NEC

MOS INTEGRATED CIRCUIT
μPD4664312-X

64M-BIT CMOS MOBILE SPECIFIED RAM
4M-WORD BY 16-BIT
EXTENDED TEMPERATURE OPERATION

Description

The μPD4664312-X is a high speed, low power, 67,108,864 bits (4,194,304 words by 16 bits) CMOS Mobile Specified RAM featuring Low Power Static RAM compatible function and pin configuration.

The μPD4664312-X is fabricated with advanced CMOS technology using one-transistor memory cell.

The μPD4664312-X is packed in 93-pin TAPE FBGA.

Features

- 4,194,304 words by 16 bits organization
- ★ • Fast access time: 65, 75 ns (MAX.)
- ★ • Fast page access time: 18, 25 ns (MAX.)
- Byte data control: /LB (I/O0 to I/O7), /UB (I/O8 to I/O15)
- ★ • Low voltage operation: 2.7 to 3.1 V (-B65X)
- ★ 2.7 to 3.1 V (Chip), 1.65 to 2.1 V (I/O) (-BE75X)
- Operating ambient temperature: T_A = –25 to +85 °C
- Output Enable input for easy application
- Chip Enable input: /CS pin
- Standby Mode input: MODE pin
- Standby Mode1: Normal standby (Memory cell data hold valid)
- Standby Mode2: Density of memory cell data hold is variable

	μPD4664312	Access time ns (MAX.)	Operating supply voltage V		Operating ambient temperature °C	Supply current					
						At operating mA (MAX.)	At standby μA (MAX.) Density of data hold				
			Chip	I/O			64M bits	16M bits	8M bits	4M bits	0M bit
★	-B65X	65	2.7 to 3.1	–	–25 to +85	45	100	60	50	45	10
★	-BE75X Note	75	2.7 to 3.1	1.65 to 2.1		40					

Note Under development

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

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The mark ★ shows major revised points.

★ Ordering Information

Part number	Package	Access time ns (MAX.)	Operating supply voltage V		Operating temperature °C
			Chip	I/O	
μPD4664312F9-B65X-CR2	93-pin TAPE FBGA (12 x 9)	65	2.7 to 3.1	–	–25 to +85
μPD4664312F9-BE75X-CR2 Note		75	2.7 to 3.1	1.65 to 2.1	

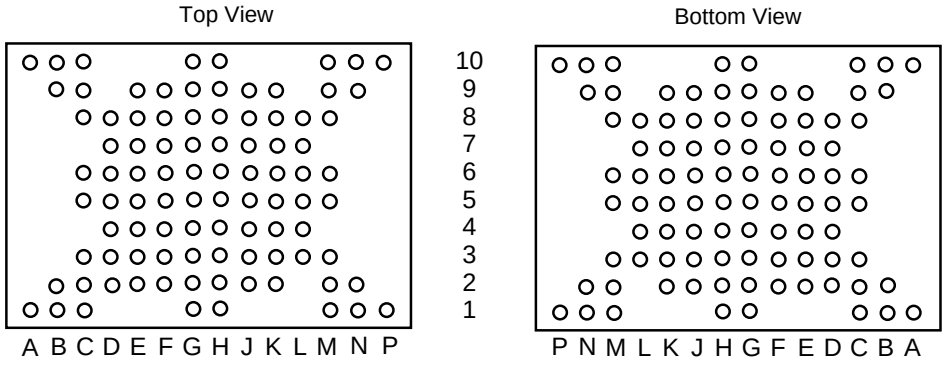
Note Under development

Pin Configurations

/xxx indicates active low signal.

93-pin TAPE FBGA (12 x 9)

★ **[μPD4664312F9-B65X-CR2]**



Top View

	A	B	C	D	E	F	G	H	J	K	L	M	N	P
10	NC	NC	NC				NC	NC				NC	NC	NC
9		NC	NC		A15	A21	NC	A16	NC	GND		NC	NC	
8			NC	A11	A12	A13	A14	NC	I/O15	I/O7	I/O14	NC		
7				A8	A19	A9	A10	I/O6	I/O13	I/O12	I/O5			
6			NC	/WE	MODE	A20	NC	NC	I/O4	V_{CC}	NC	NC		
5			NC	NC	NC	NC	NC	NC	I/O3	NC	I/O11	NC		
4				/LB	/UB	A18	A17	I/O1	I/O9	I/O10	I/O2			
3			NC	A7	A6	A5	A4	GND	/OE	I/O0	I/O8	NC		
2		NC	NC	NC	A3	A2	A1	A0	NC	/CS		NC	NC	
1	NC	NC	NC				NC	NC				NC	NC	NC

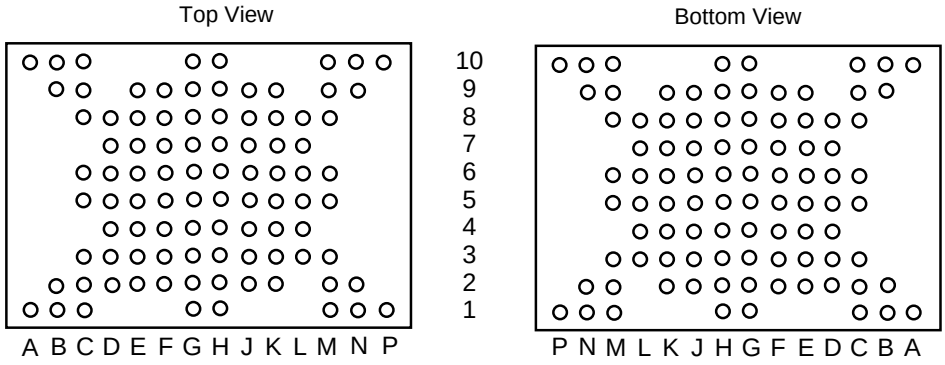
A0 to A21	: Address inputs	/LB, /UB	: Byte data select
I/O0 to I/O15	: Data inputs / outputs	V_{CC}	: Power supply
/CS	: Chip Select	GND	: Ground
MODE	: Standby mode	NC [Note]	: No Connection
/WE	: Write enable		
/OE	: Output enable		

Note Some signals can be applied because this pin is not internally connected.

Remarks Refer to **Package Drawing** for the index mark.

93-pin TAPE FBGA (12 x 9)

★ **[μPD4664312F9-BE75X-CR2]**



Top View

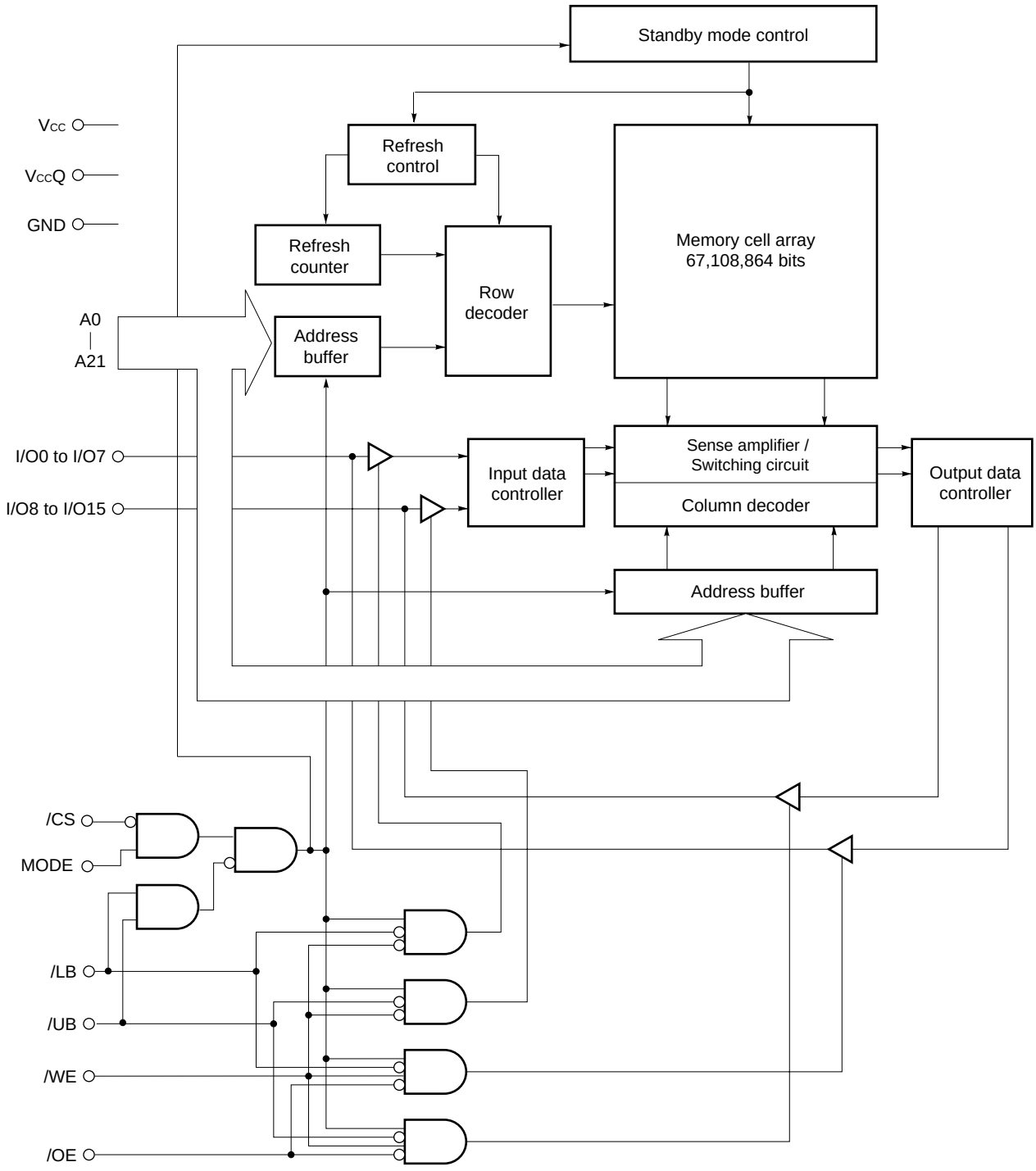
	A	B	C	D	E	F	G	H	J	K	L	M	N	P
10	NC	NC	NC				NC	NC				NC	NC	NC
9		NC	NC		A15	A21	NC	A16	NC	GND		NC	NC	
8			NC	A11	A12	A13	A14	NC	I/O15	I/O7	I/O14	NC		
7				A8	A19	A9	A10	I/O6	I/O13	I/O12	I/O5			
6			NC	/WE	MODE	A20	NC	NC	I/O4	V_{CC}	$V_{CC}Q$	NC		
5			NC	NC	NC	NC	NC	NC	I/O3	NC	I/O11	NC		
4				/LB	/UB	A18	A17	I/O1	I/O9	I/O10	I/O2			
3			NC	A7	A6	A5	A4	GND	/OE	I/O0	I/O8	NC		
2		NC	NC	NC	A3	A2	A1	A0	NC	/CS		NC	NC	
1	NC	NC	NC				NC	NC				NC	NC	NC

A0 to A21	: Address inputs	/LB, /UB	: Byte data select
I/O0 to I/O15	: Data inputs / outputs	V_{CC}	: Power supply
/CS	: Chip Select	$V_{CC}Q$	: Input / Output power supply
MODE	: Standby mode	GND	: Ground
/WE	: Write enable	NC [Note]	: No Connection
/OE	: Output enable		

Note Some signals can be applied because this pin is not internally connected.

Remarks Refer to **Package Drawing** for the index mark.

Block Diagram



★ **Remark** VccQ is the input / output power supply for -BE75X.

Truth Table

/CS	MODE	/OE	/WE	/LB	/UB	Mode	I/O		Supply current
							I/O0 to I/O7	I/O8 to I/O15	
H	H	×	×	×	×	Not selected (Standby Mode 1)	High-Z	High-Z	I_{SB1}
×	H	×	×	H	H	Not selected (Standby Mode 1)	High-Z	High-Z	
×	L	×	×	×	×	Not selected (Standby Mode 2) **Note**	High-Z	High-Z	I_{SB2}
L	H	H	H	×	×	Output disable	High-Z	High-Z	I_{CCA}
		L	H	L	L	Word read	D_{OUT}	D_{OUT}	
				L	H	Lower byte read	D_{OUT}	High-Z	
				H	L	Upper byte read	High-Z	D_{OUT}	
		H	L	L	L	Word write	D_{IN}	D_{IN}	
				L	H	Lower byte write	D_{IN}	High-Z	
				H	L	Upper byte write	High-Z	D_{IN}	

Note MODE pin must be fixed to high level except Standby Mode 2. (refer to **2.3 Standby Mode Status Transition**).

Remark ×: V_{IH} or V_{IL}, H: V_{IH}, L: V_{IL}

CONTENTS

1. Initialization

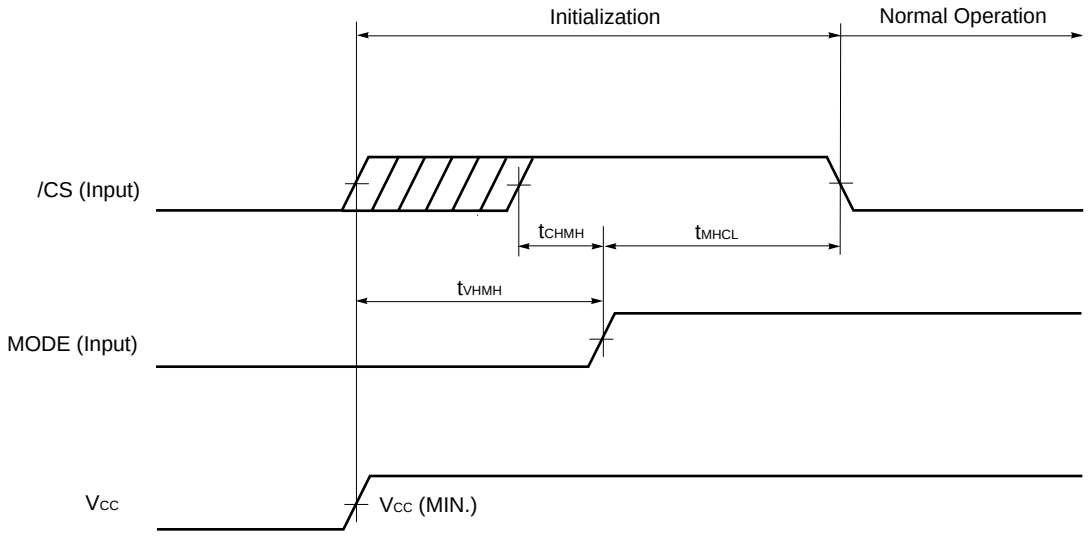
Initialize the μPD4664312-X at power application using the following sequence to stabilize internal circuits.

(1) Following power application, make MODE high level after fixing MODE to low level for the period of t_{VHMH}. Make /CS high level before making MODE high level.

(2) /CS and MODE are fixed to high level for the period of t_{MHCL}.

Normal operation is possible after the completion of initialization.

Figure1-1. Initialization Timing Chart



Cautions 1. Make MODE low level when starting the power supply.

2. t_{VHMH} is specified from when the power supply voltage reaches the prescribed minimum value (V_{CC} (MIN.)).

2. Partial Refresh

2.1 Standby Mode

In addition to the regular standby mode (Standby Mode 1) with a 64M bits density, Standby Mode 2, which performs partial refresh, is also provided.

2.2 Density Switching

In Standby Mode 2, the densities that can be selected for performing refresh are 16M bits, 8M bits, 4M bits, and 0M bit.

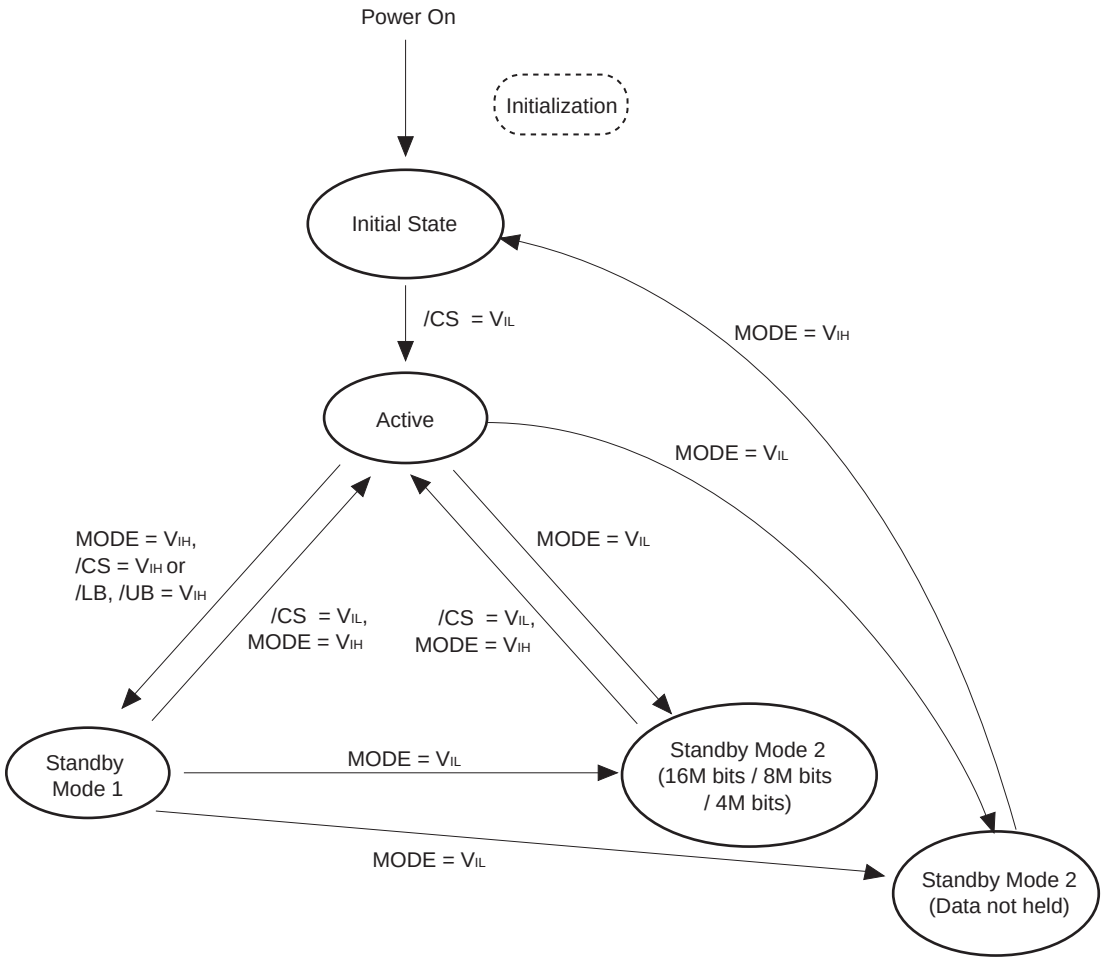
The density for performing refresh can be set with the mode register. Once the refresh density has been set in the mode register, these settings are retained until they are set again, while applying the power supply. However, the mode register setting will become undefined if the power is turned off, so set the mode register again after power application. (For how to perform mode register settings, refer to section **4. Mode Register Settings**.)

2.3 Standby Mode Status Transition

In Standby Mode 1, MODE and /CS are high level, or MODE, /LB and /UB are high level. In Standby Mode 2, MODE is low level. In Standby Mode 2, if 0M bit is set as the density, it is necessary to perform initialization the same way as after applying power, in order to return to normal operation from Standby Mode 2. When the density has been set to 16M bits, 8M bits, or 4M bits in Standby Mode 2, it is not necessary to perform initialization to return to normal operation from Standby Mode 2.

For the timing charts, refer to **Figure 6-14. Standby Mode 2 (data hold: 16M bits / 8M bits / 4M bits) Entry / Exit Timing Chart**, **Figure 6-15. Standby Mode 2 (data not held) Entry / Exit Timing Chart**.

Figure 2-1. Standby Mode State Machine



2.4 Addresses for Which Partial Refresh Is Supported

Data hold density	Correspondence address
16M bits	000000H to 0FFFFFH
8M bits	000000H to 07FFFFH
4M bits	000000H to 03FFFFH

3. Page Read Operation

3.1 Features of Page Read Operation

Features	8 Words Mode
Page length	8 words
Page read-corresponding addresses	A2, A1, A0
Page read start address	Don't care
Page direction	Don't care
Interrupt during page read operation	Enabled [Note]

Note An interrupt is output when /CS = H or in case A3 or a higher address changes.

3.2 Page Length

8 words is supported as the page lengths.

3.3 Page-Corresponding Addresses

The page read-enabled addresses are A2, A1, and A0. Fix addresses other than A2, A1, and A0 during page read operation.

3.4 Page Start Address

Since random page read is supported, any address (A2, A1, A0) can be used as the page read start address.

3.5 Page Direction

Since random page read is possible, there is not restriction on the page direction.

3.6 Interrupt during Page Read Operation

When generating an interrupt during page read, either make /CS high level or change A3 and higher addresses.

3.7 When page read is not used

Since random page read is supported, even when not using page read, random access is possible as usual.

4. Mode Register Settings

The partial refresh density can be set using the mode register. Since the initial value of the mode register at power application is undefined, be sure to set the mode register after initialization at power application. When setting the density of partial refresh, data before entering the partial refresh mode is not guaranteed. (This is the same for re-setup.) However, since partial refresh mode is not entered unless MODE = L when partial refresh is not used, it is not necessary to set the mode register. Moreover, when using page read without using partial refresh, it is not necessary to set the mode register.

4.1 Mode Register Setting Method

The mode register setting mode can be entered by successively writing two specific data after two continuous reads of the highest address (3FFFFFH). The mode register setting is a continuous four-cycle operation (two read cycles and two write cycles).

Commands are written to the command register. The command register is used to latch the addresses and data required for executing commands, and it does not have an exclusive memory area.

For the timing chart and flow chart, refer to **Figure 6-12. Mode Register Setting Timing Chart**, **Figure 6-13. Mode Register Setting Flow Chart**.

Table 4-1. shows the commands and command sequences.

Table 4-1. Command sequence

Command sequence	1st bus cycle (Read cycle)		2nd bus cycle (Read cycle)		3rd bus cycle (Write cycle)		4th bus cycle (Write cycle)	
Partial refresh density	Address	Data	Address	Data	Address	Data	Address	Data
16M bits	3FFFFFH	–	3FFFFFH	–	3FFFFFH	00H	3FFFFFH	04H
8M bits	3FFFFFH	–	3FFFFFH	–	3FFFFFH	00H	3FFFFFH	05H
4M bits	3FFFFFH	–	3FFFFFH	–	3FFFFFH	00H	3FFFFFH	06H
0M bit	3FFFFFH	–	3FFFFFH	–	3FFFFFH	00H	3FFFFFH	07H

4th bus cycle (Write cycle)

I/O	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Mode Register setting	0	0	0	0	0	0	0	0	0	0	0	0	0	PL	PD	

Page length	1	8 words

	I/O1	I/O0	Density
Partial refresh density	0	0	16M bits
	0	1	8M bits
	1	0	4M bits
	1	1	0M bit

4.2 Cautions for Setting Mode Register

Since, for the mode register setting, the internal counter status is judged by toggling /CS and /OE, toggle /CS at every cycle during entry (read cycle twice, write cycle twice), and toggle /OE like /CS at the first and second read cycles.

If incorrect addresses or data are written, or if addresses or data are written in the incorrect order, the setting of the mode register is not performed correctly.

When the highest address (3FFFFFH) is read consecutively three or more times, the mode register setting entries are not performed correctly. (Immediately after the highest address is read, the setting of the mode register is not performed correctly.) Perform the setting of the mode register after power application or after accessing other than the highest address.

Once the refresh density has been set in the mode register, these settings are retained until they are set again, while applying the power supply. However, the mode register setting will become undefined if the power is turned off, so set the mode register again after power application.

For the timing chart and flow chart, refer to **Figure 6-12. Mode Register Setting Timing Chart**, **Figure 6-13. Mode Register Setting Flow Chart**.

5. Electrical Specifications

Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating		Unit
★			-B65X	-BE75X	
Supply voltage	V_{CC}		–0.5 Note to +4.0	–0.5 Note to +4.0	V
Input / Output supply voltage	V_{CCQ}		–	–0.5 Note to +4.0	V
Input / Output voltage	V_T		–0.5 Note to V_{CC} + 0.4 (4.0 V MAX.)	–0.5 Note to V_{CCQ} + 0.4 (4.0 V MAX.)	V
Operating ambient temperature	T_A		–25 to +85	–25 to +85	°C
Storage temperature	T_{stg}		–55 to +125	–55 to +125	°C

Note –1.0 V (MIN.) (Pulse width: 30 ns)

Caution Exposing the device to stress above those listed in Absolute Maximum Rating could cause permanent damage. The device is not meant to be operated under conditions outside the limits described in the operational section of this specification. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

★	Parameter	Symbol	Condition	-B65X		-BE75X		Unit
				MIN.	MAX.	MIN.	MAX.	
★	Supply voltage	V_{CC}		2.7	3.1	2.7	3.1	V
	Input / Output supply voltage	V_{CCQ}		–	–	1.65	2.1	V
	High level input voltage	V_{IH}		0.8V_{CC}	V_{CC}+0.3	0.8V_{CCQ}	V_{CCQ}+0.3	V
	Low level input voltage	V_{IL}		–0.3 Note	0.2V_{CC}	–0.3 Note	0.2V_{CCQ}	V
	Operating ambient temperature	T_A		–25	+85	–25	+85	°C

Note –0.5 V (MIN.) (Pulse width: 30 ns)

Capacitance (T_A = 25°C, f = 1 MHz)

Parameter	Symbol	Test condition	MIN.	TYP.	MAX.	Unit
Input capacitance	C_{IN}	V_{IN} = 0 V			8	pF
Input / Output capacitance	$C_{I/O}$	$V_{I/O}$ = 0 V			10	pF

Remarks 1. V_{IN}: Input voltage, $V_{I/O}$: Input / Output voltage

2. These parameters are not 100% tested.

DC Characteristics (Recommended Operating Conditions Unless Otherwise Noted) (1/2)

★

Parameter	Symbol	Test condition	Density of data hold	-B65X			Unit
				MIN.	TYP.	MAX.	
Input leakage current	I_{LI}	V_{IN} = 0 V to V_{CC}		–1.0		+1.0	μA
I/O leakage current	I_{LO}	$V_{I/O}$ = 0 V to V_{CC}, /CS = V_{IH} or /WE = V_{IL} or /OE = V_{IH}		–1.0		+1.0	μA
Operating supply current	I_{CCA}	/CS = V_{IL}, Minimum cycle time, $I_{I/O}$ = 0 mA				45	mA
Standby supply current	I_{SB1}	/CS ≥ V_{CC} – 0.2 V, MODE ≥ V_{CC} – 0.2 V	64M bits		60	100	μA
	I_{SB2}	/CS ≥ V_{CC} – 0.2 V, MODE ≤ 0.2 V	16M bits		50	60	
			8M bits		45	50	
			4M bits		40	45	
			0M bit			10	
High level output voltage	V_{OH}	I_{OH} = –0.5 mA		0.8V_{CC}			V
Low level output voltage	V_{OL}	I_{OL} = 1 mA				0.2V_{CC}	V

Remark V_{IN}: Input voltage, $V_{I/O}$: Input / Output voltage

DC Characteristics (Recommended Operating Conditions Unless Otherwise Noted) (2/2)

★

Parameter	Symbol	Test condition	Density of data hold	-BE75X			Unit
				MIN.	TYP.	MAX.	
Input leakage current	I_{LI}	V_{IN} = 0 V to $V_{CC}Q$		–1.0		+1.0	μA
I/O leakage current	I_{LO}	$V_{I/O}$ = 0 V to $V_{CC}Q$, /CS = V_{IH} or /WE = V_{IL} or /OE = V_{IH}		–1.0		+1.0	μA
★ Operating supply current	I_{CCA}	/CS = V_{IL}, Minimum cycle time, $I_{I/O}$ = 0 mA				40	mA
Standby supply current	I_{SB1}	/CS ≥ V_{CC} – 0.2 V, MODE ≥ V_{CC} – 0.2 V	64M bits		60	100	μA
	I_{SB2}	/CS ≥ V_{CC} – 0.2 V, MODE ≤ 0.2 V	16M bits		50	60	
			8M bits		45	50	
			4M bits		40	45	
			0M bit			10	
High level output voltage	V_{OH}	I_{OH} = –0.5 mA		0.8$V_{CC}Q$			V
Low level output voltage	V_{OL}	I_{OL} = 1 mA				0.2$V_{CC}Q$	V

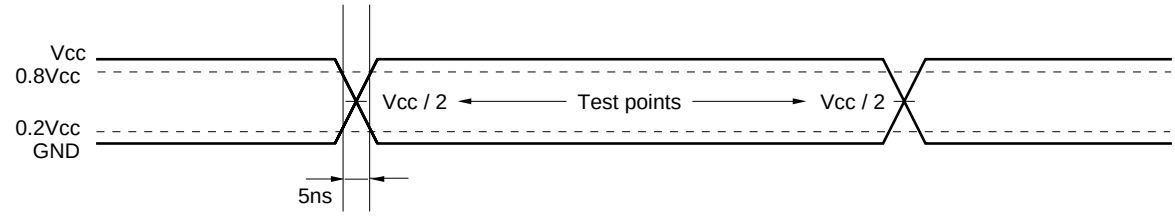
Remark V_{IN}: Input voltage, $V_{I/O}$: Input / Output voltage

AC Characteristics (Recommended Operating Conditions Unless Otherwise Noted)

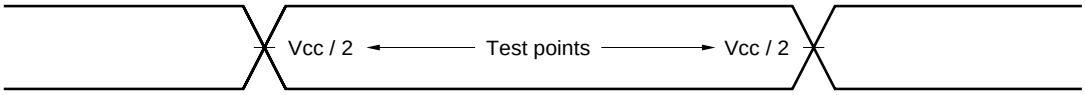
AC Test Conditions

★ **[-B65X]**

Input Waveform (Rise and Fall Time ≤ 5 ns)

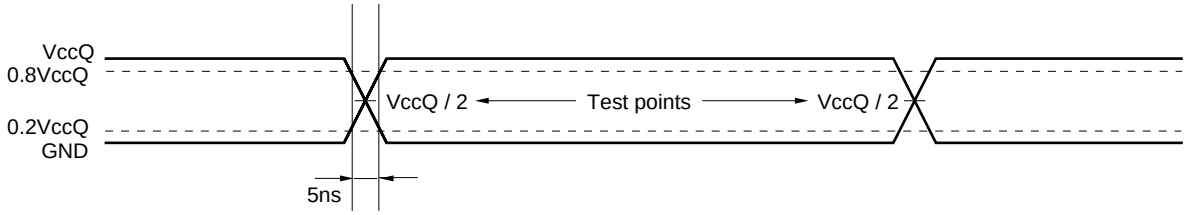


Output Waveform

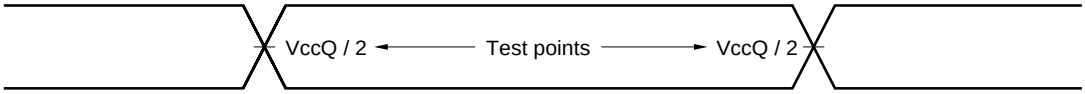


★ **[-BE75X]**

Input Waveform (Rise and Fall Time ≤ 5 ns)



Output Waveform



Output Load

AC characteristics directed with the note should be measured with the output load shown in Figure 5-1, Figure 5-2.

Figure 5-1.

★ **[-B65X]**

C_L: 30 pF

5 pF (t_{CLZ}, t_{OLZ}, t_{BLZ}, t_{CHZ}, t_{OHZ}, t_{BHZ})

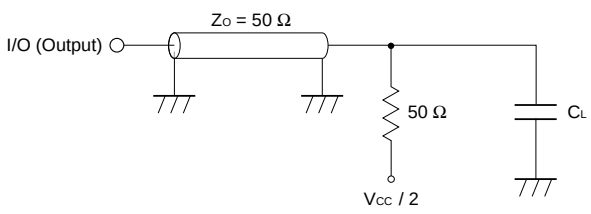
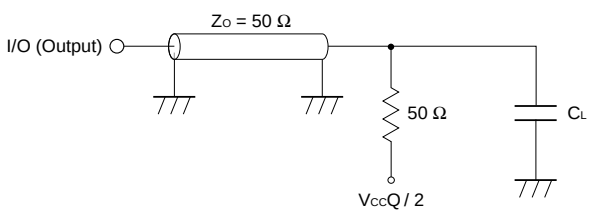


Figure 5-2.

[-BE75X]

C_L: 30 pF

5 pF (t_{CLZ}, t_{OLZ}, t_{BLZ}, t_{CHZ}, t_{OHZ}, t_{BHZ})



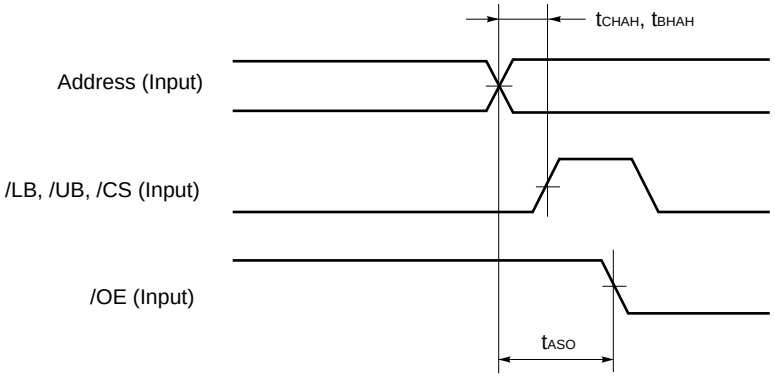
Read Cycle

	Parameter	Symbol	-B65X		-BE75X		Unit	Note
			MIN.	MAX.	MIN.	MAX.		
	Read cycle time	t_{RC}	65		75		ns	1
	Address access time	t_{AA}		65		75	ns	
	/CS access time	t_{ACS}		65		75	ns	
	/OE to output valid	t_{OE}		45		50	ns	
	/LB, /UB to output valid	t_{BA}		65		75	ns	
	Output hold from address change	t_{OH}	5		5		ns	
	Page read cycle time	t_{PRC}	18		25		ns	
	Page access time	t_{PAA}		18		25	ns	
	/CS to output in low impedance	t_{CLZ}	10		10		ns	2
	/OE to output in low impedance	t_{OLZ}	5		5		ns	
	/LB, /UB to output in low impedance	t_{BLZ}	5		5		ns	
	/CS to output in high impedance	t_{CHZ}		25		25	ns	
	/OE to output in high impedance	t_{OHZ}		25		25	ns	
	/LB, /UB to output in high impedance	t_{BHZ}		25		25	ns	
	Address set to /OE low level	t_{ASO}	0		0		ns	
	/OE high level to address hold	t_{OHAH}	–5		–5		ns	
	/CS high level to address hold	t_{CHAH}	0		0		ns	3
	/LB, /UB high level to address hold	t_{BHAH}	0		0		ns	3, 4
	/CS low level to /OE low level	t_{CLOL}	0	10,000	0	10,000	ns	5
	/OE low level to /CS high level	t_{OLCH}	45		45		ns	
	/CS high level pulse width	t_{CP}	10		10		ns	
	/LB, /UB high level pulse width	t_{BP}	10		10		ns	
	/OE high level pulse width	t_{OP}	2	10,000	2	10,000	ns	5

Notes 1. Output load: 30 pF

2. Output load: 5 pF

3. When $t_{ASO} \geq |t_{CHAH}|$, $|t_{BHAH}|$, t_{CHAH} and t_{BHAH} (MIN.) are –15 ns.



4. t_{BHAH} is specified from when both /LB and /UB become high level.

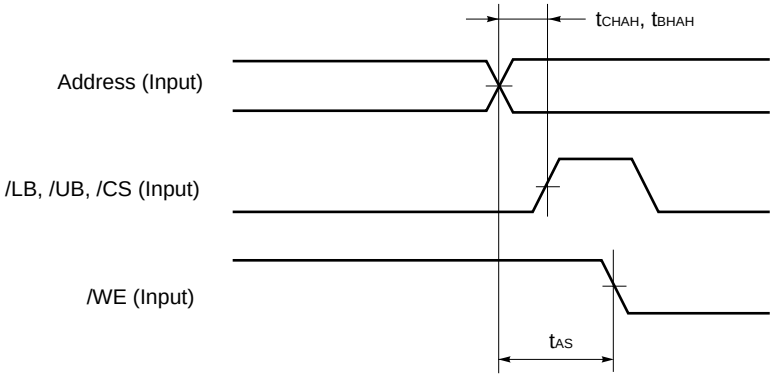
5. t_{CLOL} and t_{OP} (MAX.) are applied while /CS is being hold at low level.

Write Cycle

★

Parameter	Symbol	-B65X		-BE75X		Unit	Note
		MIN.	MAX.	MIN.	MAX.		
Write cycle time	t_{WC}	65		75		ns	
/CS to end of write	t_{CW}	55		60		ns	
Address valid to end of write	t_{AW}	55		60		ns	
/LB, /UB to end of write	t_{BW}	55		60		ns	
Write pulse width	t_{WP}	50		55		ns	
Write recovery time	t_{WR}	0		0		ns	
/CS pulse width	t_{CP}	10		10		ns	
/LB, /UB high level pulse width	t_{BP}	10		10		ns	
/WE high level pulse width	t_{WHP}	10		10		ns	
Address setup time	t_{AS}	0		0		ns	
/OE high level to address hold	t_{OHAH}	–5		–5		ns	
/CS high level to address hold	t_{CHAH}	0		0		ns	1
/LB, /UB high level to address hold	t_{BHAH}	0		0		ns	1, 2
Data valid to end of write	t_{DW}	30		35		ns	
Data hold time	t_{DH}	0		0		ns	
/OE high level to /WE set	t_{OES}	0	10,000	0	10,000	ns	3
/WE high level to /OE set	t_{OEH}	10	10,000	10	10,000	ns	

★ **Notes 1.** When $t_{AS} \geq |t_{CHAH}|, |t_{BHAH}|$ and $t_{CP} \geq 18$ ns, t_{CHAH} and t_{BHAH} (MIN.) are –15 ns.



2. t_{BHAH} is specified from when both /LB and /UB become high level.

3. t_{OES} and t_{OEH} (MAX.) are applied while /CS is being hold at low level.

Initialization

Parameter	Symbol	MIN.	MAX.	Unit	Note
Power application to MODE low level hold	t_{VHMH}	50		μs	
/CS high level to MODE high level	t_{CHMH}	0		ns	
Following power application MODE high level hold to /CS low level	t_{MHCL}	200		μs	

Standby Mode 2 Entry / Exit

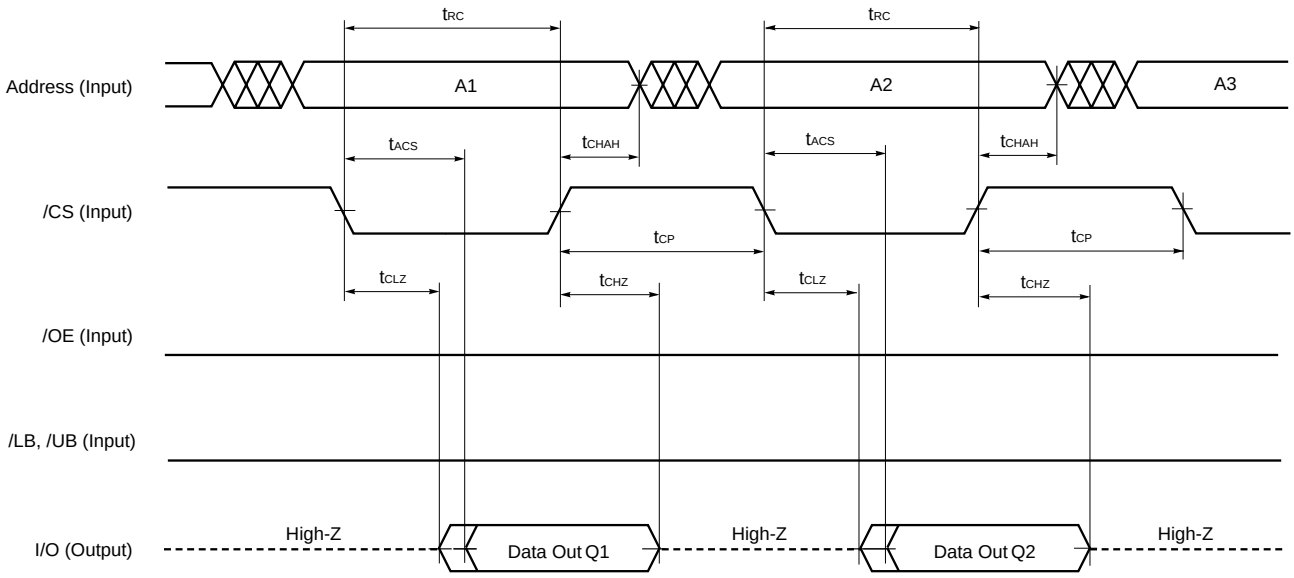
Parameter	Symbol	MIN.	MAX.	Unit	Note
Standby mode 2 entry /CS high level to MODE low level	t_{CHML}	0		ns	
Standby mode 2 exit to normal operation MODE high level to /CS low level	t_{MHCL1}	30		ns	1
Standby mode 2 exit to normal operation MODE high level to /CS low level	t_{MHCL2}	200		μs	2

Notes 1. This is the time it takes to return to normal operation from Standby Mode 2 (data hold: 16M bits / 8M bits / 4M bits).

2. This is the time it takes to return to normal operation from Standby Mode 2 (data not held).

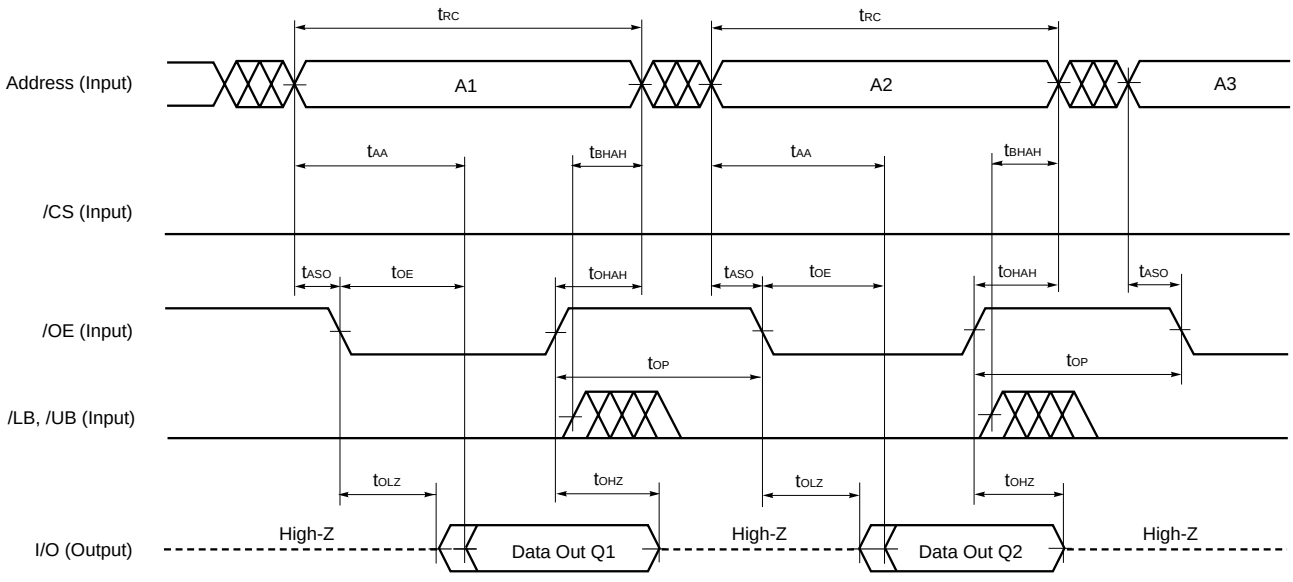
6. Timing Charts

Figure 6-1. Read Cycle Timing Chart 1 (/CS Controlled)



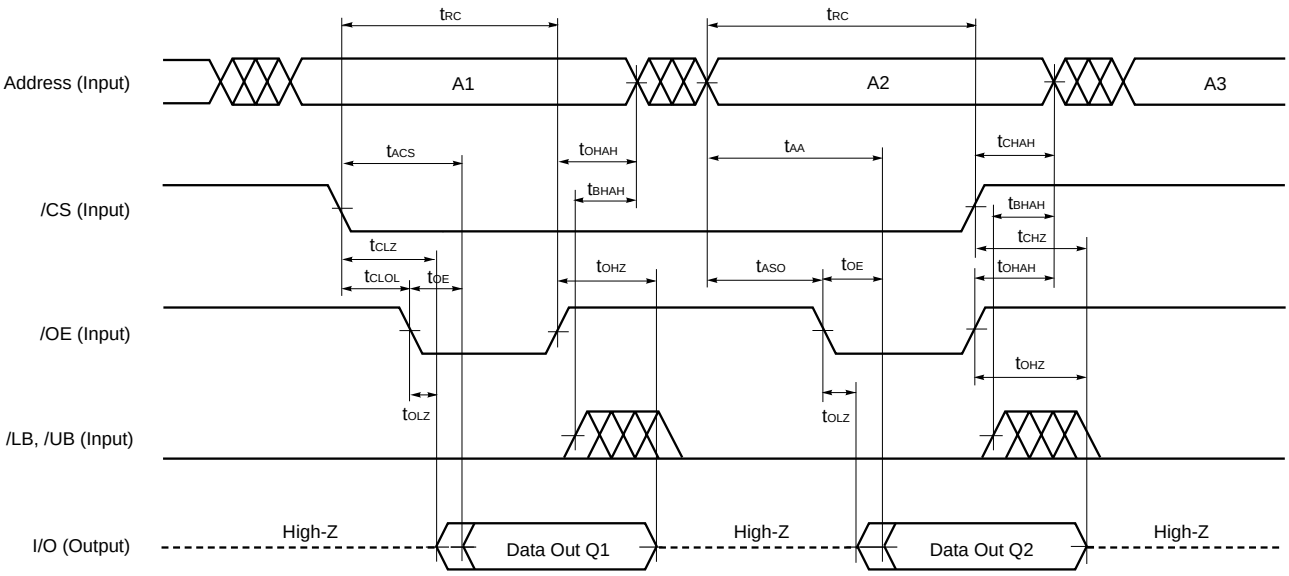
Remark In read cycle, MODE and /WE should be fixed to high level.

★ **Figure 6-2. Read Cycle Timing Chart 2 (/OE Controlled)**



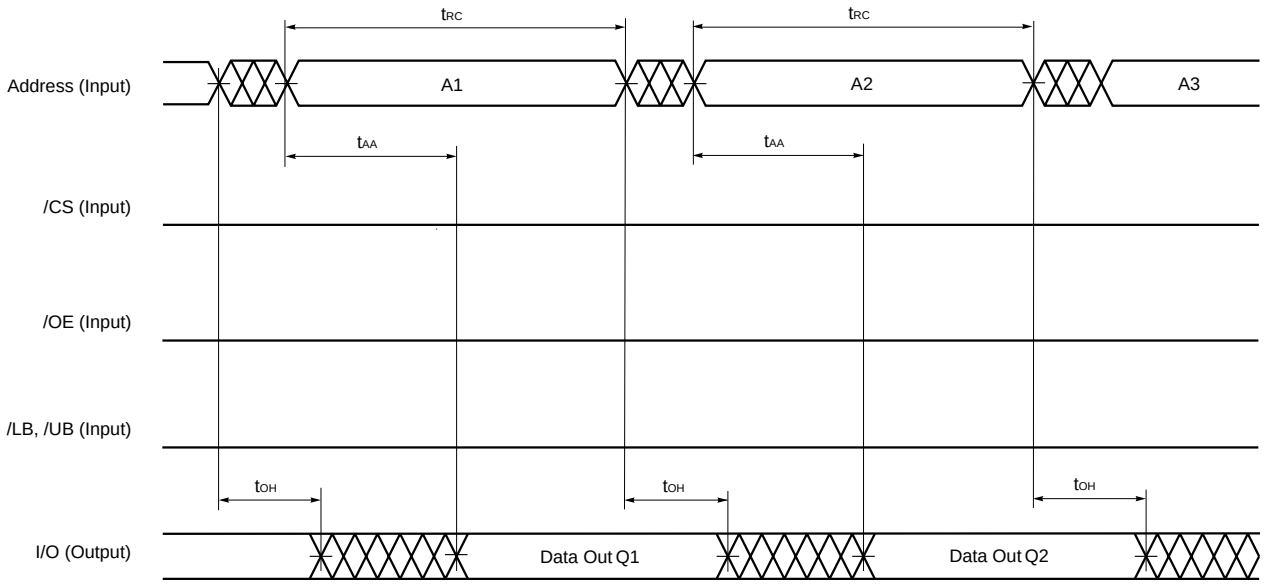
Remark In read cycle, MODE and /WE should be fixed to high level.

★ **Figure 6-3. Read Cycle Timing Chart 3 (/CS, /OE Controlled)**



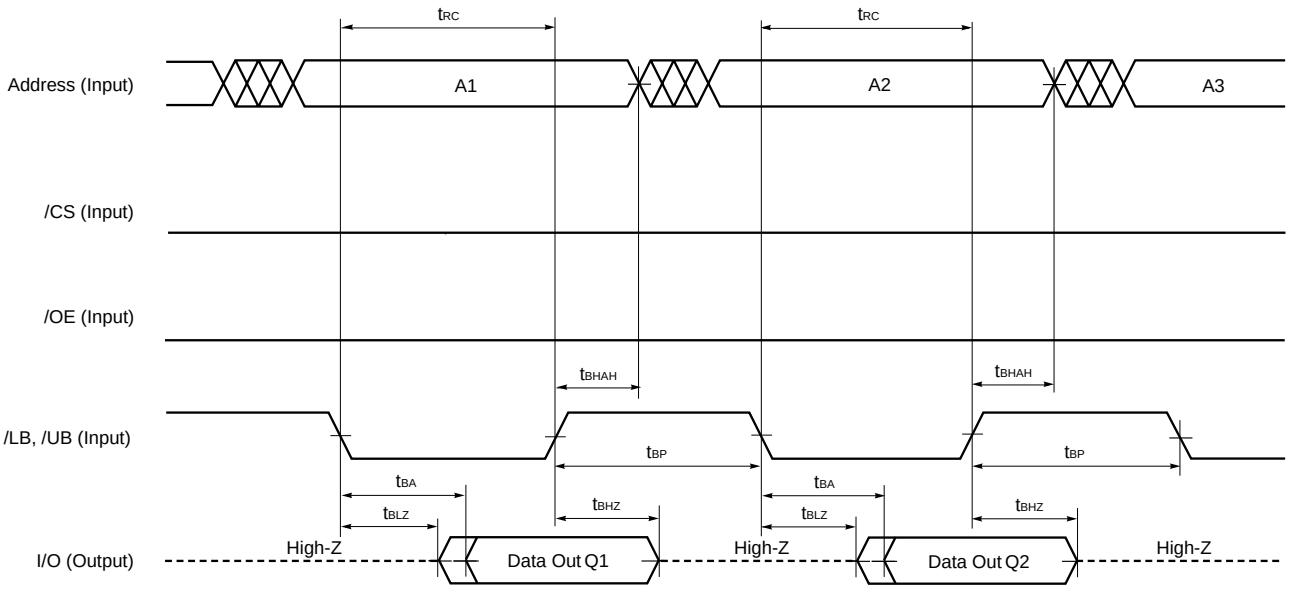
Remark In read cycle, MODE and /WE should be fixed to high level.

Figure 6-4. Read Cycle Timing Chart 4 (Address Controlled)



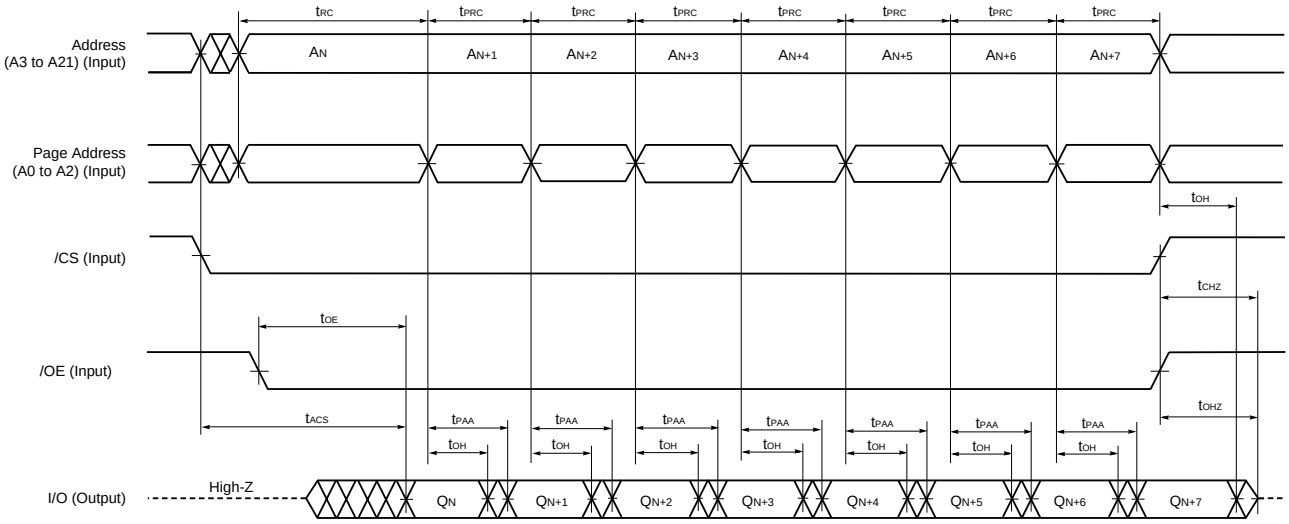
Remark In read cycle, MODE and /WE should be fixed to high level.

Figure 6-5. Read Cycle Timing Chart 5 (/LB, /UB Controlled)



Remark In read cycle, MODE and /WE should be fixed to high level.

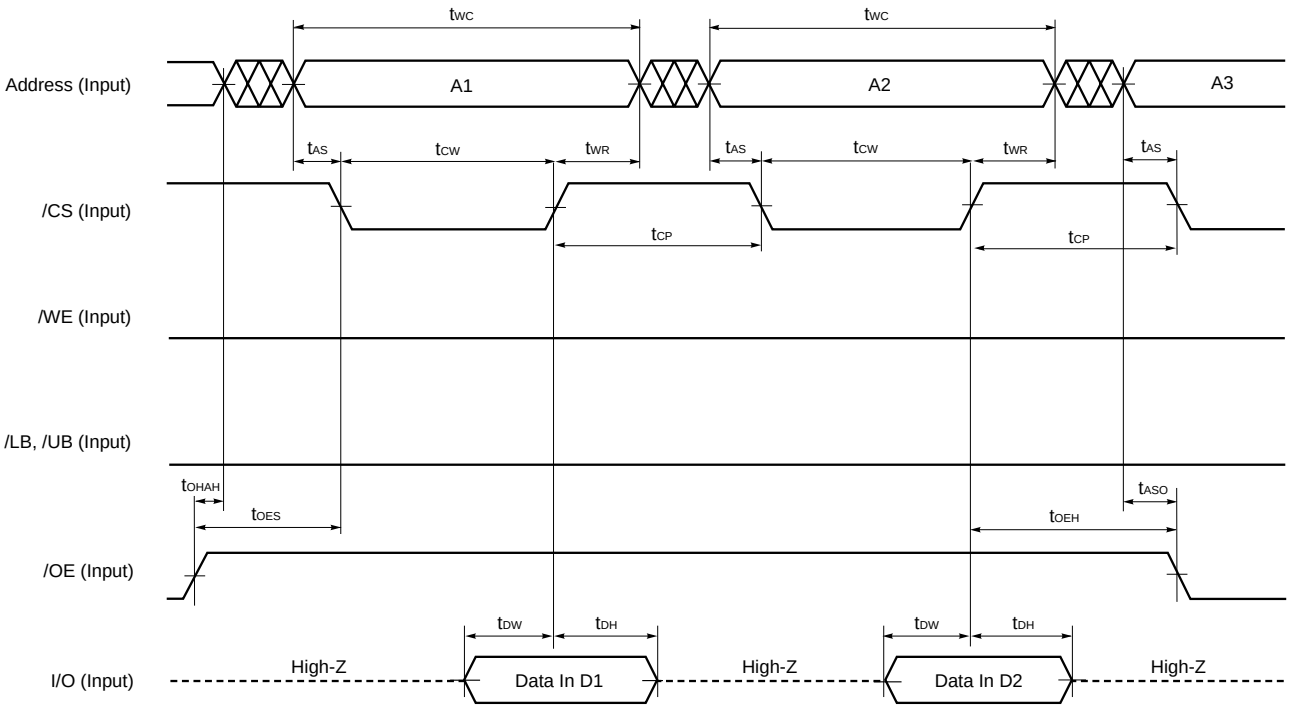
Figure 6-6. Page Read Cycle Timing Chart



Remarks 1. In read cycle, MODE and /WE should be fixed to high level.

2. /LB and /UB are low level.

Figure 6-7. Write Cycle Timing Chart 1 (/CS Controlled)



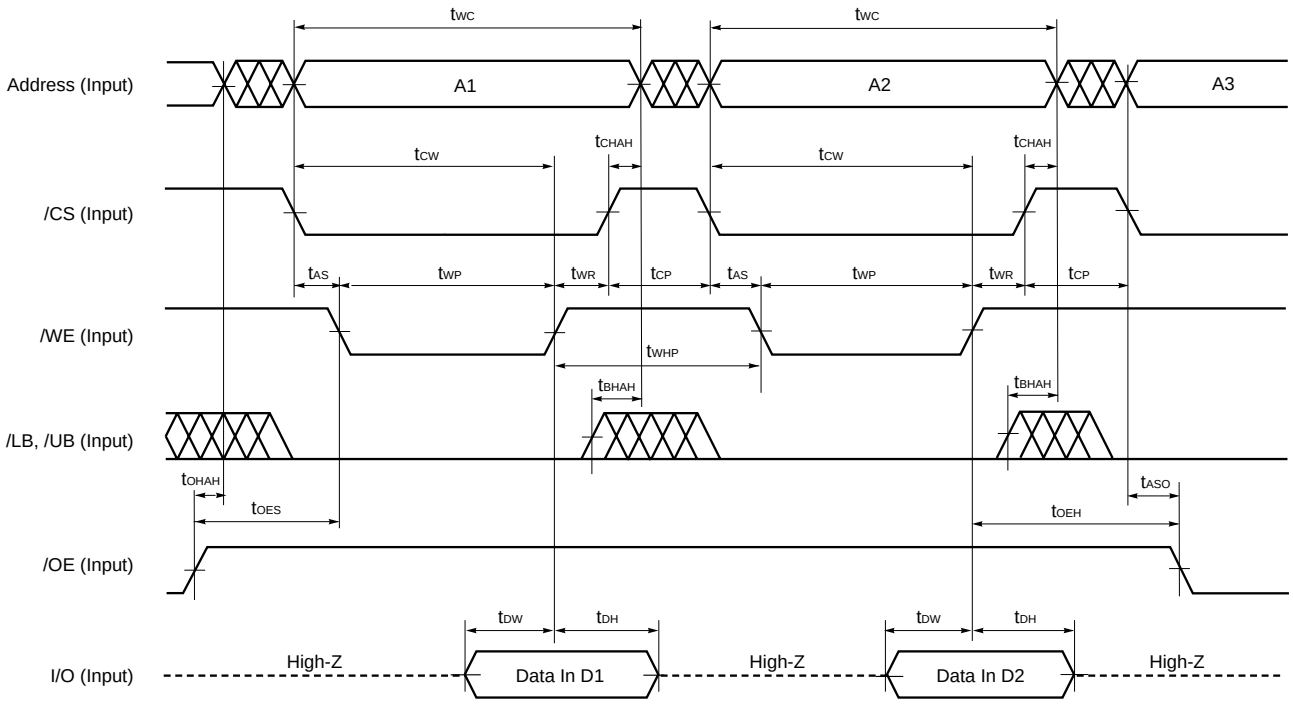
Cautions 1. During address transition, at least one of pins /CS and /WE, or both of /LB and /UB pins should be inactivated.

2. Do not input data to the I/O pins while they are in the output state.

3. In write cycle, MODE and /OE should be fixed to high level.

Remark Write operation is done during the overlap time of a low level /CS, /WE, /LB and/or /UB.

Figure 6-8. Write Cycle Timing Chart 2 (/WE Controlled)



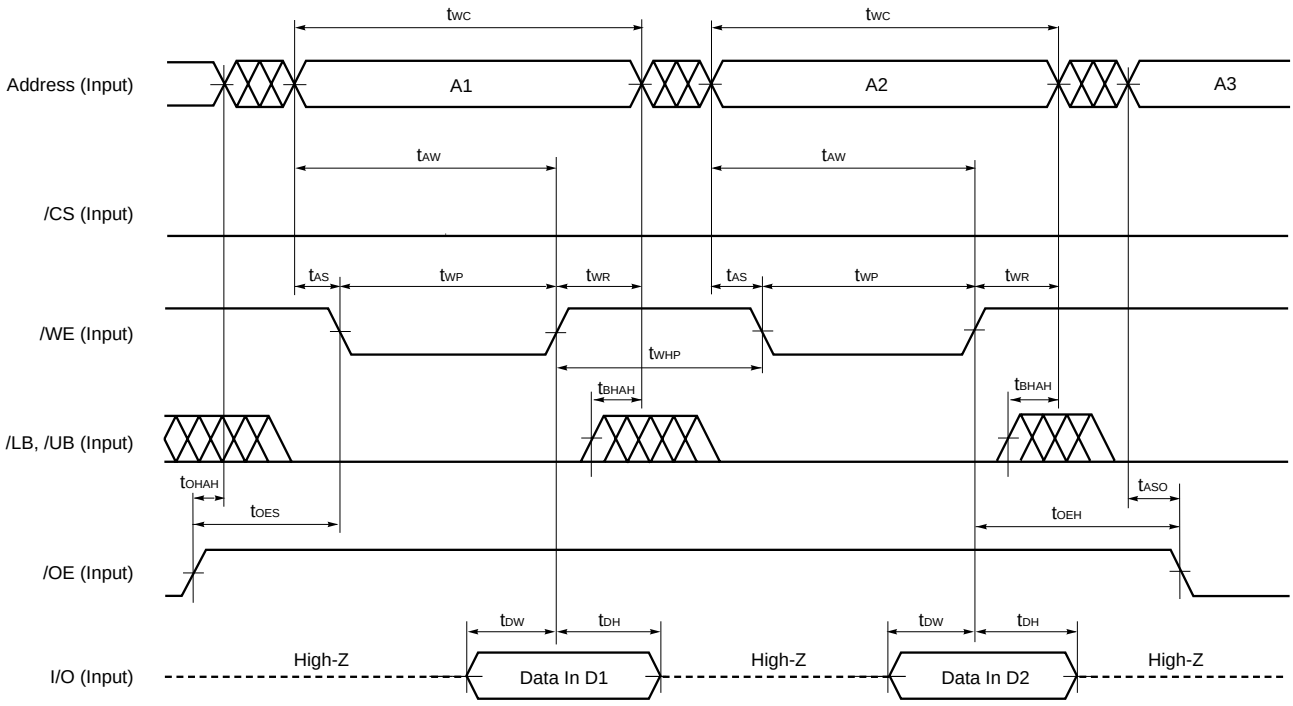
Cautions 1. During address transition, at least one of pins /CS and /WE, or both of /LB and /UB pins should be inactivated.

2. Do not input data to the I/O pins while they are in the output state.

3. In write cycle, MODE and /OE should be fixed to high level.

Remark Write operation is done during the overlap time of a low level /CS, /WE, /LB and/or /UB.

Figure 6-9. Write Cycle Timing Chart 3 (/WE Controlled)



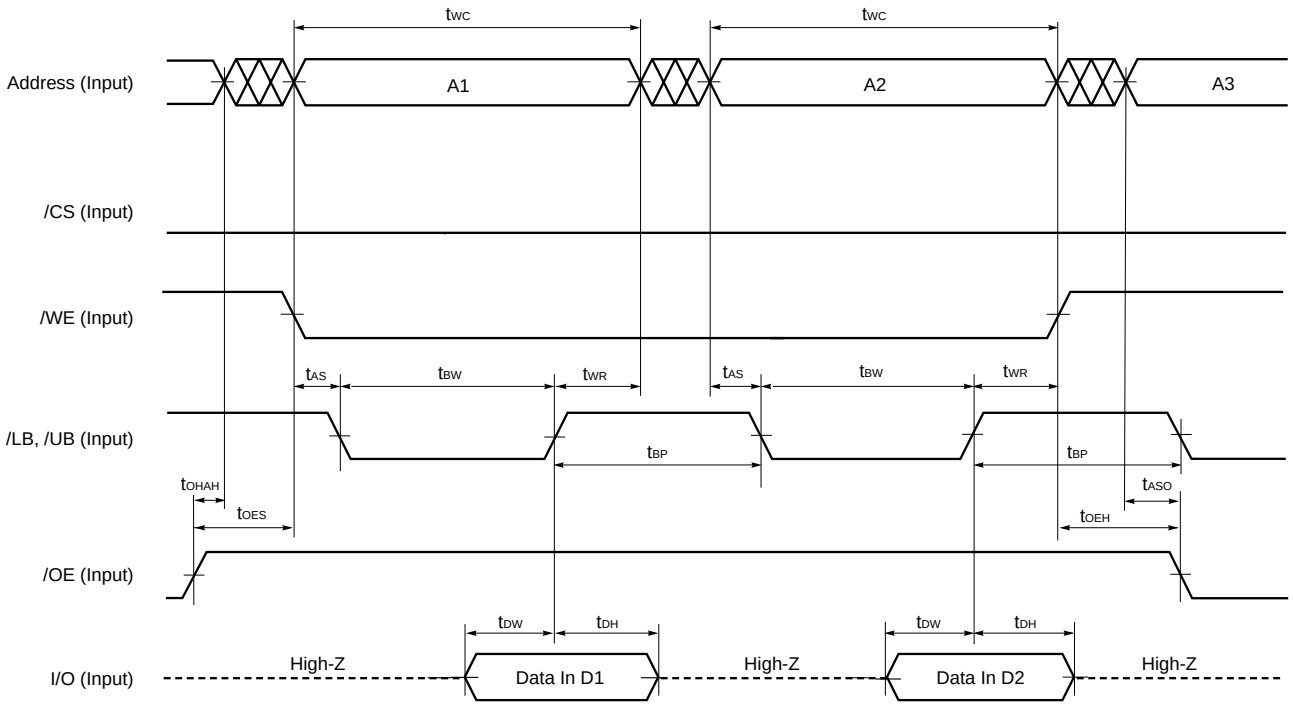
Cautions 1. During address transition, at least one of pins /CS and /WE, or both of /LB and /UB pins should be inactivated.

2. Do not input data to the I/O pins while they are in the output state.

3. In write cycle, MODE and /OE should be fixed to high level.

Remark Write operation is done during the overlap time of a low level /CS, /WE, /LB and/or /UB.

Figure 6-10. Write Cycle Timing Chart 4 (/LB, /UB Controlled)



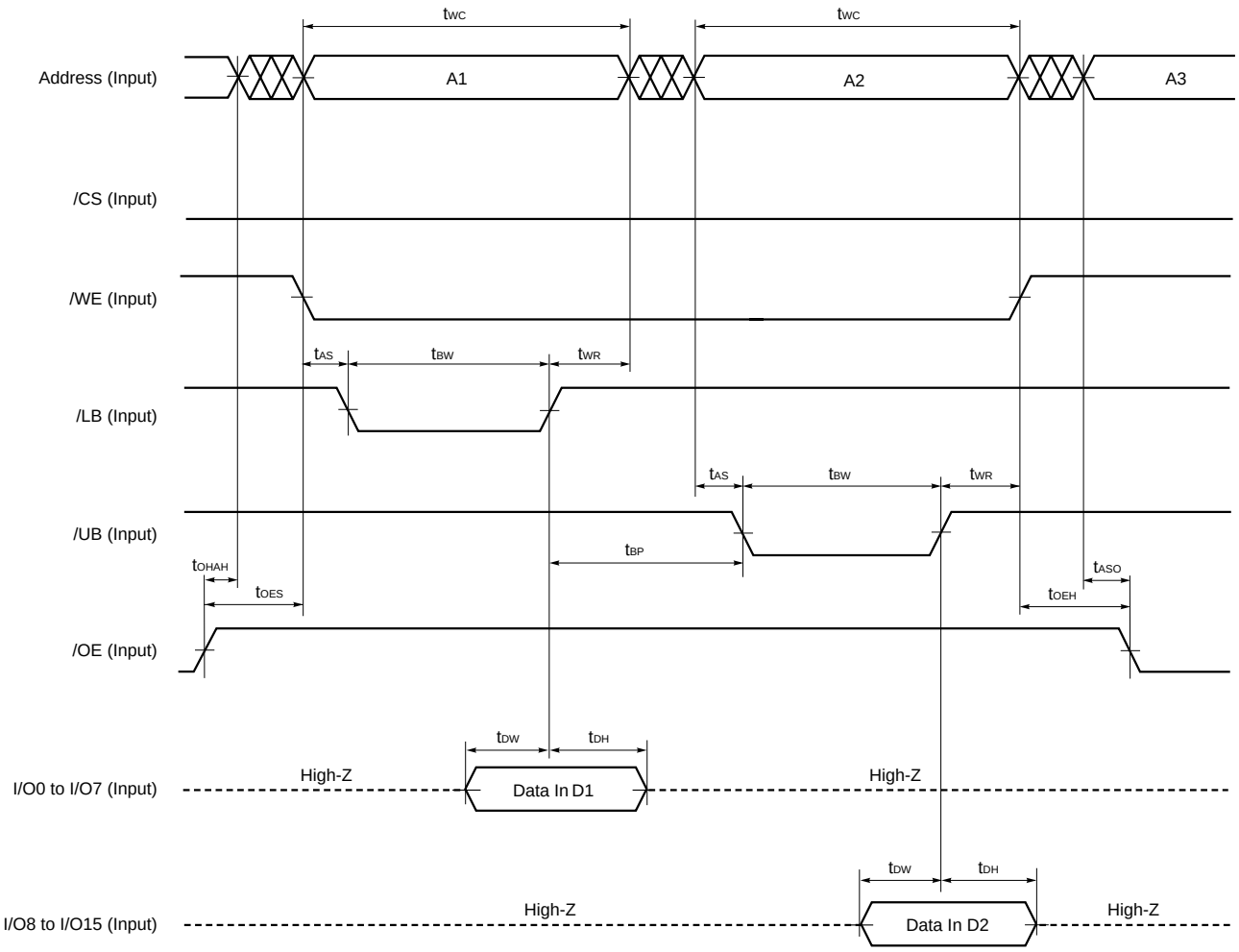
Cautions 1. During address transition, at least one of pins /CS and /WE, or both of /LB and /UB pins should be inactivated.

2. Do not input data to the I/O pins while they are in the output state.

3. In write cycle, MODE and /OE should be fixed to high level.

Remark Write operation is done during the overlap time of a low level /CS, /WE, /LB and/or /UB.

Figure 6-11. Write Cycle Timing Chart 5 (/LB, /UB Independent Controlled)



Cautions 1. During address transition, at least one of pins /CS and /WE, or both of /LB and /UB pins should be inactivated.

2. Do not input data to the I/O pins while they are in the output state.

3. In write cycle, MODE and /OE should be fixed to high level.

Remark Write operation is done during the overlap time of a low level /CS, /WE, /LB and/or /UB.

Figure 6-12. Mode Register Setting Timing Chart

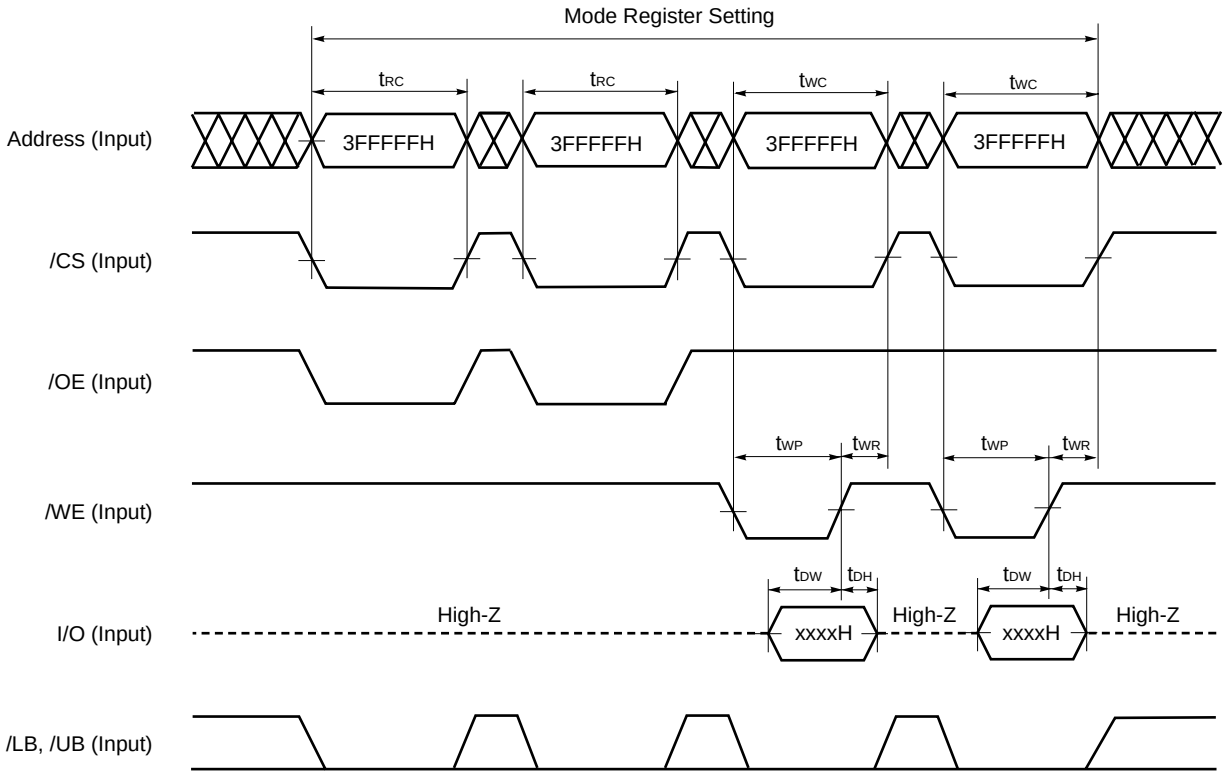
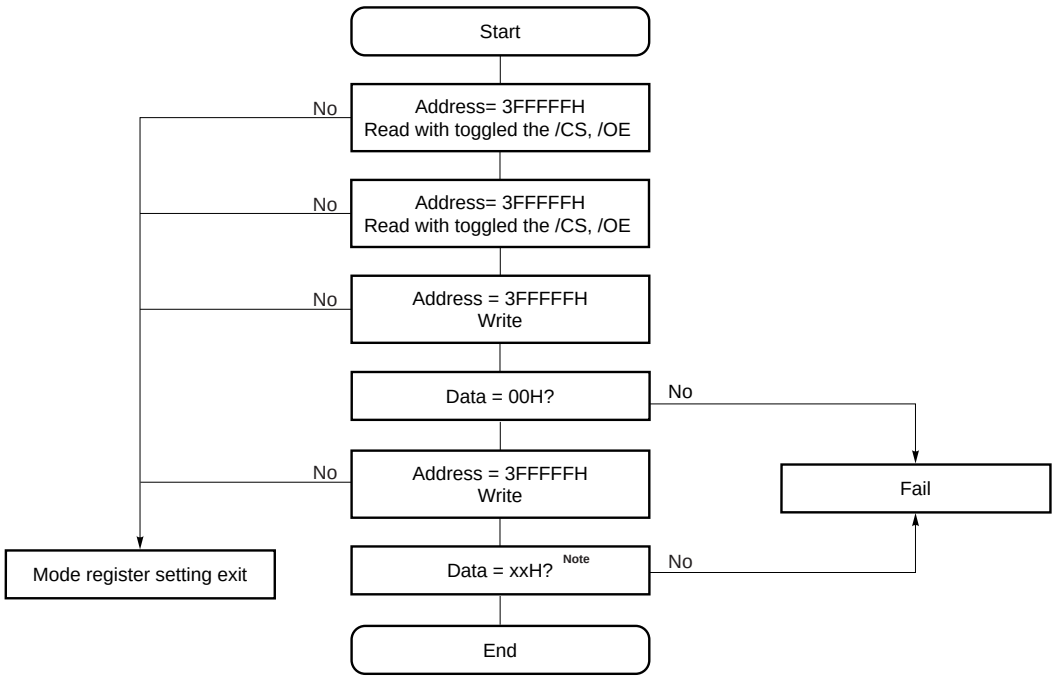


Figure 6-13. Mode Register Setting Flow Chart



Note xxH = 04H, 05H, 06H, 07H

Figure 6-14. Standby Mode 2 (data hold: 16M bits / 8M bits / 4M bits) Entry / Exit Timing Chart

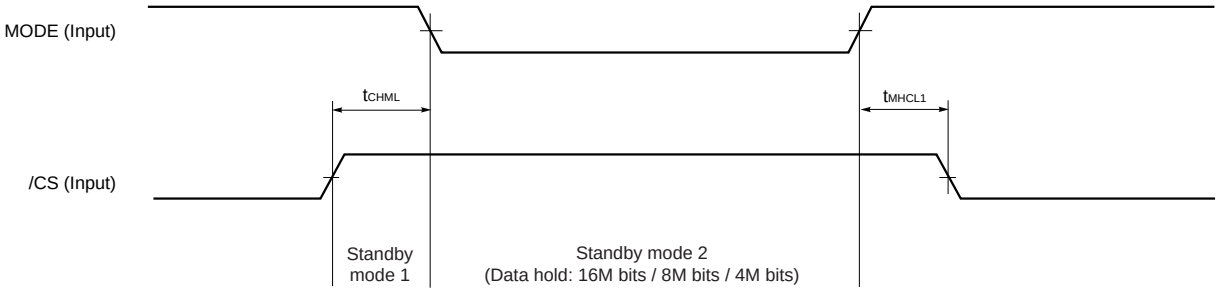
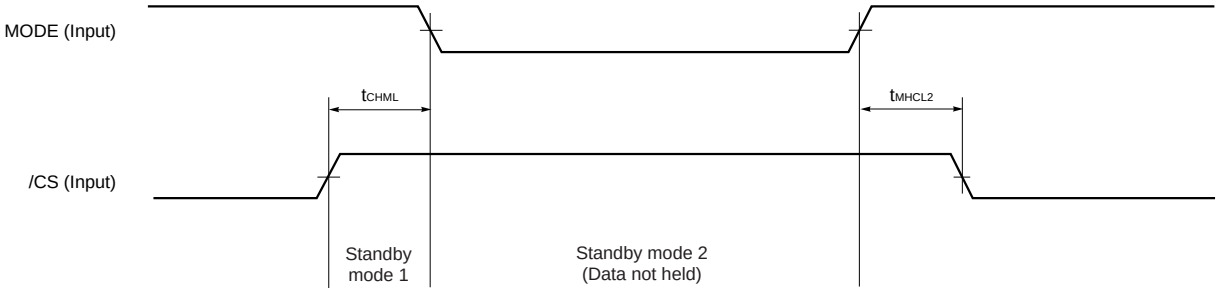
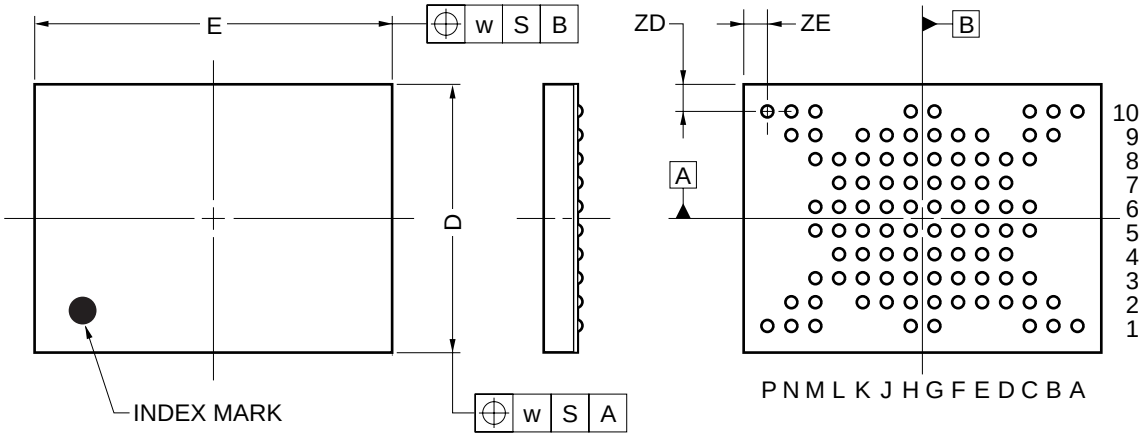


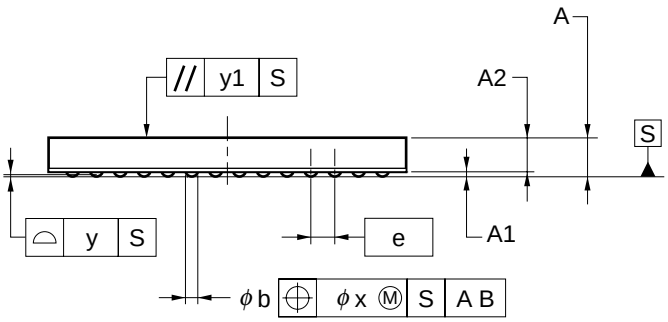
Figure 6-15. Standby Mode 2 (data not held) Entry / Exit Timing Chart



7. Package Drawing

93-PIN TAPE FBGA (12x9)





ITEM	MILLIMETERS
D	9.0±0.1
E	12.0±0.1
w	0.2
e	0.8
A	1.3±0.1
A1	0.16±0.05
A2	1.14
b	0.40±0.05
x	0.08
y	0.1
y1	0.2
ZD	0.9
ZE	0.8

P93F9-80-CR2

8. Recommended Soldering Conditions

Please consult with our sales offices for soldering conditions of the μPD4664312-X.

Type of Surface Mount Device

μPD4664312F9-CR2: 93-pin TAPE FBGA (12 x 9)

9. Revision History

Edition/ Date	Page		Type of revision	Location	Description (Previous edition → This edition)
	This edition	Previous edition			
5th edition/ Aug. 2002	Throughout	Throughout	Deletion	Class	-C75X, -C85X, -E85X, -E10X, -BE85X, -CE80X, -CE90X
			Modification	Supply Voltage (Chip)	2.6 to 3.1 V → 2.7 to 3.1 V
	p.1	p.1	Deletion	Features	Fast access time: 80, 85, 90, 100 ns Fast page access time: 30, 35 ns
	pp.1, 15	pp.1, 15	Modification	Operating supply current	-BE75X: TBD → 40 mA
	p.17	pp.17, 18	Addition	Read Cycle	t_{OP} (MIN.): 2ns
	p.20	p.22	Modification	Figure 6-2	Timing charts are modified.
	p.21	p.23	Modification	Figure 6-3	Timing charts are modified.

[MEMO]

[MEMO]

NOTES FOR CMOS DEVICES

① PRECAUTION AGAINST ESD FOR SEMICONDUCTORS

Note:

Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

② HANDLING OF UNUSED INPUT PINS FOR CMOS

Note:

No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

③ STATUS BEFORE INITIALIZATION OF MOS DEVICES

Note:

Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.