



R1WV3216R Series

32Mb superSRAM (2M wordx16bit)

REJ03C0215-0100Z

Rev.1.00

2004.4.13

Description

The R1WV3216R Series is a family of low voltage 32-Mbit static RAMs organized as 2097152-words by 16-bit, fabricated by Renesas's high-performance 0.15um CMOS and TFT technologies.

The R1WV3216R Series is suitable for memory applications where a simple interfacing , battery operating and battery backup are the important design objectives.

The R1WV3216R Series is made by stacked-micro-package technology and two chips of 16Mbit superSRAMs are assembled in one package.

The R1WV3216R Series is packaged in a 52pin micro thin small outline mount device[μTSOP / 10.79mm x 10.49mm with the pin-pitch of 0.4mm] or a 48balls fine pitch ball grid array [f-BGA / 7.5mmx8.5mm with the ball-pitch of 0.75mm and 6x8 array] . It gives the best solution for a compaction of mounting area as well as flexibility of wiring pattern of printed circuit boards.

Features

- Single 2.7-3.6V power supply
- Small stand-by current:4μA (3.0V, typ.)
- Data retention supply voltage =2.0V
- No clocks, No refresh
- All inputs and outputs are TTL compatible.
- Easy memory expansion by CS1#, CS2, LB# and UB#
- Common Data I/O
- Three-state outputs: OR-tie capability
- OE# prevents data contention on the I/O bus
- Process technology: 0.15um CMOS



Ordering Information

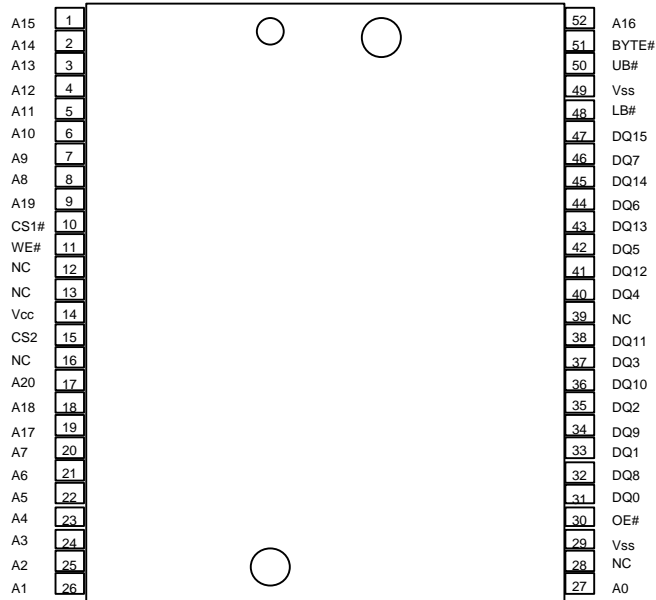
Type No.	Access time	Package
R1WV3216RSD-7S%	70 ns	350-mil 52-pin plastic μ - TSOP(II) (normal-bend type) (52PTG)
R1WV3216RSD-8S%	85 ns	
R1WV3216RBG-7S%	70 ns	7.5mmx8.5mm f-BGA 0.75mm pitch 48ball
R1WV3216RBG-8S%	85 ns	

% - Temperature version; see table below

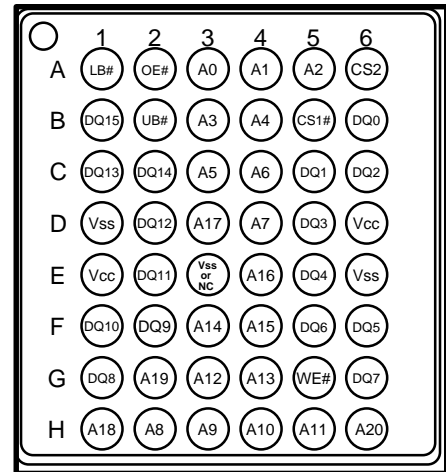
%	Temperature Range
R	0 ~ +70 °C
W	-20 ~ +85 °C
I	-40 ~ +85 °C

Pin Arrangement

52-pin μ TSSOP



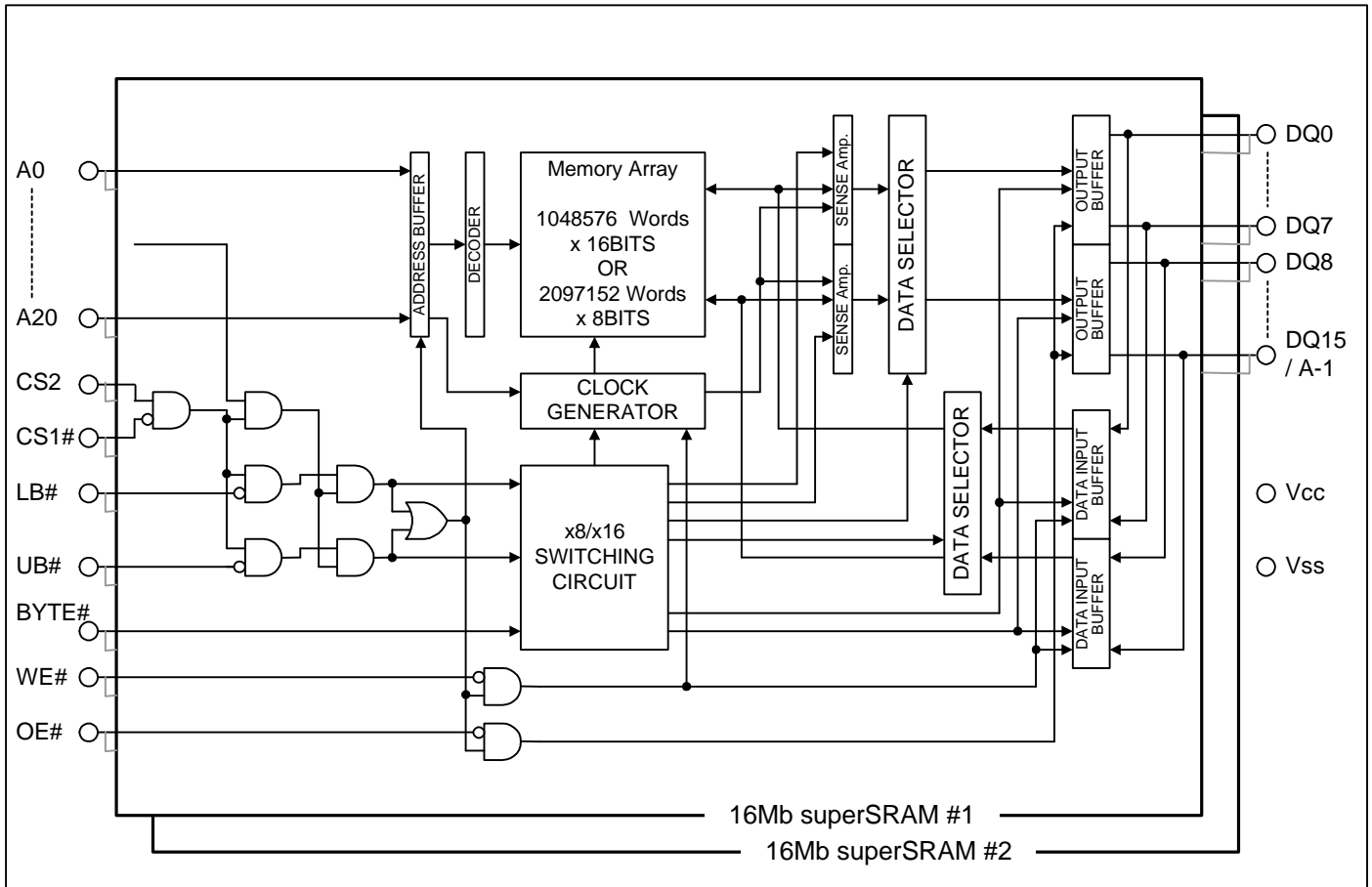
48-pin fBGA



Pin Description

Pin name	Function
A0 to A20	Address input
DQ 0 to DQ15	Data input/output
CS1# & CS2	Chip select
WE#	Write enable
OE#	Output enable
LB#	Lower byte select
UB#	Upper byte select
Vcc	Power supply
Vss	Ground
BYTE#	Byte (x8 mode) enable input
NC	Non connection

Block Diagram



Note: BYTE# pin supported by only TSOP type.

Operating Table

CS1#	CS2	BYTE#	LB#	UB#	WE#	OE#	DQ0-7	DQ8-14	DQ15	Operation
H	X	X	X	X	X	X	High-Z	High-Z	High-Z	Stand by
X	L	X	X	X	X	X	High-Z	High-Z	High-Z	Stand by
X	X	H	H	H	X	X	High-Z	High-Z	High-Z	Stand by
L	H	H	L	H	L	X	Din	High-Z	High-Z	Write in lower byte
L	H	H	L	H	H	L	Dout	High-Z	High-Z	Read from lower byte
L	H	X	X	X	H	H	High-Z	High-Z	High-Z	Output disable
L	H	H	H	L	L	X	High-Z	Din	Din	Write in upper byte
L	H	H	H	L	H	L	High-Z	Dout	Dout	Read from upper byte
L	H	H	L	L	L	X	Din	Din	Din	Write
L	H	H	L	L	H	L	Dout	Dout	Dout	Read
L	H	L	L	L	L	X	Din	High-Z	A-1	Write
L	H	L	L	L	H	L	Dout	High-Z	A-1	Read

Note 1. H:VIH L:VIL X: VIH or VIL

2. BYTE# pin supported by only TSOP type. When apply BYTE# ="L" , please assign LB#=UB#="L".

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit	
Power supply voltage relative to Vss	Vcc	-0.5 to +4.6	V	
Terminal voltage on any pin relation toVss	V _T	-0.5 ^{*1} to Vcc+0.3 ^{*2}	V	
Power dissipation	P _T	0.7	W	
Operation temperature	T _{opr}	R ver.	0 to +70	°C
		W ver.	-20 to +85	°C
		I ver.	-40 to +85	°C
Storage temperature	T _{stg}	-65 to +150	°C	
Storage temperature range under bias	T _{bias}	R ver.	0 to +70	°C
		W ver.	-20 to +85	°C
		I ver.	-40 to +85	°C

Note 1: -2.0V in case of AC (Pulse width ≤ 30ns)

2:Maximum voltage is +4.6V

Recommended 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}	2.4	-	V _{CC} +0.2	V		
Input low voltage	V _{IL}	-0.2	-	0.4	V	1	
Ambient temperature range	R ver.	T _a	0	-	+70	°C	2
	W ver.		-20	-	+85	°C	2
	I ver.		-40	-	+85	°C	2

Note 1. -2.0V in case of AC (Pulse width ≤ 30ns)

2. Ambient temperature range depends on R/W/I-version. Please see table on page 2.

DC Characteristics

Parameter	Symbol	Min.	Typ.* ¹	Max.	Unit	Test conditions* ²	
Input leakage current	I _{LI}	-	-	1	μA	V _{in} =V _{SS} to V _{CC}	
Output leakage current	I _{LO}	-	-	1	μA	CS1# =V _{IH} or CS2=V _{IL} or OE# = V _{IH} or WE# =V _{IL} or LB# =UB# =V _{IH} , V _{I/O} =V _{SS} to V _{CC}	
Average operating current	I _{CC1}	-	60	70	mA	Min. cycle, duty =100% I _{I/O} = 0 mA, CS1# =V _{IL} , CS2=V _{IH} Others = V _{IH} / V _{IL}	
	I _{CC2} Write	-	20	25	mA	Cycle time = 1 μs, I _{I/O} = 0 mA, CS1# ≤ 0.2V, CS2 ≥ V _{CC} -0.2V V _{IH} ≥ V _{CC} -0.2V, V _{IL} ≤ 0.2V, Write & Read duty=100% respectively	
	I _{CC2} Read	-	15	20	mA		
Standby current	I _{SB}	-	0.1	0.3	mA	CS2=V _{IL}	
Standby current	I _{SB1}	-	4	12	μA	~+25°C	V _{in} ≥ 0V (1) 0V ≤ CS2 ≤ 0.2V or (2) CS2 ≥ V _{CC} -0.2V, CS1# ≥ V _{CC} -0.2V or (3) LB# =UB# ≥ V _{CC} -0.2V, CS2 ≥ V _{CC} -0.2V, CS1# ≤ 0.2V Average value
		-	7	24	μA	~+40°C	
		-	-	50	μA	~+70°C	
		-	-	80	μA	~+85°C	
Output high voltage	V _{OH}	2.4	-	-	V	I _{OH} = -1mA	
Output Low voltage	V _{OL}	-	-	0.4	V	I _{OL} = 2mA	

Note 1. Typical parameter indicates the value for the center of distribution at 3.0V (T_a = 25°C), and not 100% tested.

2. BYTE# pin supported by only TSOP type.

BYTE# ≥ V_{CC}-0.2V or BYTE# ≤ 0.2V

Capacitance

(Ta = +25°C, f =1MHz)

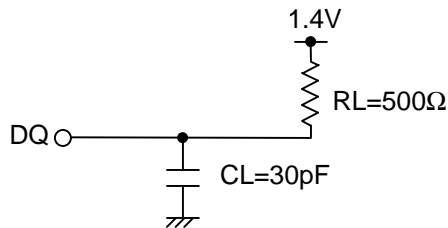
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	Note
Input capacitance	C in	-	-	20	pF	V in = 0V	1
Input / output capacitance	C I/O	-	-	20	pF	V I/O = 0V	1

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

AC Characteristics

Test Conditions (Vcc=2.7~3.6V, Ta = 0~+70°C / -20~+85°C / -40~+85°C *)

- Input pulse levels: VIL= 0.4V, VIH=2.4V
- Input rise and fall time : 5ns
- Input and output timing reference levels : 1.4V
- Output load : See figures (Including scope and jig)



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

Read Cycle

Parameter	Symbol	R1WV3216R**-7S		R1WV3216R**-8S		Unit	Notes
		Min.	Max.	Min.	Max.		
Read cycle time	t_{RC}	70	-	85	-	ns	
Address access time	t_{AA}	-	70	-	85	ns	
Chip select access time	t_{ACS1}	-	70	-	85	ns	
	t_{ACS2}	-	70	-	85	ns	
Output enable to output valid	t_{OE}	-	35	-	45	ns	
Output hold from address change	t_{OH}	10	-	10	-	ns	
LB#,UB# access time	t_{BA}	-	70	-	85	ns	
Chip select to output in low-Z	t_{CLZ}	10	-	10	-	ns	2,3
LB#,UB# enable to low-Z	t_{BLZ}	5	-	5	-	ns	2,3
Output enable to output in low-Z	t_{OLZ}	5	-	5	-	ns	2,3
Chip deselect to output in high-Z	t_{CHZ1}	0	25	0	30	ns	1,2,3
	t_{CHZ2}	0	25	0	30	ns	1,2,3
LB#,UB# disable to high-Z	t_{BHZ}	0	25	0	30	ns	1,2,3
Output disable to output in high-Z	t_{OHZ}	0	25	0	30	ns	1,2,3

Write Cycle

Parameter	Symbol	R1WV3216R**-7S		R1WV3216R**-8S		Unit	Notes
		Min.	Max.	Min.	Max.		
Write cycle time	t_{WC}	70	-	85	-	ns	
Address valid to end of write	t_{AW}	65	-	70	-	ns	
Chip selection to end of write	t_{CW}	65	-	70	-	ns	5
Write pulse width	t_{WP}	55	-	60	-	ns	4
LB#,UB# valid to end of write	t_{BW}	65	-	70	-	ns	
Address setup time	t_{AS}	0	-	0	-	ns	6
Write recovery time	t_{WR}	0	-	0	-	ns	7
Data to write time overlap	t_{DW}	35	-	40	-	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	25	0	30	ns	1,2
Write to output in high-Z	t_{WHZ}	0	25	0	30	ns	1,2

Note 1. t_{CHZ} , t_{OHZ} , t_{WHZ} and t_{BHZ} 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. AT any given temperature and voltage condition, t_{HZ} max is less than t_{LZ} min both for a given device and form device to device.

4. A write occurs during the overlap of a low CS1#, a high CS2, a low WE# and a low LB# or a low UB#.

A write begins at the latest transition among CS1# going low, CS2 going high, WE# going low and LB# going low or UB# going low .

A write ends at the earliest transition among CS1# going high, CS2 going low, WE# going high and LB# going high or UB# going high. t_{WP} is measured from the beginning of write to the end of write.

5. t_{CW} is measured from the later of CS1# going low or CS2 going high to end of write.

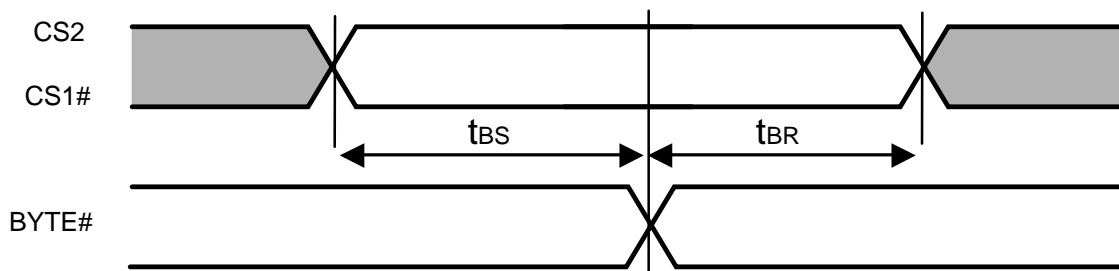
6. t_{AS} is measured the address valid to the beginning of write.

7. t_{WR} is measured from the earliest of CS1# or WE# going high or CS2 going low to the end of write cycle.

Byte enable (supported by only 52-pin μ TSOP)

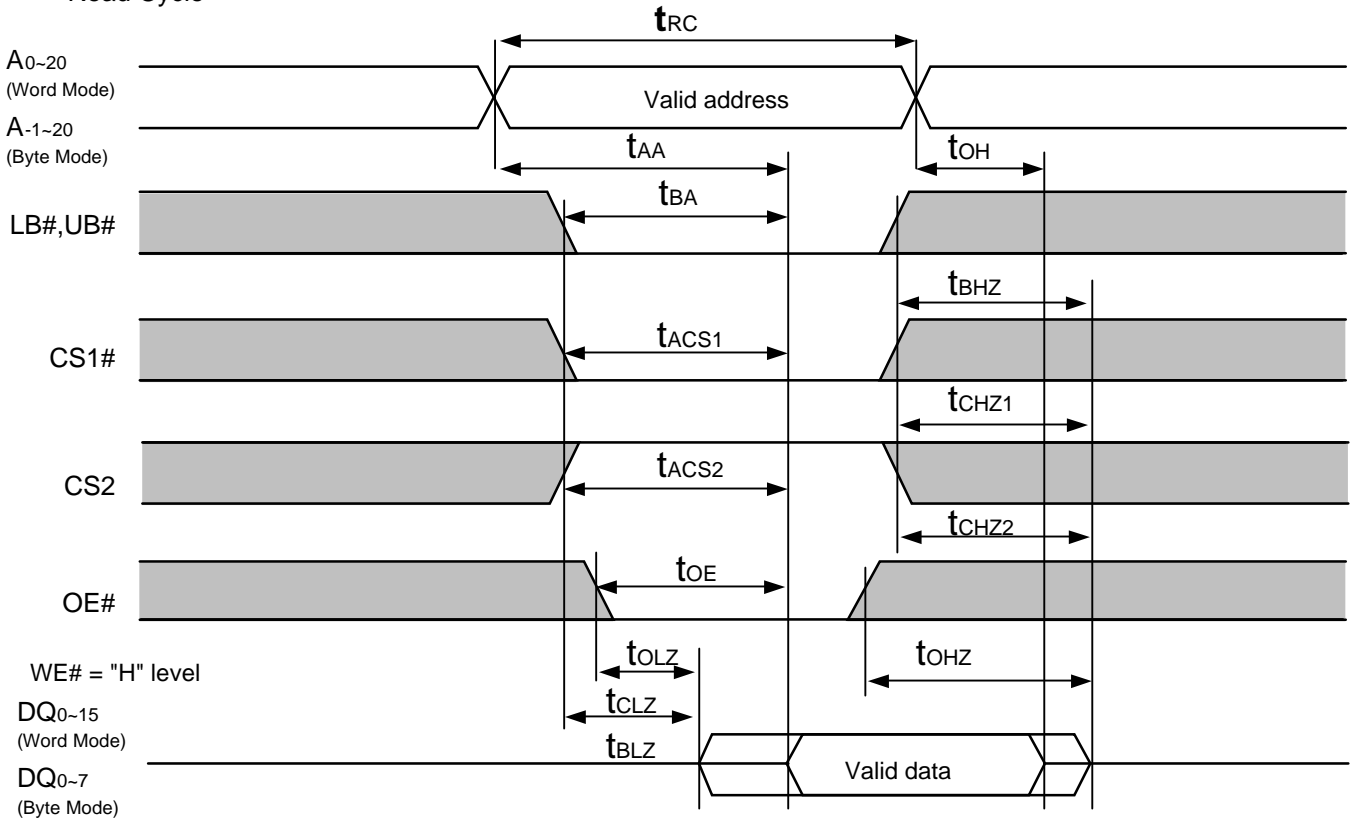
Parameter	Symbol	R1WV3216R**-7S		R1WV3216R**-8S		Unit	Notes
		Min.	Max.	Min.	Max.		
Byte setup time	t_{BS}	5	-	5	-	ms	
Byte recovery time	t_{BR}	5	-	5	-	ms	

BYTE# Timing Waveform

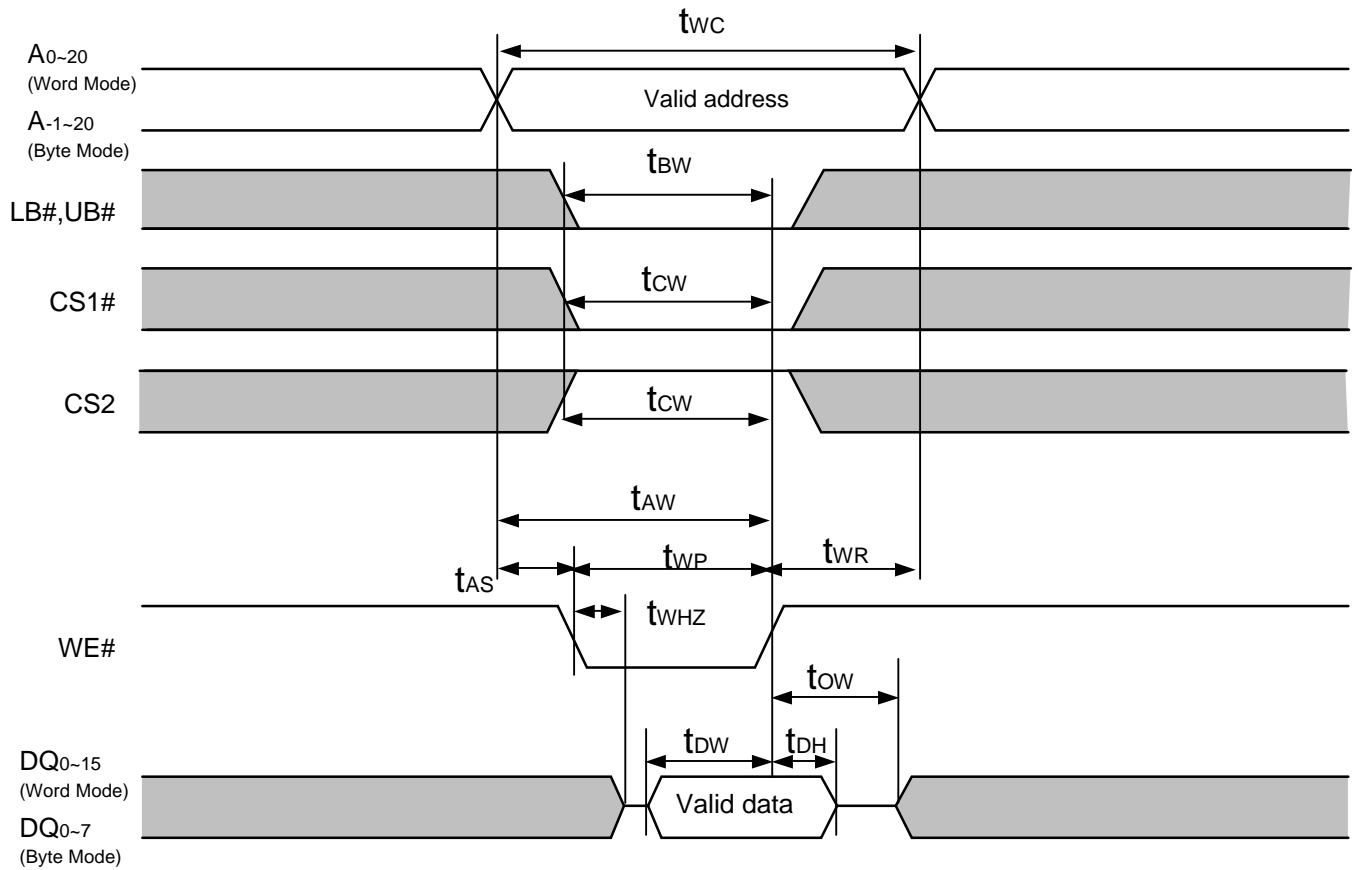


Timing Waveform

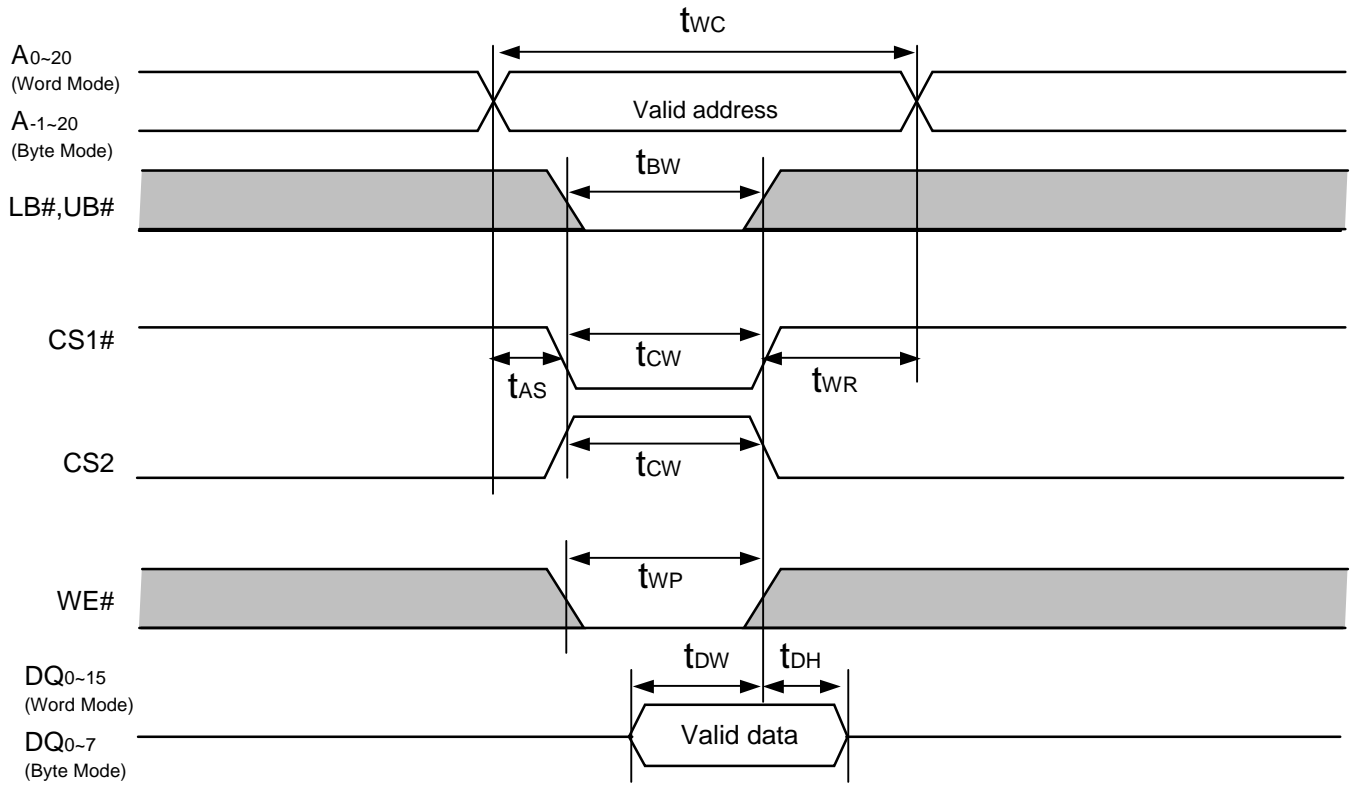
Read Cycle



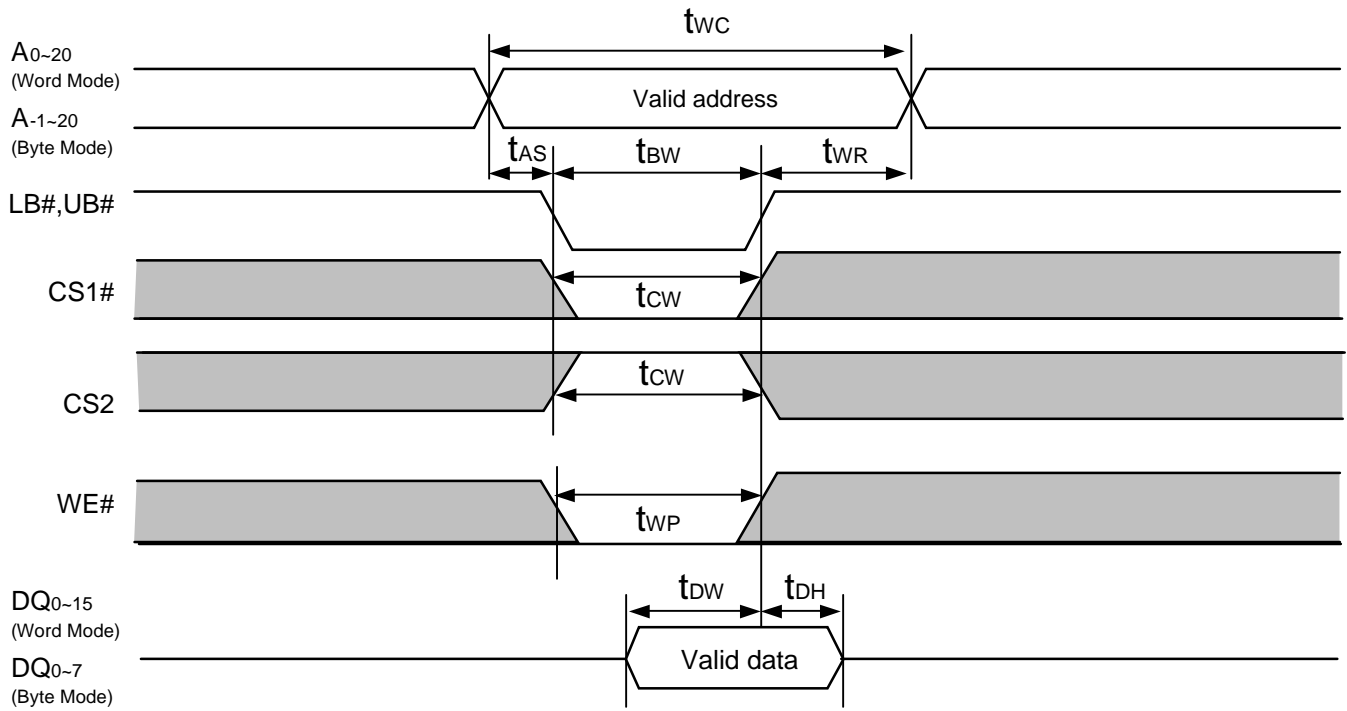
Write Cycle (1) (WE# Clock)



Write Cycle (2) (CS1# ,CS2 Clock, OE#=VIH)



Write Cycle (3) (LB#,UB#Clock, OE#=VIH)

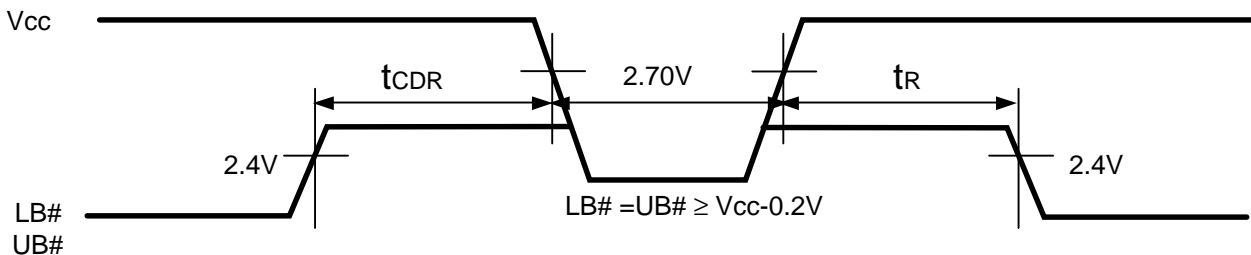


Data Retention Characteristics

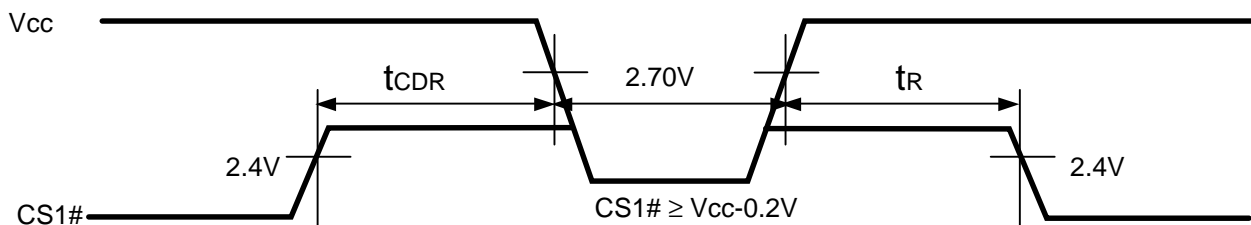
Parameter	Symbol	Min.	Typ.*1	Max.	Unit	Test conditions*2,3
Vcc for data retention	V _{DR}	2.0	-	3.6	V	V _{in} ≥ 0V (1) 0V ≤ CS2 ≤ 0.2V or (2) CS2 ≥ V _{cc} -0.2V, CS1# ≥ V _{cc} -0.2V or (3) LB# =UB# ≥ V _{cc} -0.2V, CS2 ≥ V _{cc} -0.2V, CS1# ≤ 0.2V
Data retention current	I _{CCDR}	-	4	12	μA	~+25°C
		-	7	24	μA	~+40°C
		-	-	50	μA	~+70°C
		-	-	80	μA	~+85°C
						V _{cc} =3.0V, V _{in} ≥0V (1) 0V ≤ CS2 ≤ 0.2V or (2) CS2 ≥ V _{cc} -0.2V, CS1# ≥ V _{cc} -0.2V or (3) LB# =UB# ≥ V _{cc} -0.2V, CS2 ≥ V _{cc} -0.2V, CS1# ≤ 0.2V Average value
Chip deselect to data retention time	t _{CDR}	0	-	-	ns	See retention waveform
Operation recovery time	t _R	5	-	-	ms	

- Note 1. Typical parameter of I_{CCDR} indicates the value for the center of distribution at V_{cc}=3.0V and not 100% tested.
 2. BYTE# pin supported by TSOP type. BYTE# ≥ V_{cc}-0.2V or BYTE# ≤ 0.2V
 3. Also CS2 controls address buffer, WE# buffer, CS1# buffer, OE# buffer, LB#, UB# buffer and Din buffer. If CS2 controls data retention mode, V_{in} levels (address, WE#, OE#, CS1#, LB#, UB#, I/O) can be in the high impedance state. If CS1# controls data retention mode, CS2 must be CS2 ≥ V_{cc}-0.2V or 0V ≤ CS2 ≤ 0.2V. The other input levels (address, WE#, OE#, CS1#, LB#, UB#, I/O) can be in the high impedance state.

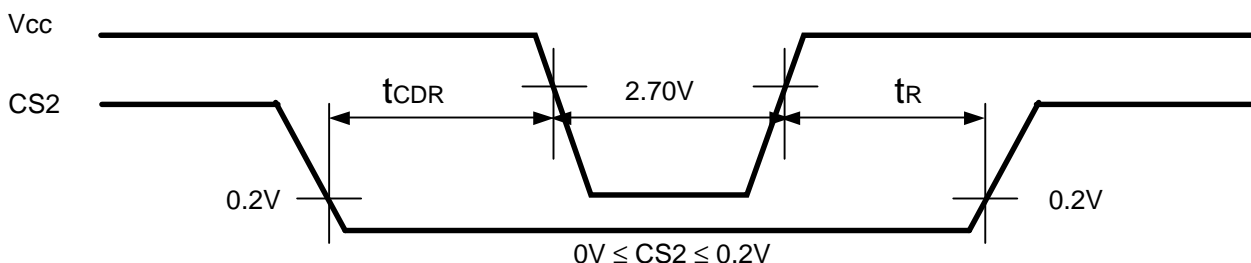
Data Retention timing Waveform (1) (LB#,UB# Controlled)



Data Retention timing Waveform (2) (CS1# Controlled)



Data Retention timing Waveform (3) (CS2 Controlled)



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

Keep safety first in your circuit designs!

1. Renesas Technology Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corporation product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corporation or a third party.
 2. Renesas Technology Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
 3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor for the latest product information before purchasing a product listed herein.
The information described here may contain technical inaccuracies or typographical errors.
Renesas Technology Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
Please also pay attention to information published by Renesas Technology Corporation by various means, including the Renesas Technology Corporation Semiconductor home page (<http://www.renesas.com>).
 4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
 5. Renesas Technology Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
 6. The prior written approval of Renesas Technology Corporation is necessary to reprint or reproduce in whole or in part these materials.
 7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
 8. Please contact Renesas Technology Corporation for further details on these materials or the products contained therein.
-



<http://www.renesas.com>