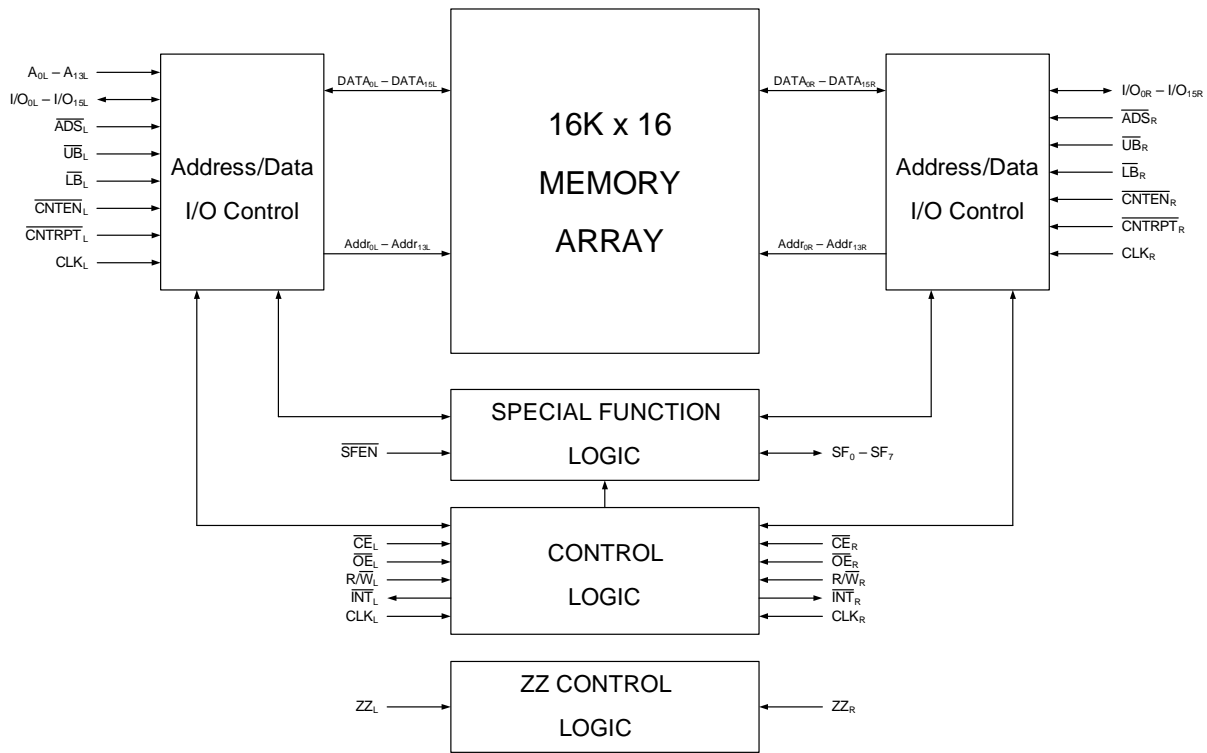


Features

- ◆ True Dual-Ported Memory Cells
 - Allows simultaneous access of the same memory location
 - ◆ High per-port throughput performance
 - Industrial: 800 Mbps
 - ◆ Low-Power Operation
 - Active: 15 mA (typ.)
 - Standby: 2 uA (typ.)
 - ◆ Multiplexed address and data I/Os
- ◆ Counter enable and repeat features
 - ◆ Full synchronous operation on both ports
 - ◆ Separate upper-byte and lower-byte controls for multiplexed bus and bus matching compatibility
 - ◆ LVTTTL-compatible, single 1.8V (+/- 100mV) power supply
 - ◆ Industrial temperature range (-40C to +85C)
 - ◆ Available in a 100-ball fpBGA (fine pitch BGA)
 - ◆ Green parts available, see ordering information

Block Diagram



NOTES:

1. This block diagram depicts operation with the address and data signals mux'd on the right port but not on the left port. If each port is set to operate with the address and data signals mux'd, then both sides of the block diagram will be the same as the right port pictured above.

Device Description

Designed primarily for use as a high-speed, low-power inter-connect in multi-processor wireless handsets, the IDT70P9268 or Mobile Multimedia Interconnect (M²I) provides many advantages over embedded serial interfaces, asynchronous memories, and other legacy solutions to inter-processor communication.

Performance

The M²I supports unparalleled data throughput rates of up to 900 Mbps per port. This is achieved through the implementation of a synchronous architecture which allows the device to support much shorter cycle times (20 ns compared to 55 ns for most low-power asynchronous memories). Additionally, the adoption of a synchronous architecture allows the M²I to support on-chip counter functionality which helps to eliminate the inefficiencies associated with asynchronous implementations of the address-data-multiplex (ADM) interface. Asynchronous ADM (address-data multiplex) interfaces require the assertion of an external address on one cycle followed by the associated data on the subsequent cycle. This results in an access scheme that imparts a 50% inefficiency into a system already limited by slow cycle times. The M²I's counter functionality allows a single external address to be asserted on one cycle followed by data being burst into or out of the device on every subsequent cycle. This, when combined with the dramatically improved cycle time, translates to roughly six times greater throughput per-port when compared with asynchronous ADM devices.

Power Consumption

In portable applications, power consumption is of vital concern. This is why the M²I includes several features targeted at reducing the power consumption of the device itself and the system as a whole. First, the M²I was designed to consume 40% less operating current than low-power asynchronous memories (15 mA compared to 25 mA). When combined with its superior performance and counter functionality, which allow it to complete media transfers in fewer cycles, this enables the M²I to consume nearly 90% less energy than asynchronous memories during transfers of a given file size. Second, the M²I features port-specific chip-enable and sleep mode pins which allow the two ports of the M²I to be powered down into standby mode independently of one another. When combined with the M²I's interrupt flag functionality, this allows the processor subsystems to communicate with one another and to shut off whole portions of the handset which are not in use, dramatically reducing the power consumption of the system.

Flexibility

To help meet the ever changing requirements of wireless handsets, the M²I has been designed to provide a great deal of flexibility. The M²I has the ability to support both ADM and traditional SRAM interfaces, allowing it to seamlessly interface with both current and legacy processors. Additionally, the M²I helps to free up GPIO pins on the processors, allowing designers to include differentiating functionality that helps set their product apart from the competition. By supporting the ADM interface, the M²I consumes nearly 50% fewer pins per-port than non-multiplexed solutions. The M²I also frees up additional GPIO pins on the processors by including 8 dynamically programmable GPIO extender pins. These pins allow the processors to offload the need to monitor or control simple, binary state devices (e.g. switches, LED drivers, etc.) to the M²I and allow the processors to use their GPIO pins for more value added functions.

IDT70P9268
BY100
100-BALL fpBGA

A1 VSS	A2 I/O0R	A3 VDD	A4 I/O4R	A5 I/O7R	A6 VDD	A7 I/O10R	A8 VDD	A9 I/O15R	A10 $\overline{\text{SFEN}}$
B1 $\overline{\text{R}}/\overline{\text{W}}\text{R}$	B2 CLKR	B3 I/O1R	B4 VSS	B5 I/O5R	B6 VSS	B7 I/O11R	B8 VSS	B9 I/O14R	B10 $\overline{\text{OE}}\text{R}$
C1 $\overline{\text{ADS}}\text{R}$	C2 $\overline{\text{CNTEN}}\text{R}$	C3 $\overline{\text{CNTRPT}}\text{R}$	C4 I/O2R	C5 I/O6R	C6 I/O8R	C7 I/O12R	C8 ZZR	C9 SF7	C10 VSS
D1 $\overline{\text{CE}}\text{R}$	D2 $\overline{\text{INT}}\text{R}$	D3 $\overline{\text{UB}}\text{R}$	D4 $\overline{\text{LB}}\text{R}$	D5 I/O3R	D6 I/O9R	D7 I/O13R	D8 SF6	D9 SF5	D10 SF4
E1 $\overline{\text{INT}}\text{L}$	E2 VSS	E3 VDD	E4 $\overline{\text{UB}}\text{L}$	E5 $\overline{\text{CNTRPT}}\text{L}$	E6 SF0	E7 MSEL ⁽²⁾	E8 VDD	E9 VSS	E10 VDD
F1 $\overline{\text{CE}}\text{L}$	F2 $\overline{\text{LB}}\text{L}$	F3 $\overline{\text{CNTEN}}\text{L}$	F4 CLKL	F5 VSS	F6 A13L ⁽³⁾	F7 SF2	F8 VSS	F9 VSS	F10 SF1
G1 $\overline{\text{AD}}\text{SL}$	G2 A0L ⁽³⁾	G3 A3L ⁽³⁾	G4 VDD	G5 I/O8L	G6 I/O12L	G7 A7L ⁽³⁾	G8 ZZL	G9 $\overline{\text{OE}}\text{L}$	G10 SF3
H1 $\overline{\text{R}}/\overline{\text{W}}\text{L}$	H2 A2L ⁽³⁾	H3 I/O0L	H4 VSS	H5 I/O4L	H6 I/O11L	H7 I/O13L	H8 A9L ⁽³⁾	H9 A12L ⁽³⁾	H10 NC
J1 A1L ⁽³⁾	J2 A5L ⁽³⁾	J3 I/O1L	J4 I/O6L	J5 I/O7L	J6 I/O9L	J7 VDD	J8 I/O15L	J9 A10L ⁽³⁾	J10 A11L ⁽³⁾
K1 A4L ⁽³⁾	K2 A6L ⁽³⁾	K3 I/O2L	K4 I/O3L	K5 I/O5L	K6 VDD	K7 I/O10L	K8 VSS	K9 I/O14L	K10 A8L ⁽³⁾

NOTES:

1. The device setup shown above features multiplexed address and data signals on the right port and non-multiplexed address and data signals on the left port.
2. For multiplexed address and data signal operation on the left port, this pin should be set to VDD. For non-multiplexed address and data signal operation on the left port, this pin should be set to VSS.
3. For multiplexed address and data signal operation on the left port, these pins should be set to VSS.

Pin Names (70P9268)

Left Port	Right Port	Names
\overline{CE}_L	\overline{CE}_R	Chip Enable (Input)
R/\overline{W}_L	R/\overline{W}_R	Read/Write Enable (Input)
\overline{OE}_L	\overline{OE}_R	Output Enable (Input)
$A_{0L} - A_{15L}$	N/A	Address (Input)
$I/O_{0L} - I/O_{15L}$	N/A	Data (Input/Output)
N/A	$I/O+A_{0R} - I/O+A_{15R}$	Multiplexed Address and Data (Input/Output)
CLK_L	CLK_R	Clock (Input)
\overline{UB}_L	\overline{UB}_R	Upper Byte Enable (Input)
\overline{LB}_L	\overline{LB}_R	Lower Byte Enable (Input)
\overline{ADS}_L	\overline{ADS}_R	Address Strobe Enable (Input)
\overline{CNTEN}_L	\overline{CNTEN}_R	Counter Enable (Input)
\overline{CNTREP}_L	\overline{CNTREP}_R	Counter Repeat (Input)
\overline{INT}_L	\overline{INT}_R	Interrupt Flag (Output)
ZZ_L	ZZ_R	Sleep Mode Enable (Input)
	$SFEN$	Special Function Enable (Input)
	SF_{0-7}	Special Function I/O (Input/Output)
	$MSEL$	Left Port Mode Select (Input)
	V_{DD}	Power (1.8V)
	V_{SS}	Ground (0V)

Truth Table I - Read/Write and Enable Control (Multiplexed Port)

\overline{OE}	CLK	\overline{CE}	\overline{UB}	\overline{LB}	R/ \overline{W}	\overline{ADS}	ZZ	Upper Byte	Lower Byte	Cycle	Address	Mode
X	↑	H	X	X	X	X	L	High Z	High Z	X	X	Deselected
X	↑	L	H	H	X	X	L	High Z	High Z	X	X	Both bytes deselected
X	↑	L	L	H	L	L	L	--	--	N	A _N	Write to Upper Byte
X	↑	X	X	X	L	H	L	D _{IN}	High Z	N+1	--	
X	↑	L	H	L	L	L	L	--	--	N	A _N	Write to Lower Byte
X	↑	X	X	X	L	H	L	High Z	D _{IN}	N+1	--	
X	↑	L	L	L	L	L	L	--	--	N	A _N	Write to Both Bytes
X	↑	X	X	X	L	H	L	D _{IN}	D _{IN}	N+1	--	
H	↑	L	L	H	H	L	L	--	--	N	A _N	Read Upper Byte Only
L	↑	X	X	X	H	H	L	D _{OUT}	High Z	N+2	--	
H	↑	L	H	L	H	L	L	--	--	N	A _N	Read Lower Byte Only
L	↑	X	X	X	H	H	L	High Z	D _{OUT}	N+2	--	
H	↑	L	L	L	H	L	L	--	--	N	A _N	Read Both Bytes
L	↑	X	X	X	H	H	L	D _{OUT}	D _{OUT}	N+2	--	
H	↑	L	L	L	X	H	L	High Z	High Z	X	X	Outputs Disabled
X	X	X	X	X	X	X	H	High Z	High Z	X	X	Sleep Mode – Power down

Truth Table II - Read/Write and Enable Control (Non-Multiplexed Port)

\overline{OE}	CLK	\overline{CE}	\overline{UB}	\overline{LB}	R/ \overline{W}	ZZ	Upper Byte I/O	Lower Byte I/O	Mode
X	↑	H	X	X	X	L	High Z	High Z	Deselected
X	↑	L	H	H	X	L	High Z	High Z	Both Bytes Deselected
X	↑	L	L	H	L	L	D _{IN}	High Z	Write To Upper Byte Only
X	↑	L	H	L	L	L	High Z	D _{IN}	Write to Lower Byte Only
X	↑	L	L	L	L	L	D _{IN}	D _{IN}	Write to Both Bytes
L	↑	L	L	H	H	L	D _{OUT}	High Z	Read Upper Byte Only
L	↑	L	H	L	H	L	High Z	D _{OUT}	Read Lower Byte Only
L	↑	L	L	L	H	L	D _{OUT}	D _{OUT}	Read Both Bytes
H	↑	L	L	L	X	L	High Z	High Z	Outputs Disabled
X	X	X	X	X	X	H	High Z	High Z	Sleep Mode – Power Down

Truth Table III - Address Counter Control

External Address	Previous Internal Address	Internal Address Used	CLK	\overline{ADS}	\overline{CNTEN}	\overline{CNRPT}	Mode
A _n	X	A _n	↑	L	X	H	External Address Used
X	A _n	A _{n+1}	↑	H	L	H	Counter Enabled – Internal Address Generation
X	A _{n+1}	A _{n+1}	↑	H	H	H	External Address Blocked – Counter Disabled (A _{n+1} reused)
X	X	A _n	↑	X	X	L	Counter Reset to Last External Address Loaded

Recommended Operating Temperature and Supply Voltage

Grade	Ambient Temperature	GND	VDD
Industrial	-40°C to +85°C	0V	1.8V +/- 100mV

Recommended DC Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{DD}	Supply Voltage	1.7	1.8	1.9	V
V _{SS}	Ground	0	0	0	V
V _{IH}	Input High Voltage	1.2	--	V _{DD} + 0.2	V
V _{IL}	Input Low Voltage	-0.2	--	0.4	V

Absolute Maximum Ratings

Symbol	Rating	Industrial	Unit
V _{DD}	Voltage on Input, Output and I/O Terminals with Respect to V _{SS}	-0.5V to V _{DD} +0.3V	V
V _{TERM}	Terminal Voltage with Respect to GND	-0.5V to +2.9V	V
T _{BIAS}	Temperature Under Bias	-55 to +125	°C
T _{STG}	Storage Temperature	-65 to +150	°C
T _{JN}	Junction Temperature	+150	°C
I _{OUT}	DC Output Current	20	mA

Capacitance

Symbol	Parameter	Conditions	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	9	PF
C _{OUT}	Output Capacitance	V _{OUT} = 0V	11	PF

DC Electrical Characteristics Over the Operating Temperature and Supply Voltage Range (V_{DD} = 1.8V +/- 100mV)

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
I _{LI}	Input Leakage Current	V _{IN} = V _{SS} to V _{DD}	--	1	μA
I _{LO}	Output Leakage Current	$\overline{CE}_X = V_{IH}$ or $\overline{OE}_X = V_{IH}$ or V _{OUT} = V _{SS} to V _{DD}	--	1	μA
V _{OL}	Output Low Voltage	I _{OL} = 0.1mA, V _{DD} = Min	--	0.2	V
V _{OH}	Output High Voltage	I _{OH} = -0.1mA, V _{DD} = Min	V _{DD} - 0.2V	--	V
V _{OLSF}	Output Low Voltage	I _{OL} = 4mA, V _{DD} = Min	--	0.4	V

DC Electrical Characteristics Over the Operating Temperature and Supply Voltage Range (V_{DD} = 1.8V +/- 100mV)

Symbol	Parameter	Test Conditions	70P9268	
			Typ.	Max.
I _{DD}	Dynamic Operating Current (Both Ports Active)	\overline{CE}_L and $\overline{CE}_R = V_{IL}$, Outputs Disabled, $f = f_{MAX}^{(1)}$	15 mA	25 mA
I _{SB1}	Standby Current (Both Ports – TTL Inputs)	$\overline{CE}_L = \overline{CE}_R = V_{IH}$, Outputs Disabled, $f = f_{MAX}^{(1)}$	2 mA	4 mA
I _{SB2}	Standby Current (One Port – TTL Inputs)	$\overline{CE}^{“A”} = V_{IL}$ and $\overline{CE}^{“B”} = V_{IH}^{(3)}$, Active Port Outputs Disabled, $f = f_{MAX}^{(1)}$	3 mA	5 mA
I _{SB3}	Full Standby Current (Both Ports CMOS Inputs)	Both Ports Outputs Disabled \overline{CE}_L and $\overline{CE}_R \geq V_{DD} - 0.2V$, $V_{IN} \geq V_{DD} - 0.2V$, or $V_{IN} \leq 0.2V$, $f = 0^{(2)}$	2 μA	8 μA
I _{SB4}	Full Standby Current (One Port – CMOS Inputs)	$\overline{CE}^{“A”} \leq 0.2V$ and $\overline{CE}^{“B”} \geq V_{DD} - 0.2V$, $V_{IN} \geq V_{DD} - 0.2V$ or $V_{IN} \leq 0.2V$, Active Port Outputs Disabled, $f = f_{MAX}^{(1)}$	3 mA	5 mA
I _{ZZ}	Sleep Mode Current	ZZ_L and $ZZ_R > V_{DD} - 0.2V$	2 μA	8 μA

NOTES:

1. At $f = f_{MAX}$, address and control lines (except Output Enable) are cycling at the maximum frequency clock cycle of 1/tcyc, using “AC TEST CONDITIONS” at input levels of GND to 1.8V.
2. $f = 0$ means no address, clock, or control lines change. Applies only to input at CMOS level standby.
3. Port “A” may be either left or right port. Port “B” is the opposite from port “A”.

AC Test Conditions

Input Pulse Levels	V _{SS} to V _{DD}
Input Rise/Fall Times	3ns Max.
Input Timing Reference Levels	V _{DD} /2
Output Reference Levels	V _{DD} /2
Output Load	Figure 1

1.8V	
R1	13500 Ω
R2	13500 Ω

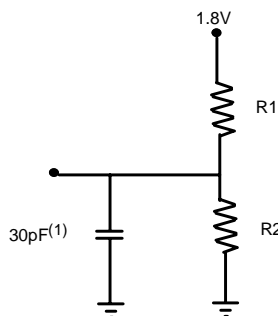


Figure 1. AC Output Test Level (5pF for tLZ, tHZ, twZ, tow)

AC Electrical Characteristics Over the Operating Temperature Range

(Read and Write Cycle Timing for Multiplexed Port) (V_{DD} = 1.8V +/- 100mV)

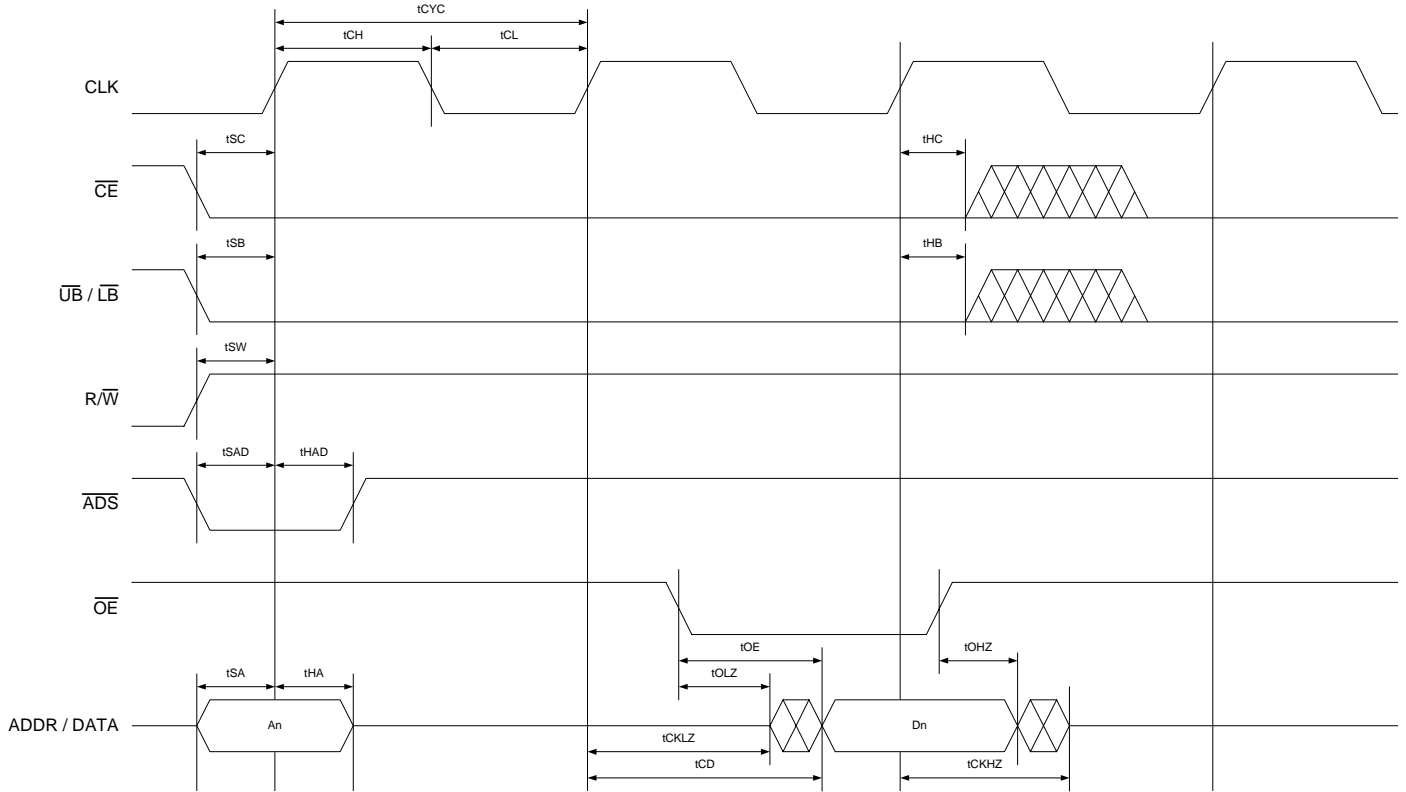
Symbol	Parameter	70P9268L Ind. Only		Unit
		Min.	Max.	
t _{CYC}	Clock Cycle Time	20	--	ns
t _{CH}	Clock High Time	8	--	ns
t _{CL}	Clock Low Time	8	--	ns
t _R	Clock Rise Time	--	3	ns
t _F	Clock Fall Time	--	3	ns
t _{SA}	Address Setup Time	5	--	ns
t _{HA}	Address Hold Time	1	--	ns
t _{SB}	Bite Enable Setup Time	5	--	ns
t _{HB}	Bite Enable Hold Time	1	--	ns
t _{SC}	Chip Enable Setup Time	5	--	ns
t _{HC}	Chip Enable Hold Time	1	--	ns
t _{SW}	R/W Setup Time	5	--	ns
t _{HW}	R/W Hold Time	1	--	ns
t _{SD}	Input Data Setup Time	5	--	ns
t _{HD}	Input Data Hold Time	1	--	ns
t _{SAD}	ADS Setup Time	5	--	ns
t _{HAD}	ADS Hold Time	1	--	ns
t _{SCN}	CNTEN Setup Time	5	--	ns
t _{HCN}	CNTEN Hold Time	1	--	ns
t _{SRST}	CNTRST Setup Time	5	--	ns
t _{HRST}	CNTRST Hold Time	1	--	ns
t _{OE}	Output Enable to Data Valid	--	10	ns
t _{OLZ}	Output Enable to Low Z	2	--	ns
t _{OHZ}	Output Enable to High Z	--	10	ns
t _{CD}	Clock to Data Valid	--	12	ns
t _{DC}	Data Output Hold After Clock High	2	--	ns
t _{CKHZ}	Clock High to Output High Z	2	9	ns
t _{CKLZ}	Clock High to Output Low Z	2	--	ns
t _{INS}	Interrupt Flag Set Time	12	--	ns
t _{INR}	Interrupt Flag Reset Time	12	--	ns
t _{CO}	Clock to Clock Offset	5	--	ns

AC Electrical Characteristics Over the Operating Temperature Range

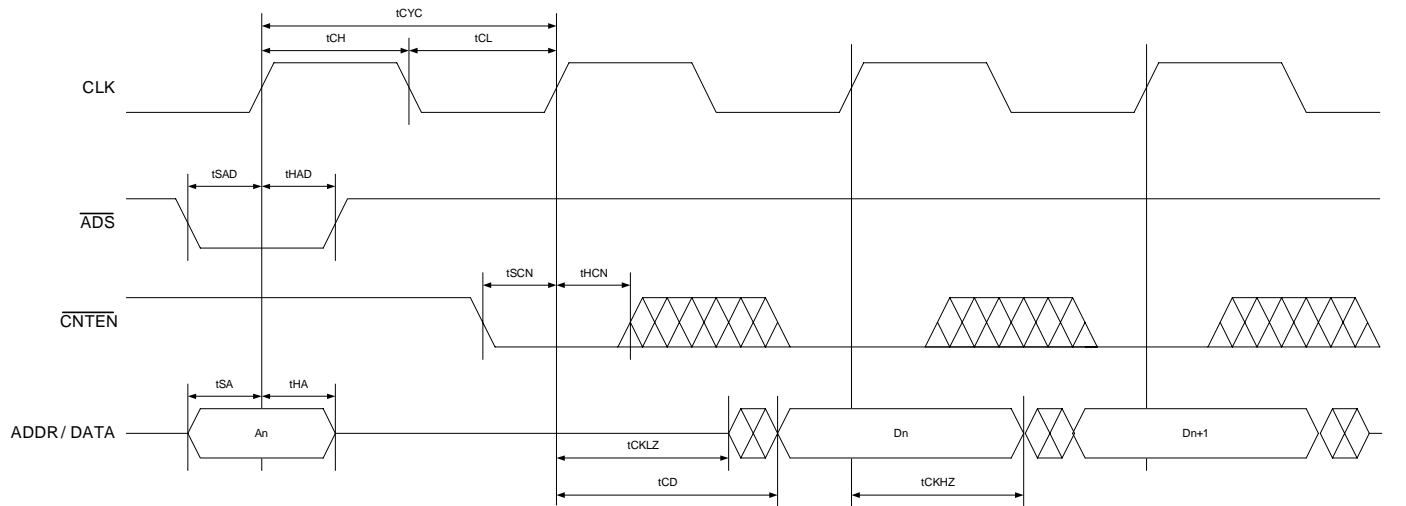
(Read and Write Cycle Timing for Non-Multiplexed Port) (V_{DD} = 1.8V +/- 100mV)

Symbol	Parameter	70P9268L Ind. Only		Unit
		Min.	Max.	
t _{CYC}	Clock Cycle Time	20	--	ns
t _{CH}	Clock High Time	8	--	ns
t _{CL}	Clock Low Time	8	--	ns
t _R	Clock Rise Time	--	3	ns
t _F	Clock Fall Time	--	3	ns
t _{SA}	Address Setup Time	5	--	ns
t _{HA}	Address Hold Time	1	--	ns
t _{SB}	Bite Enable Setup Time	5	--	ns
t _{HB}	Bite Enable Hold Time	1	--	ns
t _{SC}	Chip Enable Setup Time	5	--	ns
t _{HC}	Chip Enable Hold Time	1	--	ns
t _{SW}	R/W Setup Time	5	--	ns
t _{HW}	R/W Hold Time	1	--	ns
t _{SD}	Input Data Setup Time	5	--	ns
t _{HD}	Input Data Hold Time	1	--	ns
t _{SAD}	ADS Setup Time	5	--	ns
t _{HAD}	ADS Hold Time	1	--	ns
t _{SCN}	CNTEN Setup Time	5	--	ns
t _{HCN}	CNTEN Hold Time	1	--	ns
t _{SRST}	CNTRST Setup Time	5	--	ns
t _{HRST}	CNTRST Hold Time	1	--	ns
t _{OE}	Output Enable to Data Valid	--	10	ns
t _{OLZ}	Output Enable to Low Z	2	--	ns
t _{OHZ}	Output Enable to High Z	--	10	ns
t _{CD}	Clock to Data Valid	--	12	ns
t _{DC}	Data Output Hold After Clock High	2	--	ns
t _{CKHZ}	Clock High to Output High Z	2	10	ns
t _{CKLZ}	Clock High to Output Low Z	2	--	ns
t _{INS}	Interrupt Flag Set Time	12	--	ns
t _{INR}	Interrupt Flag Reset Time	12	--	ns
t _{CO}	Clock to Clock Offset	5	--	ns

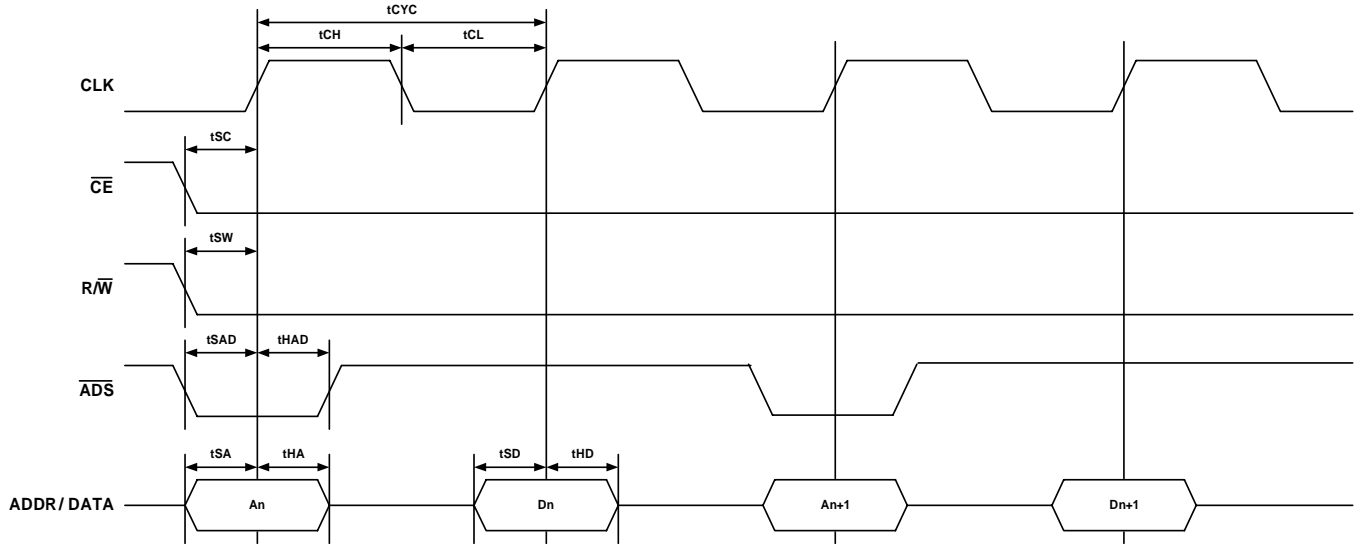
Timing Waveform for Mux'd Port Single Read Cycle



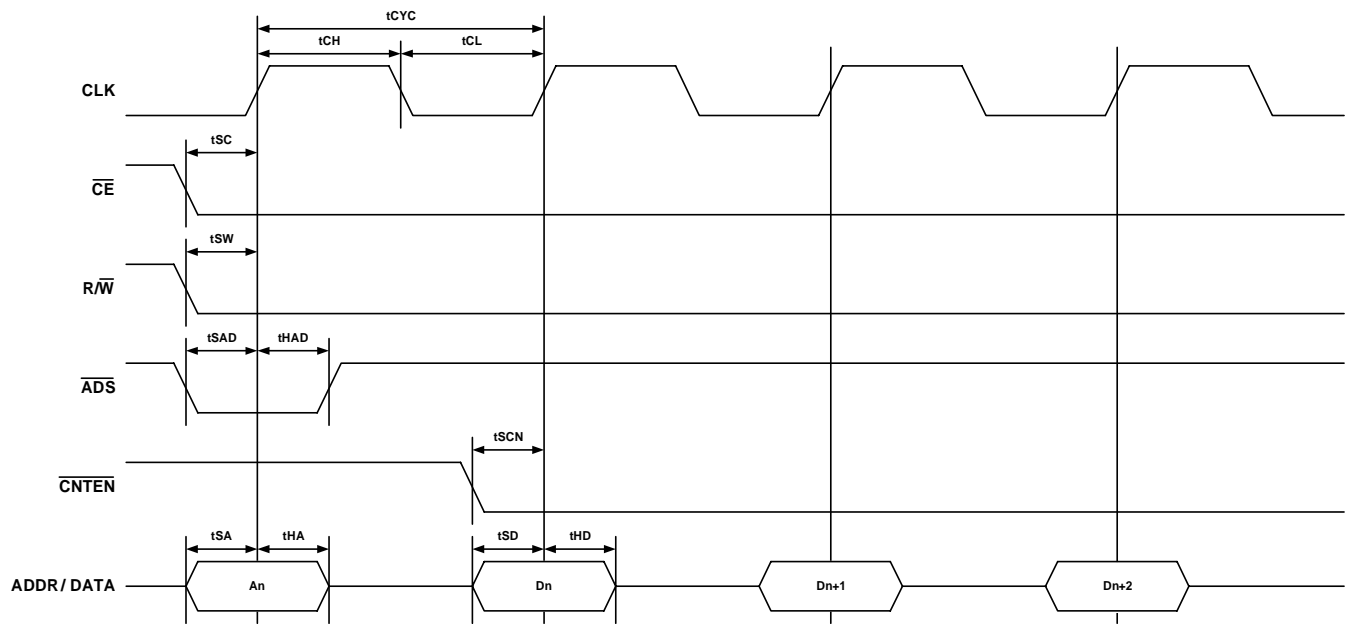
Timing Waveform for Mux'd Port Burst Read Cycle



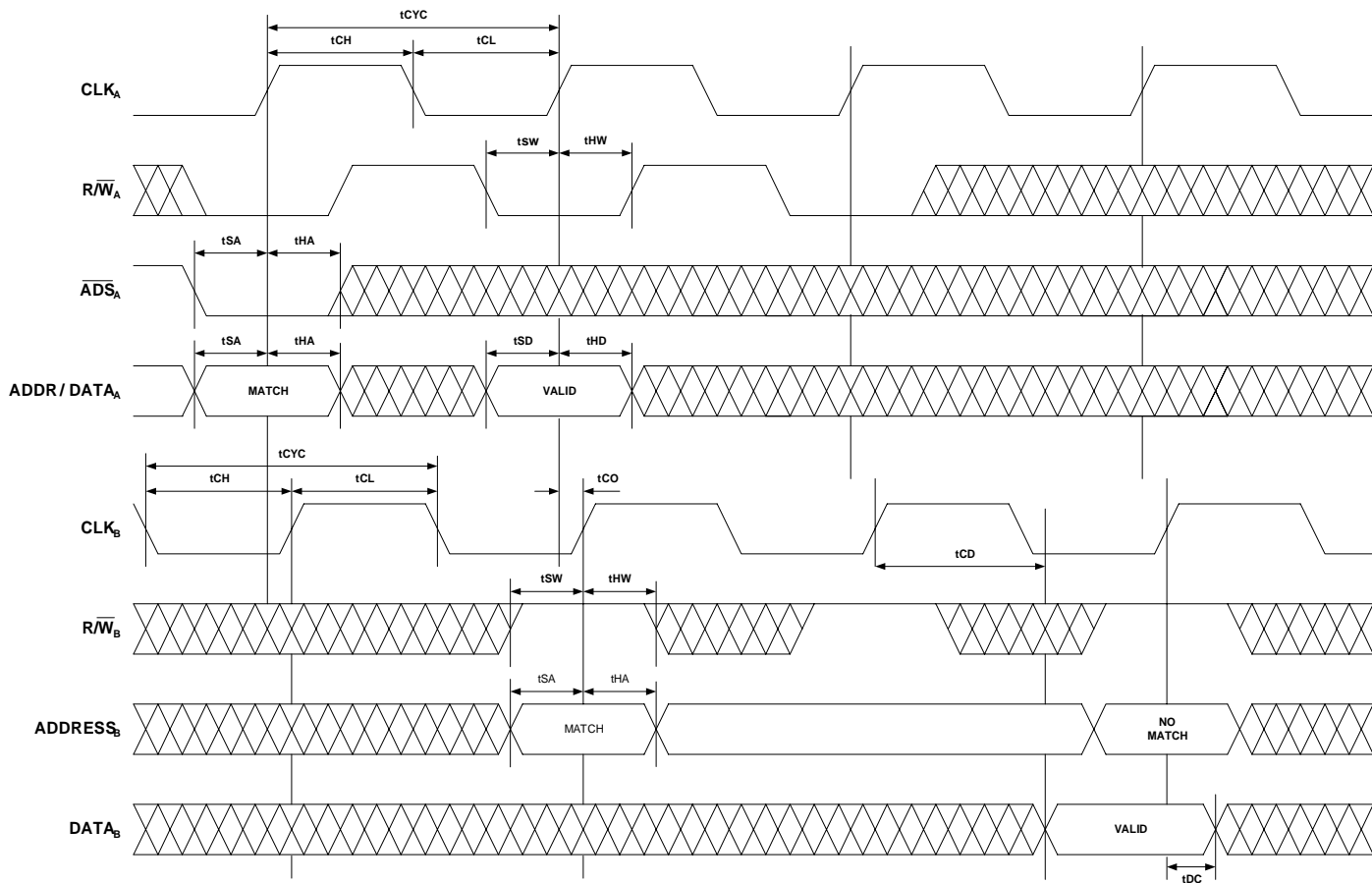
Timing Waveform for Mux'd Port Single Write Cycle



Timing Waveform for Mux'd Port Burst Write Cycle



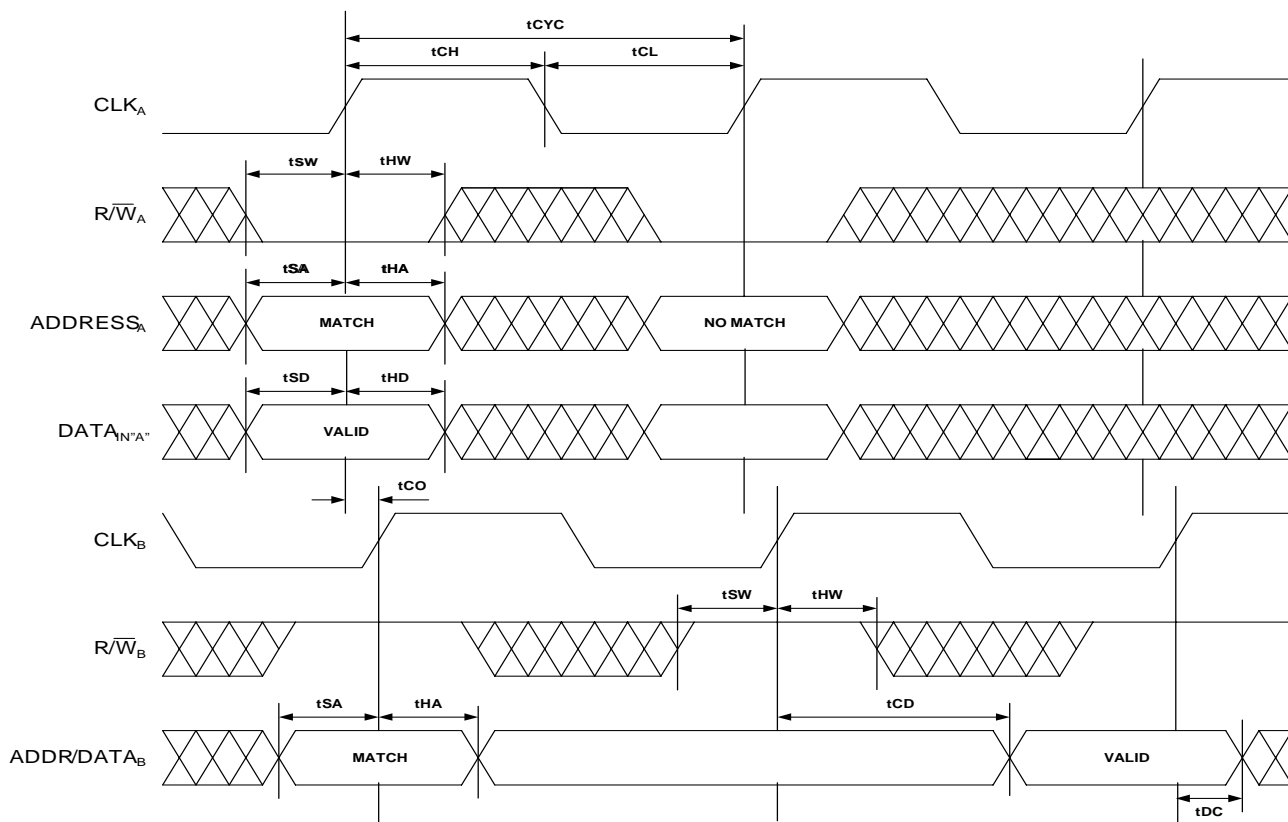
Timing Waveform of Mux'd Port Write to Non-Mux'd Port Read



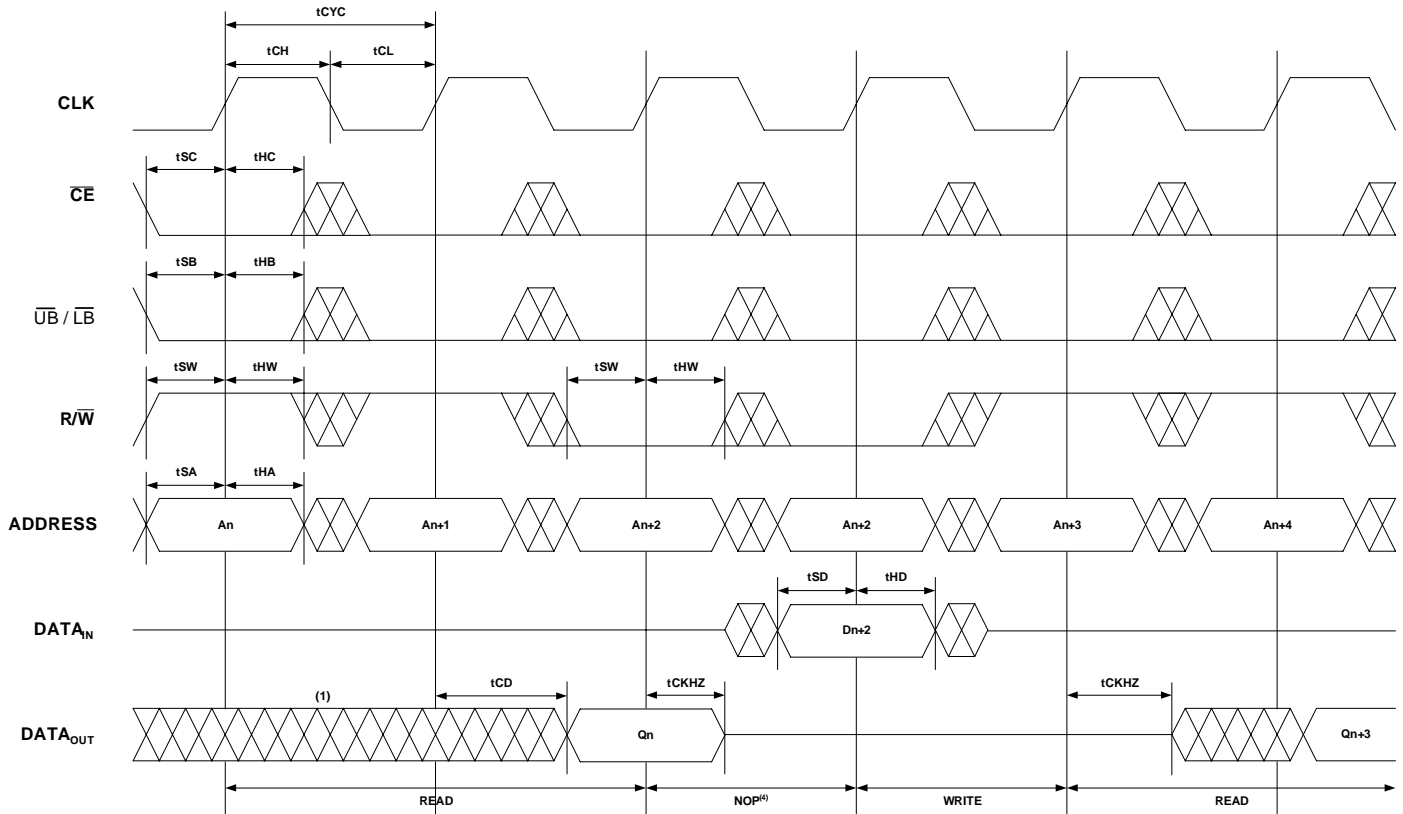
NOTES:

1. \overline{CE} , $\overline{UB/LB_n}$ = V_{IL}; \overline{CNTEN} and \overline{CNTRPT} = V_{IH}.
2. \overline{OE} = V_{IH} for Port, which is being read from. \overline{OE} = V_{IH} for Mux'd Port, which is being written to.
3. If t_{CO} ≤ minimum specified, then data from Non-Mux'd Port read is not valid until following Non-Mux'd Port clock cycle (i.e., time from write to valid read on opposite port will be t_{CO} + 2 t_{CYC2} + t_{CD2}). If t_{CO} > minimum, then data from Non-Mux'd Port read is available on first Non-Mux'd Port clock cycle (i.e., time from write to valid read on opposite port will be t_{CO} + t_{CYC2} + t_{CD2}).

Timing Waveform of Non-Mux'd Port Write to Mux'd Port Read

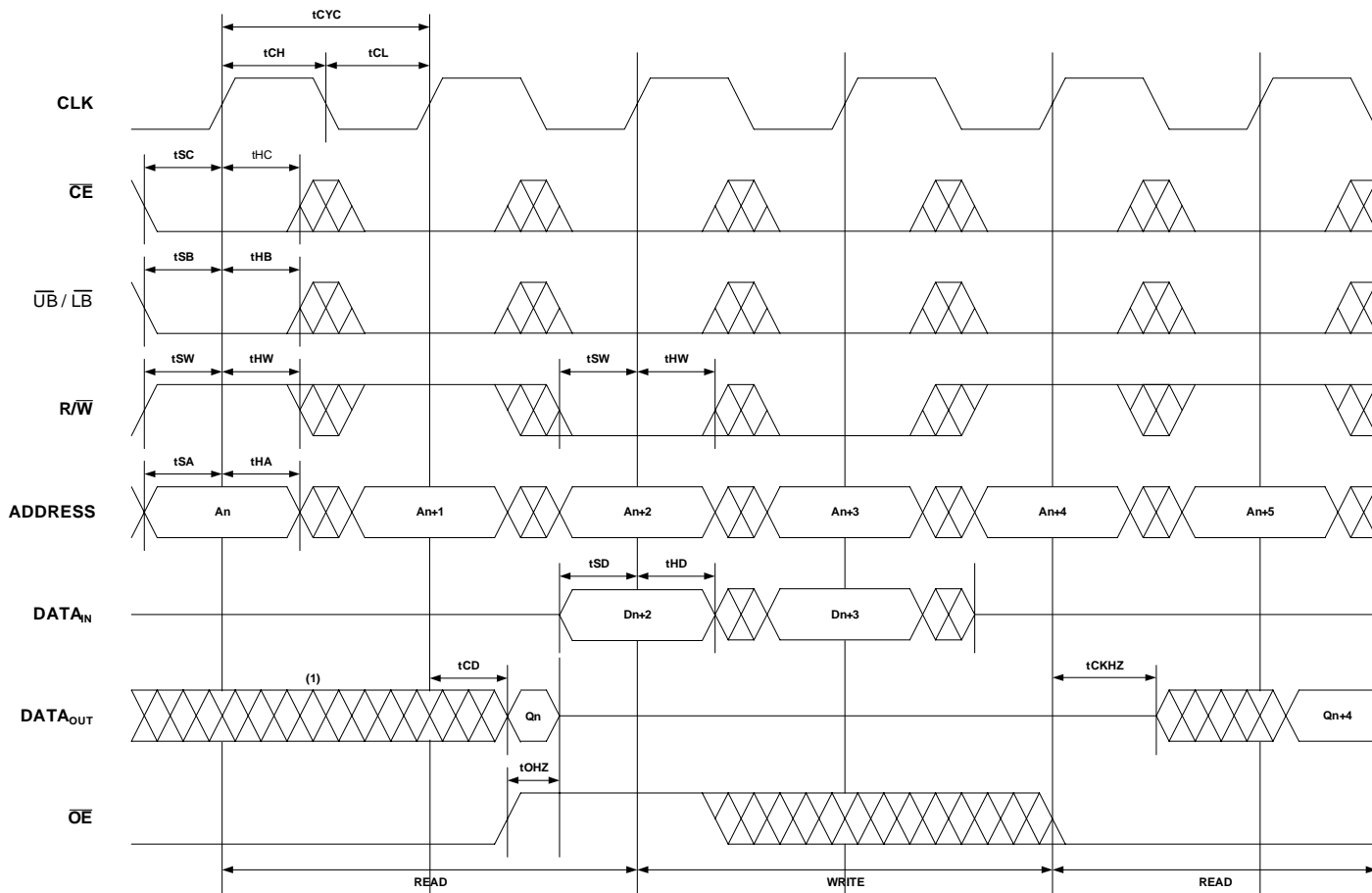


Timing Waveform of Non-Mux'd Port Read-to-Write-to-Read



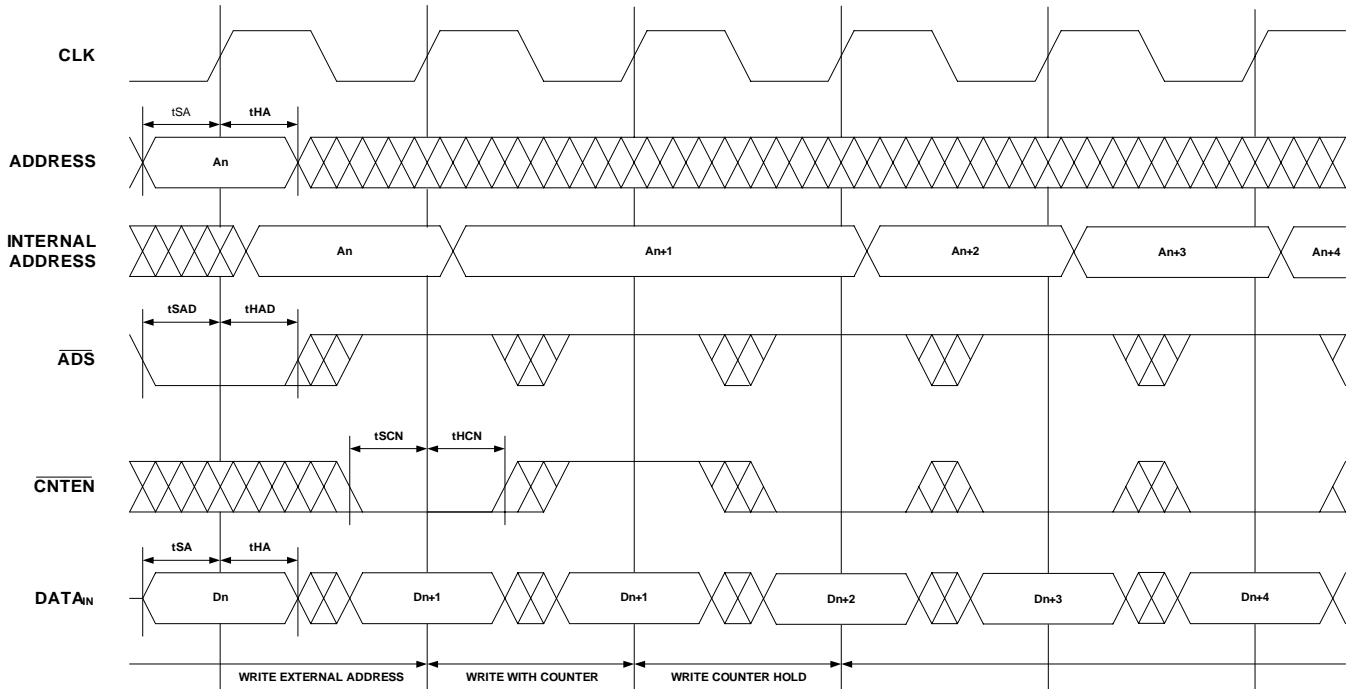
NOTES:

1. Output state (High, Low, or High-impedance) is determined by the previous cycle control signals.
2. \overline{CE} and $\overline{ADS} = V_{IL}$; \overline{CNTEN} , and $\overline{CNTRPT} = V_{IH}$. "NOP" is "No Operation".
3. Addresses do not have to be accessed sequentially since $\overline{ADS} = V_{IL}$ constantly loads the address on the rising edge of the CLK; numbers are for reference use only.
4. "NOP" is "No Operation." Data in memory at the selected address may be corrupted and should be re-written to guarantee data integrity.



NOTES:

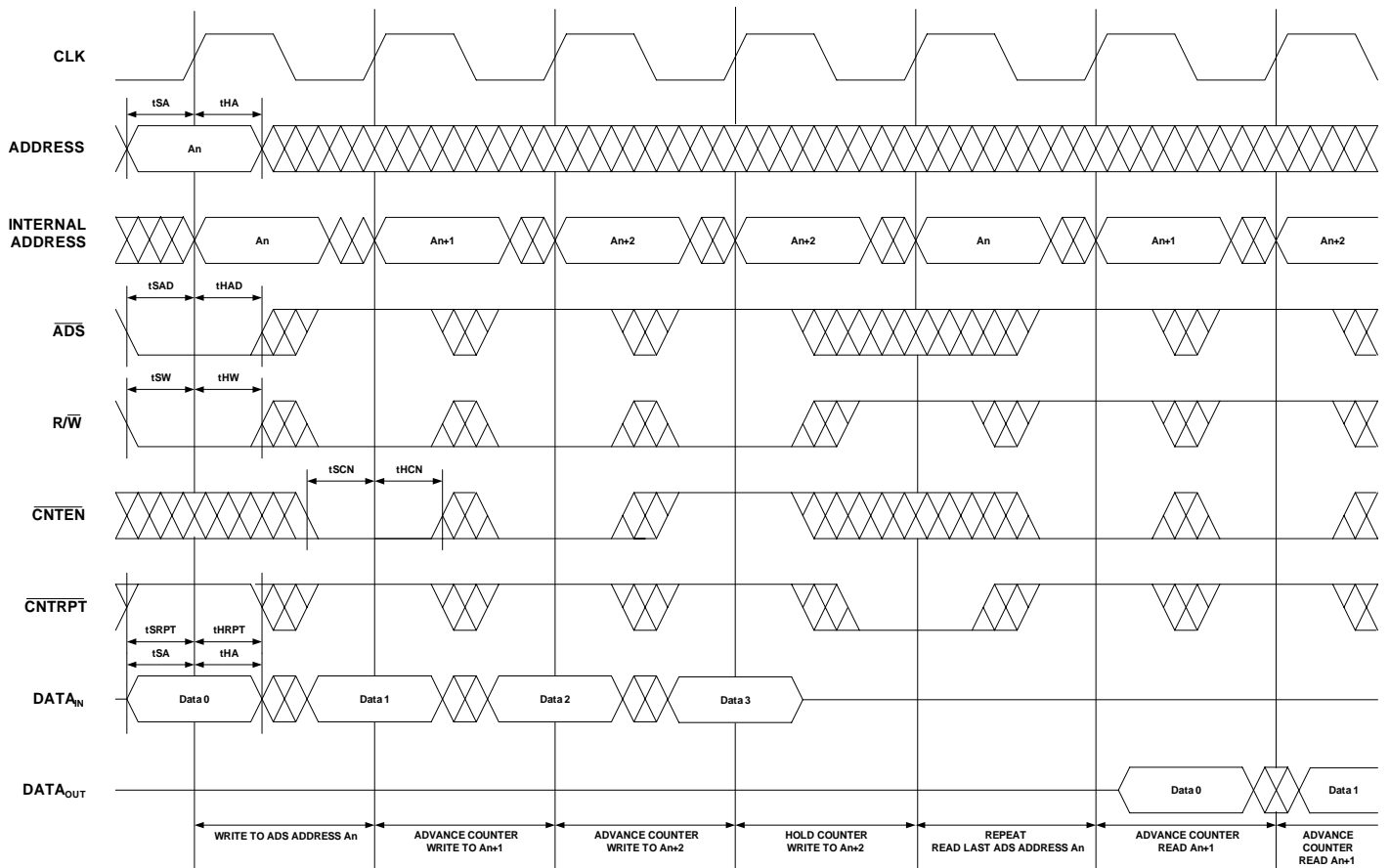
1. Output state (High, Low, or High-impedance) is determined by the previous cycle control signals.
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3. Addresses do not have to be accessed sequentially since $\overline{ADS} = V_{IL}$ constantly loads the address on the rising edge of the CLK; numbers are for reference use only.



NOTES:

1. \overline{CE} , $\overline{UB/LB}$, and $R\overline{W} = V_{IL}$; $\overline{CNRPT} = V_{IH}$.
2. \overline{CE} , $\overline{UB/LB} = V_{IL}$.
3. The "Internal Address" is equal to the "External Address" when $\overline{ADS} = V_{IL}$ and equals the counter output when $\overline{ADS} = V_{IH}$.
4. $\overline{CNTEN} = V_{IL}$ advances Internal Address from 'An' to 'An +1'. The transition shown indicates the time required for the counter to advance. The 'An +1' Address is written to during this cycle.

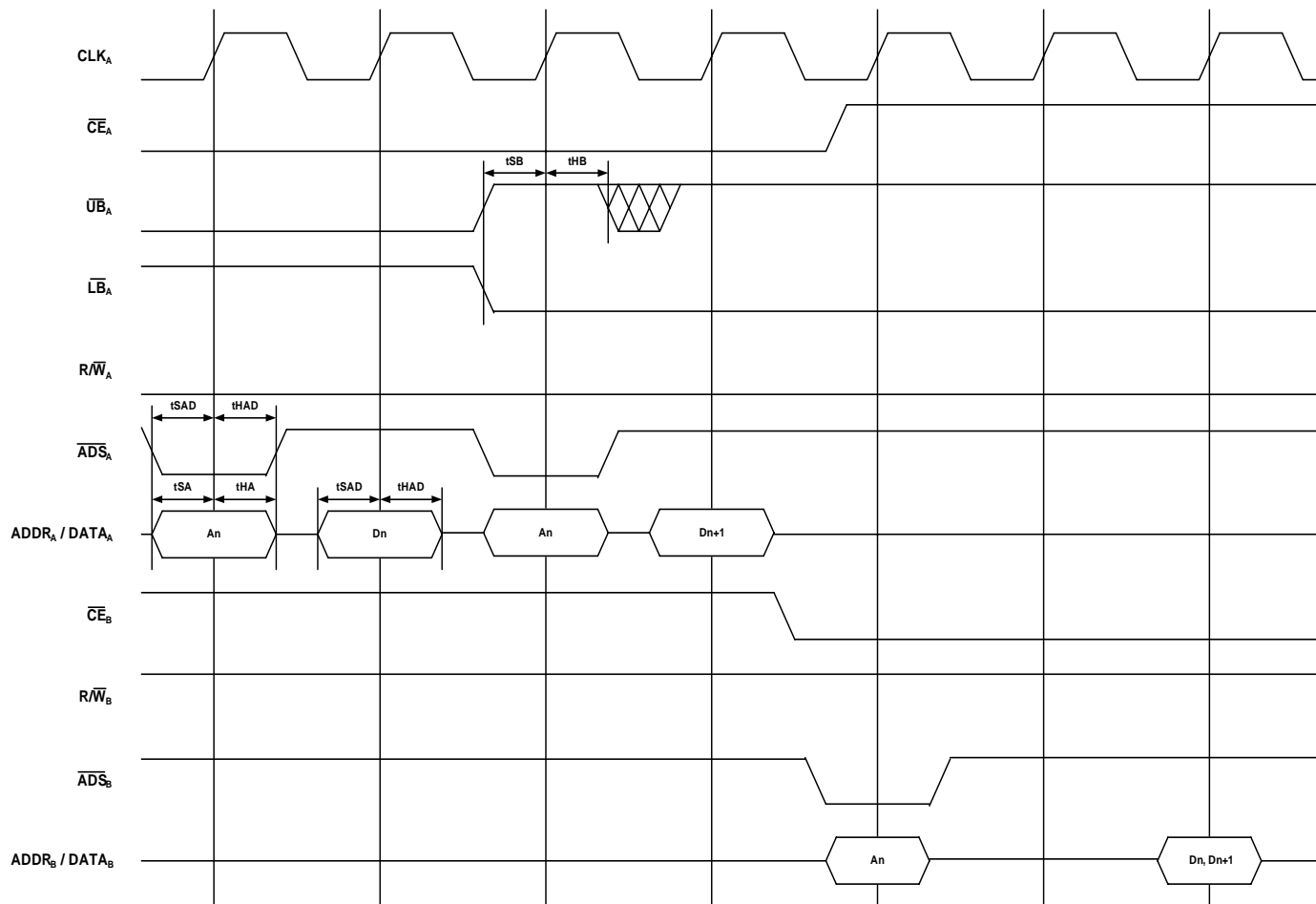
Timing Waveform of Non-Mux'd Port Operation with Counter Repeat



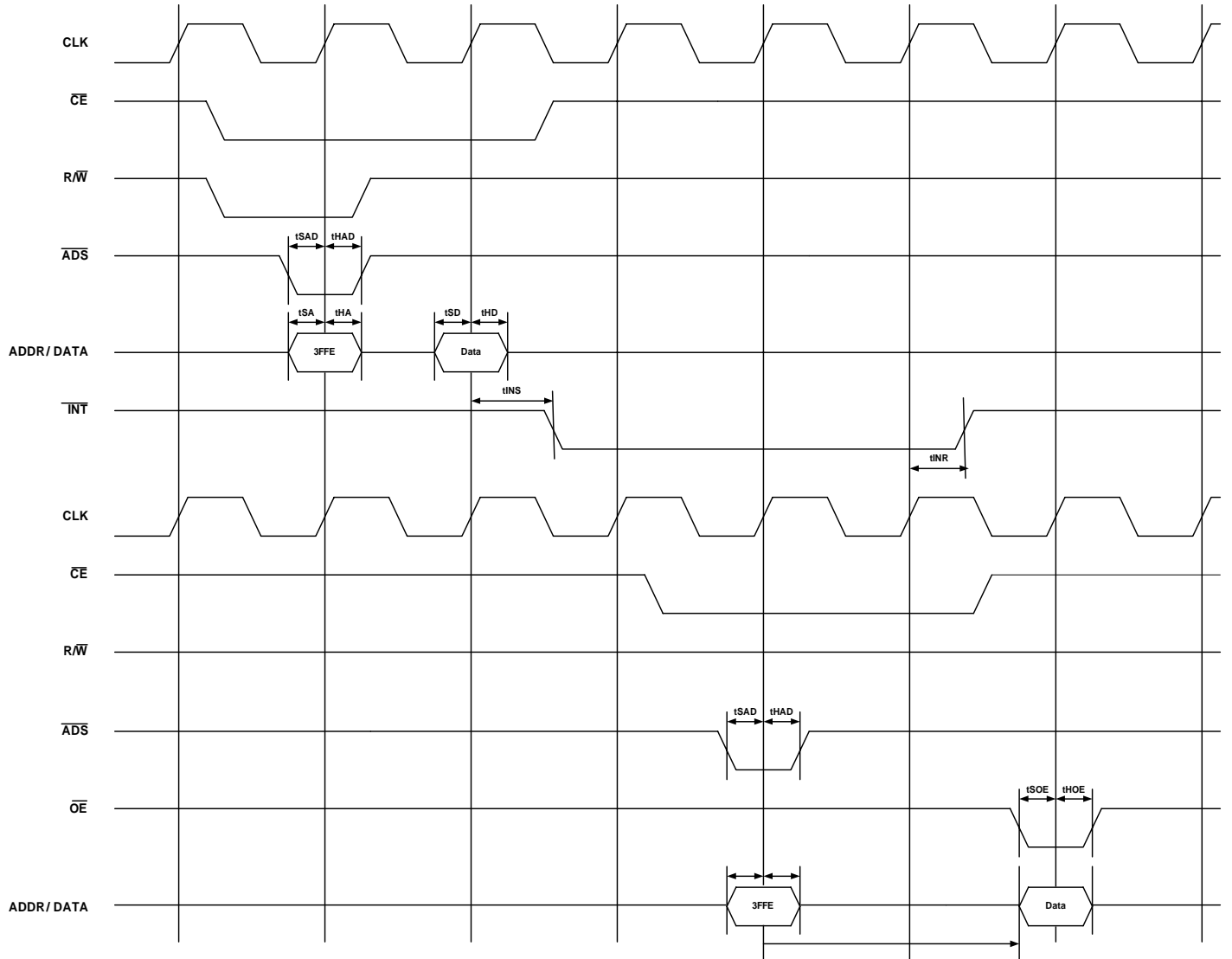
NOTES:

1. \overline{CE} , $\overline{UB/LB}$ = V_{IL} .
2. The "Internal Address" is equal to the "External Address" when $\overline{ADS} = V_{IL}$ and equals the counter output when $\overline{ADS} = V_{IH}$.
3. No dead cycle exists during CNTRPT operation. A READ or WRITE cycle may be coincidental with the counter CNTRPT cycle: Address loaded by last valid \overline{ADS} load will be accessed.
4. $\overline{CNTEN} = V_{IL}$ advances Internal Address from 'An' to 'An + 1'. The transition shown indicates the time required for the counter to advance. The 'An + 1' Address is written to during this cycle.

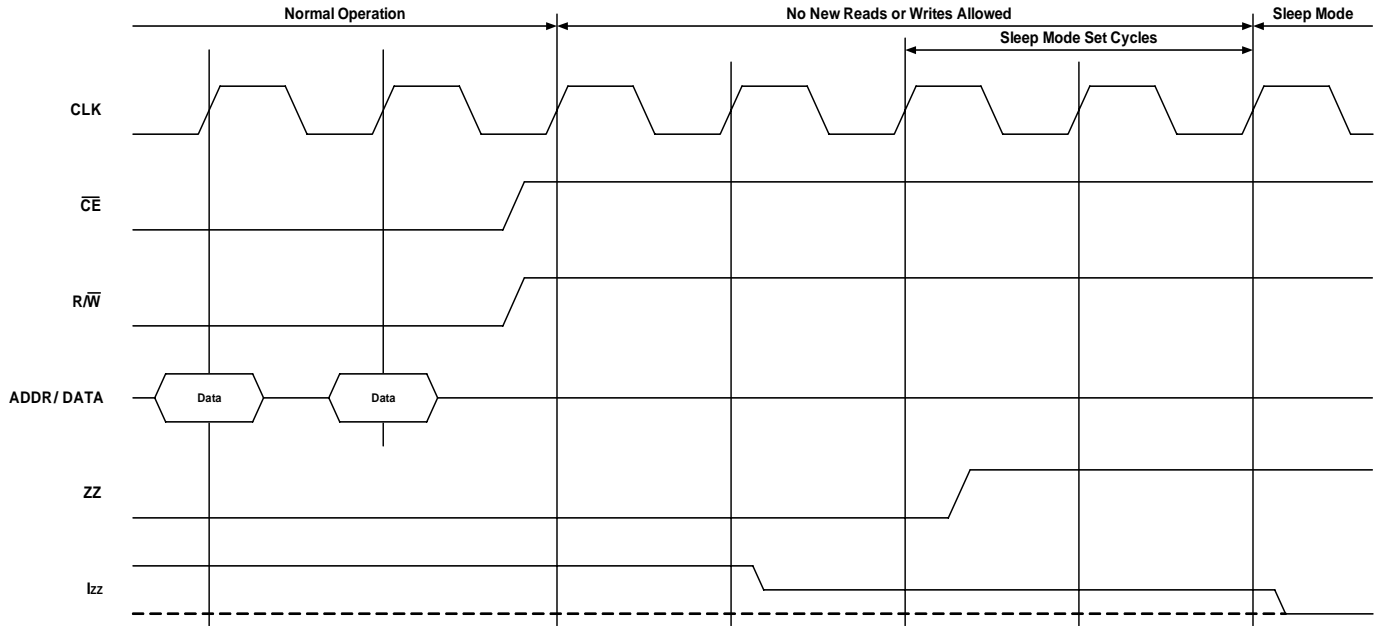
Timing Waveform for x8 to x16 Bus Matching



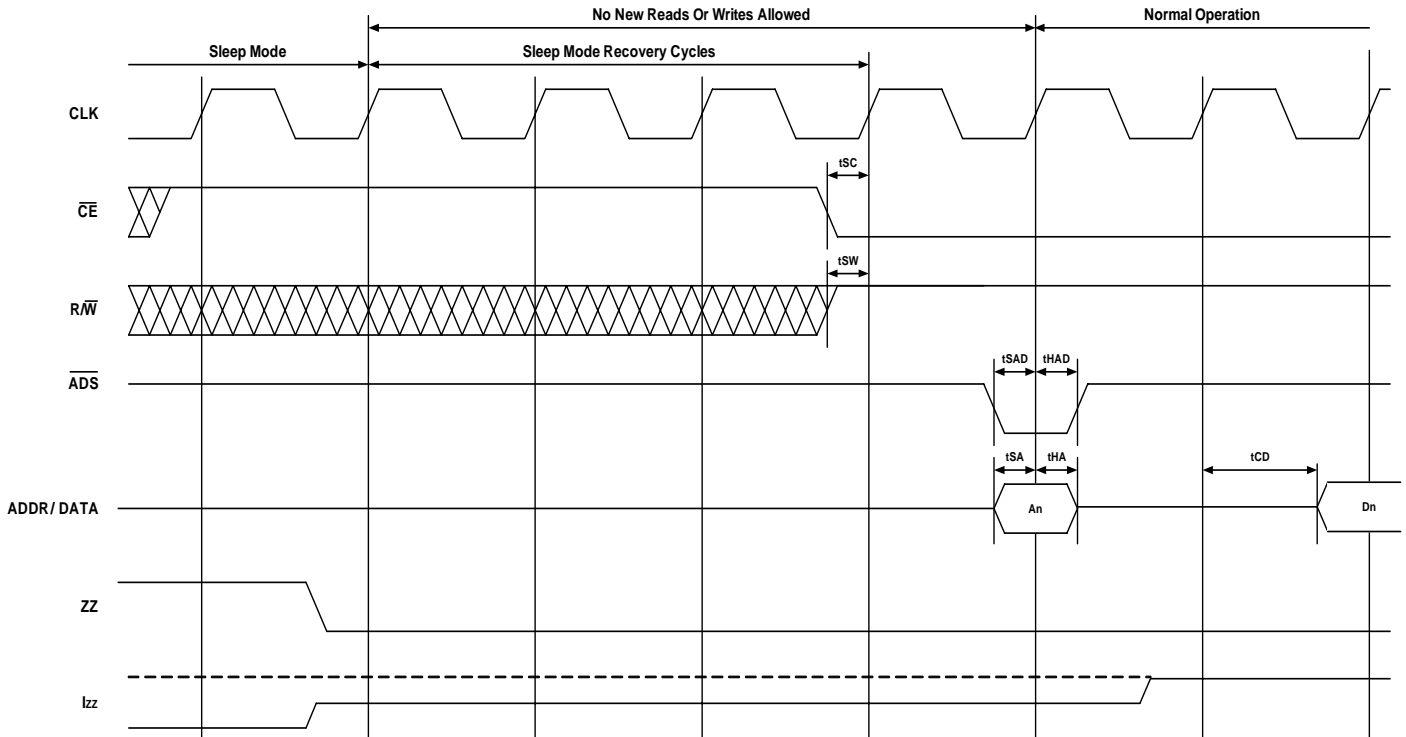
Timing Waveform - Interrupt Timing



Timing Waveform - Entering Sleep Mode



Timing Waveform - Exiting Sleep Mode



Functional Description

The 70P9268L provides a true synchronous multiplexed and non-multiplexed Dual-Port Static RAM interface. Registered inputs provide minimal set-up and hold times on address, data, and all critical control inputs. All internal registers are clocked on the rising edge of the clock signal. Counter enable and counter repeat inputs are provided to facilitate burst reads and writes to the memory.

Synchronous Interrupts

If the user chooses the interrupt function, a memory location (mail box or message center) is assigned to each port. The left port interrupt flag ($\overline{\text{INT}}_L$) is asserted when the right port writes to memory location 3FFE (HEX), where a write is defined as $\overline{\text{CE}}_R = \overline{\text{R}}/\overline{\text{W}}_R = \text{V}_{\text{IL}}$. The left port clears the interrupt through access of address location 3FFE when $\overline{\text{CE}}_L = \text{V}_{\text{IL}}$, $\overline{\text{R}}/\overline{\text{W}}_L = \text{V}_{\text{IH}}$. Likewise, the right port interrupt flag ($\overline{\text{INT}}_R$) is asserted when the left port writes to memory location 3FFF (HEX) and to clear the interrupt flag ($\overline{\text{INT}}_R$), the right port must read the memory location 3FFF. The message (16 bits) at 3FFE or 3FFF is user-defined since it is an addressable SRAM location. If the interrupt function is not used, address, locations 3FFE and 3FFF are not used as mail boxes, but as part of the random access memory.

Truth Table IV - Interrupt Flag

Left Port					Right Port					Function
CLK _L	R/ $\overline{\text{W}}_L$	$\overline{\text{CE}}_L$	ADD _L	$\overline{\text{INT}}_L$	CLK _R	R/ $\overline{\text{W}}_R$	$\overline{\text{CE}}_R$	ADD _R	$\overline{\text{INT}}_R$	
↑	L	L	3FFF	X	↑	X	X	X	L	Set Right INTR Flag
↑	X	X	X	X	↑	H	L	3FFF	H	Reset Right INTR Flag
↑	X	X	X	L	↑	L	L	3FFE	X	Set Left INTL Flag
↑	H	L	3FFE	H	↑	X	X	X	X	Reset Left INTL Flag

Advanced Input Read and Output Drive Registers

The IDT70P9268L is equipped with 8 Special Function (SFx) pins that can be programmed to function as either Input Read Register (IRR) or Output Drive Register (ODR) pins. IRR pins allow the user to capture the status of external binary state devices and report that status to a processor, ASIC, FPGA, etc. via a standard read access from either port. ODR pins allow the user to monitor and control the state of external binary state devices via standard reads and writes from either port. The functionality of the SF pins are determined by the status of the Pin Direction Register (PDR). Refer to Truth Table V for information on programming the PDR and operating the special function pins.

Truth Table V - Input Read and Output Drive Registers

$\overline{\text{SF}}\overline{\text{EN}}$	ADDR	R/ $\overline{\text{W}}$	I/O0 - I/O7	I/O8	I/O9 - I/O15	Function
L	0	L	Note 1	H	X	Program Pin Direction Register
L	0	H	Note 2	Note 3	Note 3	Reading the status of SFn and PDRn
L	0	L	Note 4	L	X	Write to Output Drive Register

NOTES:

1. If I/O_n = H, SF_n is programmed as an output and I/O_n will be used to read and write to this ODR location during subsequent transactions when I/O₈ = L. If I/O_n = L, SF_n is programmed as an input and I/O_n will be used to read this IRR location during subsequent reads where I/O₈ = L.
2. For n = 0-7. If PDR_n = 0, I/O_n = IRR_n (the registered value of SF_n). If PDR_n = 1, I/O_n = ODR_n (the value last written to ODR_n).
3. For n = 8-15, I/O_n = PDR_{n-8}.
4. For I/O₀ - I/O₇, the value written to I/O_n will be input to each ODR_n location (where PDR_n = 1) with a "1" corresponding to "on" and a "0" corresponding to "off".

Special Function I/O Operation

I/O	Function
0 – 7	With $\overline{SFEN} = L$, $I/O_8 = H$, the value written to address 0 on I/O_n will determine the status of PDR_n (1 = output, 0 = input). With $\overline{SFEN} = L$, $I/O_8 = L$, the value written to address 0 on I/O_n will be input to the corresponding ODR_n location (1 = on, 0 = off).
8	With $\overline{SFEN} = L$, writing a "0" to address 0 on this I/O causes the values of $I/O_0 - I/O_7$ to be input to their corresponding ODR locations. With $\overline{SFEN} = L$, writing a "1" to address 0 on this I/O causes the values of $I/O_0 - I/O_7$ to be input to their corresponding PDR locations, which in turn determine whether $SF_0 - SF_7$ are individually programmed to be inputs (IRR) or outputs (ODR).
9 – 15	With $\overline{SFEN} = L$, reads to address 0 will output the status of the PDR, where $I/O_n = PDR_{n-8}$.

The PDR determines whether the SF_x pins will operate as IRR or ODR. The PDR is programmed by writing to address x0000 with $\overline{SFEN} = V_{IL}$ and $I/O_8 = H$. Writing a "0" to I/O_x will set SF_x to be an IRR pin. Writing a "1" to I/O_x will set SF_x to be an ODR pin.

The status of the Special Function pins and the PDR can be read as a standard memory access to address x0000 from either port and the data is output via the standard I/Os (Truth Table V). During Special Function reads $I/O_0 - I/O_7$ output the status of the Special Function pins with I/O_n corresponding to SF_n . $I/O_8 - I/O_{15}$ outputs the status of the Pin Direction Register with $I/O_n = PDR_{n-8}$.

For SF pins set to ODR operation, the status of these pins is determined by using standard write accesses from either port to address x0000 with $\overline{SFEN} = V_{IL}$ and $I/O_8 = L$. A written "1" will correspond to "on" for the connected binary state device and a written "0" will correspond to "off".

Sleep Mode

The IDT70P9268 is equipped with an optional sleep or low-power mode on both ports. The sleep mode pin on both ports is asynchronous and active high. During normal operation, the ZZ-pin is pulled low. When ZZ is pulled high, the port will enter sleep mode where it will meet lowest possible power conditions. The sleep mode timing diagram shows the modes of operation: Normal Operation, No Read/Write Allowed and Sleep Mode.

For normal operation all inputs must meet setup and hold times prior to sleep and after recovering from sleep. Clocks must also meet cycle high and low times during these periods. Three cycles prior to asserting ZZ ($ZZx = V_{IH}$) and three cycles after de-asserting ZZ ($ZZx = V_{IL}$), the device must be disabled via the chip enable pins. If a write or a read operation occurs during these periods, the memory array may be corrupted. Validity of data out from the RAM cannot be guaranteed immediately after ZZ is asserted (prior to being in sleep). When exiting sleep mode, the device must be in Read mode ($R/\overline{W}x = V_{IH}$) when chip enable is asserted, and the chip enable must be valid for one full cycle before a read will result in the output of valid data.

During sleep mode the RAM automatically deselects itself. The RAM disconnects its internal clock buffer. The external clock may continue to run without impacting the RAM's sleep current (I_{zz}). All outputs will remain in high-Z state while in sleep mode. All inputs are allowed to toggle. The RAM will not be selected and will not perform any reads or writes.

Ordering Information

XXXXX	999	A	A	A		
Device Type	Speed	Package		Process/ Temperature Range		
					Blank I	Commercial (0°C to+70°C) Industrial (-40°C to+85°C)
					G	Green
					BZ	100-pin FPBGA (BY-100)
					50	Speed in Megahertz
					70P9268	16Kx16 Low-Power Dual-Port RAM

Revision History

02/06/07: Initial Release

08/21/07: Final Datasheet. Initial Release

11/16/07: Signal corrections - added overbars to indicate low active signals. See pages 3, 4, 5, 21 & 22.

FBD correction - changed signal arrow indicator for Addr_{0L} - Addr_{13L} and added overbar to SFEN to indicate low active signal. See page 1.

Footnote correction - removed CE₁ and replaced REPEAT with CNTRPT. See pages 12, 14, 15 & 16.

Footnote correction - removed UB/LB. See pages 14 & 15.

Unit measurement column corrected for DC Electrical Chars Over Operating Temp & Supply Voltage Range table. See page 6.

Added Bite Enable Setup Time (t_{SB}), Bite Enable Hold Time (t_{HB}) values and the unit measurement column to the AC Electrical Chars Over Operating Temp Range tables. See pages 8 & 9.

Added Output Enable to Data Valid (t_{OE}) values to the AC Electrical Chars Over Operating Temp Range table (non-multiplexed port). See page 9.

Corrected the Clock High to Output Low Z (t_{CKLZ}) symbol in the Timing Waveform for Mux'd Port Single Read Cycle. See page 10.

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