

R1LV0408D Series

4M SRAM (512-kword $\times$ 8-bit)

REJ03C0310-0100

Rev.1.00

May.24.2007

Description

The R1LV0408D is a 4-Mbit static RAM organized 512-kword $\times$ 8-bit, fabricated by Renesas's high-performance 0.15 μ m CMOS and TFT technologies. R1LV0408D Series has realized higher density, higher performance and low power consumption. The R1LV0408D Series offers low power standby power dissipation; therefore, it is suitable for battery backup systems. It has packaged in 32-pin SOP, 32-pin TSOP II and 32-pin STSOP.

Features

- Single 3 V supply: 2.7 V to 3.6 V
- Access time: 55/70 ns (max)
- Power dissipation:
 - Standby: 3 μ W (typ)
- Equal access and cycle times
- Common data input and output.
 - Three state output
- Directly TTL compatible.
 - All inputs and outputs
- Battery backup operation.

R1LV0408D Series

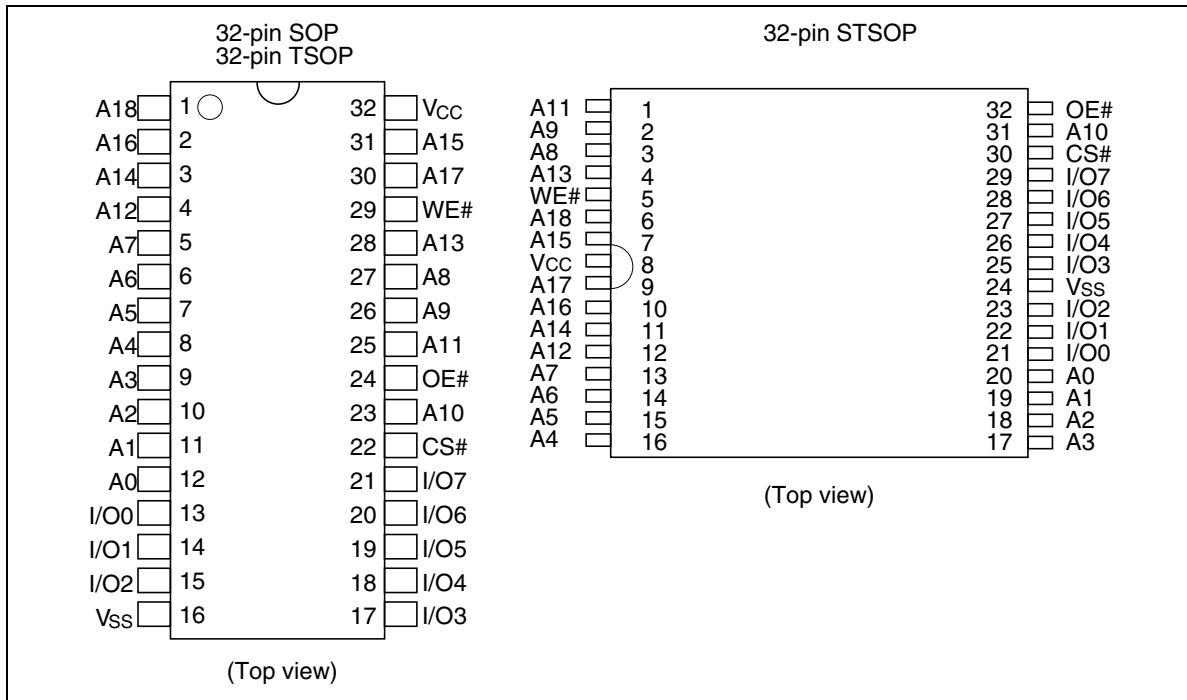
Ordering Information

Type No.	Access time	Package
R1LV0408DSP-5S%	55 ns	525-mil 32-pin plastic SOP (32P2M-A)
R1LV0408DSP-7L%	70 ns	
R1LV0408DSB-5S%	55 ns	400-mil 32-pin plastic TSOP II (32P3Y-H)
R1LV0408DSB-7L%	70 ns	
R1LV0408DSA-5S%	55 ns	8mm × 13.4mm STSOP (32P3K-B)
R1LV0408DSA-7L%	70 ns	

?: Temperature version; see table below.

%	Temperature Range
R	0 to +70°C
I	−40 to +85°C

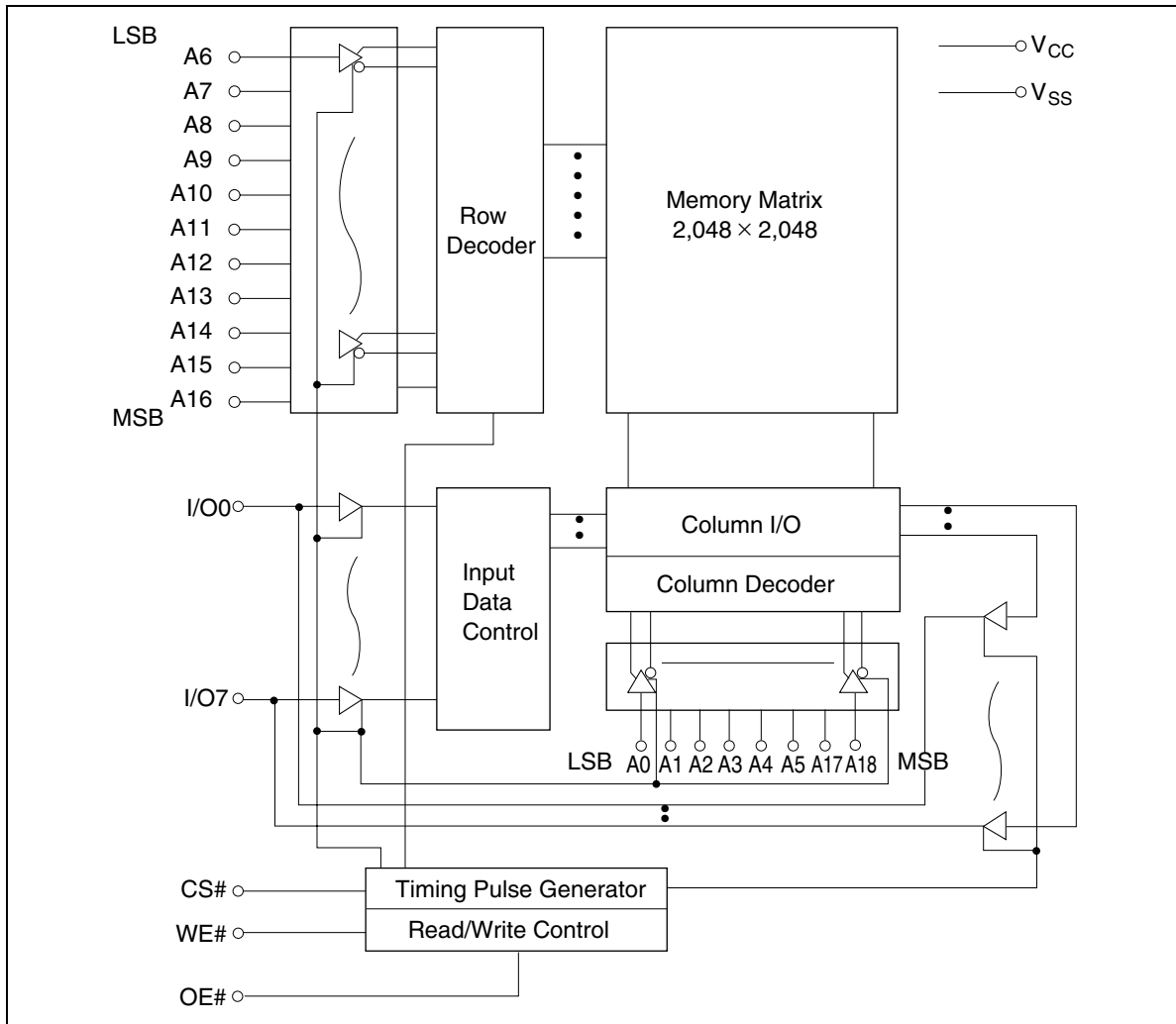
Pin Arrangement



Pin Description

Pin name	Function
A0 to A18	Address input
I/O0 to I/O7	Data input/output
CS# ($\overline{CS}$)	Chip select
OE# ($\overline{OE}$)	Output enable
WE# ($\overline{WE}$)	Write enable
V _{cc}	Power supply
V _{ss}	Ground

Block Diagram



Operation Table

WE#	CS#	OE#	Mode	V _{CC} current	I/O0 to I/O7	Ref. cycle
×	H	×	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: H: V_{IH}, L: V_{IL}, ×: V_{IH} or V_{IL}

Absolute Maximum Ratings

Parameter	Symbol	Value		Unit
Power supply voltage relative to V _{SS}	V _{CC}	−0.5 to +4.6		V
Terminal voltage on any pin relative to V _{SS}	V _T	−0.5* ¹ to V _{CC} + 0.5* ²		V
Power dissipation	P _T	0.7		W
Operating temperature	Topr	R ver.	0 to +70	°C
		I ver.	−40 to +85	
Storage temperature range	Tstg	−65 to +150		°C
Storage temperature range under bias	Tbias	R ver.	0 to +70	°C
		I ver.	−40 to +85	

Notes: 1. V_T min: −3.0 V for pulse half-width ≤ 30 ns.

2. Maximum voltage is +4.6 V.

DC Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	V _{CC}	2.7	3.0	3.6	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* ¹	—	0.6	V
Ambient temperature range	R ver.	Ta	0	+70	°C
	I ver.		−40	+85	

Note: 1. V_{IL} min: −3.0 V for pulse half-width ≤ 30 ns.

DC Characteristics

Parameter			Symbol	Min	Typ	Max	Unit	Test conditions
Input leakage current			$ I_{LI} $	—	—	1	μA	$V_{in} = V_{SS}$ to V_{CC}
Output leakage current			$ I_{LO} $	—	—	1	μA	$CS\# = V_{IH}$ or $OE\# = V_{IH}$ or $WE\# = V_{IL}$ or $V_{I/O} = V_{SS}$ to V_{CC}
Operating current			I_{CC}	—	—	10	mA	$CS\# = V_{IL}$, Others = V_{IH}/V_{IL} , $I_{I/O} = 0$ mA
Average operating current			I_{CC1}	—	—	25	mA	Min. cycle, duty = 100%, $CS\# = V_{IL}$, Others = V_{IH}/V_{IL} $I_{I/O} = 0$ mA
			I_{CC2}	—	—	5	mA	Cycle time = 1 μs , duty = 100%, $I_{I/O} = 0$ mA, $CS\# \leq 0.2$ V, $V_{IH} \geq V_{CC} - 0.2$ V, $V_{IL} \leq 0.2$ V
Standby current			I_{SB}	—	0.1* ¹	0.3	mA	$CS\# = V_{IH}$
Standby current	-5S%	to +85°C	I_{SB1}	—	—	10	μA	Average values $V_{in} \geq 0$ V, $CS\# \geq V_{CC} - 0.2$ V
		to +70°C	I_{SB1}	—	—	8	μA	
		to +40°C	I_{SB1}	—	—	3	μA	
		to +25°C	I_{SB1}	—	1* ¹	2.5	μA	
	-7L%	to +85°C	I_{SB1}	—	—	20	μA	
		to +70°C	I_{SB1}	—	—	16	μA	
		to +40°C	I_{SB1}	—	—	10	μA	
		to +25°C	I_{SB1}	—	1* ¹	10	μA	
Output low voltage			V_{OL}	—	—	0.4	V	$I_{OL} = 2.1$ mA
			V_{OL2}	—	—	0.2	V	$I_{OL} = 100$ μA
Output high voltage			V_{OH}	2.4	—	—	V	$I_{OH} = -1.0$ mA
			V_{OH2}	$V_{CC} - 0.2$	—	—	V	$I_{OH} = -0.1$ mA

Note: 1. Typical values are at $V_{CC} = 3.0$ V, $T_a = +25^\circ C$ and specified loading, and not guaranteed.

Capacitance

($T_a = +25^\circ C$, $f = 1.0$ MHz)

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

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

AC Characteristics(Ta = 0 to +70°C / -40 to +85°C, V_{CC} = 2.7 V to 3.6 V)**Test Conditions**

- Input pulse levels: V_{IL} = 0.4 V, V_{IH} = 2.4 V
- Input rise and fall time: 5 ns
- Input and output timing reference levels: 1.5 V
- Output load: 1 TTL Gate + C_L (50 pF) (R1LV0408D-5S%)
1 TTL Gate + C_L (100 pF) (R1LV0408D-7L%)
(Including scope and jig)

Note: Temperature range depends on R/I-version. Please see table on page 2.

Read Cycle

Parameter	Symbol	R1LV0408D				Unit	Notes
		-5S%		-7L%			
		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 _{CO}	—	55	—	70	ns	
Output enable to output valid	t _{OE}	—	30	—	35	ns	
Chip select to output in low-Z	t _{LZ}	10	—	10	—	ns	2
Output enable to output in low-Z	t _{OLZ}	5	—	5	—	ns	2
Chip deselect to output in high-Z	t _{HZ}	0	20	0	25	ns	1, 2
Output disable to output in high-Z	t _{OHZ}	0	20	0	25	ns	1, 2
Output hold from address change	t _{OH}	10	—	10	—	ns	

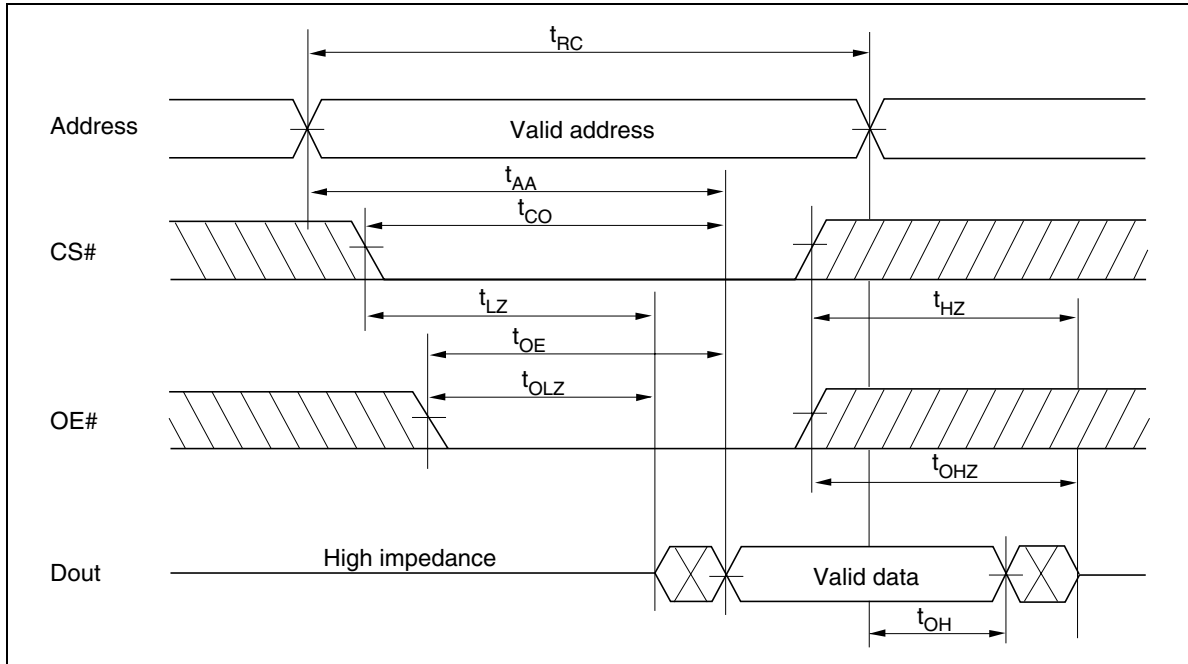
Write Cycle

Parameter	Symbol	R1LV0408D				Unit	Notes
		-5S%		-7L%			
		Min	Max	Min	Max		
Write cycle time	t _{WC}	55	—	70	—	ns	
Chip selection to end of write	t _{CW}	50	—	60	—	ns	4
Address setup time	t _{AS}	0	—	0	—	ns	5
Address valid to end of write	t _{AW}	50	—	60	—	ns	
Write pulse width	t _{WP}	40	—	50	—	ns	3, 12
Write recovery time	t _{WR}	0	—	0	—	ns	6
Write to output in high-Z	t _{WHZ}	0	20	0	25	ns	1, 2, 7
Data to write time overlap	t _{DW}	25	—	30	—	ns	
Data hold from write time	t _{DH}	0	—	0	—	ns	
Output active 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, 7

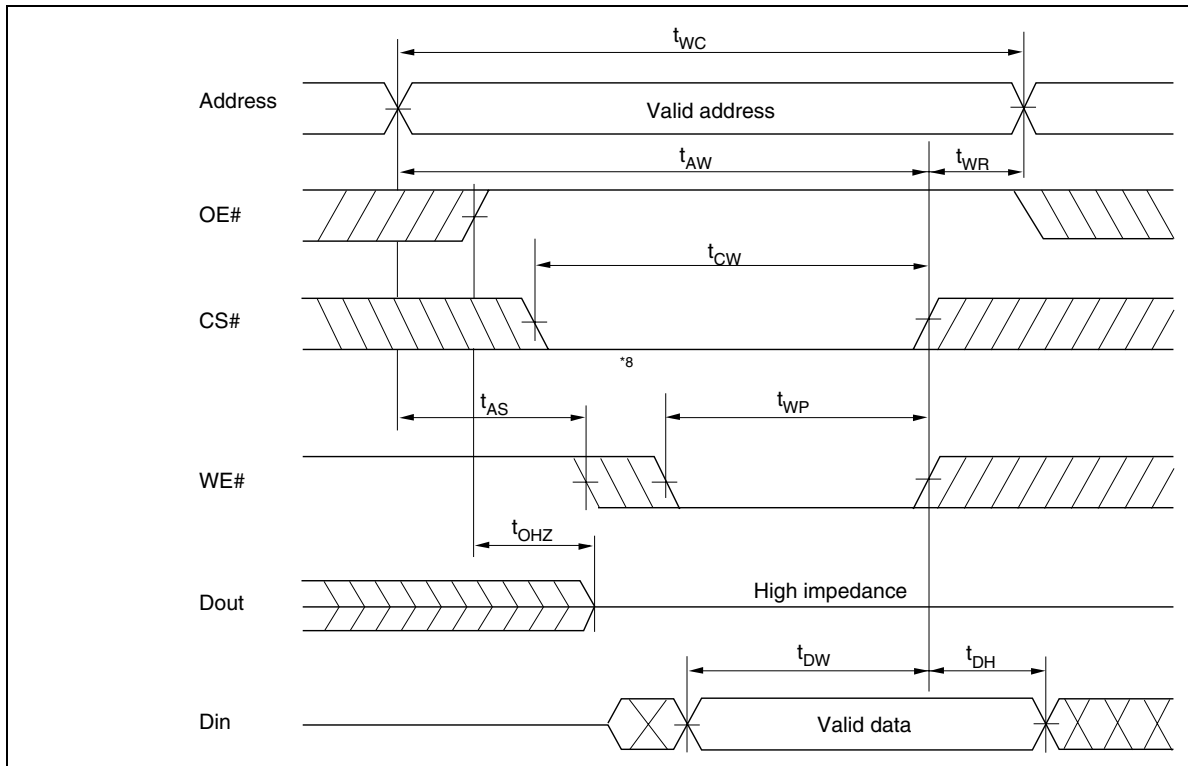
- Notes: 1. t_{HZ} , t_{OHZ} and t_{WHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.
2. This parameter is sampled and not 100% tested.
3. A write occurs during the overlap (t_{WP}) of a low CS# and a low WE#. A write 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 the end of write.
5. t_{AS} is measured from 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 Waveform

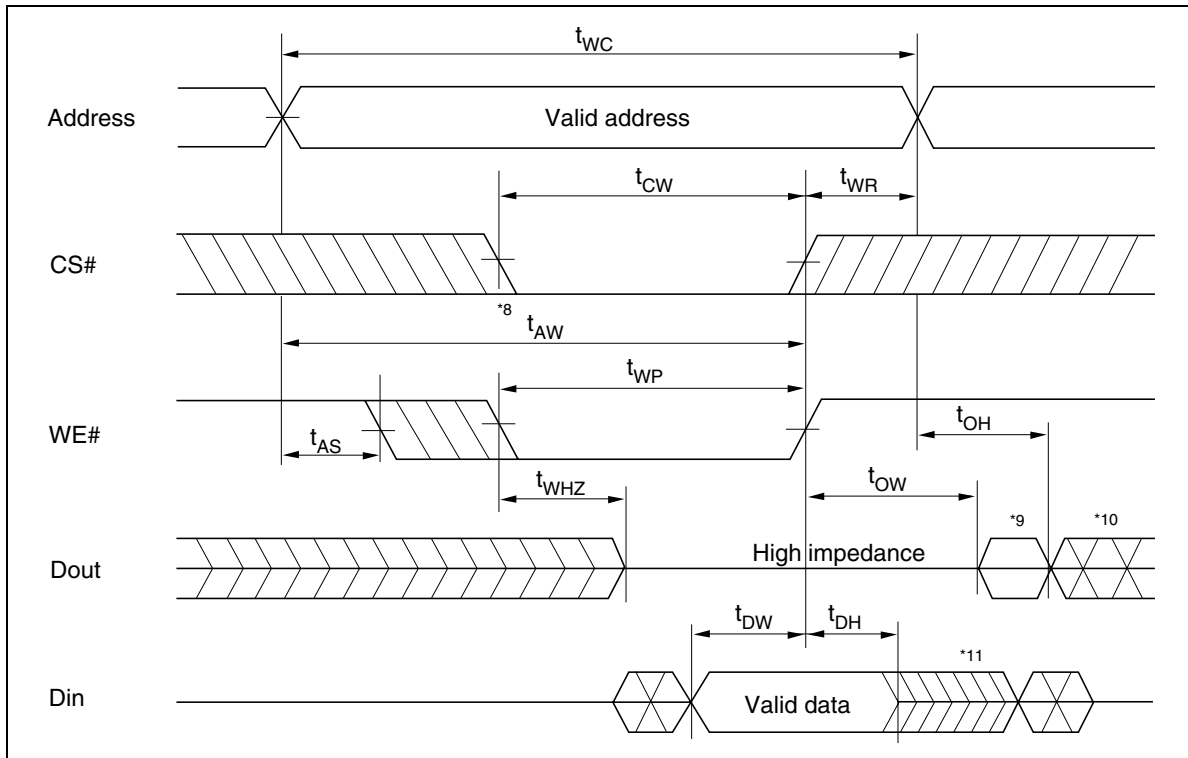
Read Timing Waveform (WE# = V_{IH})



Write Timing Waveform (1) (OE# Clock)



Write Timing Waveform (2) (OE# Low Fixed)



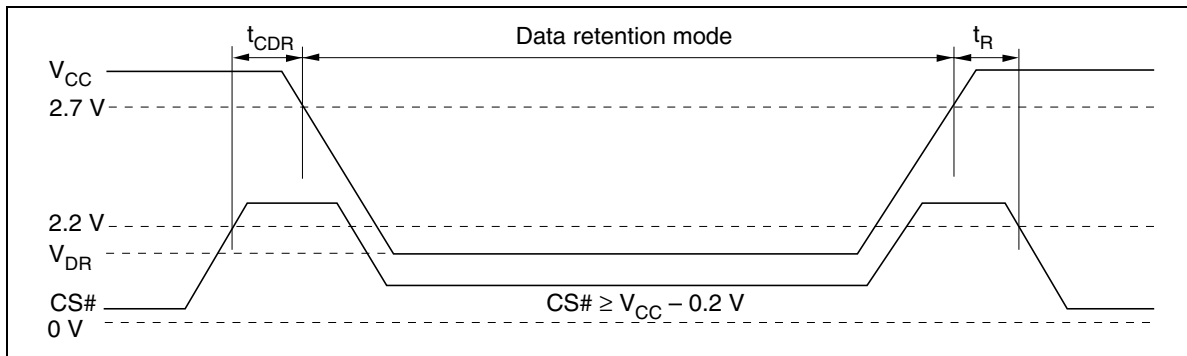
Low V_{CC} Data Retention Characteristics

($T_a = 0$ to $+70^\circ\text{C}$ / -40 to $+85^\circ\text{C}$)

Parameter			Symbol	Min	Typ	Max	Unit	Test conditions
V _{CC} for data retention			V _{DR}	2	—	—	V	CS# ≥ V _{CC} − 0.2 V, Vin ≥ 0 V
Data retention current	−5S%	to +85°C	I _{CCDR}	—	—	10	μA	V _{CC} = 3.0 V, Vin ≥ 0 V CS# ≥ V _{CC} − 0.2 V Average values
		to +70°C	I _{CCDR}	—	—	8	μA	
		to +40°C	I _{CCDR}	—	—	3	μA	
		to +25°C	I _{CCDR}	—	1* ¹	2.5	μA	
	−7L%	to +85°C	I _{CCDR}	—	—	20	μA	
		to +70°C	I _{CCDR}	—	—	16	μA	
		to +40°C	I _{CCDR}	—	—	10	μA	
		to +25°C	I _{CCDR}	—	1* ¹	10	μA	
Chip deselect to data retention time			t _{CDR}	0	—	—	ns	See retention waveform
Operation recovery time			t _R	5	—	—	ms	

Note: 1. Typical values are at $V_{CC} = 3.0\text{ V}$, $T_a = +25^\circ\text{C}$ and specified loading, and not guaranteed.

Low V_{CC} Data Retention Timing Waveform (CS# Controlled)



Revision History	R1LV0408D Series Data Sheet
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Rev.	Date	Contents of Modification	
		Page	Description
0.01	Dec. 25, 2006	—	Initial issue
1.00	May. 24, 2007	6	DC Characteristics I _{SB1} (-5S%) (to +25°C) max: 3 μA to 2.5 μA
		12	Low V _{CC} Data Retention Characteristics I _{CCDR} (-5S%) (to +25°C) max: 3 μA to 2.5 μA Deletion of note 2

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