

To our customers,

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# R1LV0816ASA -5SI, 7SI

8Mb Advanced LPSRAM (512k word x 16bit / 1M word x 8bit)

REJ03C0395-0001

Rev.1.00

2009.12.08

## Description

The R1LV0816ASA is a family of low voltage 8-Mbit static RAMs organized as 524,288-words by 16-bit, fabricated by Renesas's high-performance 0.15um CMOS and TFT technologies. The R1LV0816ASA is suitable for memory applications where a simple interfacing, battery operating and battery backup are the important design objectives.

The R1LV0816ASA is packaged in a 48pin thin small outline mount device [TSOP/ 12mm x 20mm with the pin-pitch of 0.50mm]. It gives the best solution for a compaction of mounting area as well as flexibility of wiring pattern of printed circuit boards.

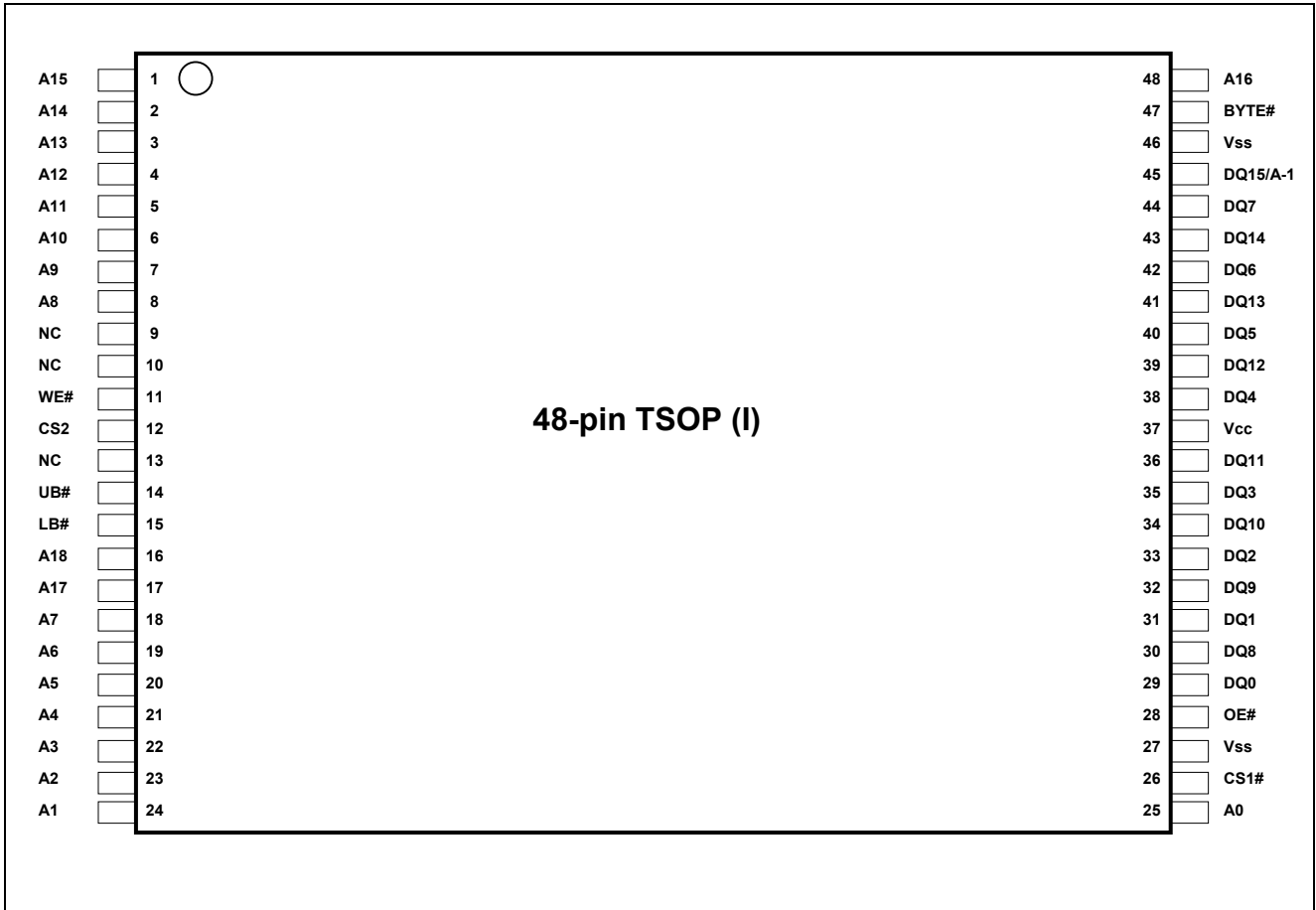
## Features

- Single 2.4-3.6V power supply
- Small stand-by current: 1.2μA (Vcc=3.0V, typ.)
- No clocks, No refresh
- All inputs and outputs are TTL compatible
- Easy memory expansion by CS2, CS1#, LB# and UB#
- Common Data I/O
- Three-state outputs: OR-tie capability
- OE# prevents data contention in the I/O bus
- Operation temperature: -40 ~ +85°C

## Ordering information

Type No.	Power supply	Access time	Temperature Range	Package
R1LV0816ASA-5SI	2.7V to 3.6V	55 ns	-40 ~ +85°C	12mm x 20mm 48-pin plastic TSOP (I) (normal-bend type) (48P3E)
	2.4V to 2.7V	70 ns		
R1LV0816ASA-7SI	2.4V to 3.6V	70 ns		

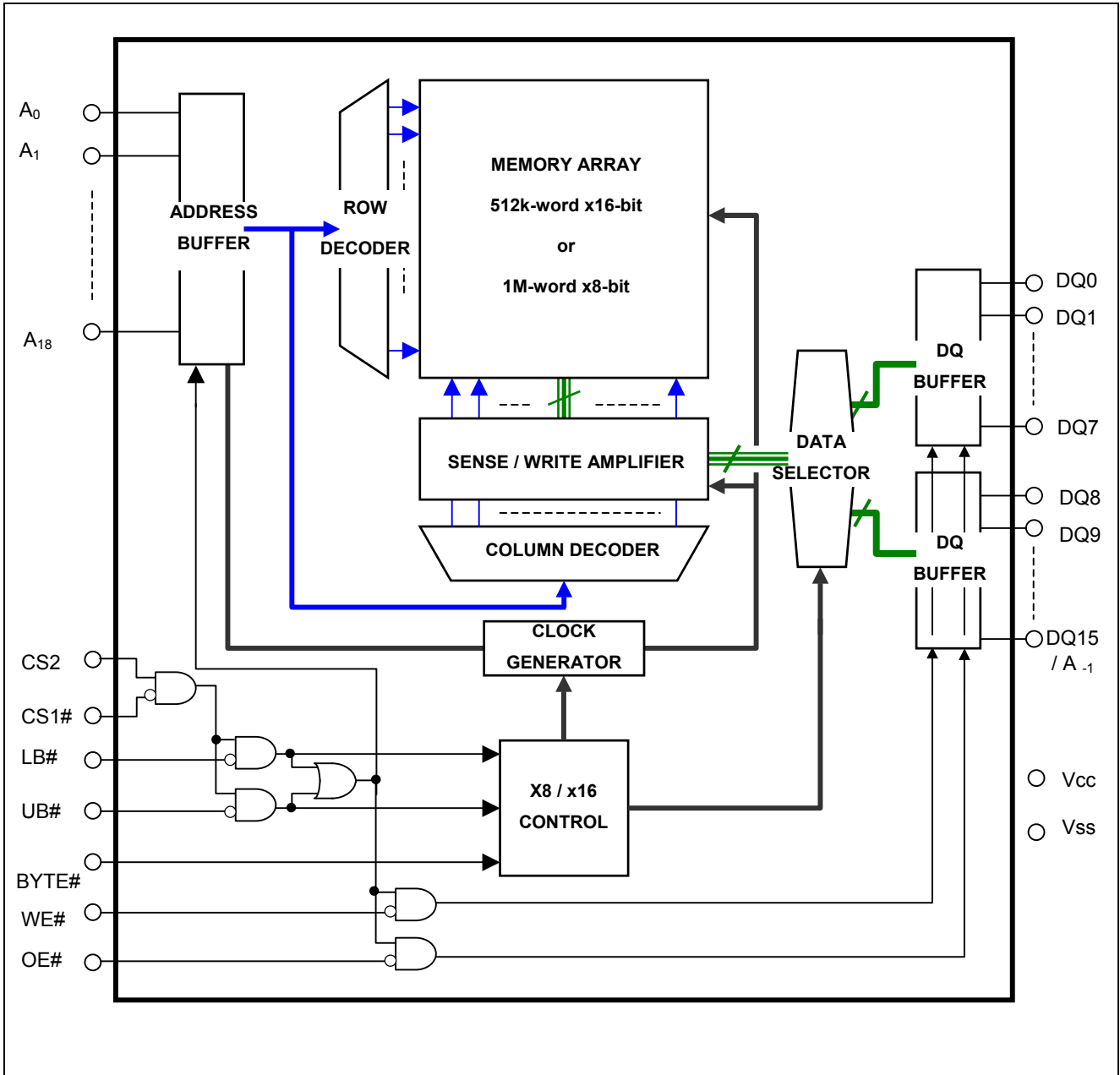
Pin Arrangement



## Pin Description

Pin name	Function
Vcc	Power supply
Vss	Ground
A0 to A18	Address input (word mode)
A-1 to A18	Address input (byte mode)
DQ0 to DQ15	Data input/output
CS1#	Chip select 1
CS2	Chip select 2
WE#	Write enable
OE#	Output enable
LB#	Lower byte enable
UB#	Upper byte enable
BYTE#	Byte control mode enable
NC	Non connection

Block Diagram



## Operation Table

CS1#	CS2	BYTE#	LB#	UB#	WE#	OE#	DQ0~7	DQ8~14	DQ15	Operation
H	X	X	X	X	X	X	High-Z	High-Z	High-Z	Stand-by
X	L	X	X	X	X	X	High-Z	High-Z	High-Z	Stand-by
X	X	H	H	H	X	X	High-Z	High-Z	High-Z	Stand-by
L	H	H	L	H	L	X	Din	High-Z	High-Z	Write in lower byte
L	H	H	L	H	H	L	Dout	High-Z	High-Z	Read in lower byte
L	H	H	L	H	H	H	High-Z	High-Z	High-Z	Output disable
L	H	H	H	L	L	X	High-Z	Din	Din	Write in upper byte
L	H	H	H	L	H	L	High-Z	Dout	Dout	Read in upper byte
L	H	H	H	L	H	H	High-Z	High-Z	High-Z	Output disable
L	H	H	L	L	L	X	Din	Din	Din	Word write
L	H	H	L	L	H	L	Dout	Dout	Dout	Word read
L	H	H	L	L	H	H	High-Z	High-Z	High-Z	Output disable
L	H	L	L	L	L	X	Din	High-Z	A-1	Byte write
L	H	L	L	L	H	L	Dout	High-Z	A-1	Byte read
L	H	L	L	L	H	H	High-Z	High-Z	A-1	Output disable

Note 1. H:  $V_{IH}$  L:  $V_{IL}$  X:  $V_{IH}$  or  $V_{IL}$

2. When BYTE#="L", both LB# and UB# must be active. (LB#=UB#="L")

## Absolute Maximum Ratings

Parameter	Symbol	Value	unit
Power supply voltage relative to Vss	Vcc	-0.5 to +4.6	V
Terminal voltage on any pin relative to Vss	$V_T$	$-0.5^{*1}$ to $V_{cc}+0.3^{*2}$	V
Power dissipation	$P_T$	0.7	W
Operation temperature	Topr	-40 to +85	°C
Storage temperature range	Tstg	-65 to 150	°C
Storage temperature range under bias	Tbias	-40 to +85	°C

Note 1. -3.0V in case of AC (Pulse width  $\leq 30$ ns)

2. Maximum voltage is +4.6V

## Recommend Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	Note
Supply voltage	V <sub>CC</sub>	2.4	3.0	3.6	V	-	
	V <sub>SS</sub>	0	0	0	V	-	
Input high voltage	V <sub>IH</sub>	2.0	-	V <sub>CC</sub> +0.2	V	V <sub>CC</sub> =2.4V to 2.7V	
		2.2	-	V <sub>CC</sub> +0.2	V	V <sub>CC</sub> =2.7V to 3.6V	
Input low voltage	V <sub>IL</sub>	-0.2	-	0.4	V	V <sub>CC</sub> =2.4V to 2.7V	1
		-0.2	-	0.6	V	V <sub>CC</sub> =2.7V to 3.6V	1
Ambient temperature range	T <sub>a</sub>	-40	-	+85	°C	-	

Note 1. -3.0V in case of AC (Pulse width ≤30ns)

## DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions
Input leakage current	I <sub>LI</sub>	-	-	1	μA	V <sub>in</sub> = V <sub>SS</sub> to V <sub>CC</sub>
Output leakage current	I <sub>LO</sub>	-	-	1	μA	BYTE# ≥ V <sub>CC</sub> -0.2V or BYTE# ≤ 0.2V CS1# =V <sub>IH</sub> or CS2 =V <sub>IL</sub> or OE# =V <sub>IH</sub> or WE# =V <sub>IL</sub> or LB# = UB# =V <sub>IH</sub> , VI/O =V <sub>SS</sub> to V <sub>CC</sub>
Average operating current	I <sub>CC1</sub>	-	20 <sup>*1</sup>	35	mA	Min. cycle, duty =100%, I <sub>I/O</sub> = 0mA BYTE# ≥ V <sub>CC</sub> -0.2V or BYTE# ≤ 0.2V CS1# =V <sub>IL</sub> , CS2 =V <sub>IH</sub> , Others = V <sub>IH</sub> /V <sub>IL</sub>
	I <sub>CC2</sub>	-	2 <sup>*1</sup>	5	mA	Cycle =1μs, duty =100%, I <sub>I/O</sub> = 0mA BYTE# ≥ V <sub>CC</sub> -0.2V or BYTE# ≤ 0.2V CS1# ≤ 0.2V, CS2 ≥ V <sub>CC</sub> -0.2V, V <sub>IH</sub> ≥ V <sub>CC</sub> -0.2V, V <sub>IL</sub> ≤ 0.2V
Standby current	I <sub>SB</sub>	-	0.1 <sup>*1</sup>	0.3	mA	BYTE# ≥ V <sub>CC</sub> -0.2V or BYTE# ≤ 0.2V CS2 =V <sub>IL</sub>
Standby current	I <sub>SB1</sub>	-	1.2 <sup>*1</sup>	4	μA	~+25°C V <sub>in</sub> ≥ 0V BYTE# ≥ V <sub>CC</sub> -0.2V or BYTE# ≤ 0.2V
		-	3 <sup>*2</sup>	6	μA	~+40°C (1) 0V ≤ CS2 ≤ 0.2V or (2) CS1# ≥ V <sub>CC</sub> -0.2V, CS2 ≥ V <sub>CC</sub> -0.2V or (3) LB# = UB# ≥ V <sub>CC</sub> -0.2V, CS1# ≤ 0.2V, CS2 ≥ V <sub>CC</sub> -0.2V
		-	-	15	μA	~+70°C
		-	-	20	μA	~+85°C
Output high voltage	V <sub>OH</sub>	2.4	-	-	V	BYTE# ≥ V <sub>CC</sub> -0.2V or BYTE# ≤ 0.2V I <sub>OH</sub> = -1mA V <sub>CC</sub> ≥ 2.7V
	V <sub>OH2</sub>	2.0	-	-	V	BYTE# ≥ V <sub>CC</sub> -0.2V or BYTE# ≤ 0.2V I <sub>OH</sub> = -0.1mA
Output low voltage	V <sub>OL</sub>	-	-	0.4	V	BYTE# ≥ V <sub>CC</sub> -0.2V or BYTE# ≤ 0.2V I <sub>OL</sub> = 2mA V <sub>CC</sub> ≥ 2.7V
	V <sub>OL2</sub>	-	-	0.4	V	BYTE# ≥ V <sub>CC</sub> -0.2V or BYTE# ≤ 0.2V I <sub>OL</sub> = 0.1mA

Note 1. Typical parameter indicates the value for the center of distribution at 3.0V(T<sub>a</sub>=+25°C), and not 100% tested.

2. Typical parameter indicates the value for the center of distribution at 3.0V(T<sub>a</sub>=+40°C), and not 100% tested.



## Capacitance

(Ta =25°C, f =1MHz)

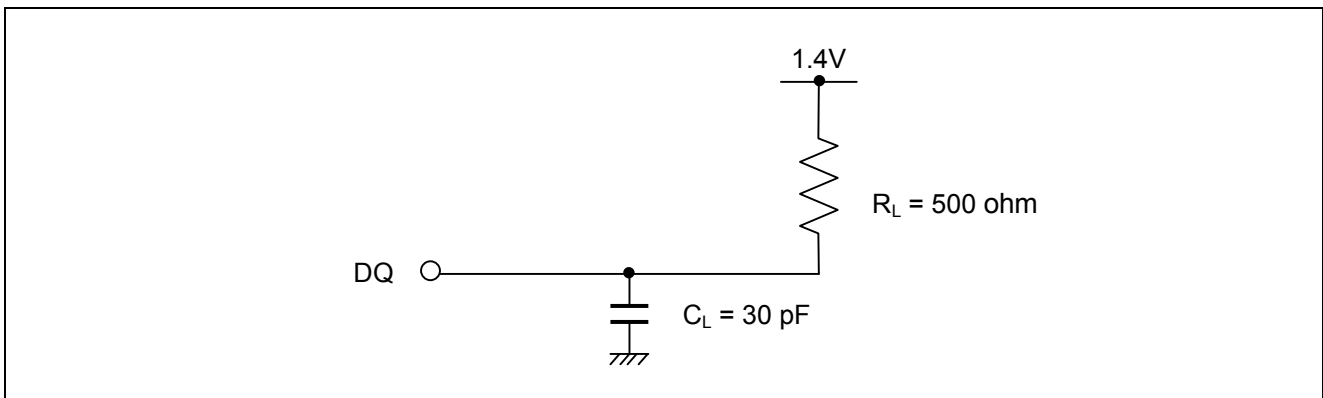
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	Note
Input capacitance	C <sub>in</sub>	-	-	10	pF	V <sub>in</sub> =0V	1
Input / output capacitance	C <sub>I/O</sub>	-	-	10	pF	V <sub>I/O</sub> =0V	1

Note 1. Typical parameter is sampled and not 100% tested.

## AC Characteristics

Test Conditions (V<sub>cc</sub> = 2.4V ~ 3.6V, Ta = -40 ~ +85°C)

- Input pulse levels: V<sub>IL</sub> = 0.4V, V<sub>IH</sub> = 2.4V (V<sub>cc</sub> = 2.7V ~ 3.6 V)  
V<sub>IL</sub> = 0.4V, V<sub>IH</sub> = 2.2V (V<sub>cc</sub> = 2.4V ~ 2.7 V)
- Input rise and fall times: 5ns
- Input and output timing reference level: 1.4V
- Output load: See figures (Including scope and jig)



## Read cycle

Parameter	Symbol	R1LV0816ASA-5SI (Note 0)		R1LV0816ASA-7SI		Unit	Note
		Min.	Max.	Min.	Max.		
Read cycle time	$t_{RC}$	55	-	70	-	ns	
Address access time	$t_{AA}$	-	55	-	70	ns	
Chip select access time	$t_{ACS1}$	-	55	-	70	ns	
	$t_{ACS2}$	-	55	-	70	ns	
Output enable to output valid	$t_{OE}$	-	30	-	35	ns	
Output hold from address change	$t_{OH}$	10	-	10	-	ns	
LB#, UB# access time	$t_{BA}$	-	55	-	70	ns	
Chip select to output in low-Z	$t_{CLZ1}$	10	-	10	-	ns	2,3
	$t_{CLZ2}$	10	-	10	-	ns	2,3
LB#, UB# enable to low-Z	$t_{BLZ}$	5	-	5	-	ns	2,3
Output enable to output in low-Z	$t_{OLZ}$	5	-	5	-	ns	2,3
Chip deselect to output in high-Z	$t_{CHZ1}$	0	20	0	25	ns	1,2,3
	$t_{CHZ2}$	0	20	0	25	ns	1,2,3
LB#, UB# disable to high-Z	$t_{BHZ}$	0	20	0	25	ns	1,2,3
Output disable to output in high-Z	$t_{OHZ}$	0	20	0	25	ns	1,2,3

## Write Cycle

Parameter	Symbol	R1LV0816ASA-5SI (Note 0)		R1LV0816ASA-7SI		Unit	Note
		Min.	Max.	Min.	Max.		
Write cycle time	$t_{WC}$	55	-	70	-	ns	
Address valid to end of write	$t_{AW}$	50	-	65	-	ns	
Chip select to end of write	$t_{CW}$	50	-	65	-	ns	5
Write pulse width	$t_{WP}$	40	-	55	-	ns	4
LB#, UB# valid to end of write	$t_{BW}$	50	-	65	-	ns	
Address setup time	$t_{AS}$	0	-	0	-	ns	6
Write recovery time	$t_{WR}$	0	-	0	-	ns	7
Data to write time overlap	$t_{DW}$	25	-	35	-	ns	
Data hold from write time	$t_{DH}$	0	-	0	-	ns	
Output enable from end of write	$t_{OW}$	5	-	5	-	ns	2
Output disable to output in high-Z	$t_{OHZ}$	0	20	0	25	ns	1,2
Write to output in high-Z	$t_{WHZ}$	0	20	0	25	ns	1,2

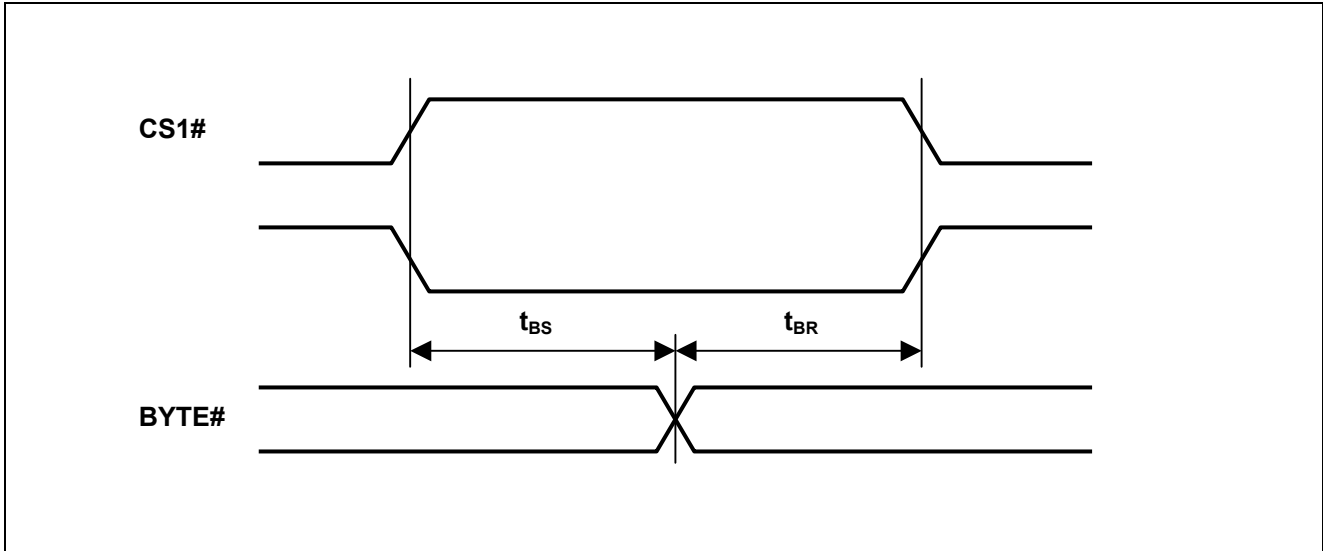
Note 0. If  $V_{CC}$  is 2.4-2.7V, parameters of R1LV0816ASA-7SI and R1LV0816ASD-7SI/7SI are applied.

- $t_{CHZ}$ ,  $t_{OHZ}$ ,  $t_{WHZ}$  and  $t_{BHZ}$  are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.
- Typical parameter is sampled and not 100% tested.
- At any given temperature and voltage condition,  $t_{HZ}$  max is less than  $t_{LZ}$  min both for given device and from device to device.
- A write occurs during the overlap of a low CS1#, a high CS2, a low WE# and a low LB# or low UB#. A write begins at the latest transitions among CS1# going low, CS2 going high, WE# going low and LB# going low or UB# going low. A write ends at the earliest transitions among CS1# going high, CS2 going low, WE# going high and LB# going high or UB# going high.  $t_{WP}$  is measured from the beginning of write to the end of write.
- $t_{CW}$  is measured from the later of CS1# going low or CS2 going high to the end of write.
- $t_{AS}$  is measured the address valid to the beginning of write.
- $t_{WR}$  is measured from the earliest of CS1# or WE# going high or CS2 going low to the end of write cycle

## BYTE# function

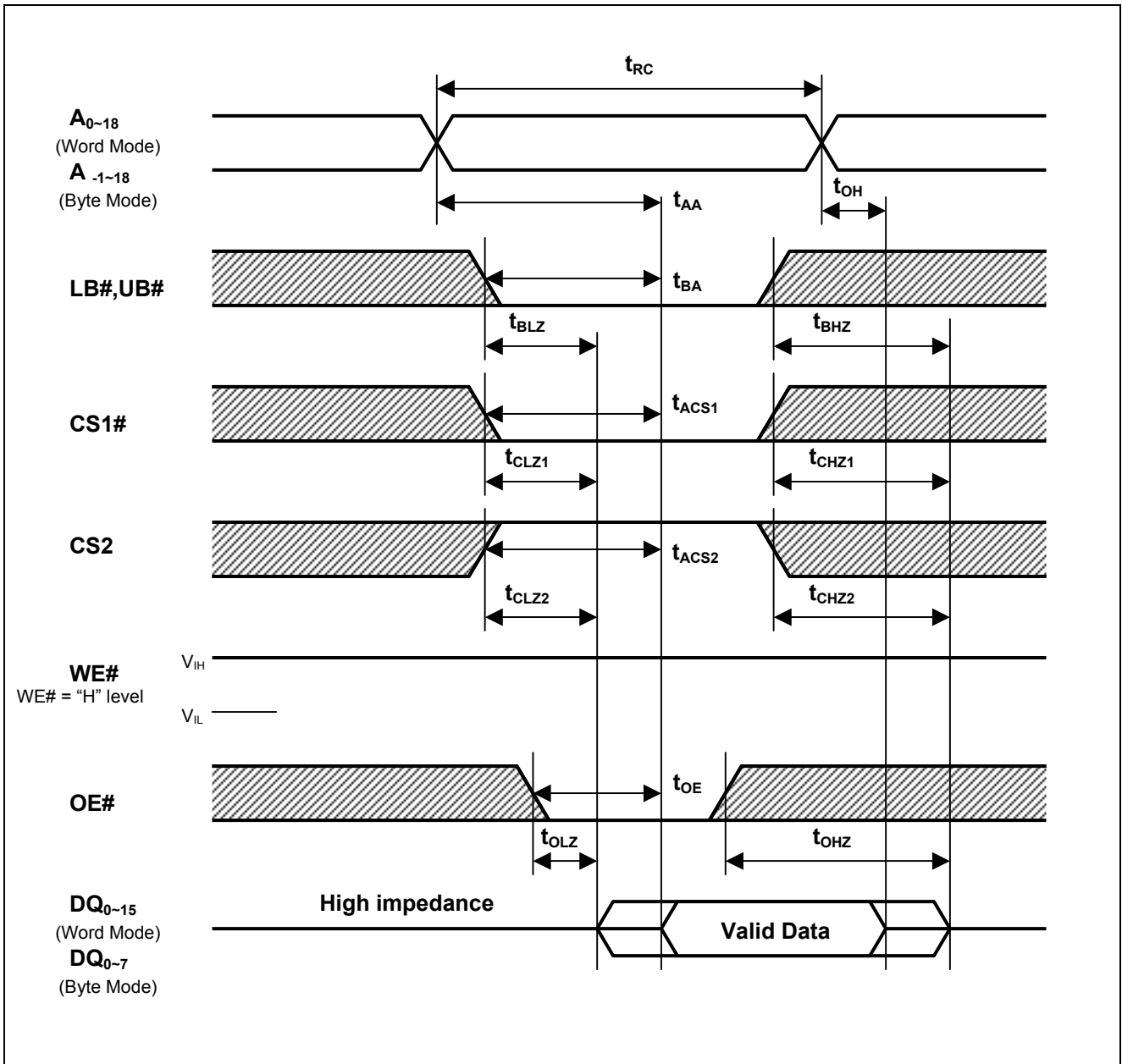
Parameter	Symbol	R1LV0816ASA-5SI		R1LV0816ASA-7SI		Unit	Note
		Min.	Max.	Min.	Max.		
Byte setup time	$t_{BS}$	5	-	5	-	ms	
Byte recovery time	$t_{BR}$	5	-	5	-	ms	

## BYTE# Timing Waveforms



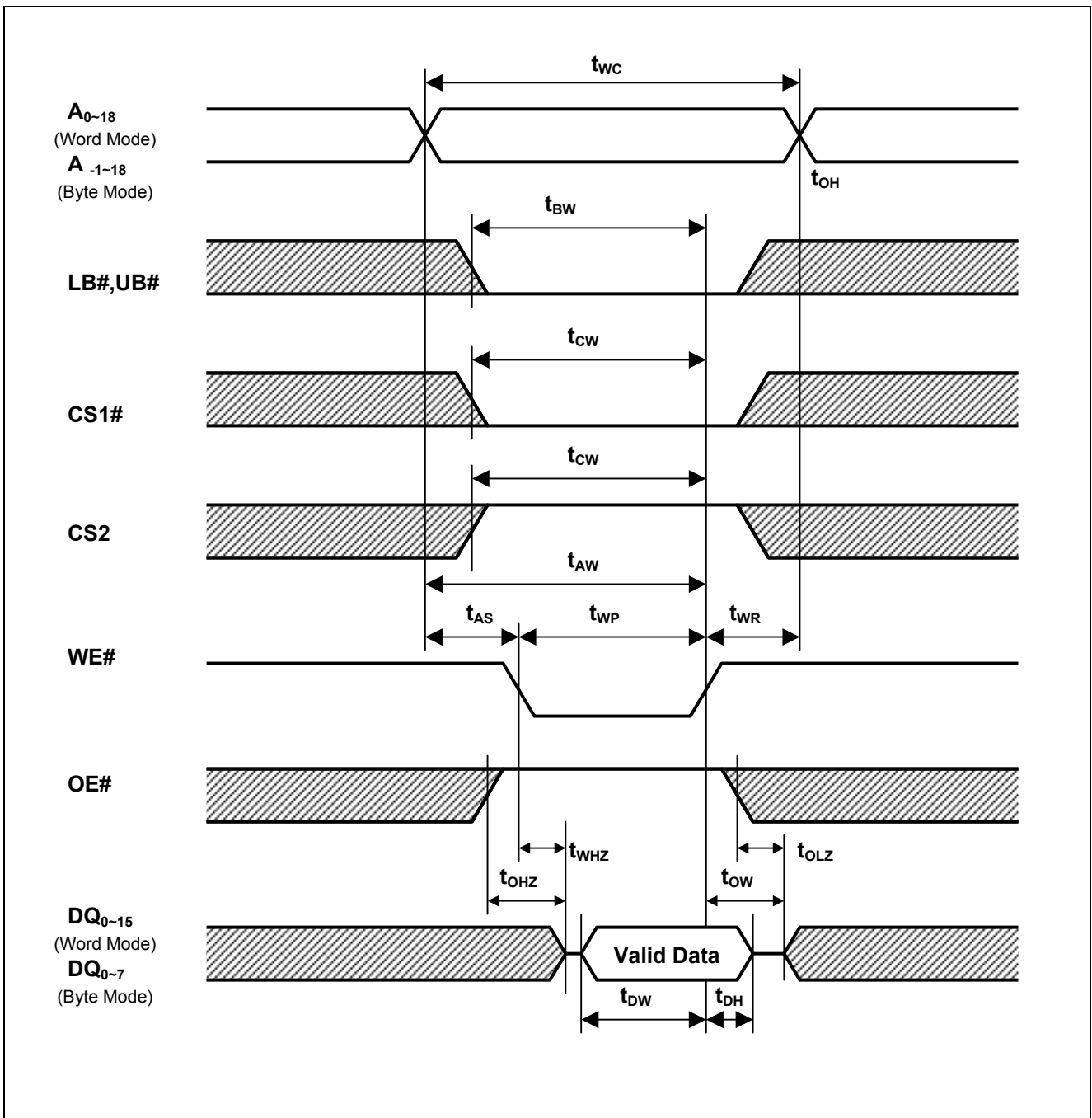
Timing Waveforms

Read Cycle \*1



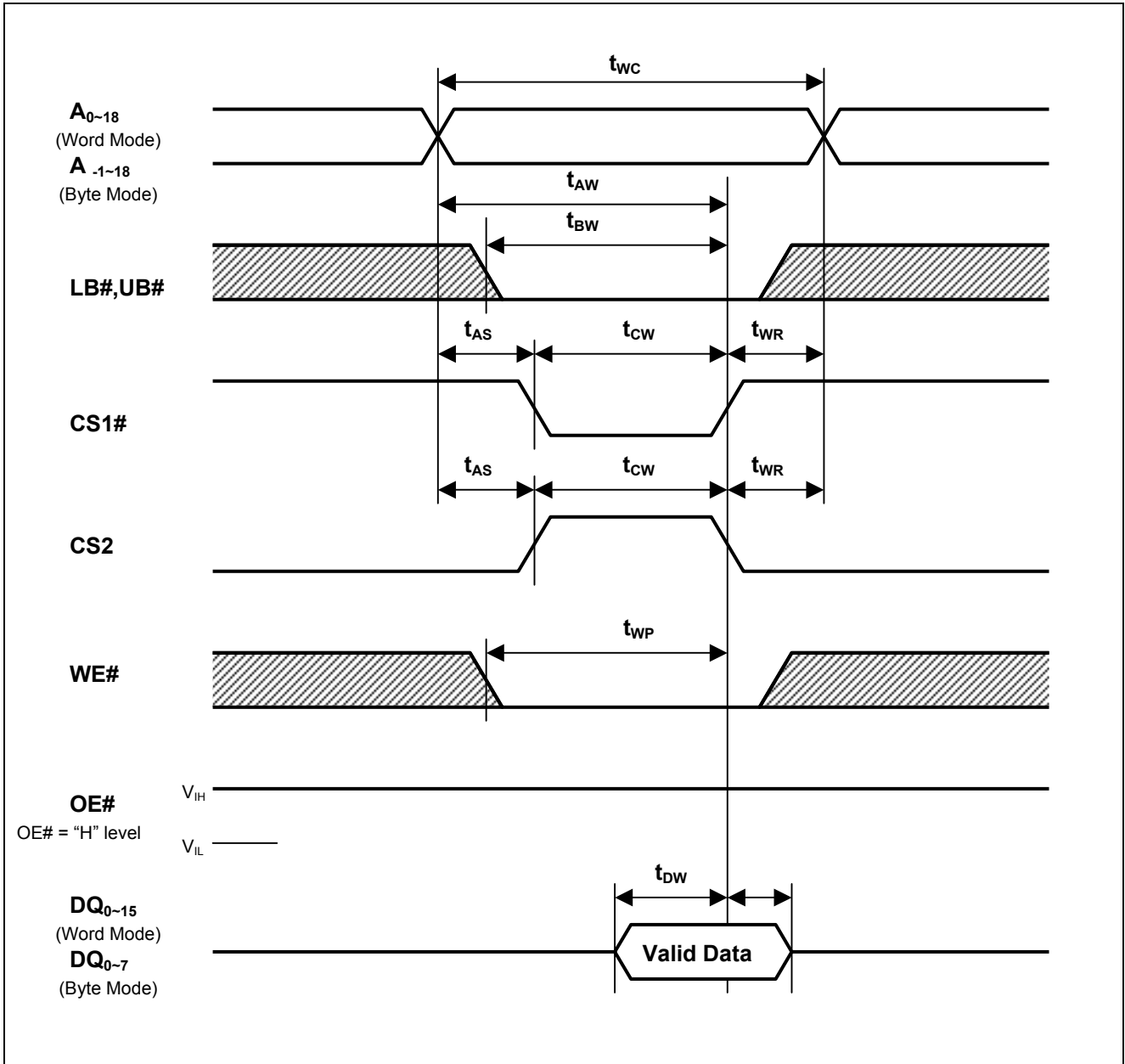
Note1. BYTE# ≥ V<sub>CC</sub> - 0.2V or BYTE# ≤ 0.2V

Write Cycle (1)<sup>\*\*1</sup> (WE# CLOCK)



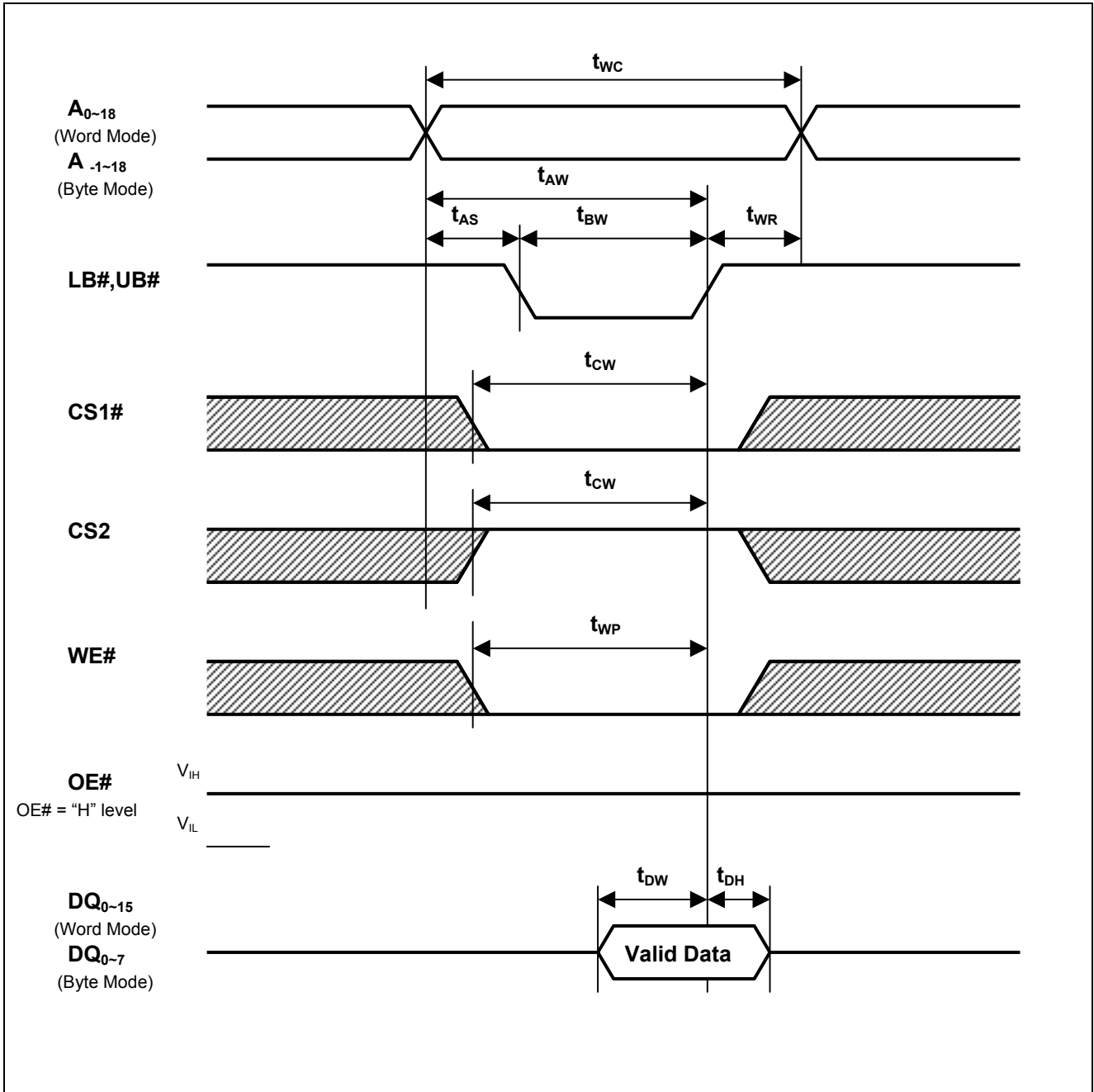
Note1. BYTE# ≥ V<sub>CC</sub> - 0.2V or BYTE# ≤ 0.2V

Write Cycle (2)<sup>\*1</sup> (CS1#, CS2 CLOCK)



Note1. BYTE#  $\geq V_{CC} - 0.2V$  or BYTE#  $\leq 0.2V$

Write Cycle (3)<sup>\*1</sup> (LB#, UB# CLOCK)



Note1. BYTE#  $\geq V_{CC} - 0.2V$  or BYTE#  $\leq 0.2V$



## Data Retention Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions <sup>3</sup>
$V_{CC}$ for data retention	$V_{DR}$	1.5	-	3.6	V	$V_{in} \geq 0V$ $BYTE\# \geq V_{CC} - 0.2V$ or $BYTE\# \leq 0.2V$ (1) $0V \leq CS2 \leq 0.2V$ or (2) $CS1\# \geq V_{CC} - 0.2V$ , $CS2 \geq V_{CC} - 0.2V$ or (3) $LB\# = UB\# \geq V_{CC} - 0.2V$ , $CS1\# \leq 0.2V$ , $CS2 \geq V_{CC} - 0.2V$
Data retention current	$I_{CCDR}$	-	$1.2^{*1}$	4	$\mu A$	$\sim +25^{\circ}C$ $V_{CC} = 3.0V$ , $V_{in} \geq 0V$ $BYTE\# \geq V_{CC} - 0.2V$ or $BYTE\# \leq 0.2V$
		-	$3^{*2}$	6	$\mu A$	$\sim +40^{\circ}C$ (1) $0V \leq CS2 \leq 0.2V$ or (2) $CS1\# \geq V_{CC} - 0.2V$ , $CS2 \geq V_{CC} - 0.2V$ or
		-	-	15	$\mu A$	$\sim +70^{\circ}C$ (3) $LB\# = UB\# \geq V_{CC} - 0.2V$ , $CS1\# \leq 0.2V$ ,
		-	-	20	$\mu A$	$\sim +85^{\circ}C$ $CS2 \geq V_{CC} - 0.2V$
Chip select to data retention time	$t_{CDR}$	0	-	-	ns	See retention waveform.
Operation recovery time	$t_R$	5	-	-	ms	

Note 1. Typical parameter indicates the value for the center of distribution at 3.0V ( $T_a = +25^{\circ}C$ ), and not 100% tested.

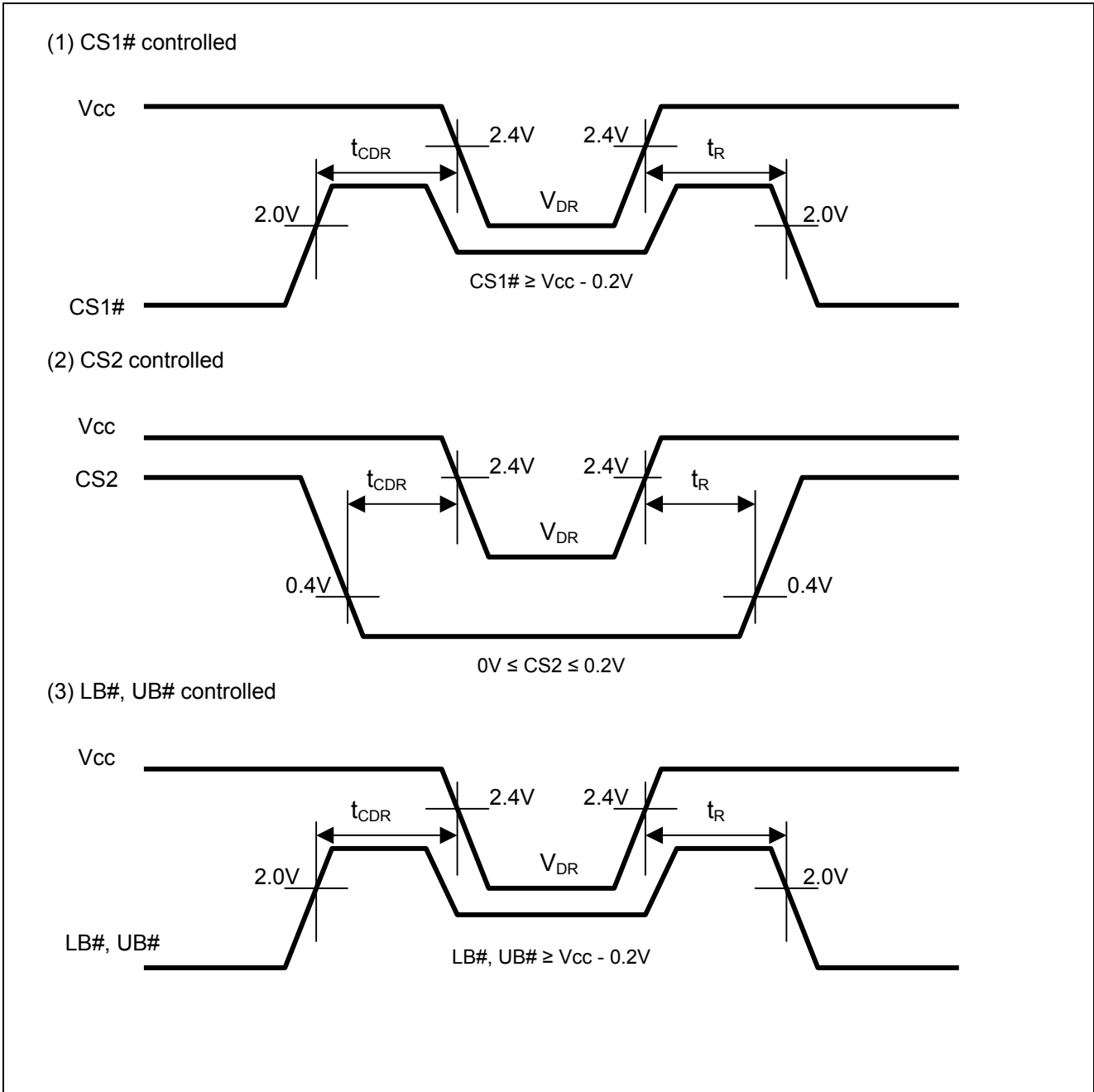
2. Typical parameter indicates the value for the center of distribution at 3.0V ( $T_a = +40^{\circ}C$ ), and not 100% tested.

3. CS2 controls address buffer, WE# buffer, CS1# Buffer, OE# buffer, LB#, UB# buffer and Din buffer.

If CS2 controls data retention mode,  $V_{in}$  levels (address, WE#, OE#, LB#, UB#, DQ) can be in the high impedance state. If CS1# controls data retention mode, CS2 must be  $CS2 \geq V_{CC} - 0.2V$  or  $0V \leq CS2 \leq 0.2V$ .

The other inputs levels (address, WE#, OE#, CS1#, LB#, UB#, DQ) can be in the high impedance state.

Data Retention Timing Waveforms \*\*1



Note1. BYTE#  $\geq V_{CC} - 0.2V$  or BYTE#  $\leq 0.2V$

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