

R1LP0408D Series

4Mb Advanced LPSRAM (512-kword × 8-bit)

R10DS0274EJ0200
Rev.2.00
2019.10.29

Description

The R1LP0408D Series is a family of 4-Mbit static RAMs organized 512-kword × 8-bit, fabricated by Renesas's high-performance CMOS and TFT technologies. The R1LP0408D Series has realized higher density, higher performance and low power consumption. The R1LP0408D Series offers low power standby power dissipation; therefore, it is suitable for battery backup systems. It is offered in 32-pin SOP and 32-pin TSOP.

Features

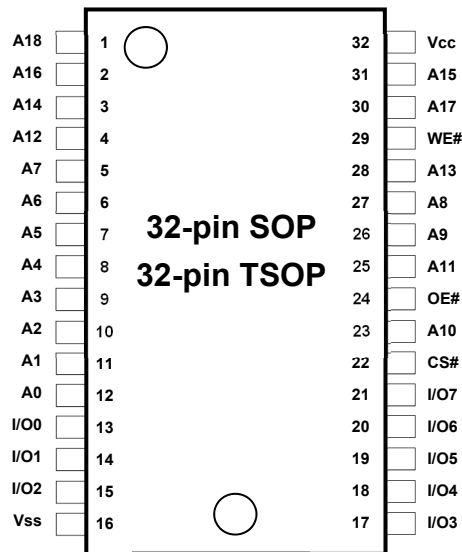
- Single 5V supply: 4.5V to 5.5V
- Access time: 55ns (max.)
- Power dissipation:
 - Standby: 4μW (typ.)
- Equal access and cycle times
- Common data input and output
 - Three state output
- Directly TTL compatible
 - All inputs and outputs
- Battery backup operation

Ordering Information

Orderable part name	Access time	Temperature range	Package	Shipping container
R1LP0408DSP-5SI#B*	55 ns	-40 ~ +85°C	525-mil 32-pin plastic SOP	Tube (Magazine)
R1LP0408DSP-5SI#S*				Embossed tape
R1LP0408DSB-5SI#B*			400-mil 32-pin plastic TSOP (II)	Tray
R1LP0408DSB-5SI#S*				Embossed tape

Note 1. * = Revision code for Assembly site change, etc. (* = 0, 1, etc.)

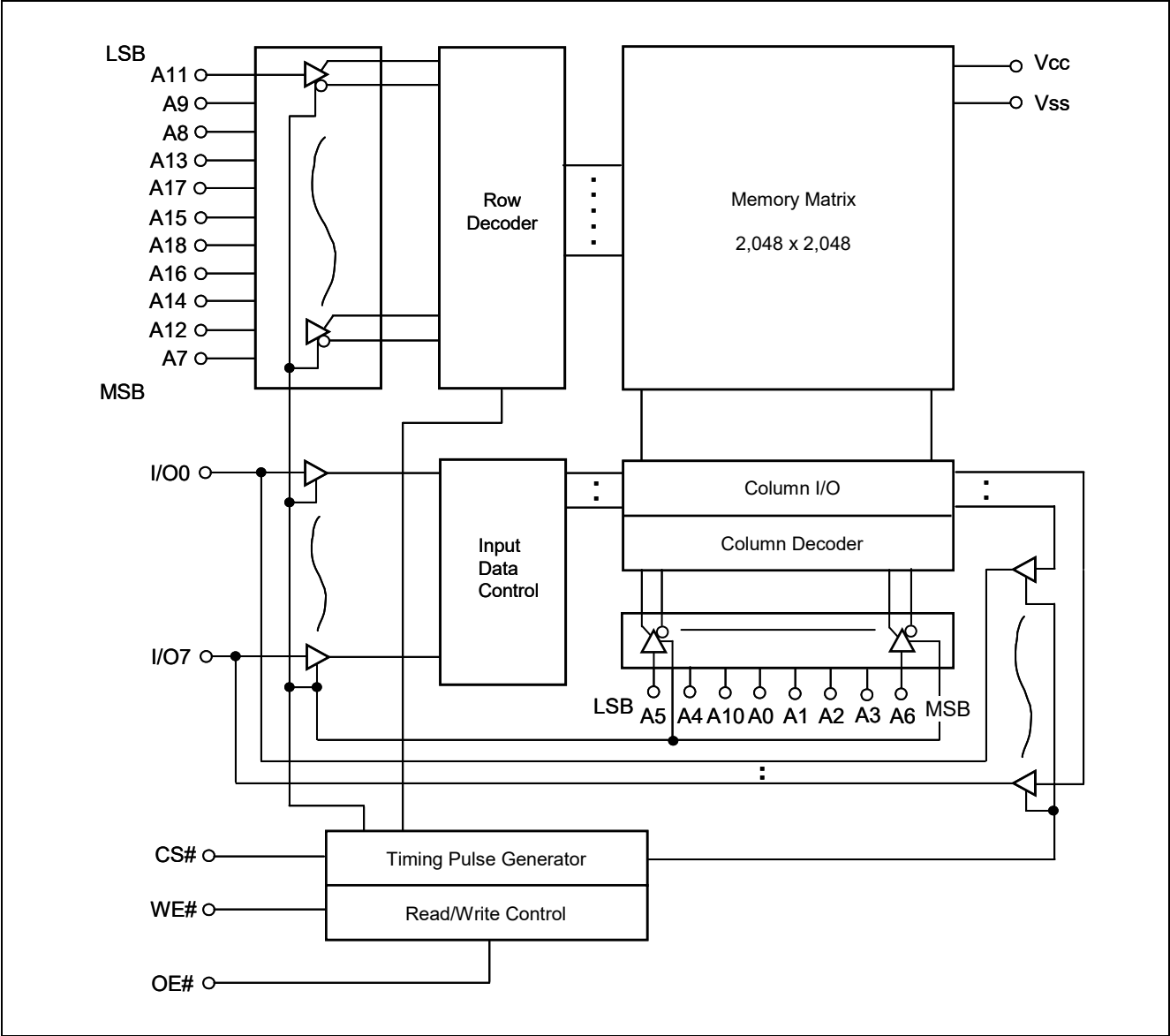
Pin Arrangement



Pin Description

Pin name	Function
Vcc	Power supply
Vss	Ground
A0 to A18	Address input
I/O0 to I/O7	Data input/output
CS#	Chip select
WE#	Write enable
OE#	Output enable

Block Diagram



Operation Table

WE#	CS#	OE#	Mode	Vcc current	I/O0 to I/O7	Ref. cycle
x	H	x	Not selected	I_{SB}, I_{SB1}	High-Z	—
H	L	H	Output disable	I_{CC}	High-Z	—
H	L	L	Read	I_{CC}	Dout	Read cycle
L	L	H	Write	I_{CC}	Din	Write cycle (1)
L	L	L	Write	I_{CC}	Din	Write cycle (2)

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

Absolute Maximum Ratings

Parameter	Symbol	Value	unit
Power supply voltage relative to Vss	V_{CC}	-0.5 to +7.0	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	T_{opr}	-40 to +85	°C
Storage temperature range	T_{stg}	-65 to 150	°C
Storage temperature range under bias	T_{bias}	-40 to +85	°C

Note 1. -3.0V for pulse ≤ 30 ns (full width at half maximum)
 2. Maximum voltage is +7.0V.

DC Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage	V _{CC}	4.5	5.0	5.5	V	
	V _{SS}	0	0	0	V	
Input high voltage	V _{IH}	2.2	—	V _{CC} +0.3	V	
Input low voltage	V _{IL}	-0.3	—	0.8	V	1
Ambient temperature range	T _a	-40	—	+85	°C	

Note 1. -3.0V for pulse ≤ 30ns (full width at half maximum)

DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	
Input leakage current	I _{LI}	—	—	1	μA	Vin = Vss to Vcc	
Output leakage current	I _{LO}	—	—	1	μA	CS# =V _{IH} or OE# =V _{IH} , VI/O =Vss to Vcc	
Operating current	I _{CC}	—	5* ¹	10	mA	CS# =V _{IL} , Others = V _{IH} /V _{IL} , II/O = 0mA	
Average operating current	I _{CC1}	—	15* ¹	25	mA	Min. cycle, duty =100%, II/O = 0mA, CS# =V _{IL} , Others = V _{IH} /V _{IL}	
	I _{CC2}	—	3* ¹	5	mA	Cycle =1μs, duty =100%, II/O = 0mA, CS# ≤ 0.2V, V _{IH} ≥ Vcc-0.2V, V _{IL} ≤ 0.2V	
Standby current	I _{SB}	—	0.1* ¹	0.5	mA	CS# =V _{IH} , Others = Vss to Vcc	
Standby current	I _{SB1}	—	0.8* ¹	2.5	μA	~+25°C	Vin = Vss to Vcc, CS# ≥ Vcc-0.2V
		—	1* ²	3	μA	~+40°C	
		—	—	8	μA	~+70°C	
		—	—	10	μA	~+85°C	
Output high voltage	V _{OH}	2.4	—	—	V	I _{OH} = -1mA	
	V _{OH2}	Vcc-0.5	—	—	V	I _{OH} = -0.1mA	
Output low voltage	V _{OL}	—	—	0.4	V	I _{OL} = 2.1mA	

Note 1. Typical parameter indicates the value for the center of distribution at 5.0V (T_a=25°C), and not 100% tested.

2. Typical parameter indicates the value for the center of distribution at 5.0V (T_a=40°C), and not 100% tested.

Capacitance

(V_{CC} = 4.5V ~ 5.5V, f = 1MHz, T_a = -40 ~ +85°C)

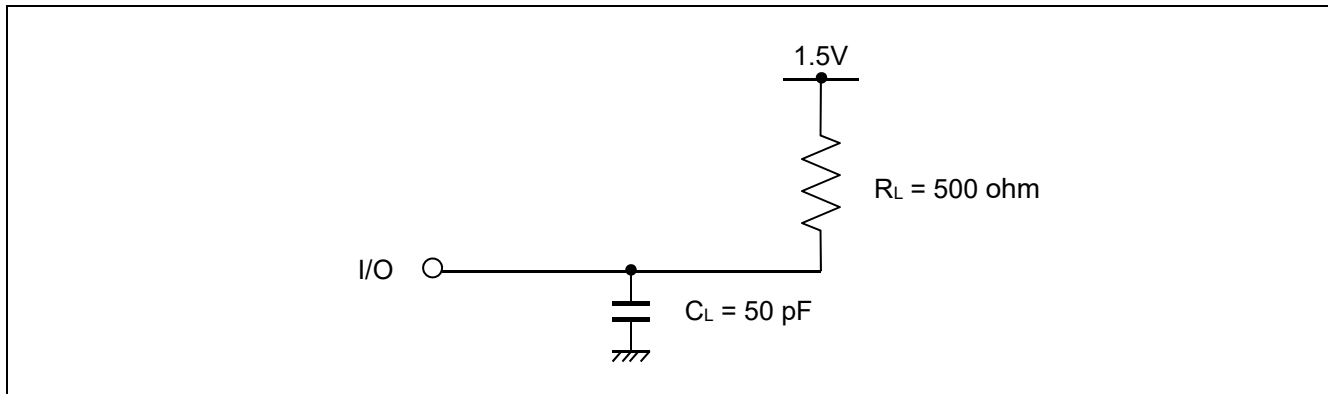
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	Note
Input capacitance	C _{in}	—	—	8	pF	V _{in} = 0V	1
Input / output capacitance	C _{I/O}	—	—	10	pF	V _{I/O} = 0V	1

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

AC Characteristics

Test Conditions ($V_{CC} = 4.5V \sim 5.5V$, $T_a = -40 \sim +85^{\circ}C$)

- Input pulse levels: $V_{IL} = 0.4V$, $V_{IH} = 2.4V$
- Input rise and fall time: 5ns
- Input and output timing reference level: 1.5V
- Output load: See figures (Including scope and jig)



Read Cycle

Parameter	Symbol	Min.	Max.	Unit	Note
Read cycle time	t_{RC}	55	—	ns	
Address access time	t_{AA}	—	55	ns	
Chip select access time	t_{ACS}	—	55	ns	
Output enable to output valid	t_{OE}	—	25	ns	
Chip select to output in low-Z	t_{CLZ}	10	—	ns	2
Output enable to output in low-Z	t_{OLZ}	5	—	ns	2
Chip deselect to output in high-Z	t_{CHZ}	0	20	ns	1,2
Output disable to output in high-Z	t_{OHZ}	0	20	ns	1,2
Output hold from address change	t_{OH}	10	—	ns	

Write Cycle

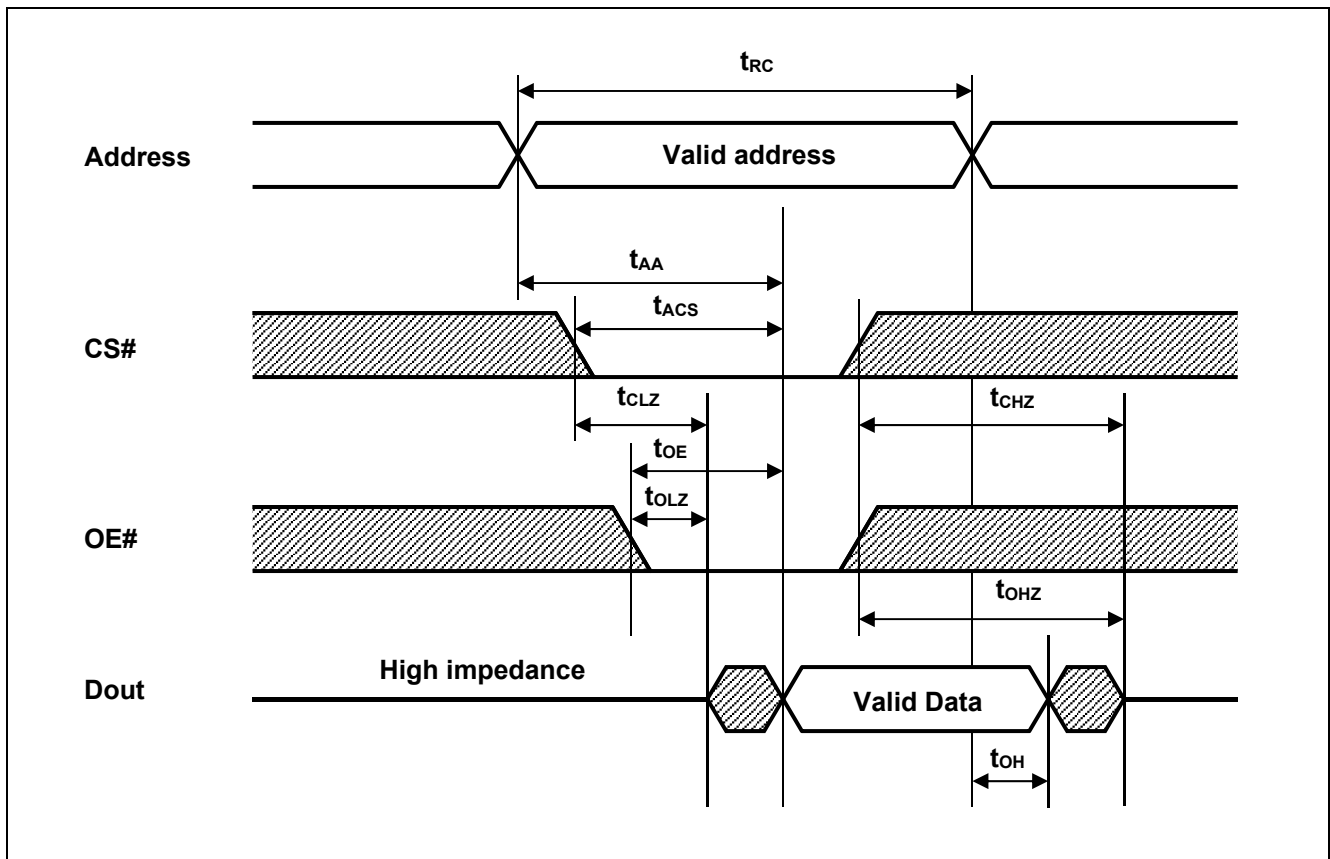
Parameter	Symbol	Min.	Max.	Unit	Note
Write cycle time	t_{WC}	55	—	ns	
Chip select to end of write	t_{CW}	50	—	ns	4
Address setup time	t_{AS}	0	—	ns	5
Address valid to end of write	t_{AW}	50	—	ns	
Write pulse width	t_{WP}	40	—	ns	3,12
Write recovery time	t_{WR}	0	—	ns	6
Write to output in high-Z	t_{WHZ}	0	20	ns	1,2,7
Data to write time overlap	t_{DW}	25	—	ns	
Data hold from write time	t_{DH}	0	—	ns	
Output enable from end of write	t_{OW}	5	—	ns	2
Output disable to output in high-Z	t_{OHZ}	0	20	ns	1,2,7

- Note
1. t_{CHZ} , t_{OHZ} and t_{WHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.
 2. This parameter is sampled and not 100% tested.
 3. A write occurs during the overlap (t_{WP}) of a low CS# and a low WE#.
A write begins at the later transition of CS# going low or WE# going low.
A write ends at the earlier transition of CS# going high or WE# going high.
 t_{WP} is measured from the beginning of write to the end of write.
 4. t_{CW} is measured from CS# going low to end of write.
 5. t_{AS} is measured the address valid to the beginning of write.
 6. t_{WR} is measured from the earlier of WE# or CS# going high to the end of write cycle.
 7. During this period, I/O pins are in the output state so that the input signals of the opposite phase to the outputs must not be applied.
 8. If the CS# low transition occurs simultaneously with the WE# low transition or after the WE# transition, the output remain in a high impedance state.
 9. Dout is the same phase of the write data of this write cycle.
 10. Dout is the read data of next address.
 11. If CS# is low during this period, I/O pins are in the output state. Therefore, the input signals of the opposite phase to the outputs must not be applied to them.
 12. In the write cycle with OE# low fixed, t_{WP} must satisfy the following equation to avoid a problem of data bus contention.

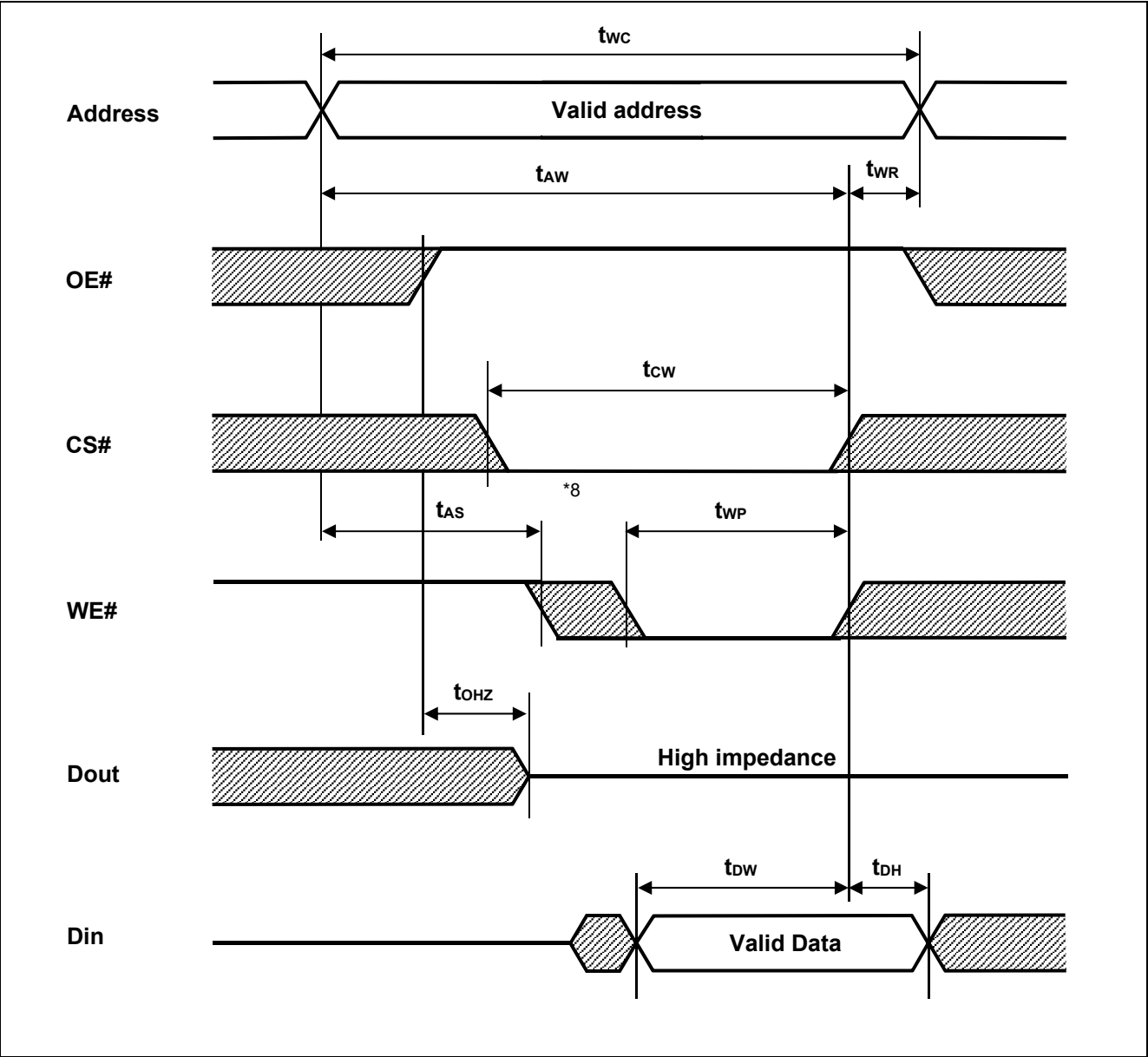
$$t_{WP} \geq t_{DW} \text{ min} + t_{WHZ} \text{ max}$$

Timing Waveforms

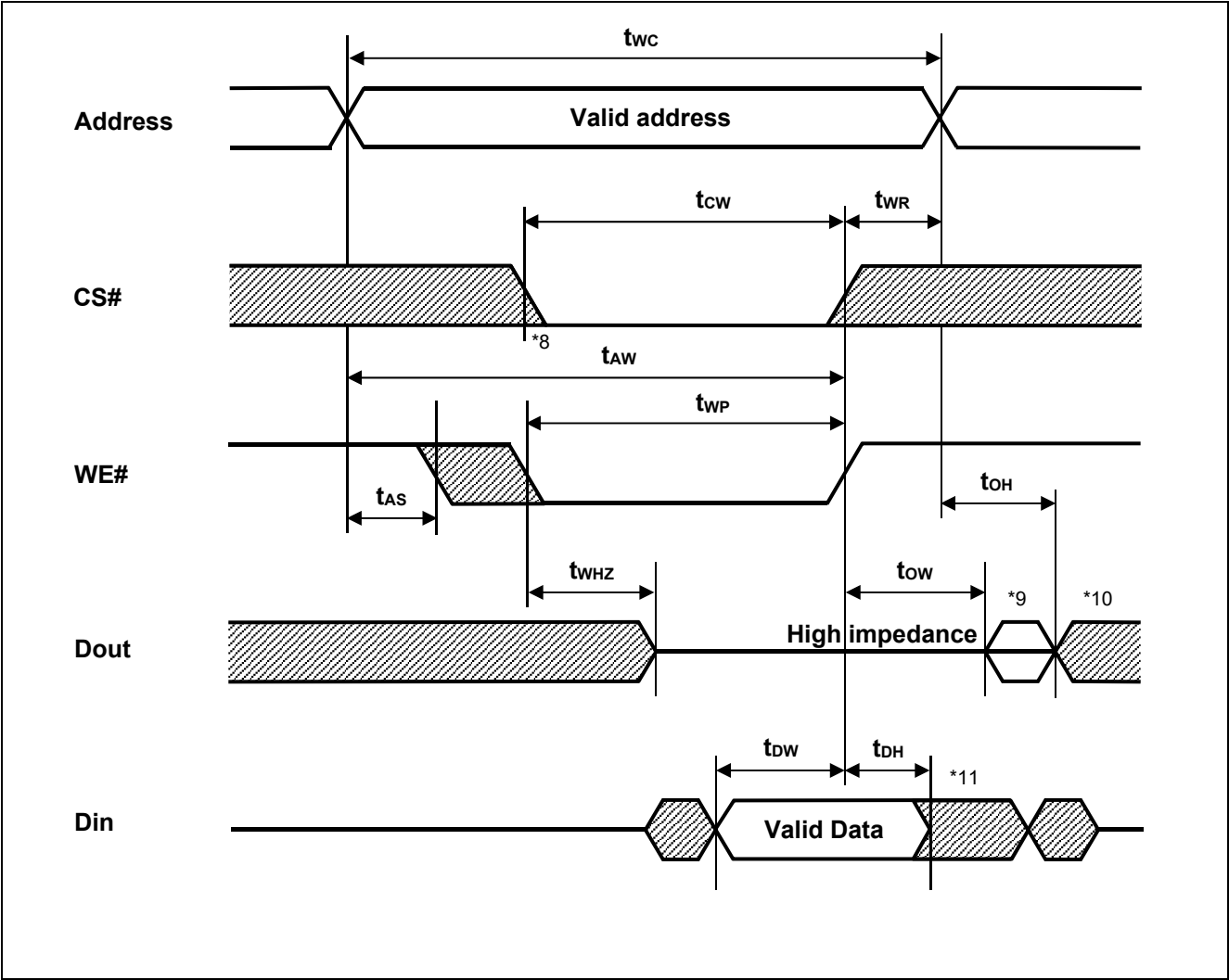
Read Cycle (WE# = V_{IH})



Write Cycle (1) (OE# CLOCK)



Write Cycle (2) (OE# Low Fixed)



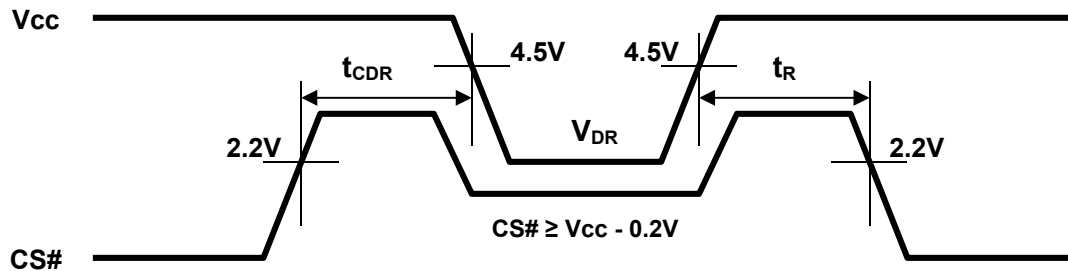
Low Vcc Data Retention Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions*3	
V _{CC} for data retention	V _{DR}	2.0	—	5.5	V	Vin ≥ 0V, CS# ≥ V _{CC} -0.2V	
Data retention current	I _{CCDR}	—	0.8*1	2.5	μA	~+25°C	V _{CC} =3.0V, Vin ≥ 0V, CS# ≥ V _{CC} -0.2V
		—	1*2	3	μA	~+40°C	
		—	—	8	μA	~+70°C	
		—	—	10	μA	~+85°C	
Chip deselect time to data retention	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 (Ta=25°C), and not 100% tested.
 2. Typical parameter indicates the value for the center of distribution at 3.0V (Ta=40°C), and not 100% tested.
 3. CS# controls address buffer, WE# buffer, OE# buffer and Din buffer. If data retention mode, V_{in} levels (address, WE#, OE#, I/O) can be in the high impedance state.

Low Vcc Data Retention Timing Waveforms

CS# Controlled



Revision History	R1LP0408D Series Data Sheet
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Rev.	Date	Description	
		Page	Summary
1.00	2017.1.27	—	First Edition issued
2.00	2019.10.29	p.1	Revised orderable part name information.

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