RMLV0408E Series

4Mb Advanced LPSRAM (512k word × 8bit)

R10DS0217EJ0001
Rev.0.01
2013.09.10

Description

The RMLV0408E Series is a family of 4-Mbit static RAMs organized 524,288-word × 8-bit, fabricated by Renesas's high-performance Advanced LPSRAM technologies. The RMLV0408E Series has realized higher density, higher performance and low power consumption. The RMLV0408E Series offers low power standby power dissipation; therefore, it is suitable for battery backup systems. It is offered in 32-pin SOP, 32-pin TSOP II or 32-pin STSOP.

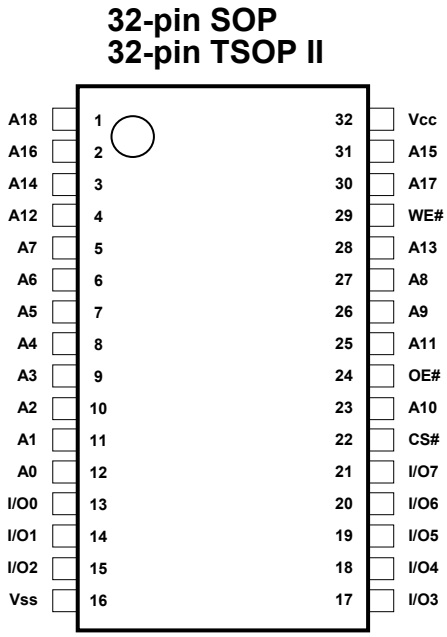
Features

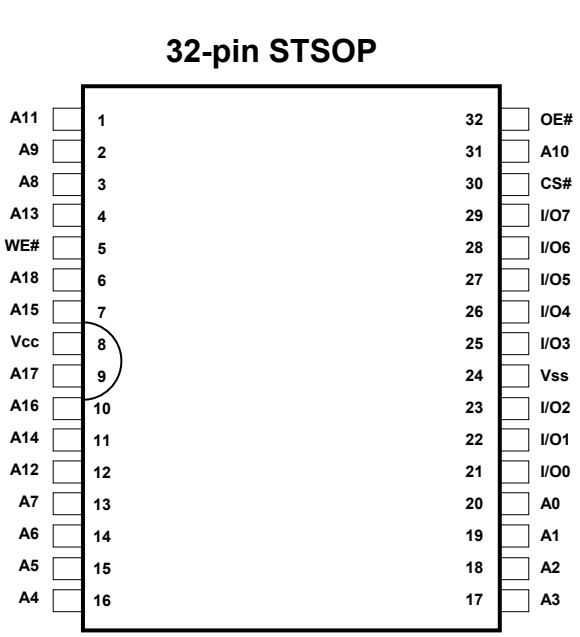
- Single 3V supply: 2.7V to 3.6V
- Access time: 45/55ns (max.)
- Current consumption:
  — Standby: 0.4µA (typ.)
- Equal access and cycle times
- Common data input and output
  — Three state output
- Directly TTL compatible
  — All inputs and outputs
- Battery backup operation

Part Name Information

Part Name	Access time	Temperature Range	Package
RMLV0408EGSP-4S2	45 ns	-40 ~ +85°C	525-mil 32-pin plastic SOP
RMLV0408EGSP-5S2	55 ns		
RMLV0408EGSB-4S2	45 ns		400-mil 32-pin plastic TSOP II
RMLV0408EGSB-5S2	55 ns		
RMLV0408EGSA-4S2	45 ns		8mm x 13.4mm STSOP
RMLV0408EGSA-5S2	55 ns		

Pin Arrangement

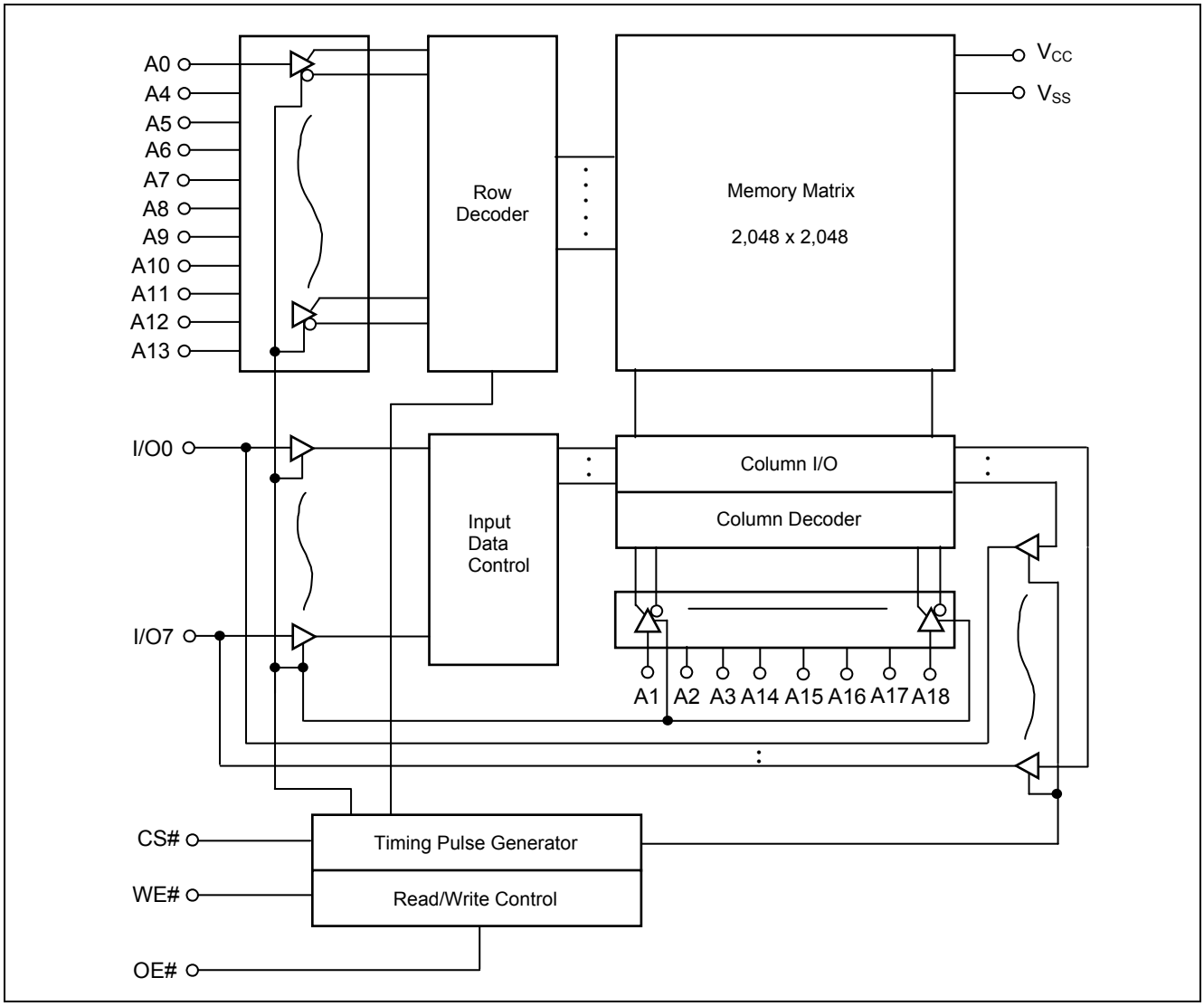




Pin Description

Pin name	Function
V_{CC}	Power supply
V_{SS}	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

CS#	WE#	OE#	I/O0 to I/O7	Operation
H	X	X	High-Z	Standby
L	H	L	Dout	Read
L	L	X	Din	Write
L	H	H	High-Z	Output disable

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 V_{SS}	V_{CC}	-0.5 to +4.6	V
Terminal voltage on any pin relative to V_{SS}	V_T	-0.5[*2] to V_{CC}+0.3[*3]	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 2. -3.0V for pulse ≤ 30ns (full width at half maximum)
3. Maximum voltage is +4.6V.

DC Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
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	—	0.6	V	4
Ambient temperature range	Ta	-40	—	+85	°C	

Note 4. -3.0V for pulse ≤ 30ns (full width at half maximum)

DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions
Input leakage current	$\lvert I_{LI} \rvert$	—	—	1	µA	Vin = V_{SS} to V_{CC}
Output leakage current	$\lvert I_{LO} \rvert$	—	—	1	µA	CS# =V_{IH} or OE# =V_{IH} or WE#= V_{IL}, VI/O = V_{SS} to V_{CC}
Operating current	I_{CC}	—	—	10	mA	CS# =V_{IL}, Others = V_{IH}/V_{IL}, II/O = 0mA
Average operating current	I_{CC1}	—	—	20	mA	Min. cycle, duty =100%, II/O = 0mA CS# =V_{IL}, Others = V_{IH}/V_{IL}
	I_{CC2}	—	—	2.5	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[*5]	0.3	mA	CS# =V_{IH}, Others = V_{SS} to V_{CC}
Standby current	I_{SB1}	—	0.4[*5]	2	µA	~+25°C; Vin = V_{SS} to V_{CC}, CS# ≥ V_{CC}-0.2V
		—	—	3	µA	~+40°C
		—	—	5	µA	~+70°C
		—	—	7	µA	~+85°C
Output high voltage	V_{OH}	2.4	—	—	V	I_{OH} = -1mA
	V_{OH2}	V_{CC}-0.2	—	—	V	I_{OH} = -0.1mA
Output low voltage	V_{OL}	—	—	0.4	V	I_{OL} = 2.1mA
	V_{OL2}	—	—	0.2	V	I_{OL} = 0.1mA

Note 5. Typical parameter indicates the value for the center of distribution at 3.0V (Ta=25ºC), and not 100% tested.

Capacitance

(Vcc = 2.7V ~ 3.6V, f = 1MHz, Ta = -40 ~ +85°C[*2])

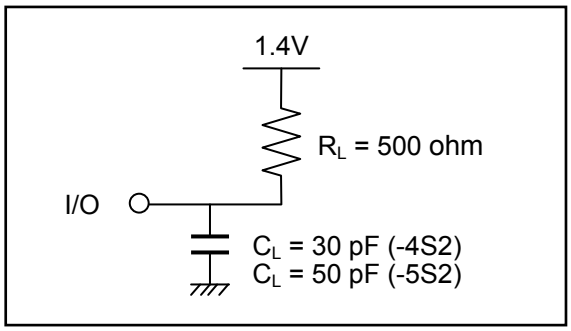
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	Note
Input capacitance	C in	—	—	8	pF	Vin =0V	6
Input / output capacitance	$C_{I/O}$	—	—	10	pF	$V_{I/O}$ =0V	6

Note 6. This parameter is sampled and not 100% tested.

AC Characteristics

Test Conditions (Vcc = 2.7V ~ 3.6V, Ta = -40 ~ +85°C)

- Input pulse levels: V_{IL} = 0.4V, V_{IH} = 2.4V
- Input rise and fall time: 5ns
- Input and output timing reference level: 1.4V
- Output load: See figures (Including scope and jig)



Read Cycle

Parameter	Symbol	RMLV0408EG**-4S2		RMLV0408EG**-5S2		Unit	Note
		Min.	Max.	Min.	Max.		
Read cycle time	t_{RC}	45	—	55	—	ns	
Address access time	t_{AA}	—	45	—	55	ns	
Chip select access time	t_{ACS}	—	45	—	55	ns	
Output enable to output valid	t_{OE}	—	22	—	30	ns	
Output hold from address change	t_{OH}	10	—	10	—	ns	
Chip select to output in low-Z	t_{CLZ}	10	—	10	—	ns	7,8
Output enable to output in low-Z	t_{OLZ}	5	—	5	—	ns	7,8
Chip deselect to output in high-Z	t_{CHZ}	0	18	0	20	ns	7,8,9
Output disable to output in high-Z	t_{OHZ}	0	18	0	20	ns	7,8,9

Write Cycle

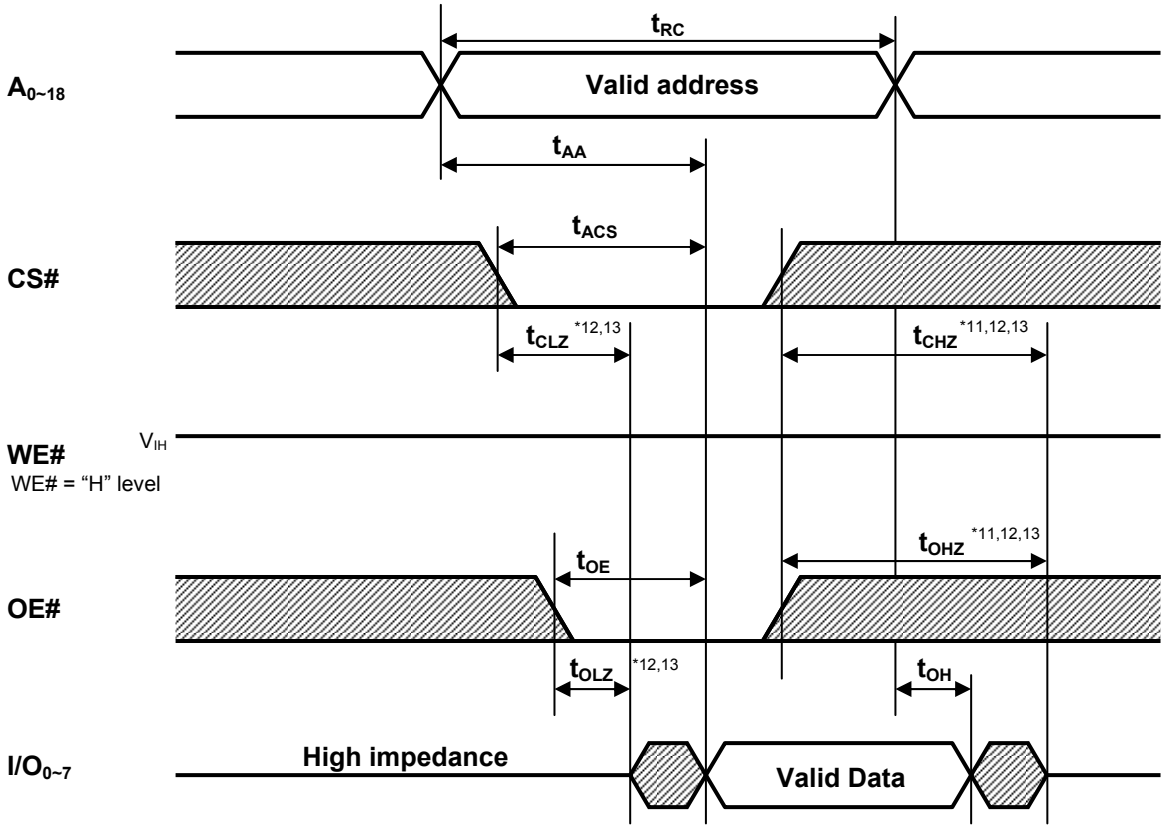
Parameter	Symbol	RMLV0408EG**-4S2		RMLV0408EG**-5S2		Unit	Note
		Min.	Max.	Min.	Max.		
Write cycle time	t_{WC}	45	—	55	—	ns	
Address valid to write end	t_{AW}	35	—	50	—	ns	
Chip select to write end	t_{CW}	35	—	50	—	ns	
Write pulse width	t_{WP}	35	—	40	—	ns	10
Address setup time to write start	t_{AS}	0	—	0	—	ns	
Write recovery time from write end	t_{WR}	0	—	0	—	ns	
Data to write time overlap	t_{DW}	25	—	25	—	ns	
Data hold from write end	t_{DH}	0	—	0	—	ns	
Output enable from write end	t_{OW}	5	—	5	—	ns	7
Output disable to output in high-Z	t_{OHZ}	0	18	0	20	ns	7,9
Write to output in high-Z	t_{WHZ}	0	18	0	20	ns	7,9

Note 7. This parameter is sampled and not 100% tested.

8. At any given temperature and voltage condition, t_{CHZ} max is less than t_{CLZ} min, and t_{OHZ} max is less than t_{OLZ} min, for any device.
9. t_{CHZ}, t_{OHZ} and t_{WHZ} are defined as the time when the I/O pins enter a high-impedance state and are not referred to the I/O levels.
10. t_{WP} is the interval between write start and write end.
    A write starts when both of CS# and WE# become active
    A write is performed during the overlap of a low CS#, a low WE#
    A write ends when any of CS#, WE# becomes inactive.

Timing Waveforms

Read Cycle

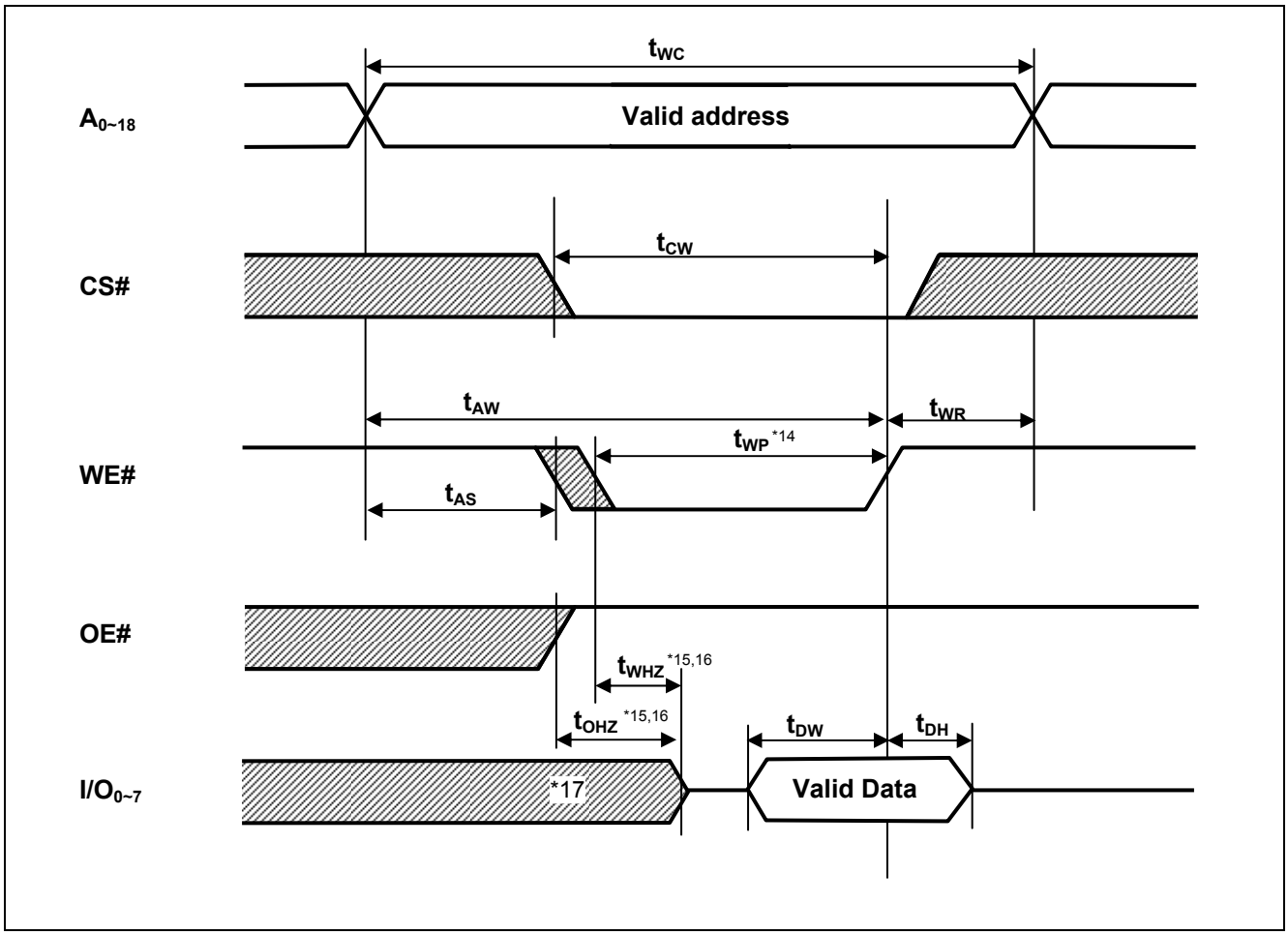


Note 11. t_{CHZ} and t_{OHZ} are defined as the time when the I/O pins enter a high-impedance state and are not referred to the I/O levels.

12. This parameter is sampled and not 100% tested.

13. At any given temperature and voltage condition, t_{CHZ} max is less than t_{CLZ} min, and t_{OHZ} max is less than t_{OLZ} min, for any device.

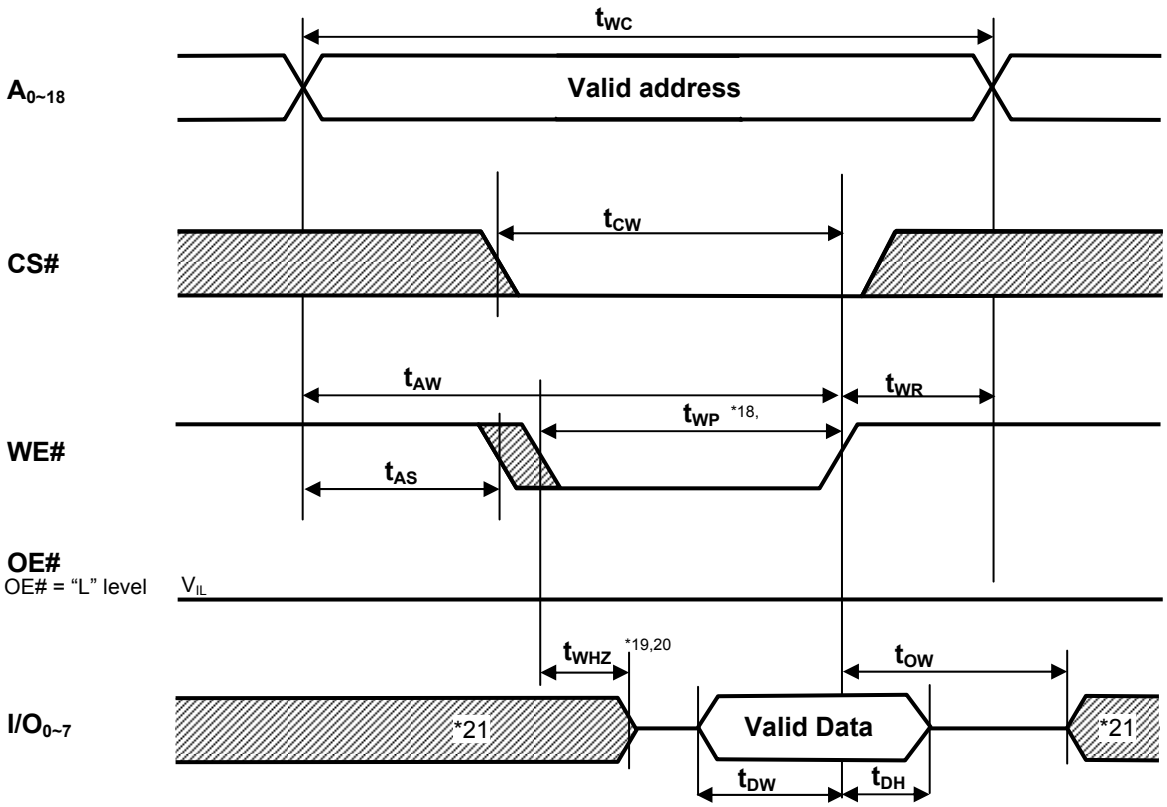
Write Cycle (1) (WE# CLOCK, OE#="H" while writing)



Note 14. t_{WP} is the interval between write start and write end.
A write starts when both of CS# and WE# become active.
A write is performed during the overlap of a low CS# and a low WE#.
A write ends when any of CS# or WE# becomes inactive.

15. t_{OHZ} and t_{WHZ} are defined as the time when the I/O pins enter a high-impedance state and are not referred to the I/O levels.
16. This parameter is sampled and not 100% tested.
17. During this period, I/O pins are in the output state so input signals must not be applied to the I/O pins.

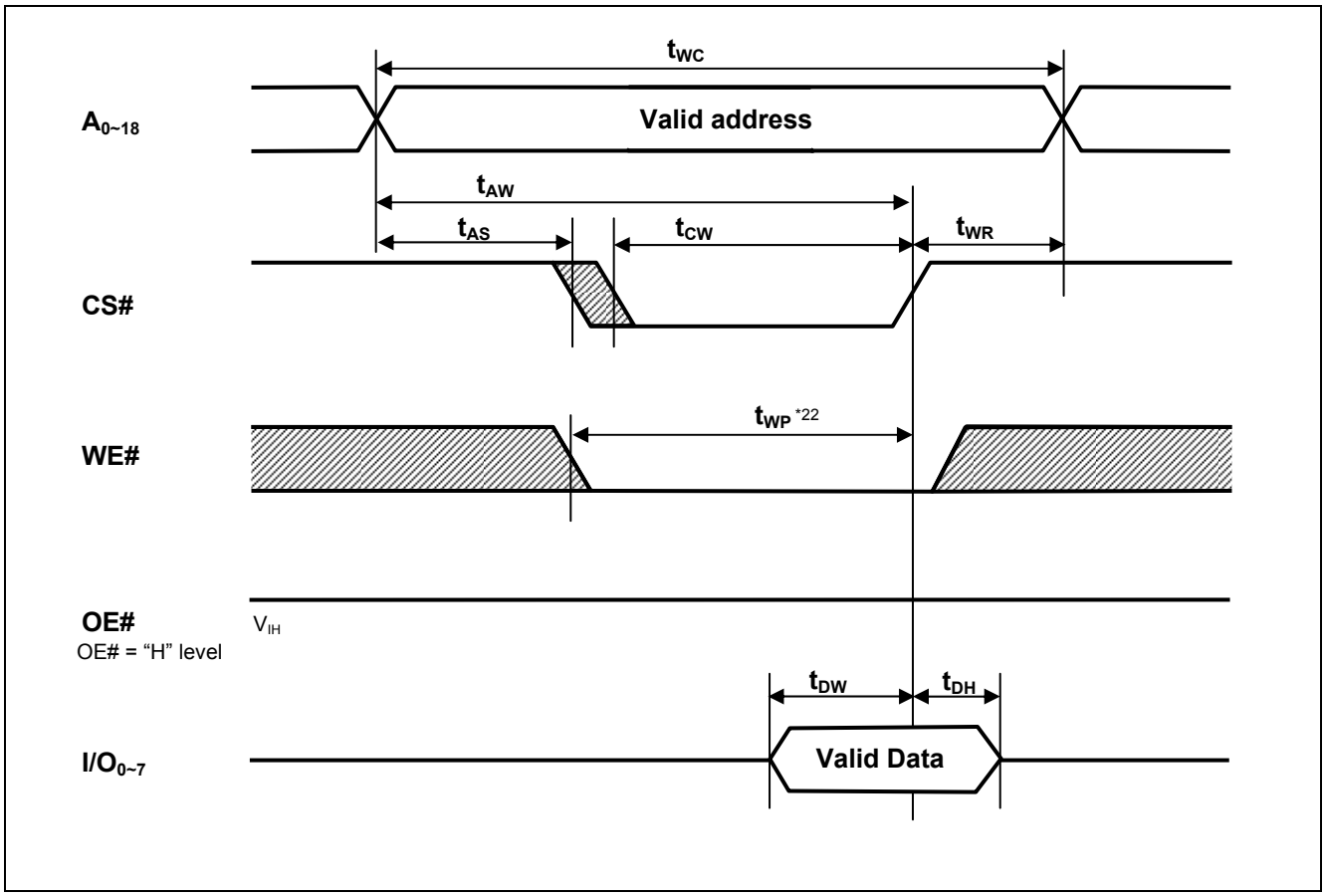
Write Cycle (2) (WE# CLOCK, OE# Low Fixed)



Note 18. t_{WP} is the interval between write start and write end.
A write starts when both of CS# and WE# become active.
A write is performed during the overlap of a low CS# and a low WE#.
A write ends when any of CS# or WE# becomes inactive.

19. t_{WHZ} is defined as the time when the I/O pins enter a high-impedance state and are not referred to the I/O levels.
20. This parameter is sampled and not 100% tested.
21. During this period, I/O pins are in the output state so input signals must not be applied to the I/O pins.

Write Cycle (3) (CS# CLOCK)



Note 22. t_{WP} is the interval between write start and write end.
A write starts when both of CS# and WE# become active.
A write is performed during the overlap of a low CS# and a low WE#.
A write ends when any of CS# or WE# becomes inactive.

Low V_{CC} Data Retention Characteristics

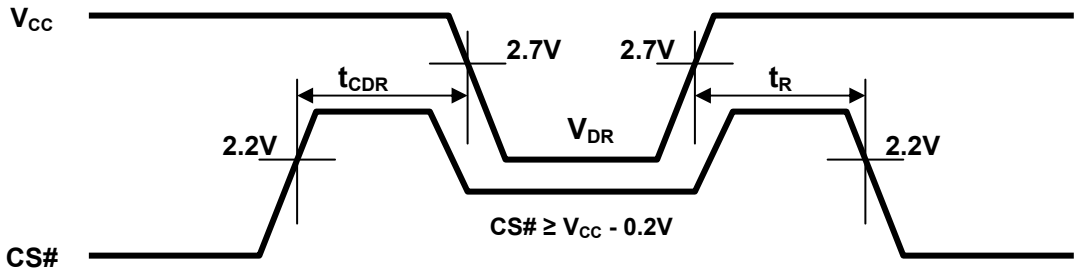
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions[*24]	
V_{CC} for data retention	V_{DR}	1.5	—	—	V	Vin ≥ 0V, CS# ≥ V_{CC}-0.2V	
Data retention current	I_{CCDR}	—	0.4[*23]	2	µA	~+25°C	V_{CC}=3.0V, Vin ≥ 0V, CS# ≥ Vcc-0.2V
		—	—	3	µA	~+40°C	
		—	—	5	µA	~+70°C	
		—	—	7	µA	~+85°C	
Chip deselect time to data retention	t_{CDR}	0	—	—	ns	See retention waveform.	
Operation recovery time	t_R	5	—	—	ms		

Note 23. Typical parameter indicates the value for the center of distribution at 3.0V (Ta=25ºC), and not 100% tested.

24. CS# controls address buffer, WE# buffer, OE# buffer, and I/O buffer. If CS# controls data retention mode, Vin levels (address, WE#, OE#, I/O) can be in the high-impedance state.

Low Vcc Data Retention Timing Waveforms (CS# controlled)

CS# Controlled



Revision History	RMLV0408E Series Data Sheet

Rev.	Date	Description	
		Page	Summary
0.01	2013.09.10	—	Preliminary First Edition issued

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
3. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.
   Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.
6. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
11. This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

RENESAS

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

Colophon 2.2