R1LV1616R Series

16Mb superSRAM (1M wordx16bit)

REJ03C0101-0100Z
Rev.1.00
2004.04.13

Description

The R1LV1616R Series is a family of low voltage 16-Mbit static RAMs organized as 1048576-words by 16-bit, fabricated by Renesas's high-performance 0.15um CMOS and TFT technologies.

The R1LV1616R Series is suitable for memory applications where a simple interfacing , battery operating and battery backup are the important design objectives.

The R1LV1616R 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:2µA (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

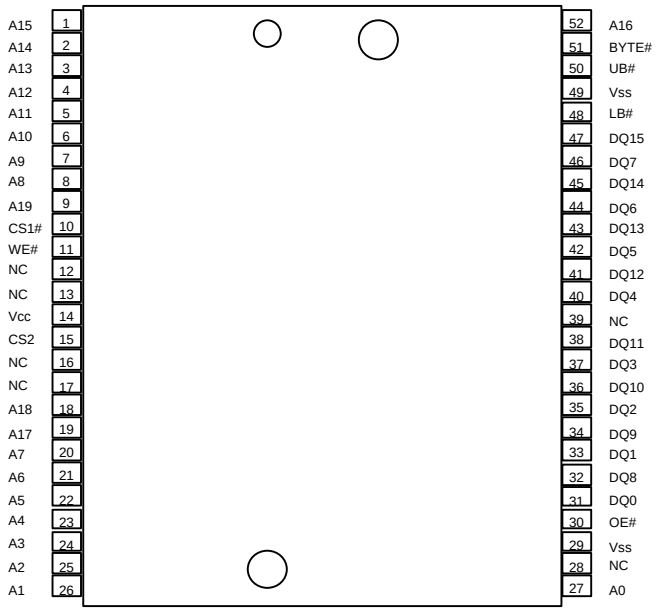
Type No.	Access time	Package
R1LV1616RSD-7S%	70 ns	350-mil 52-pin plastic µ - TSOP(II) (normal-bend type) (52PTG)
R1LV1616RSD-8S%	85 ns	
R1LV1616RBG-7S%	70 ns	7.5mmx8.5mm f-BGA 0.75mm pitch 48ball
R1LV1616RBG-8S%	85 ns	

% - Temperature version; see table below

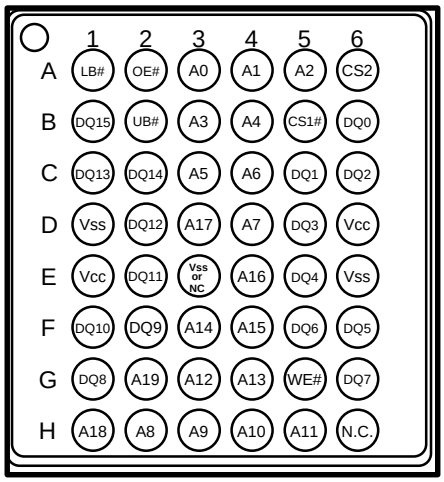
%	Temperature Range
R	0 ~ +70 ºC
W	-20 ~ +85 ºC
I	-40 ~ +85 ºC

Pin Arrangement

52-pin µTSOP



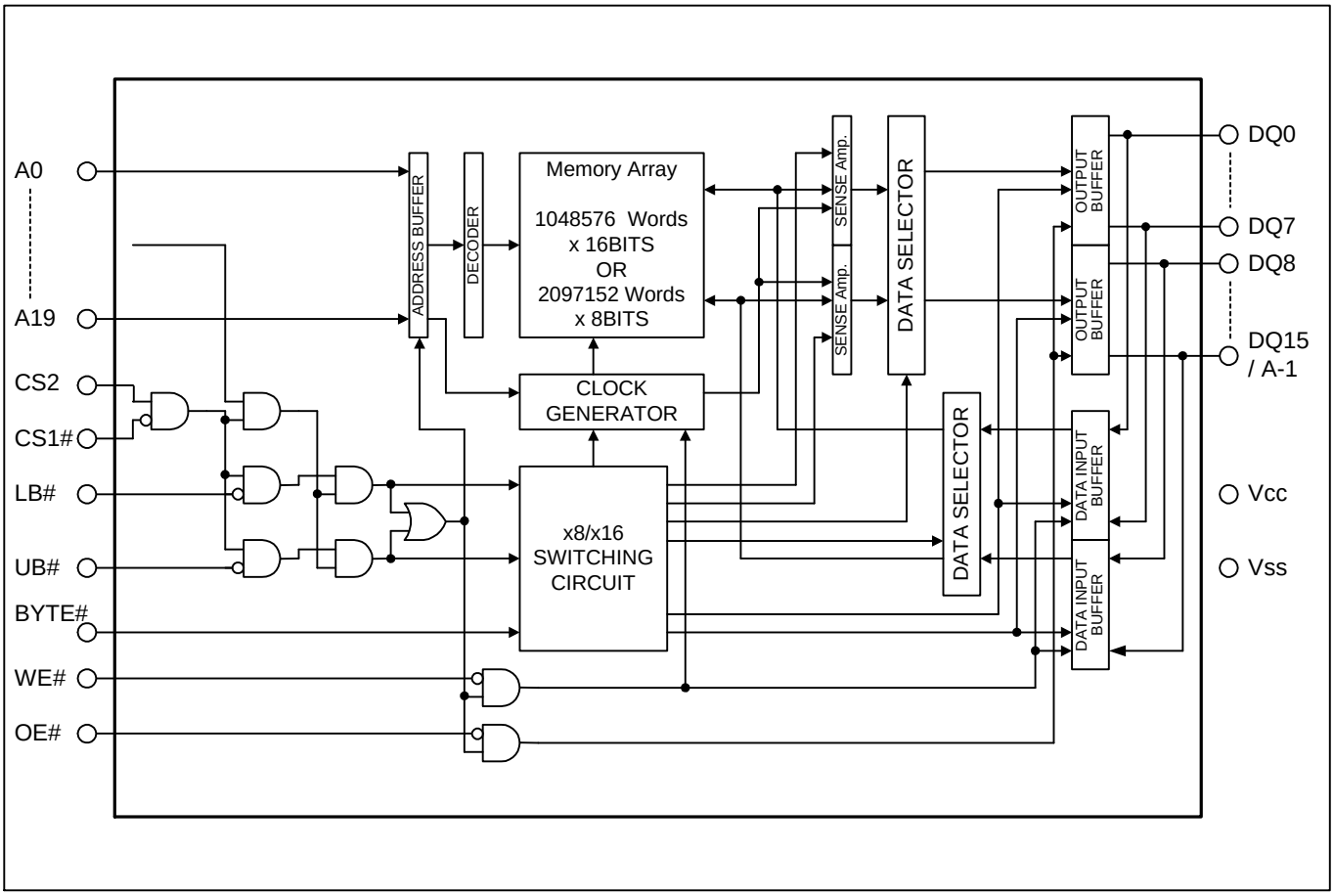
48-pin fBGA



Pin Description

Pin name	Function
A0 to A19	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	Topr	R ver.	0 to +70	ºC
		W ver.	-20 to +85	ºC
		I ver.	-40 to +85	ºC
Storage temperature	Tstg	-65 to +150		ºC
Storage temperature range under bias	Tbias	R ver.	0 to +70	ºC
		W ver.	-20 to +85	ºC
		I ver.	-40 to +85	ºC

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		Vcc	2.7	3.0	3.6	V	
		Vss	0	0	0	V	
Input high voltage		V_{IH}	2.4	-	Vcc+0.2	V	
Input low voltage		V_{IL}	-0.2	-	0.4	V	1
Ambient temperature range	R ver.	Ta	0	-	+70	ºC	2
	W ver.		-20	-	+85	ºC	2
	I ver.		-40	-	+85	ºC	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	Vin=Vss to Vcc	
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},$V_{I/O}$=Vss to Vcc	
Average operating current	I_{CC1}	-	45	55	mA	Min. cycle, duty =100% I I/O = 0 mA, CS1# =V_{IL}, CS2=V_{IH} Others = V_{IH} / V_{IL}	
	I_{CC2} Write	-	15	20	mA	Cycle time = 1 µs, I I/O = 0 mA, CS1#≤ 0.2V, CS2 ≥ Vcc-0.2V V_{IH} ≥ Vcc-0.2V , V_{IL} ≤ 0.2V, Write & Read duty=100% respectively	
	I_{CC2} Read	-	10	15	mA		
Standby current	I_{SB}	-	0.1	0.3	mA	CS2=V_{IL}	
Standby current	I_{SB1}	-	2	6	µA	~+25ºC	V in ≥ 0V (1) 0V≤CS2≤0.2V or (2) CS2≥Vcc-0.2V, CS1# ≥Vcc-0.2V or (3)LB# =UB# ≥Vcc-0.2V, CS2≥Vcc-0.2V, CS1# ≤0.2V Average value
		-	4	12	µA	~+40ºC	
		-	-	25	µA	~+70ºC	
		-	-	40	µA	~+85ºC	
Output hige 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 (Ta= 25ºC), and not 100% tested.
2. BYTE# pin supported by only TSOP type.
BYTE# ≥ Vcc-0.2V or BYTE# ≤ 0.2V

Capacitance

(Ta = +25ºC, f =1MHz)

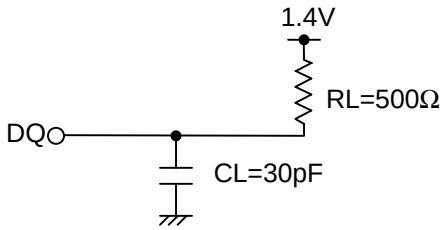
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	Note
Input capacitance	C in	-	-	10	pF	V in = 0V	1
Input / output capacitance	C I/O	-	-	10	pF	V I/O = 0V	1

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

AC Characteristics

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

- 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	R1LV1616R**-7S		R1LV1616R**-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	R1LV1616R**-7S		R1LV1616R**-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

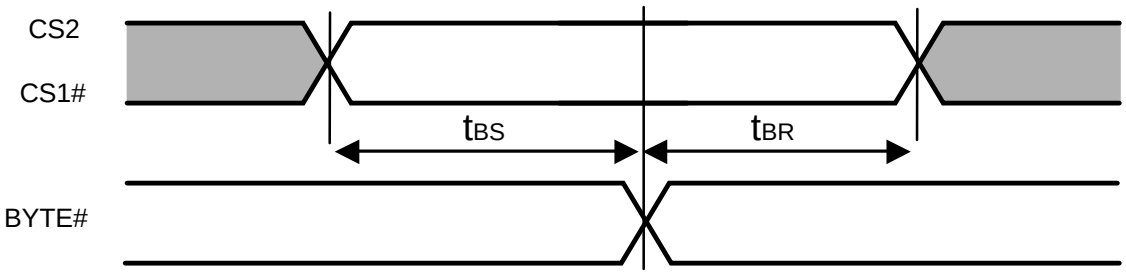
Note1. t_{CHZ}, t_{OHZ}, t_{WHZ} and t_{BHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.

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 µTSOP)

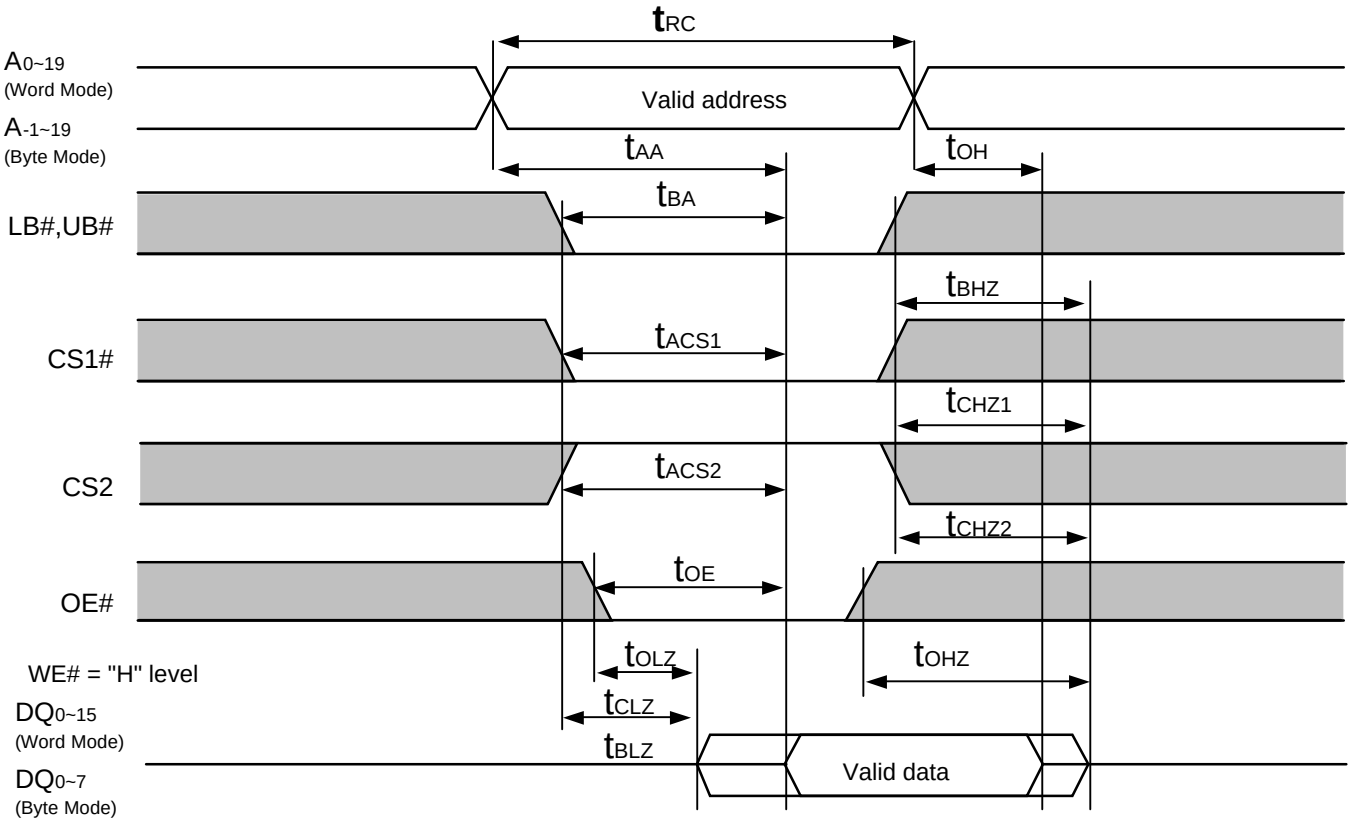
Parameter	Symbol	R1LV1616R**-7S		R1LV1616R**-8S		Unit	Notes
		Min.	Max.	Min.	Max.		
Byte setup time	t_{BS}	5	-	5	-	ms	
Byte recovery time	t_{BR}	5	-	5	-	ms	

BYTE# Timing Waveform

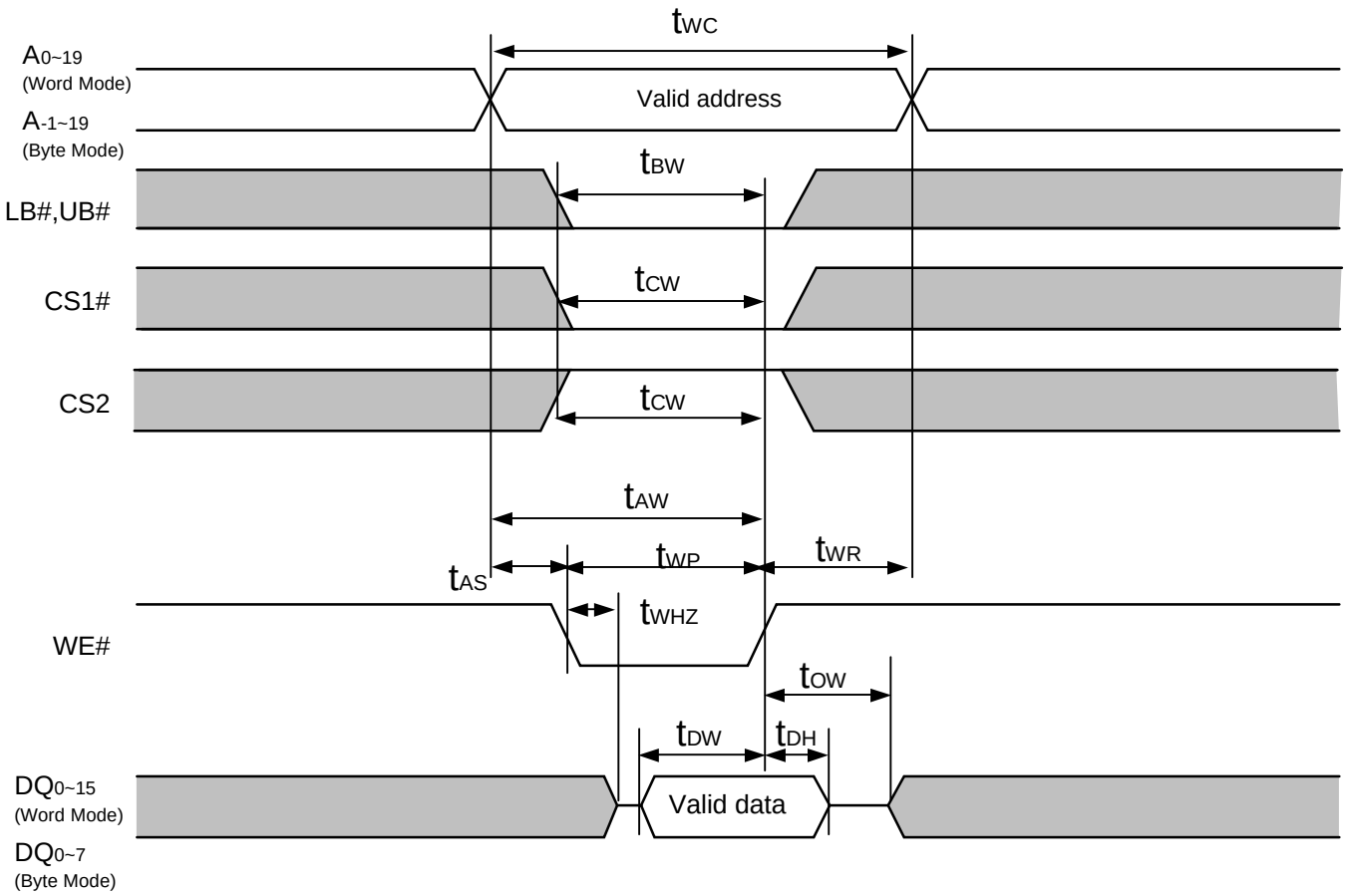


Timing Waveform

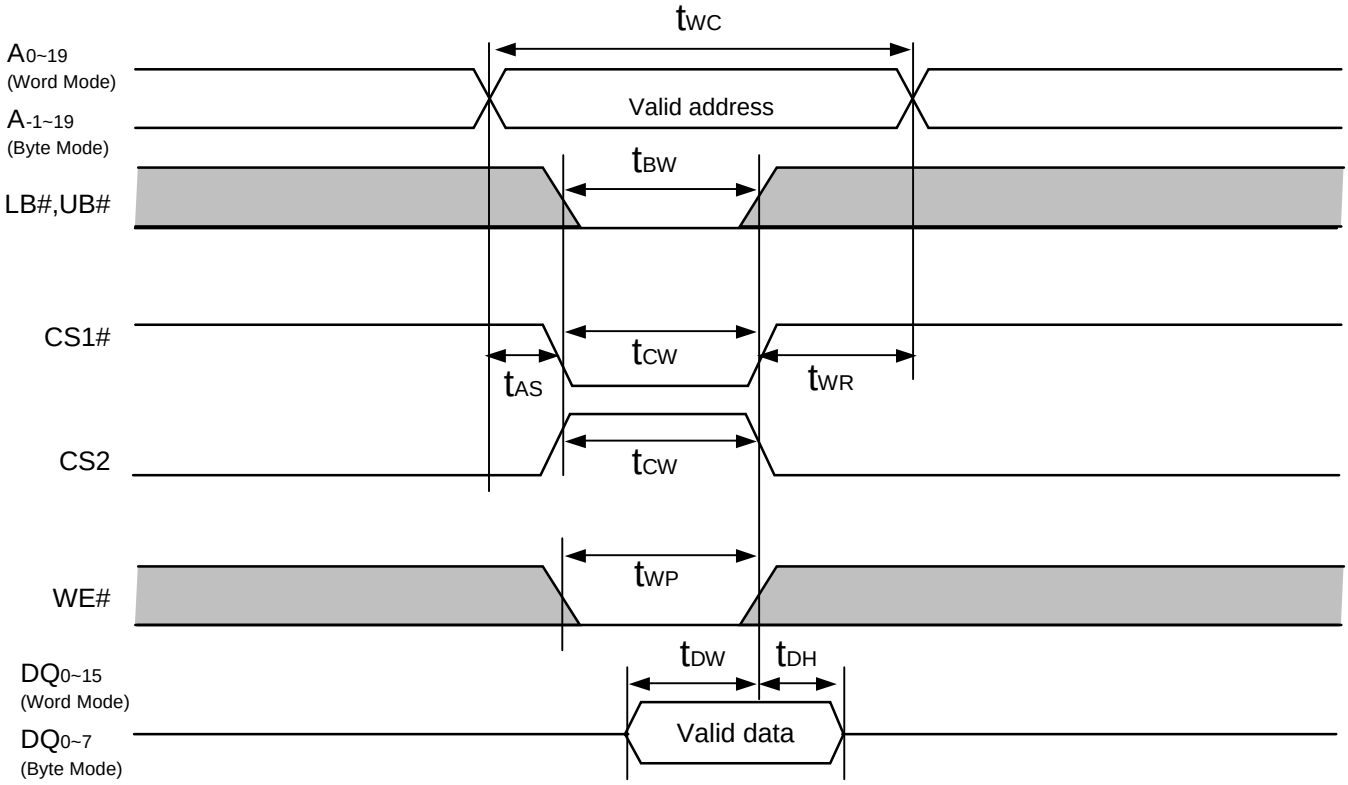
Read Cycle



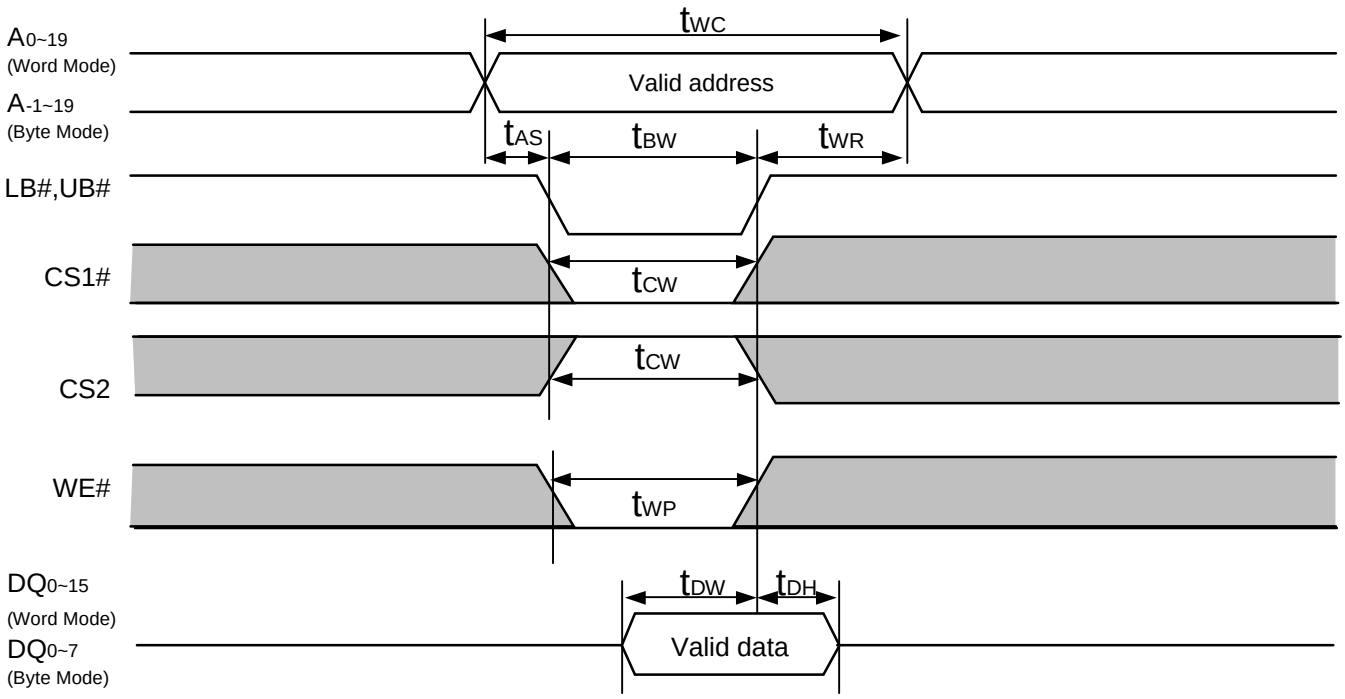
Write Cycle (1) (WE# Clock)



Write Cycle (2) (CS1# ,CS2 Clock, OE#=V_{IH})



Write Cycle (3) (LB#,UB# Clock, OE#=V_{IH})

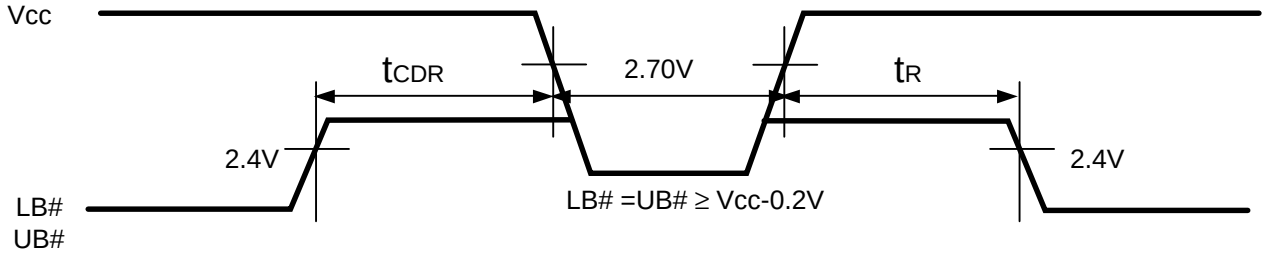


Data Retention Characteristics

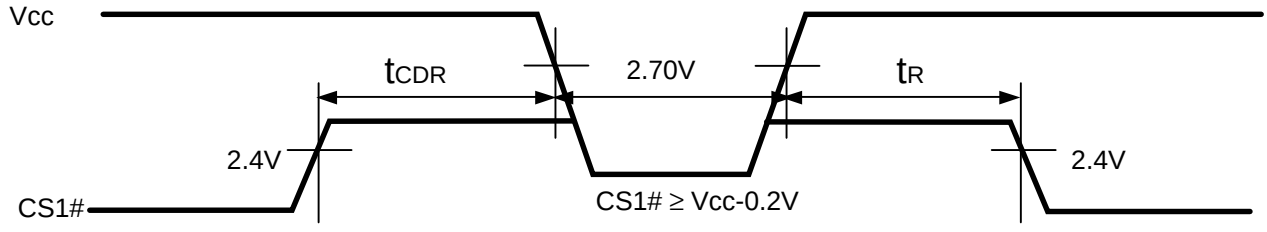
Parameter	Symbol	MIn.	Typ.*1	Max.	Unit	Test conditions*2,3	
Vcc for data retention	V_{DR}	2.0	-	3.6	V	V in ≥ 0V (1) 0V ≤ CS2 ≤ 0.2V or (2) CS2 ≥ Vcc-0.2V, CS1# ≥ Vcc-0.2V or (3) LB# =UB# ≥ Vcc-0.2V, CS2 ≥ Vcc-0.2V, CS1# ≤ 0.2V	
Data retention current	I_{CCDR}	-	2	6	µA	~+25ºC	Vcc=3.0V,Vin≥0V (1) 0V ≤ CS2 ≤ 0.2V or (2) CS2 ≥ Vcc-0.2V, CS1# ≥ Vcc-0.2V or (3) LB# =UB# ≥Vcc-0.2V, CS2 ≥ Vcc-0.2V, CS1# ≤ 0.2V Average value
		-	4	12	µA	~+40ºC	
		-	-	25	µA	~+70ºC	
		-	-	40	µA	~+85ºC	
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 Vcc=3.0V and not 100% tested.
2. BYTE# pin supported by TSOP type. BYTE# ≥ Vcc-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,Vin 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 ≥ Vcc-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.

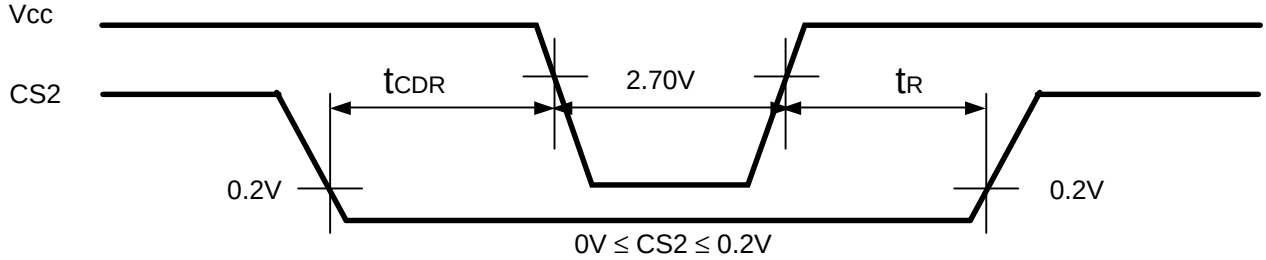
Data Retention timing Waveform (1) (LB#,UB# Controlled)



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



Data Retention timing Waveform (3) (CS2 Controlled)



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