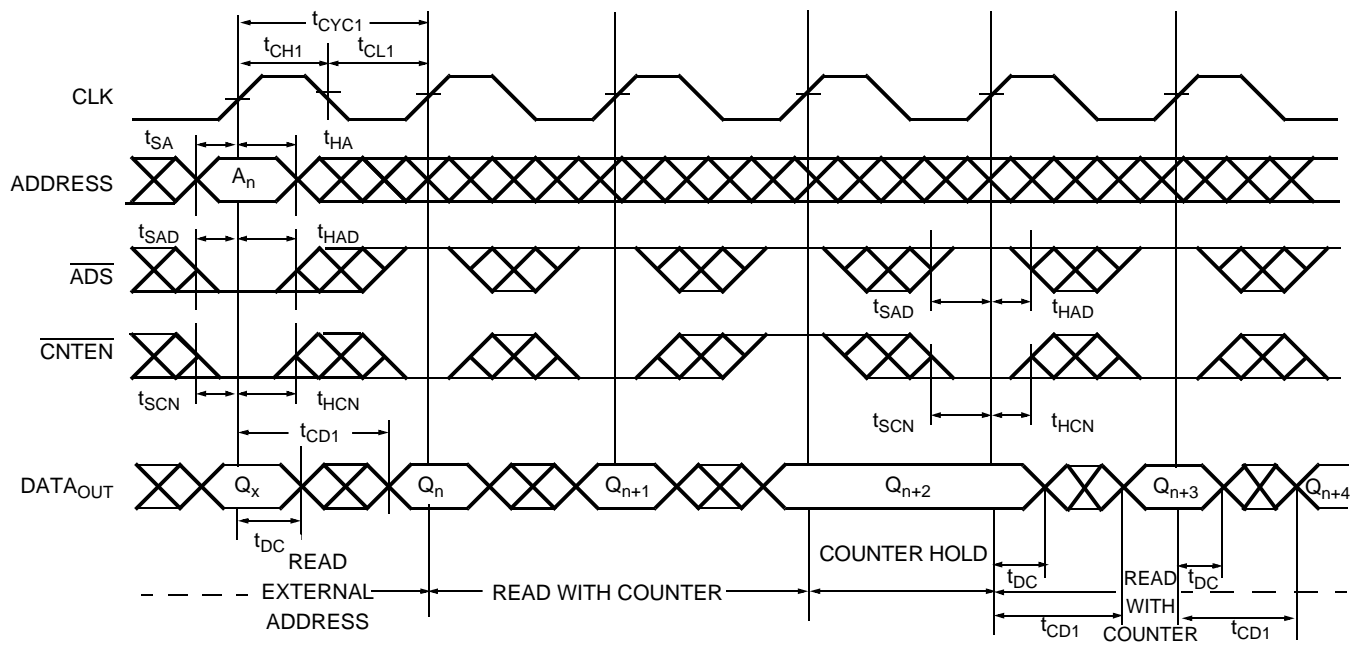
**Switching Waveforms (continued)**
**Bus Match Pipelined Read-to-Write-to-Read ( $\overline{OE} = V_{IL}$ ) [11, 14, 15, 16, 24, 25, 26]**

**Note:**

26. BM, SIZE, and BE must be reconfigured 1 cycle before operation is guaranteed. BM, SIZE, and BE should remain static for any particular port configuration.

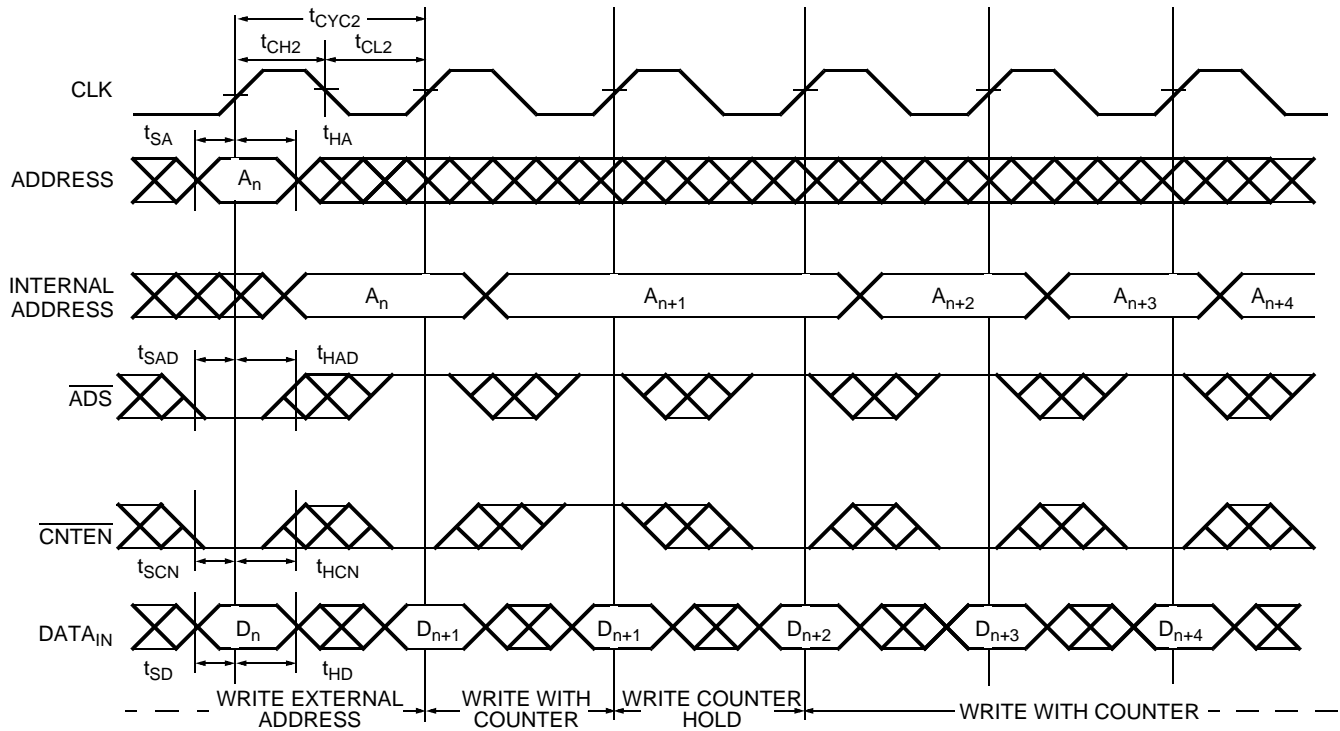
**Switching Waveforms (continued)**
**Flow-Through Read-to-Write-to-Read ( $\overline{OE} = V_{IL}$ )<sup>[11, 13, 14, 15, 24, 25]</sup>**

**Flow-Through Read-to-Write-to-Read ( $\overline{OE}$  Controlled)<sup>[11, 13, 23, 24, 25]</sup>**




**Switching Waveforms (continued)**
**Bus Match Flow-Through Read-to-Write-to-Read ( $\overline{OE} = V_{IL}$ )<sup>[11, 14, 15, 16, 24, 25, 26]</sup>**


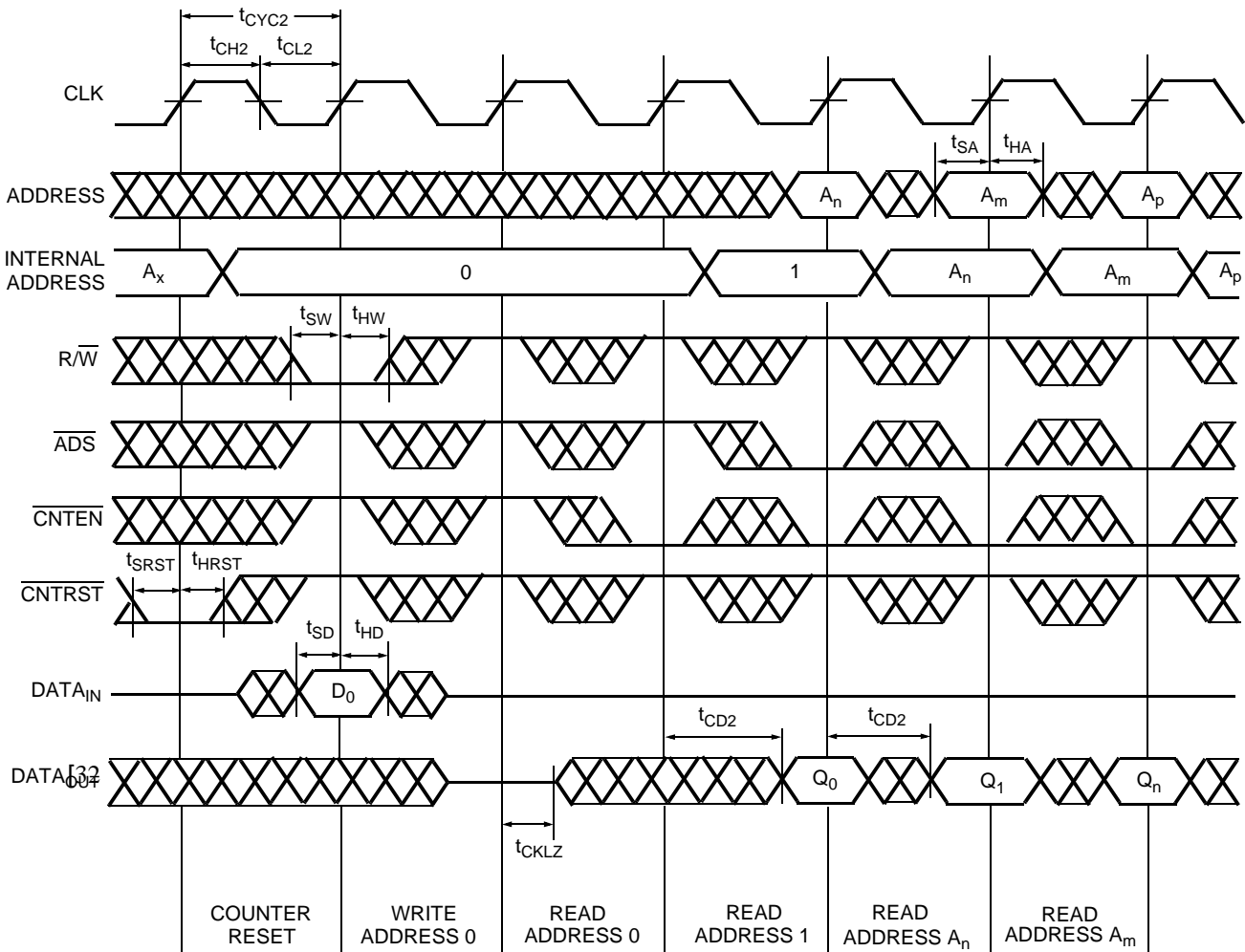
**Switching Waveforms (continued)**
**Pipelined Read with Address Counter Advance<sup>[27]</sup>**

**Flow-Through Read with Address Counter Advance<sup>[27]</sup>**


**Note:**  
 27.  $\overline{CE} = \overline{OE} = V_{IL}$ ;  $R/\overline{W} = \overline{CNTRST} = V_{IH}$ .

**Switching Waveforms (continued)**
**Write with Address Counter Advance (Flow-Through or Pipelined Outputs)<sup>[28, 29]</sup>**

**Notes:**

28.  $\overline{CE} = \overline{B0} = \overline{B1} = \overline{B2} = \overline{B3} = R/\overline{W} = V_{IL}$ ;  $\overline{CNRST} = V_{IH}$ .

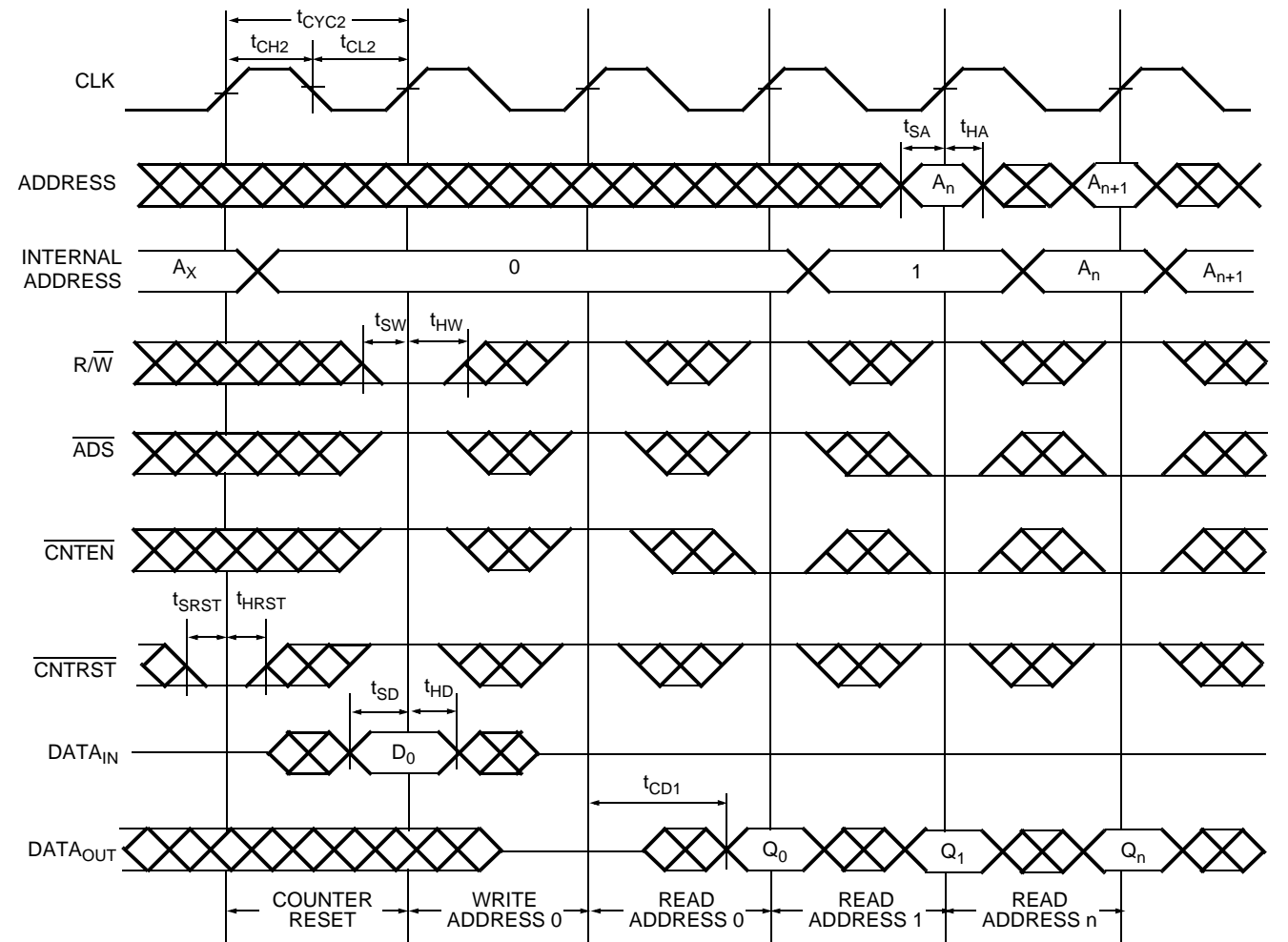
29. The "Internal Address" is equal to the "External Address" when  $\overline{ADS} = \overline{CNTEN} = V_{IL}$  and  $\overline{CNRST} = V_{IH}$ .

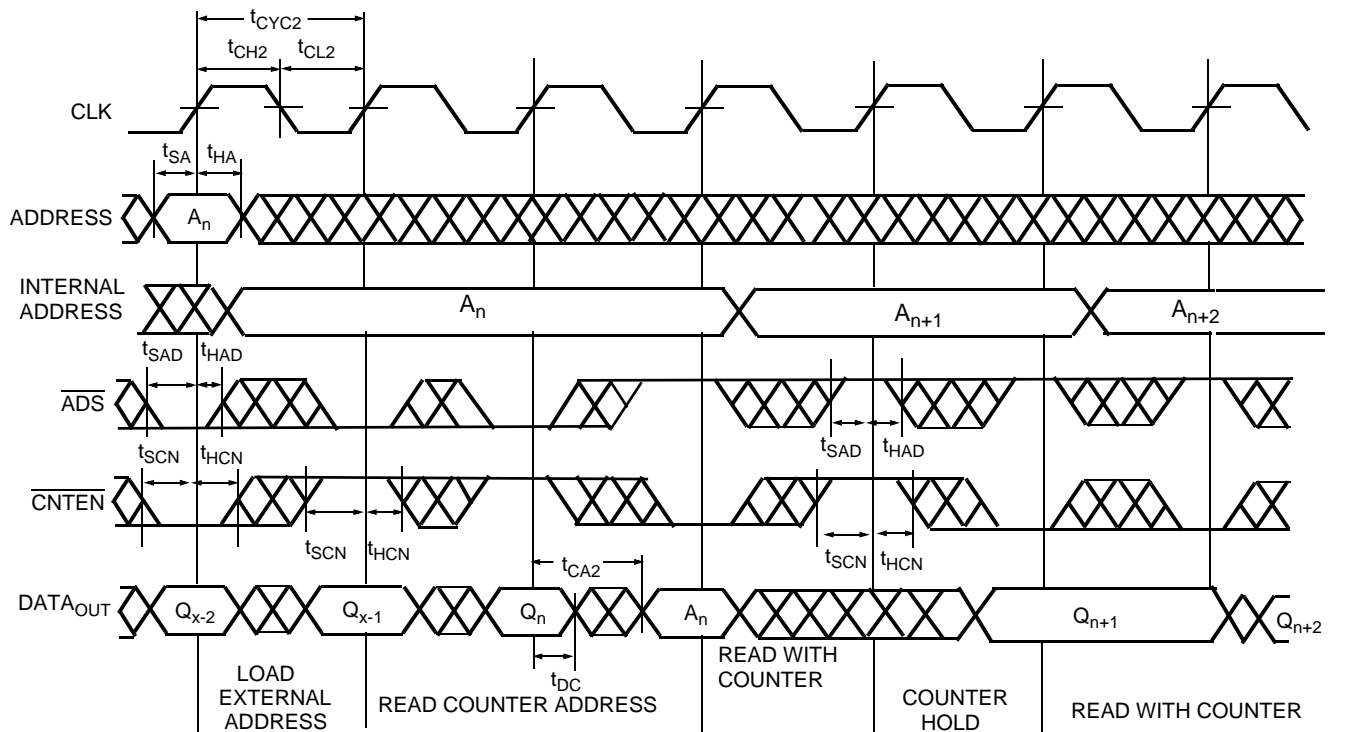
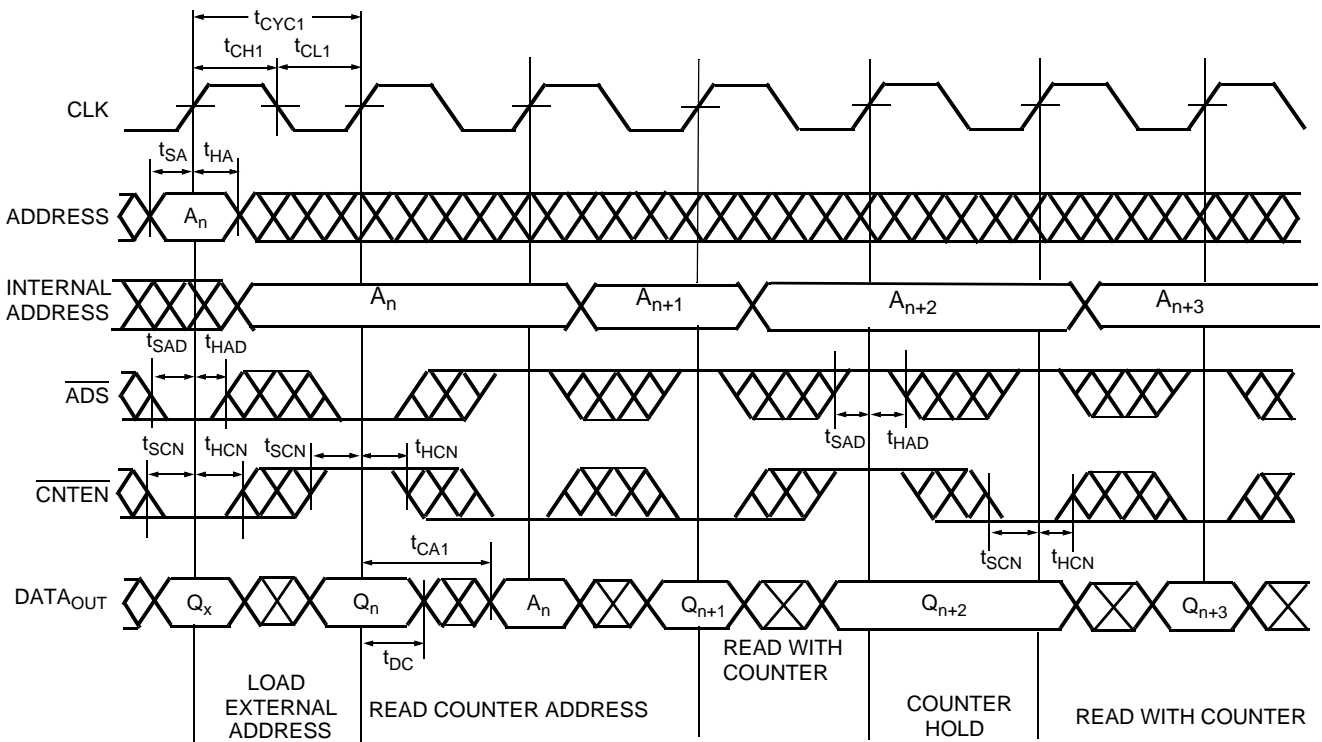
**Switching Waveforms (continued)**
**Counter Reset (Pipelined Outputs)<sup>[11, 23, 30, 31, 32]</sup>**

**Notes:**

30.  $\overline{CE} = \overline{B0} = \overline{B1} = \overline{B2} = \overline{B3} = V_{IL}$ .

31. No dead cycle exists during counter reset. A READ or WRITE cycle may be coincidental with the counter reset.

32. Output state (HIGH, LOW, or High-Impedance) is determined by the previous cycle control signals. Ideally, DATA<sub>OUT</sub> should be in the High-Impedance state during a valid WRITE cycle.

**Switching Waveforms (continued)**
**Counter Reset (Flow-Through Outputs)<sup>[23, 25, 30, 31, 32]</sup>**


**Switching Waveforms (continued)**
**Pipelined Read of State of Address Counter [33, 34, 35]**

**Flow-Through Read of State of Address Counter [33, 34, 36]**

**Notes:**




33.  $\overline{CE} = \overline{OE} = V_{IL}$ ;  $R/\overline{W} = \overline{CNRST} = V_{IH}$ .

34. When reading ADDRESS<sub>OUT</sub> in x9 Bus Match mode, readout of  $A_n$  is extended by 1 cycle.






35. For Pipelined address counter read, signals from address counter operation table must be valid for 2 consecutive cycles for x36 and x18 mode and for 3 consecutive cycles for x9 mode.

36. For flow-through address counter read, signals from address counter operation table must be valid for consecutive cycles for x36.

**Read/Write and Enable Operation**<sup>[37, 38, 39]</sup>

| Inputs |   |    |     | Outputs                             | Operation                  |
|--------|---|----|-----|-------------------------------------|----------------------------|
| OE     | CLK   | CE | R/W | I/O <sub>0</sub> -I/O <sub>35</sub> |                            |
| X      |  | H  | X   | High-Z                              | Deselected <sup>[40]</sup> |
| X      |  | L  | L   | D <sub>IN</sub>                     | Write                      |
| L      |  | L  | H   | D <sub>OUT</sub>                    | Read <sup>[40]</sup>       |
| H      | X   | L  | X   | High-Z                              | Outputs Disabled           |

**Address Counter Control Operation**<sup>[37, 41]</sup>

| Address        | Previous Address | CLK  | OE | R/W | ADS | CNTEN | CNTRST | Mode        | Operation  |
|----------------|------------------|--|----|-----|-----|-------|--------|-------------|--|
| X              | X                |   | X  | X   | X   | X     | L      | Reset       | Counter Reset                                      |
| A <sub>n</sub> | X                |   | X  | X   | L   | L     | H      | Load        | Address Load into Counter                          |
| A <sub>n</sub> | A <sub>n</sub>   |   | L  | H   | L   | H     | H      | Hold + Read | External Address Blocked - Counter Address Readout |
| X              | A <sub>n</sub>   |   | X  | X   | H   | H     | H      | Hold        | External Address Blocked - Counter Disabled        |
| X              | A <sub>n</sub>   |  | X  | X   | H   | L     | H      | Increment   | Counter Increment                                  |

**Notes:**

37. "X" = "Don't Care." "H" = V<sub>IH</sub>, "L" = V<sub>IL</sub>.

38. ADS, CNTEN, CNTRST = "Don't Care."

39. OE is an asynchronous input signal.

40. When CE changes state in the pipelined mode, deselection and read happen in the following clock cycle.

41. Counter operation is independent of CE.

**Right Port Configuration**<sup>[26, 42]</sup>

| BM | SIZE | Configuration | I/O Pins used         |
|----|------|---------------|-----------------------|
| 0  | 0    | x36           | I/O <sub>0R-35R</sub> |
| 1  | 0    | x18           | I/O <sub>0R-17R</sub> |
| 1  | 1    | x9            | I/O <sub>0R-8R</sub>  |

**Right Port Operation**<sup>[43]</sup>

| Configuration | BE | Data on 1st Cycle     | Data on 2nd Cycle     | Data on 3rd Cycle     | Data on 4th Cycle     |
|---------------|----|-----------------------|-----------------------|-----------------------|-----------------------|
| x18           | 0  | DQ <sub>0R-17R</sub>  | DQ <sub>18R-35R</sub> | -                     | -                     |
| x18           | 1  | DQ <sub>18R-35R</sub> | DQ <sub>0R-17R</sub>  | -                     | -                     |
| x9            | 0  | DQ <sub>0R-8R</sub>   | DQ <sub>9R-17R</sub>  | DQ <sub>18R-26R</sub> | DQ <sub>27R-35R</sub> |
| x9            | 1  | DQ <sub>27R-35R</sub> | DQ <sub>18R-26R</sub> | DQ <sub>9R-17R</sub>  | DQ <sub>0R-8R</sub>   |

**Readout of Internal Address Counter**<sup>[44]</sup>

| Configuration  | Address on 1st Cycle    | I/O Pins used on 1st Cycle | Address on 2nd Cycle       | I/O Pins used on 2nd Cycle |
|----------------|-------------------------|----------------------------|----------------------------|----------------------------|
| Left Port x36  | A <sub>0L-14L</sub>     | I/O <sub>3L-17L</sub>      | -                          | -                          |
| Right Port x36 | A <sub>0R-14R</sub>     | I/O <sub>3R-17R</sub>      | -                          | -                          |
| Right Port x18 | WA, A <sub>0R-14R</sub> | I/O <sub>2R-17R</sub>      | -                          | -                          |
| Right Port x9  | A <sub>6R-14R</sub>     | I/O <sub>0R-8R</sub>       | BA, WA, A <sub>0R-5R</sub> | I/O <sub>1R-8R</sub>       |

**Left Port Operation**

| Control Pin     | Effect                            |
|-----------------|-----------------------------------|
| $\overline{B0}$ | I/O <sub>0-8</sub> Byte Control   |
| $\overline{B1}$ | I/O <sub>9-17</sub> Byte Control  |
| $\overline{B2}$ | I/O <sub>18-26</sub> Byte Control |
| $\overline{B3}$ | I/O <sub>27-35</sub> Byte Control |

**Notes:**

42. In x36 mode, BE input is a "Don't Care."

43. DQ represents data output of the chip.

44. x18 and x9 configuration apply to right port only.



## Counter Operation

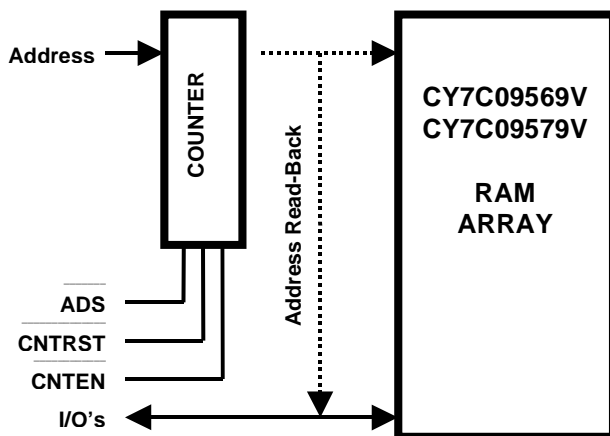
The CY7C09569V/09579V Dual-Port RAM (DPRAM) contains on-chip address counters (one for each port) for the synchronous members of the product family. Besides the main x36 format, the right port allows bus matching (x18 or x9, user-selectable). An internal sub-counter provides the extra addresses required to sequence out the 36-bit word in 18-bit or 9-bit increments. The sub-counter counts up in the "Little Endian" mode, and counts down if the user has chosen the "Big Endian" mode. The address counter is required to be in increment mode in order for the sub-counter to sequence out the second word (in x18 mode) or the remaining three bytes (in x9 mode).

For a x36 format (the only active format on the left port), each address counter in the CY7C09579V uses addresses ( $A_{0-14}$ ).

For the right port (allowing for the bus-matching feature), a maximum of two address bits (out of a 2-bit sub-counter) are added.

1.  $\overline{ADS}_{L/R}$  (pin #23/86) is a port's address strobe, allowing the loading of that port's burst counters if the corresponding  $\overline{CNTEN}_{L/R}$  pin is active as well.
2.  $\overline{CNTEN}_{L/R}$  (pin #25/84) is a port's count enable, provided to stall the operation of the address input and utilize the internal address generated by the internal counter for fast interleaved memory applications; when asserted, the address counter will increment on each positive transition of that port's clock signal.
3.  $\overline{CNTRST}_{L/R}$  (pin #24/85) is a port's burst counter reset.

A new read-back (Hold+Read Mode) feature has been added, which is different between the left and right port due to the bus matching feature provided only for the right port. In read-back mode the internal address of the counter will be read from the data I/Os as shown in *Figure 1*.



**Figure 1. Counter Operation Diagram**

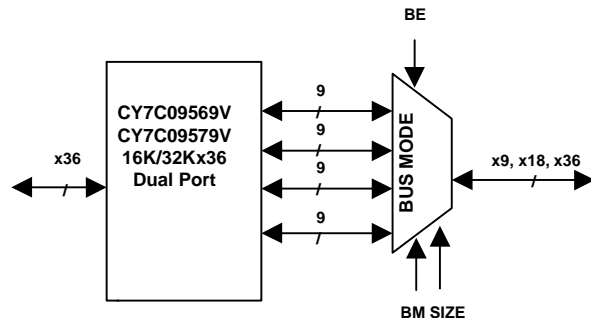
## Bus Match Operation

The right port of the CY7C09569V/09579V 16K/32Kx36 dual-port SRAM can be configured in a 36-bit long-word, 18-bit

**Note:**

45. Even though a logic level applied to a "Don't Care" input will not change the logical operation of the dual-port, inputs that are temporarily a "Don't Care" (along with unused inputs) must not be allowed to float. They must be forced either HIGH or LOW.

word, or 9-bit byte format for data I/O. The data lines are divided into four lanes, each consisting of 9 bits (byte-size data lines).



**Figure 2. Bus Match Operation Diagram**

The Bus Match Select (BM) pin works with Bus Size Select (SIZE) and Big Endian Select (BE) to select the bus width (long-word, word, or byte) and data sequencing arrangement for the right port of the dual-port device. A logic "0" applied to both the Bus Match Select (BM) pin and to the Bus Size Select (SIZE) pin will select long-word (36-bit) operation. A logic "1" level applied to the Bus Match Select (BM) pin will enable whether byte or word bus width operation on the right port I/Os depending on the logic level applied to the SIZE pin. The level of Bus Match Select (BM) must be static throughout normal device operation.

The Bus Size Select (SIZE) pin selects either a byte or word data arrangement on the right port when the Bus Match Select (BM) pin is HIGH. A logic "1" on the SIZE pin when the BM pin is HIGH selects a byte bus (9-bit) data arrangement. A logic "0" on the SIZE pin when the BM pin is HIGH selects a word bus (18-bit) data arrangement. The level of the Bus Size Select (SIZE) must also be static throughout normal device operation.

The Big Endian Select (BE) pin is a multiple-function pin during word or byte bus selection ( $BM = 1$ ). BE is used in Big Endian Select mode to determine the order by which bytes (or words) of data are transferred through the right data port. A logic "0" on the BE pin will select Little Endian data sequencing arrangement and a logic "1" on the BE pin will select a Big Endian data sequencing arrangement. Under these circumstances, the level on the BE pin should be static throughout dual-port operation.

### Long-Word (36-bit) Operation

Bus Match Select (BM) and Bus Size Select (SIZE) set to a logic "0" will enable standard cycle long-word (36-bit) operation. In this mode, the right port's I/O operates essentially in an identical fashion to the left port of the dual-port SRAM. However no Byte Select control is available. All 36 bits of the long-word are shifted into and out of the right port's I/O buffer stages. All read and write timing parameters may be identical with respect to the two data ports. When the right port is configured for a long-word size, Big-Endian Select (BE) pin has no application and their inputs are "Don't Care"<sup>[45]</sup> for the external user.

### Word (18-bit) Operation

Word (18-bit) bus sizing operation is enabled when Bus Match Select (BM) is set to a logic "1" and the Bus Size Select (SIZE) pin is set to a logic "0." In this mode, 18 bits of data are ported through I/O<sub>0R-17R</sub>. The level applied to the Big Endian (BE) pin determines the right port data I/O sequencing order (Big Endian or Little Endian).

During word (18-bit) bus size operation, a logic LOW applied to the BE pin will select Little Endian operation. In this case, the least significant data word is read from the right port first or written to the right port first. A logic "1" on the BE pin during word (18-bit) bus size operation will select Big Endian operation resulting in the most significant data word being transferred through the right port first. Internally, the data will be stored in the appropriate 36-bit LSB or MSB I/O memory location. Device operation requires a minimum of two clock cycles to read or write during word (18-bit) bus size operation. An internal sub-counter automatically increments the right port multiplexer control when Little or Big Endian operation is in effect.

### Byte (9-bit) Operation

Byte (9-bit) bus sizing operation is enabled when Bus Match Select (BM) is set to a logic "1" and the Bus Size Select (SIZE) pin is set to a logic "1." In this mode, 9 bits of data are ported through I/O<sub>0R-8R</sub>.

Big Endian and Little Endian data sequencing is available for dual-port operation. The level applied to the Big Endian pin (BE) under these circumstances will determine the right port data I/O sequencing order (Big or Little Endian). A logic LOW applied to the BE pin during byte (9-bit) bus size operation will select Little Endian operation. In this case, the least significant data byte is read from the right port first or written to the right port first. A logic "1" on the BE pin during byte (9-bit) bus size operation will select Big Endian operation resulting in the most significant data word to be transferred through the right port first. Internally, the data will be stored in the appropriate 36-bit LSB or MSB I/O memory location. Device operation requires a minimum of four clock cycles to read or write during byte (9-bit) bus size operation. An internal sub-counter automatically increments the right port multiplexer control when Little or Big Endian operation is in effect. When transferring data in byte (9-bit) bus match format, the unused I/O pins (I/O<sub>9RQ-35R</sub>) are three-stated.

**Ordering Information**
**16K x36 3.3V Synchronous Dual-Port SRAM**

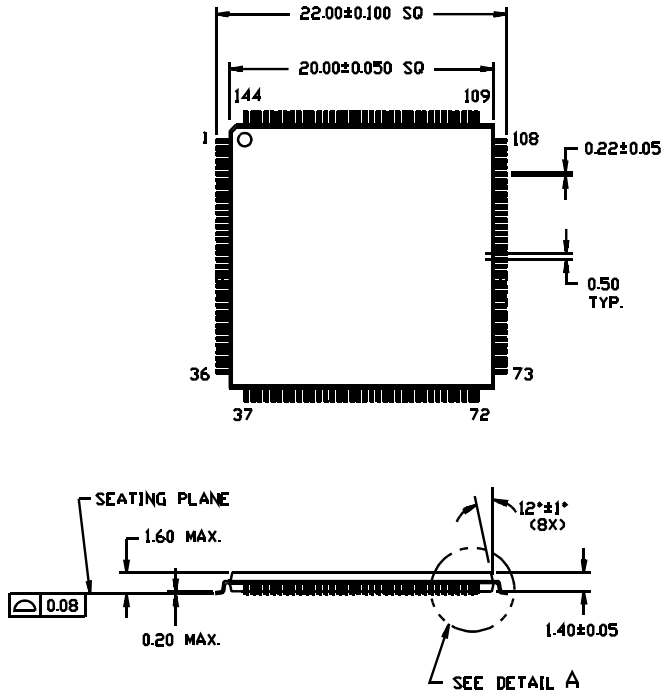
| Speed (MHz) | Ordering Code     | Package Name | Package Type                        | Operating Range |
|-------------|-------------------|--------------|-------------------------------------|-----------------|
| 100         | CY7C09569V-100AC  | A144         | 144-Pin Thin Quad Flat Pack         | Commercial      |
|             | CY7C09569V-100AXC | A144         | 144-Pin Pb-Free Thin Quad Flat Pack | Commercial      |
|             | CY7C09569V-100BBC | BB172        | 172-Ball Ball Grid Array (BGA)      | Commercial      |
| 83          | CY7C09569V-83AC   | A144         | 144-Pin Thin Quad Flat Pack         | Commercial      |
|             | CY7C09569V-83AXC  | A144         | 144-Pin Pb-Free Thin Quad Flat Pack | Commercial      |
|             | CY7C09569V-83BBC  | BB172        | 172-Ball Ball Grid Array (BGA)      | Commercial      |
| 67          | CY7C09569V-67AC   | A144         | 144-Pin Thin Quad Flat Pack         | Commercial      |
|             | CY7C09569V-67BBC  | BB172        | 172-Ball Ball Grid Array (BGA)      | Commercial      |

**32K x36 3.3V Synchronous Dual-Port SRAM**

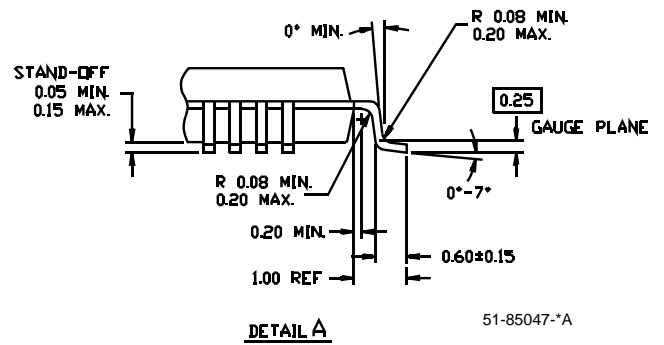
| Speed (MHz) | Ordering Code     | Package Name | Package Type                        | Operating Range |
|-------------|-------------------|--------------|-------------------------------------|-----------------|
| 100         | CY7C09579V-100AC  | A144         | 144-Pin Thin Quad Flat Pack         | Commercial      |
|             | CY7C09579V-100AXC | A144         | 144-Pin Pb-Free Thin Quad Flat Pack | Commercial      |
|             | CY7C09579V-100BBC | BB172        | 172-Ball Ball Grid Array (BGA)      | Commercial      |
| 83          | CY7C09579V-83AC   | A144         | 144-Pin Thin Quad Flat Pack         | Commercial      |
|             | CY7C09579V-83AXC  | A144         | 144-Pin Pb-Free Thin Quad Flat Pack | Commercial      |
|             | CY7C09579V-83AI   | A144         | 144-Pin Thin Quad Flat Pack         | Industrial      |
|             | CY7C09579V-83AXI  | A144         | 144-Pin Pb-Free Thin Quad Flat Pack | Industrial      |
|             | CY7C09579V-83BBC  | BB172        | 172-Ball Ball Grid Array (BGA)      | Commercial      |
|             | CY7C09579V-83BBI  | BB172        | 172-Ball Ball Grid Array (BGA)      | Industrial      |
| 67          | CY7C09579V-67AC   | A144         | 144-Pin Thin Quad Flat Pack         | Commercial      |
|             | CY7C09579V-67BBC  | BB172        | 172-Ball Ball Grid Array (BGA)      | Commercial      |

Package Diagrams

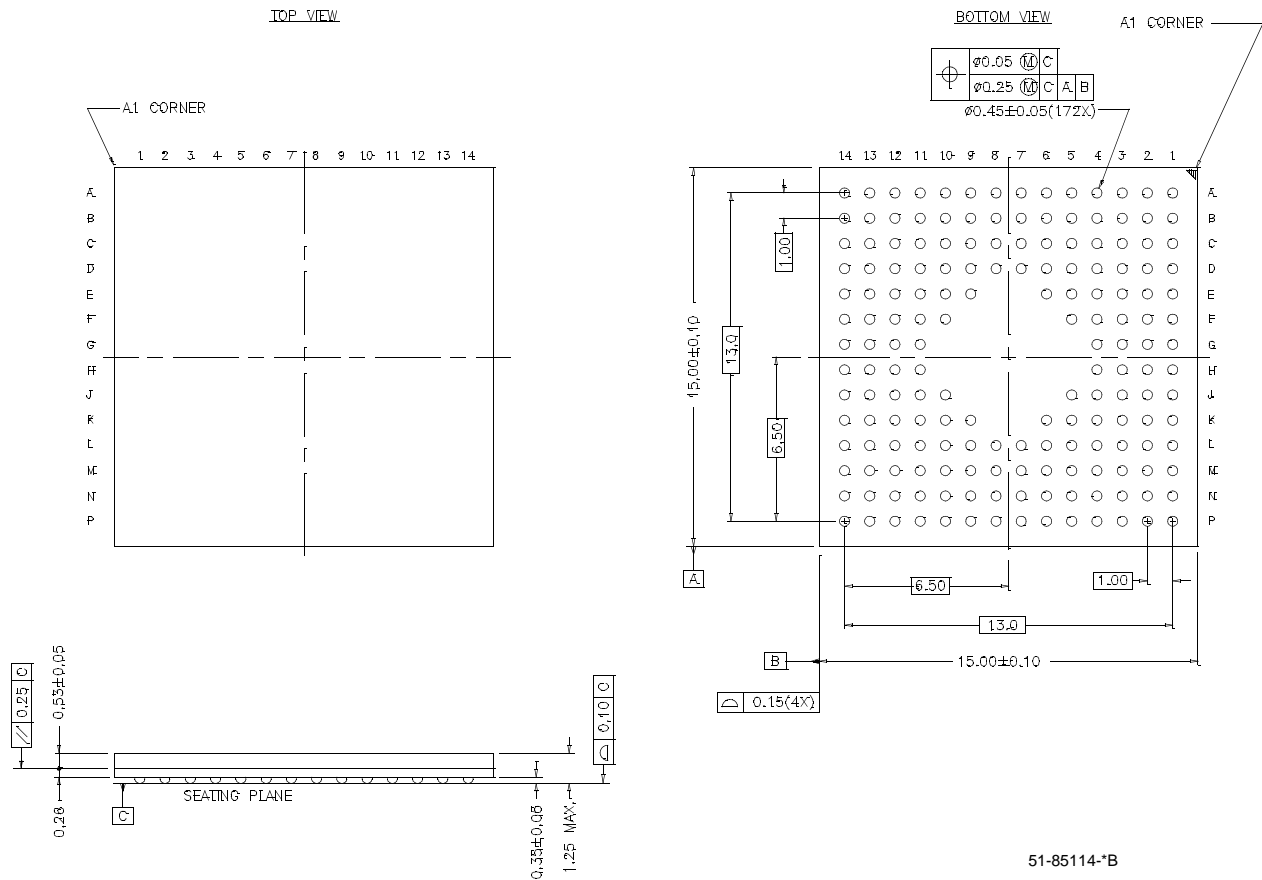
144-Pin Plastic Thin Quad Flat Pack (TQFP) A144  
144-Pin Pb-Free Plastic Thin Quad Flat Pack (TQFP) A144



DIMENSIONS ARE IN MILLIMETERS.



51-85047-A

**Package Diagrams (continued)**
**172-Ball FBGA (15 x 15 x 1.25 mm) BB172**


51-85114-\*B

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**Document History Page**

| <b>Document Title: CY7C09569V/CY7C09579V 3.3 16K/ 32K x 36 FLEx36™ Synchronous Dual-Port Static RAM</b> |                |                   |                        |  |
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| <b>Document Number: 38-06054</b>  |                |                   |                        |  |
| <b>REV.</b>   | <b>ECN NO.</b> | <b>Issue Date</b> | <b>Orig. of Change</b> | <b>Description of Change</b>                               |
| **  | 110213         | 12/16/01          | SZV                    | Change from Spec number: 38-00743 to 38-06054              |
| *A  | 122304         | 12/27/02          | RBI                    | Power up requirements added to Maximum Ratings Information |
| *B  | 349775         | See ECN           | RUY                    | Added Pb-Free Information                                  |