RMLV0408E Series

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

R10DS0206EJ0300
Rev.3.00
2021.8.18

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

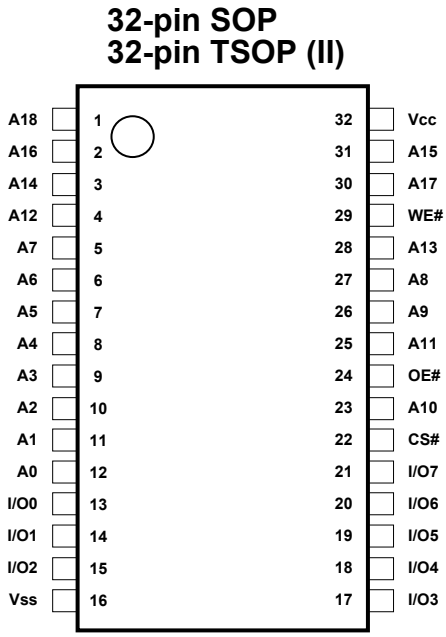
- Single 3V supply: 2.7V to 3.6V
- Access time: 45ns (max.)
- Current consumption:
  — Standby: 0.3µA (typ.)
- Equal access and cycle times
- Common data input and output
  — Three state output
- Directly TTL compatible
  — All inputs and outputs
- Battery backup operation

Orderable part number information

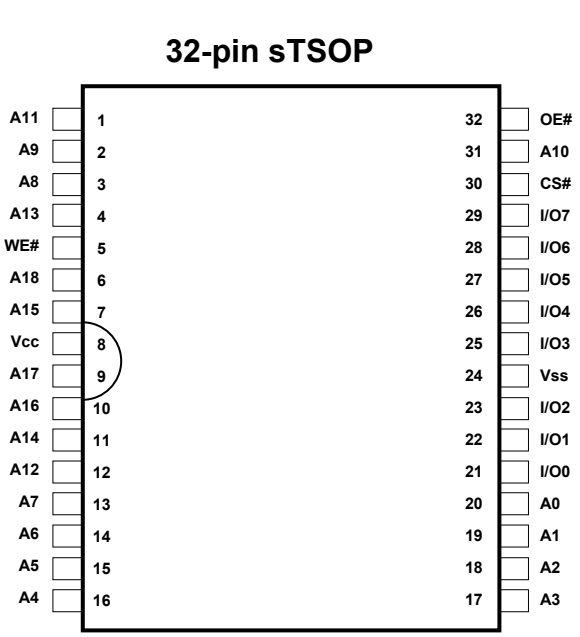
Orderable part number	Access time	Temperature range	Package	Shipping container
RMLV0408EGSA-4S2#AA*	45 ns	-40 ~ +85°C	8mm×13.4mm 32-pin plastic sTSOP	Tray
RMLV0408EGSA-4S2#KA*				Embossed tape
RMLV0408EGSB-4S2#AA*			400-mil 32pin plastic TSOP (II)	Tray
RMLV0408EGSB-4S2#HA*				Embossed tape
RMLV0408EGSP-4S2#CA*			525-mil 32-pin plastic SOP	Tube
RMLV0408EGSP-4S2#HA*				Embossed tape

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

Pin Arrangement



(Top view)

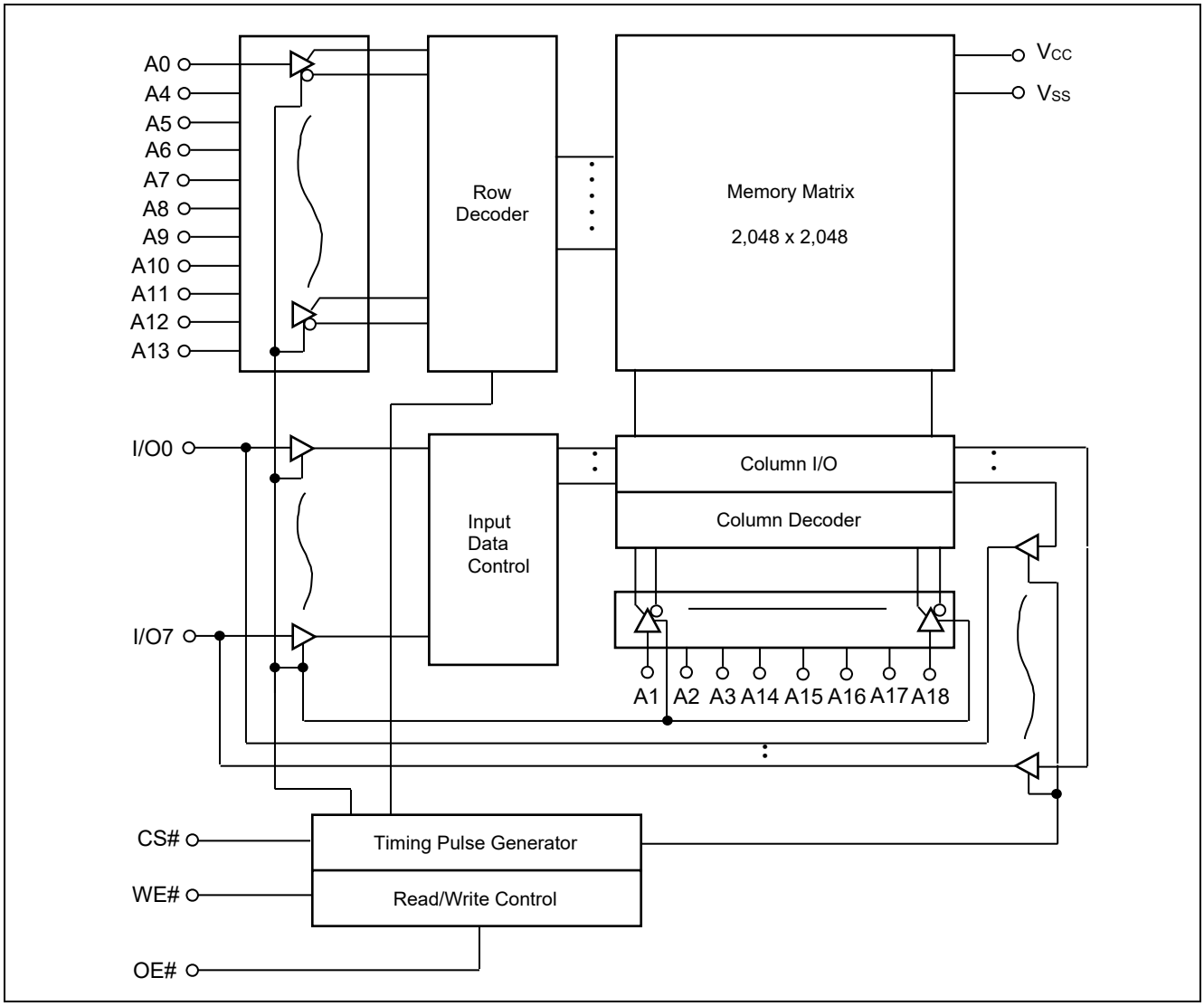


(Top view)

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 2. 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[*3] to V_{CC}+0.3[*4]	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 3. -3.0V for pulse ≤ 30ns (full width at half maximum)

4. 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	5
Ambient temperature range	Ta	-40	—	+85	°C	

Note 5. -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}, $V_{I/O}$ = V_{SS} to V_{CC}
Operating current	I_{CC}	—	—	10	mA	CS# =V_{IL}, Others = V_{IH}/V_{IL}, $I_{I/O}$ = 0mA
Average operating current	I_{CC1}	—	—	20	mA	Cycle = 55ns, duty = 100%, $I_{I/O}$ = 0mA, CS# = V_{IL}, Others = V_{IH}/V_{IL}
		—	—	25	mA	Cycle = 45ns, duty = 100%, $I_{I/O}$ = 0mA, CS# = V_{IL}, Others = V_{IH}/V_{IL}
	I_{CC2}	—	—	2.5	mA	Cycle = 1µs, duty = 100%, $I_{I/O}$ = 0mA, CS# ≤ 0.2V, V_{IH} ≥ Vcc-0.2V, V_{IL} ≤ 0.2V
Standby current	I_{SB}	—	0.1*6	0.3	mA	CS# =V_{IH}, Others = V_{SS} to V_{CC}
Standby current	I_{SB1}	—	0.3*6	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 6. 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)

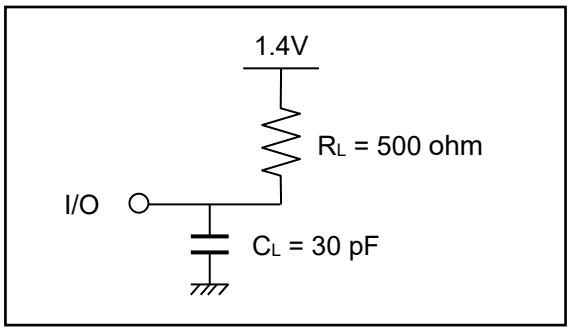
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	Note
Input capacitance	C in	—	—	8	pF	Vin =0V	7
Input / output capacitance	$C_{I/O}$	—	—	10	pF	$V_{I/O}$ =0V	7

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

Write Cycle

Parameter	Symbol	Min.	Max.	Unit	Note
Write cycle time	t_{WC}	45	—	ns	
Address valid to write end	t_{AW}	35	—	ns	
Chip select to write end	t_{CW}	35	—	ns	
Write pulse width	t_{WP}	35	—	ns	11
Address setup time to write start	t_{AS}	0	—	ns	
Write recovery time from write end	t_{WR}	0	—	ns	
Data to write time overlap	t_{DW}	25	—	ns	
Data hold from write end	t_{DH}	0	—	ns	
Output enable from write end	t_{OW}	5	—	ns	8
Output disable to output in high-Z	t_{OHZ}	0	18	ns	8,10
Write to output in high-Z	t_{WHZ}	0	18	ns	8,10

Note 8. This parameter is sampled and not 100% tested.

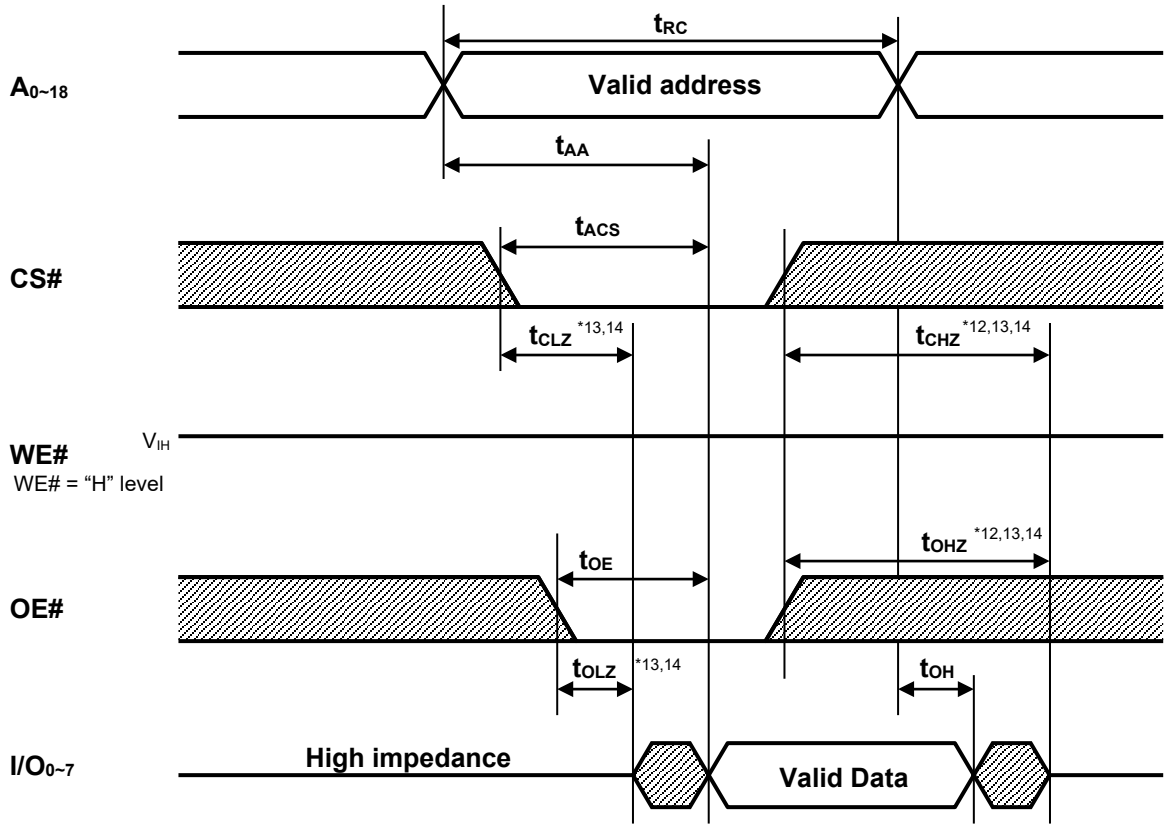
9. At any given temperature and voltage condition, t_{CHZ} max is less than t_{CLZ} min, and t_{OHZ} max is less than t_{OLZ} min, for any device.

10. 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.

11. 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

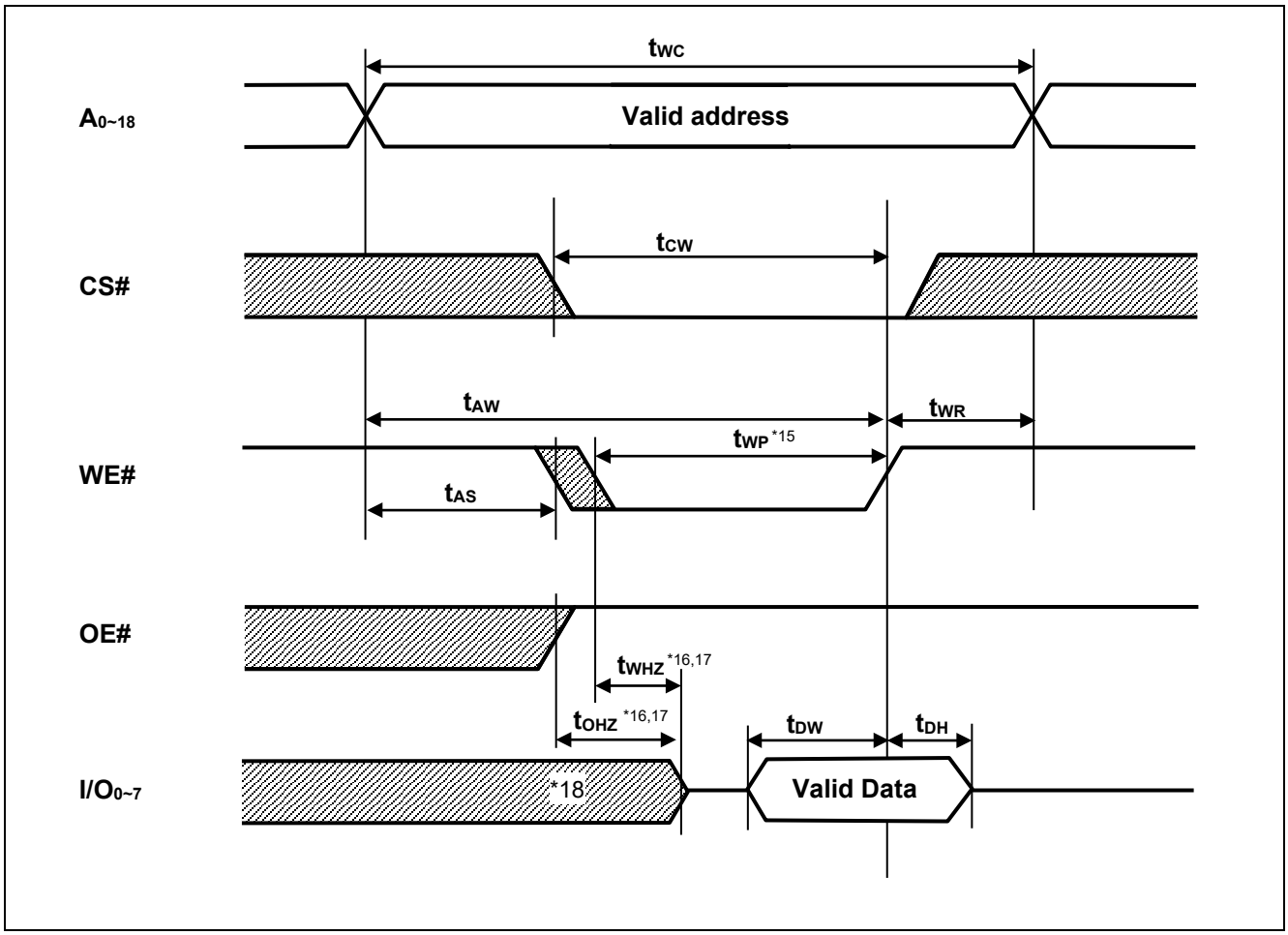


Note 12. t_{CHZ} and t_{OHZ} are defined as the time when the I/O pins enter a high-impedance state and are not referred to the I/O levels.

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

14. 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.

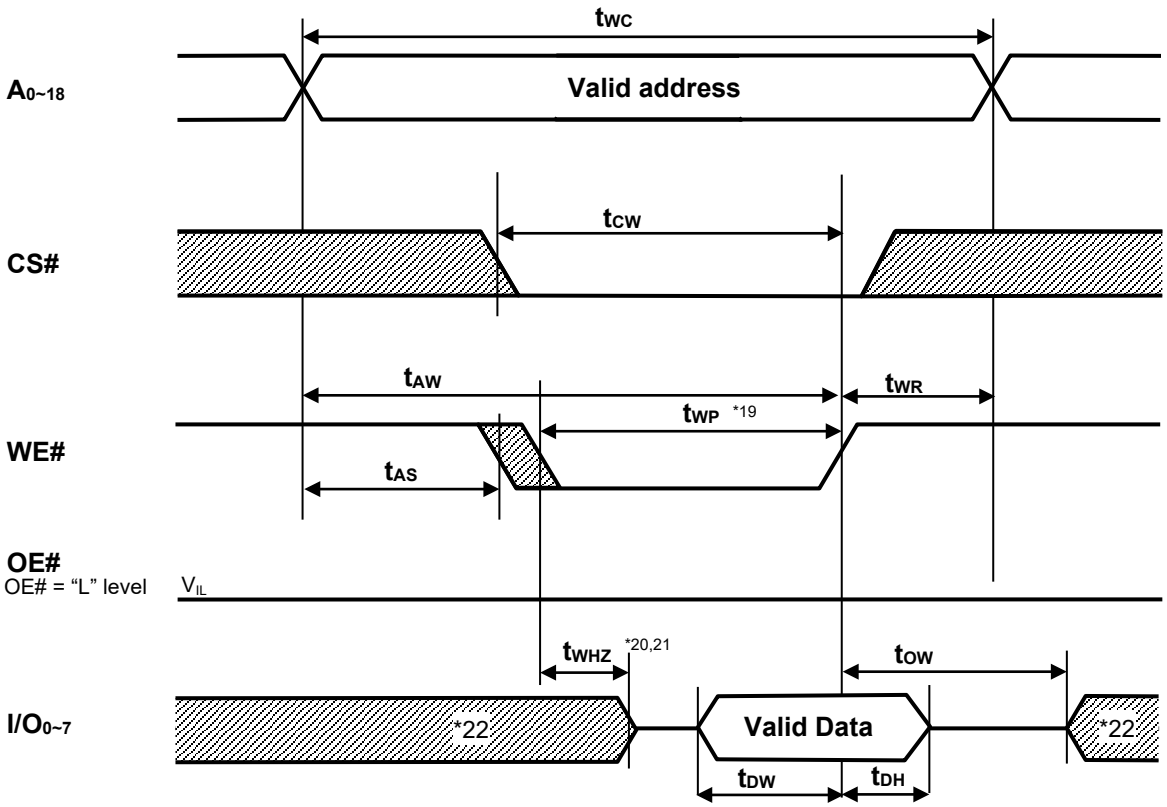
Write Cycle (1) (WE# CLOCK, OE#="H" while writing)



Note 15. 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.

16. 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.
17. This parameter is sampled and not 100% tested.
18. During this period, I/O pins are in the output state so input signals must not be applied to the I/O pins.

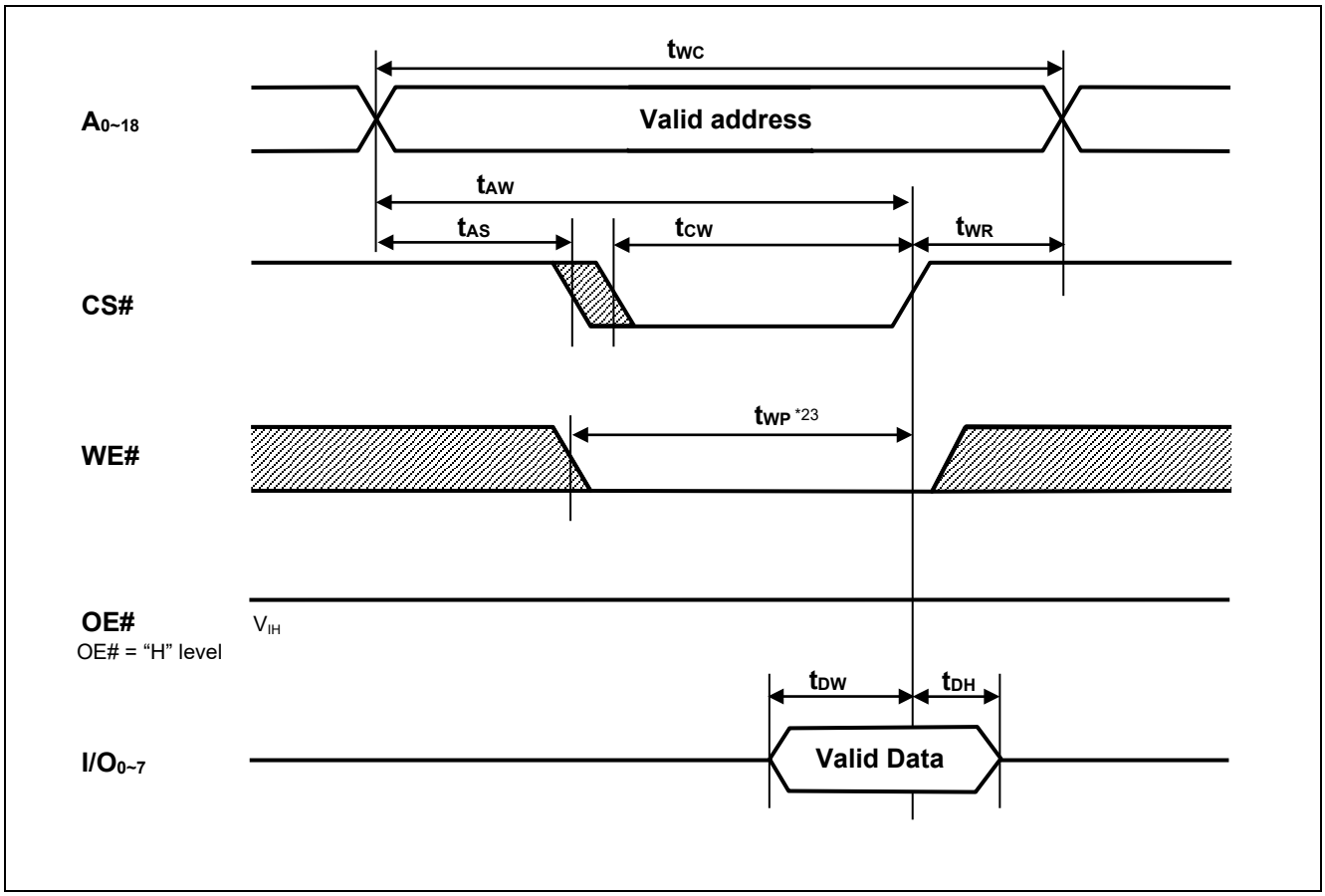
Write Cycle (2) (WE# CLOCK, OE# Low Fixed)



Note 19. 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.

20. 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.
21. This parameter is sampled and not 100% tested.
22. 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 23. 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.

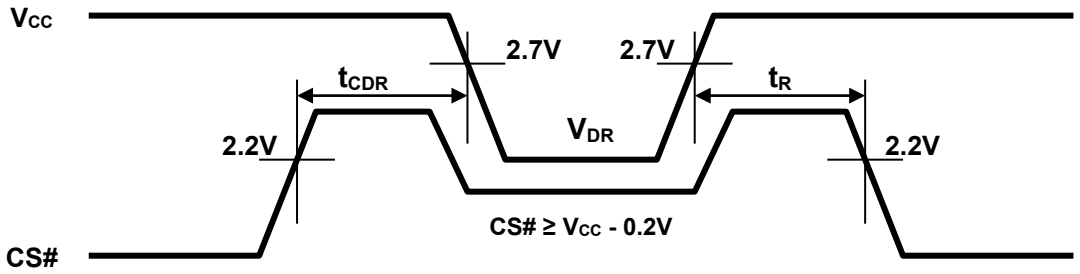
Low V_{CC} Data Retention Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions[*25]	
V_{CC} for data retention	V_{DR}	1.5	—	—	V	Vin ≥ 0V, CS# ≥ V_{CC}-0.2V	
Data retention current	I_{CCDR}	—	0.3[*24]	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 24. Typical parameter indicates the value for the center of distribution at 3.0V (Ta=25ºC), and not 100% tested.
25. 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
1.00	2014.2.27	—	First edition issued
2.00	2016.1.12	1	Changed section from “Part Name Information” to “Orderable part number information”
2.01	2020.2.20	Last page	Updated the Notice to the latest version
3.00	2021.8.18	1,4,10	Changed the typical value of I_{SB1} and I_{CCDR} from 0.4μA to 0.3μA. Revised orderable part number information

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