R1LV0408D Series

4M SRAM (512-kword × 8-bit)

REJ03C0310-0100
Rev.1.00
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Description

The R1LV0408D is a 4-Mbit static RAM organized 512-kword × 8-bit, fabricated by Renesas's high-performance 0.15µm 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 µW (typ)
- Equal access and cycle times
- Common data input and output.
  - Three state output
- Directly TTL compatible.
  - All inputs and outputs
- Battery backup operation.

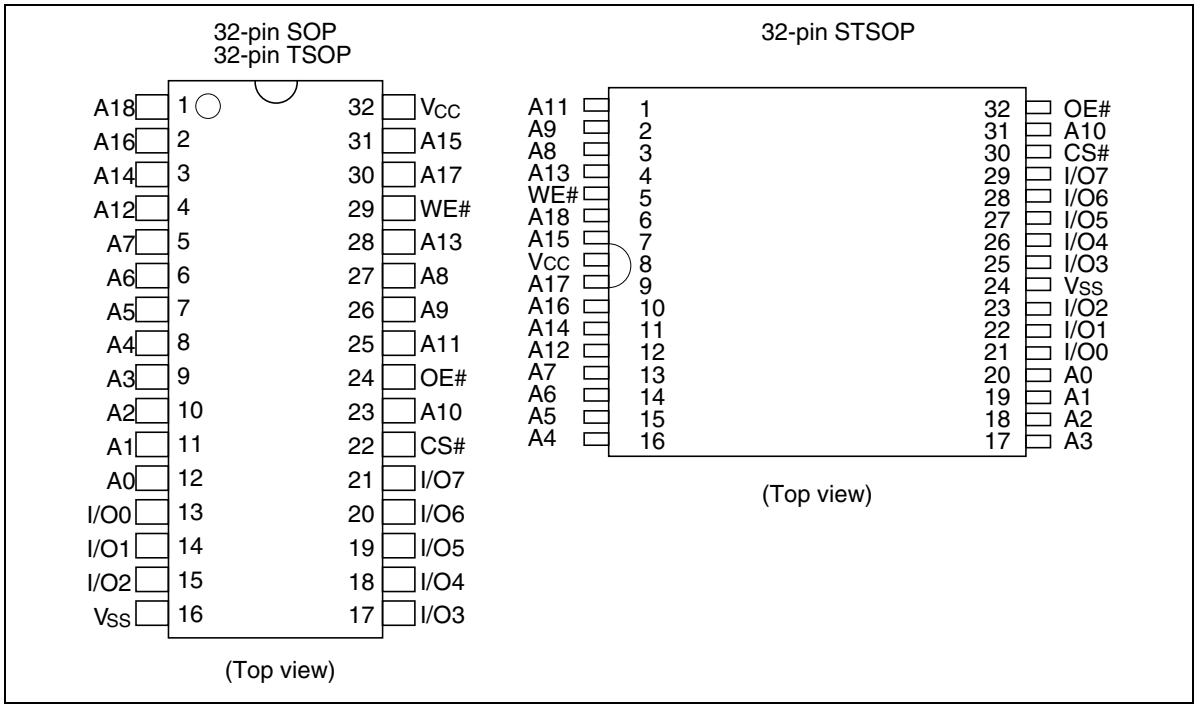
Ordering Information

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

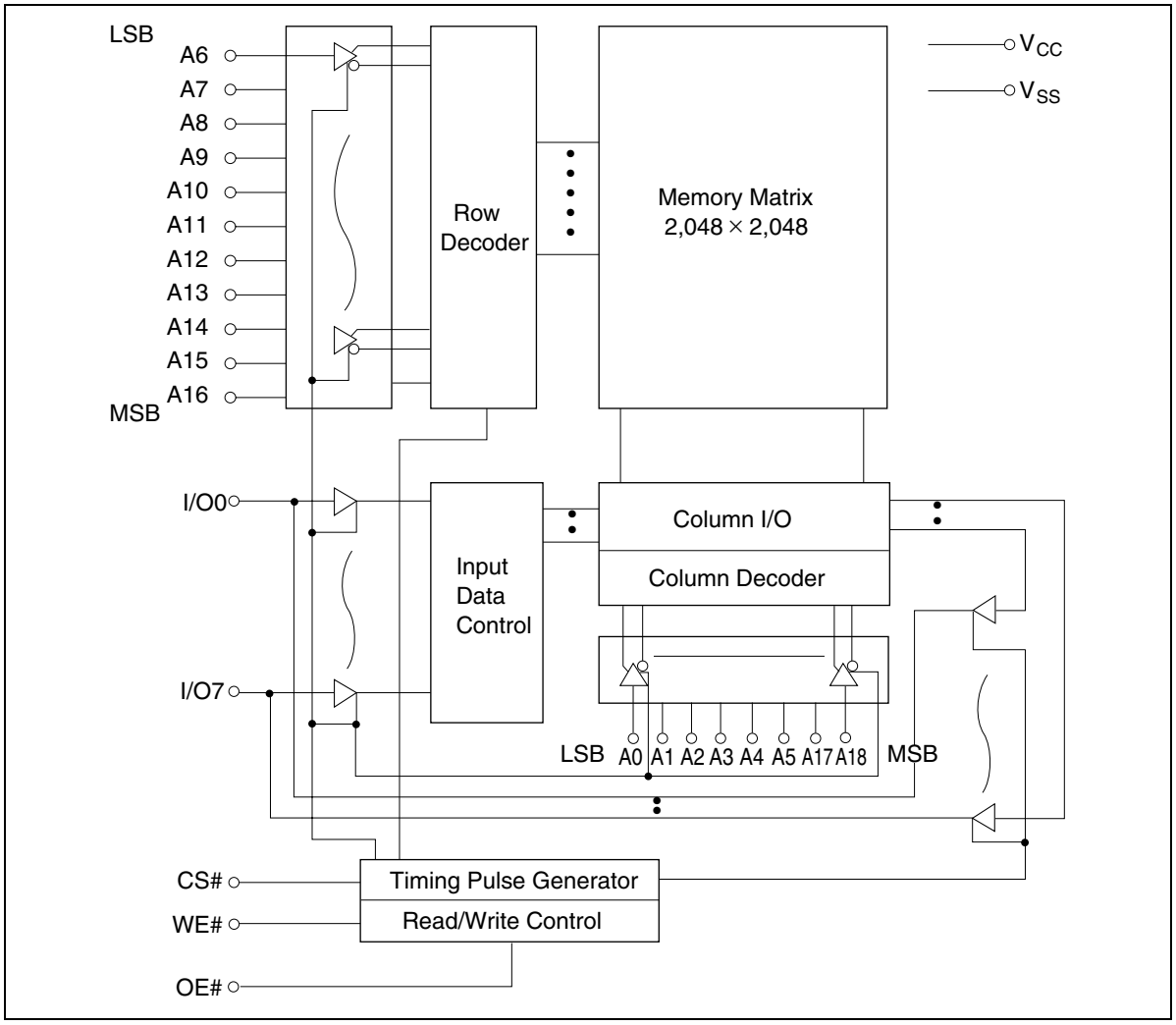
Pin Arrangement



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	Vin = 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# ≤ 0.2 V, V_{IH} ≥ V_{CC} – 0.2 V, V_{IL} ≤ 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	Vin ≥ 0 V, CS# ≥ V_{CC} – 0.2 V Average values
		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, Ta = +25°C and specified loading, and not guaranteed.

Capacitance

(Ta = +25°C, f = 1.0 MHz)

Parameter	Symbol	Min	Typ	Max	Unit	Test conditions	Note
Input capacitance	Cin	—	—	8	pF	Vin = 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	

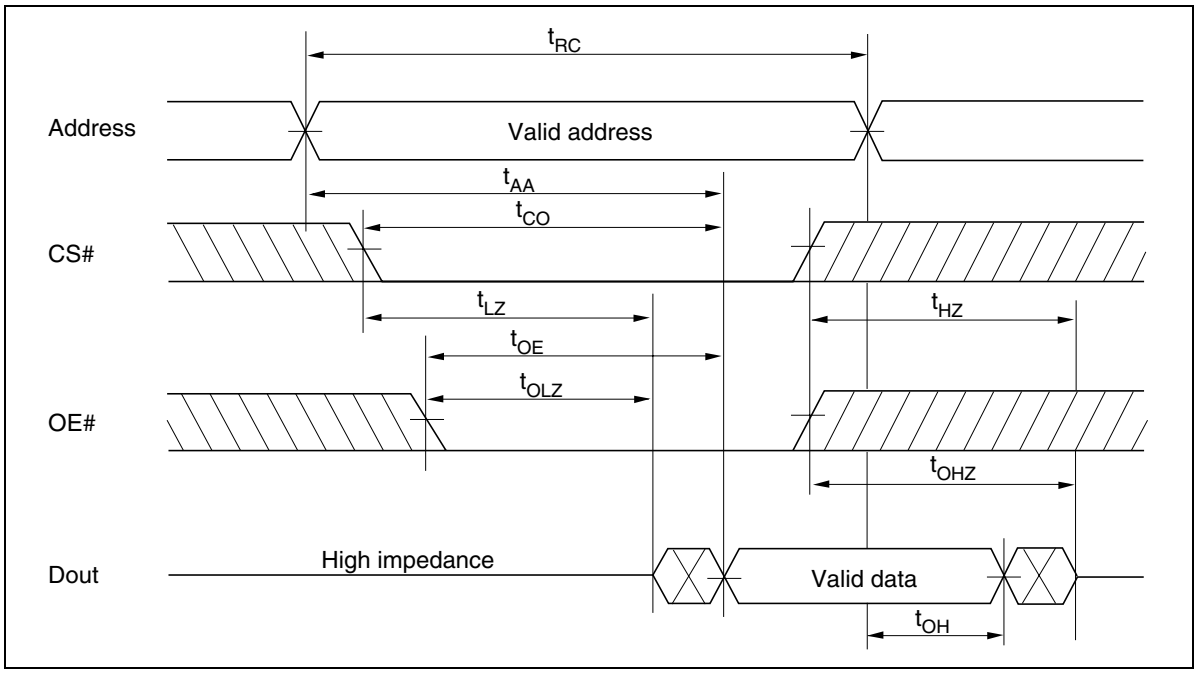
Write Cycle

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

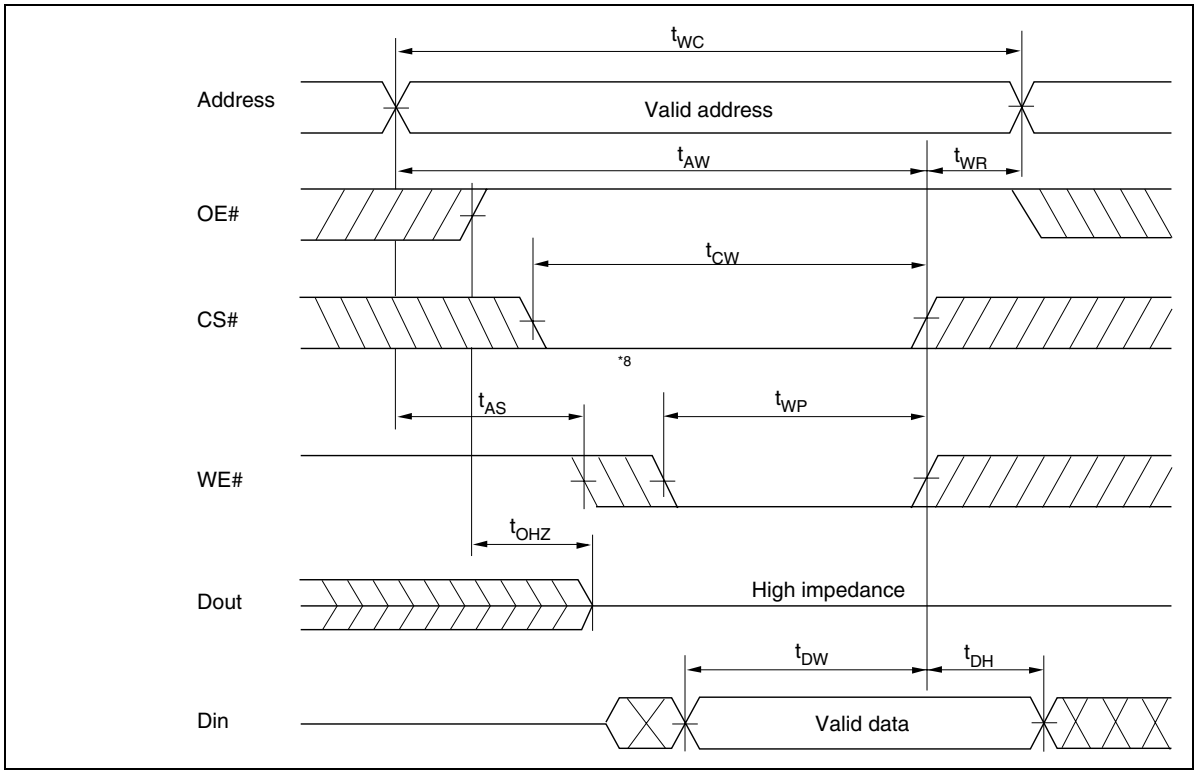
Notes:
1. t_{HZ}, t_{OHZ} and t_{WHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.
2. This parameter is sampled and not 100% tested.
3. A write occurs during the overlap (t_{WP}) of a low CS# and a low WE#. A write begins 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. $t_{WP} \geq t_{DW}$ min + t_{WHZ} max

Timing Waveform

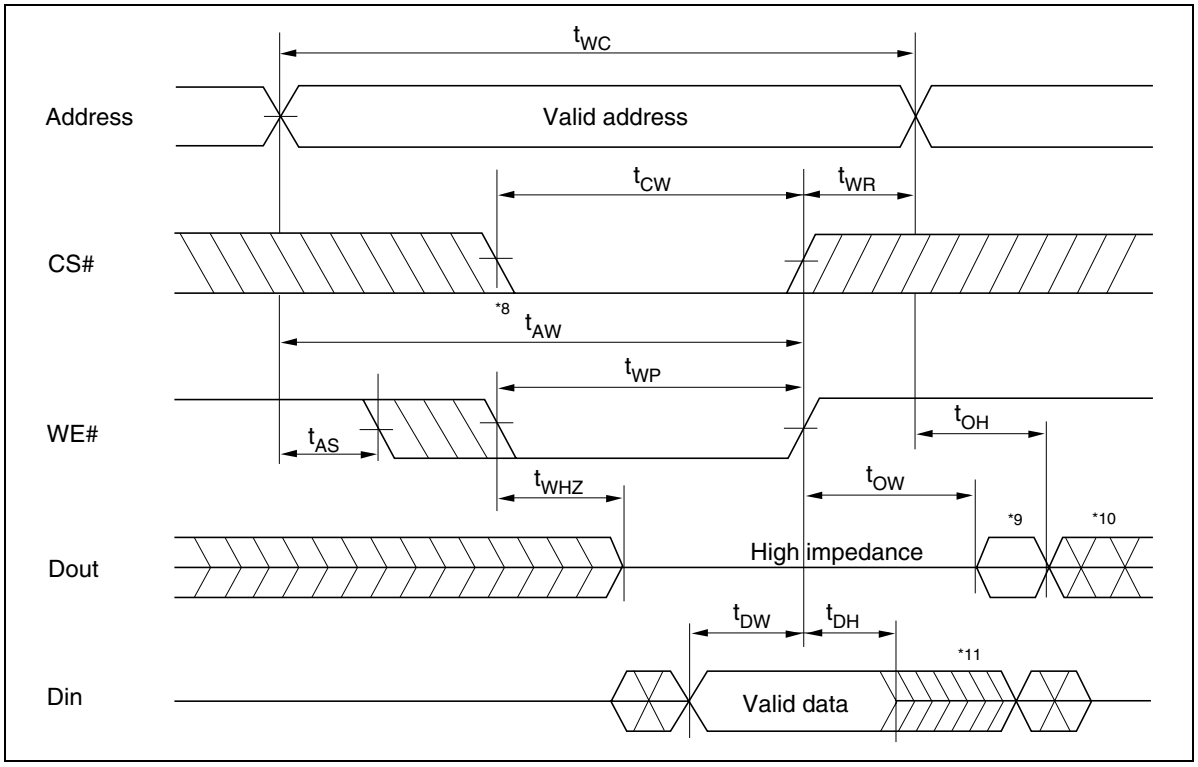
Read Timing Waveform (WE# = V_{IH})



Write Timing Waveform (1) (OE# Clock)



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



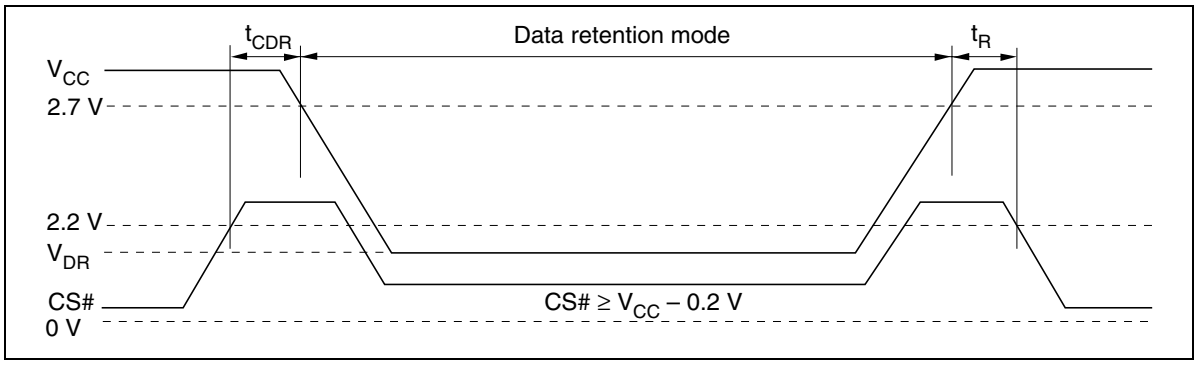
Low V_{CC} Data Retention Characteristics

(Ta = 0 to +70°C / –40 to +85°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
		to +70°C	I_{CCDR}	—	—	8	µA	CS# ≥ V_{CC} – 0.2 V
		to +40°C	I_{CCDR}	—	—	3	µA	Average values
		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 V, Ta = +25°C and specified loading, and not guaranteed.

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



Revision History	R1LV0408D Series Data Sheet

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

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

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Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

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Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2730-6071

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510

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