

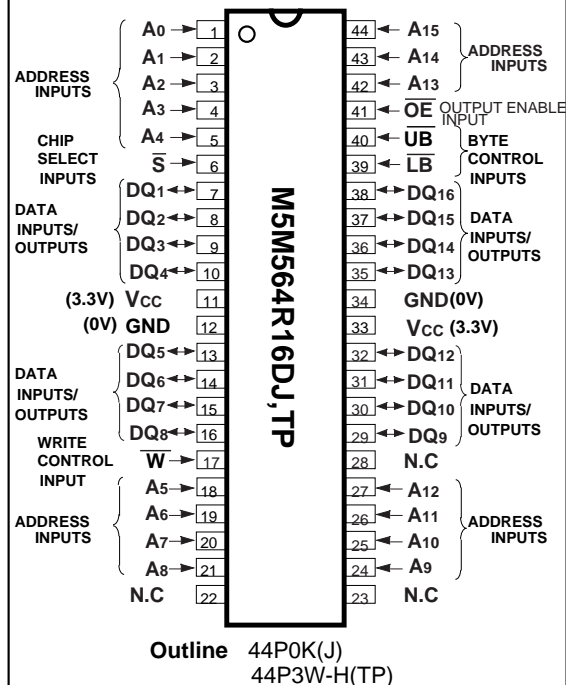
DESCRIPTION

The M5M564R16D is a family of 65536-word by 16-bit static RAMs, fabricated with the high performance CMOS process and designed for high speed application. These devices operate on a single 3.3V supply, and are directly TTL compatible.

They include a power down feature as well. In write and read cycles, the lower and upper bytes are able to be controled either together or separately by $\overline{\text{LB}}$ and $\overline{\text{UB}}$.

FEATURES

- Fast access time M5M564R16DJ,TP-10 ... 10ns(max)
M5M564R16DJ,TP-12 ... 12ns(max)
M5M564R16DJ,TP-15 ... 15ns(max)
- Low power dissipation Active 363mW(typ)
- Single +3.3V power supply
- Fully static operation : No clocks, No refresh
- Common data I/O
- Easy memory expansion by $\overline{\text{S}}$
- Three-state outputs : OR-tie capability
- OE prevents data contention in the I/O bus
- Directly TTL compatible : All inputs and outputs
- Separate control of lower and upper bytes by $\overline{\text{LB}}$ and $\overline{\text{UB}}$

PIN CONFIGURATION (TOP VIEW)**APPLICATION**

High-speed memory system

FUNCTION

The operation mode of the M5M564R16D is determined by a combination of the device control inputs $\overline{\text{S}}$, $\overline{\text{W}}$, $\overline{\text{OE}}$, $\overline{\text{LB}}$, and $\overline{\text{UB}}$. Each mode is summarized in the function table.

A write cycle is executed whenever the low level $\overline{\text{W}}$ overlaps with low level $\overline{\text{LB}}$ and/or low level $\overline{\text{UB}}$ and low level $\overline{\text{S}}$. The address must be set-up before write cycle and must be stable during the entire cycle.

The data is latched into a cell on the trailing edge of $\overline{\text{W}}$, $\overline{\text{LB}}$, $\overline{\text{UB}}$ or $\overline{\text{S}}$, whichever occurs first, requiring the set-up and hold time relative to these edge to be maintained. The output enable input $\overline{\text{OE}}$ directly controls the output stage. Setting the $\overline{\text{OE}}$ at a high level, the output stage is in a high impedance state, and the data bus contention problem in the write cycle is eliminated.

A read cycle is excuted by setting $\overline{\text{W}}$ at a high level and $\overline{\text{OE}}$ at a low level while $\overline{\text{LB}}$ and/or $\overline{\text{UB}}$ and $\overline{\text{S}}$ are in an active

PACKAGE

- M5M564R16DJ : 44pin 400mil SOJ
M5M564R16DTP : 44pin 400mil TSOP(II)

state. ($\overline{\text{LB}}$ and/or $\overline{\text{UB}}=\text{L}$, $\overline{\text{S}}=\text{L}$)

When setting $\overline{\text{LB}}$ at a high level and other pins are in an active state, upper-Byte are in a selectable mode in which both reading and writing are enable, and lower-Byte are in a non-selectable mode. And when setting $\overline{\text{UB}}$ at a high level and other pins are in an active state, lower-Byte are in a selectable mode in which both reading and writing are enable, and upper-Byte are in a non-selectable mode.

When setting $\overline{\text{LB}}$ and $\overline{\text{UB}}$ at a high level or $\overline{\text{S}}$ at high level, the chip is in a non-selectable mode in which both reading and writing are disabled. In this mode, the output stage is in a high-impedance state, allowing OR-tie with other chips and memory expansion by $\overline{\text{LB}}$, $\overline{\text{UB}}$ and $\overline{\text{S}}$.

Signal $\overline{\text{S}}$ controls the power-down feature. When $\overline{\text{S}}$ goes high, power dissipation is reduced extremely. The access time from $\overline{\text{S}}$ is equivalent to the address access time.

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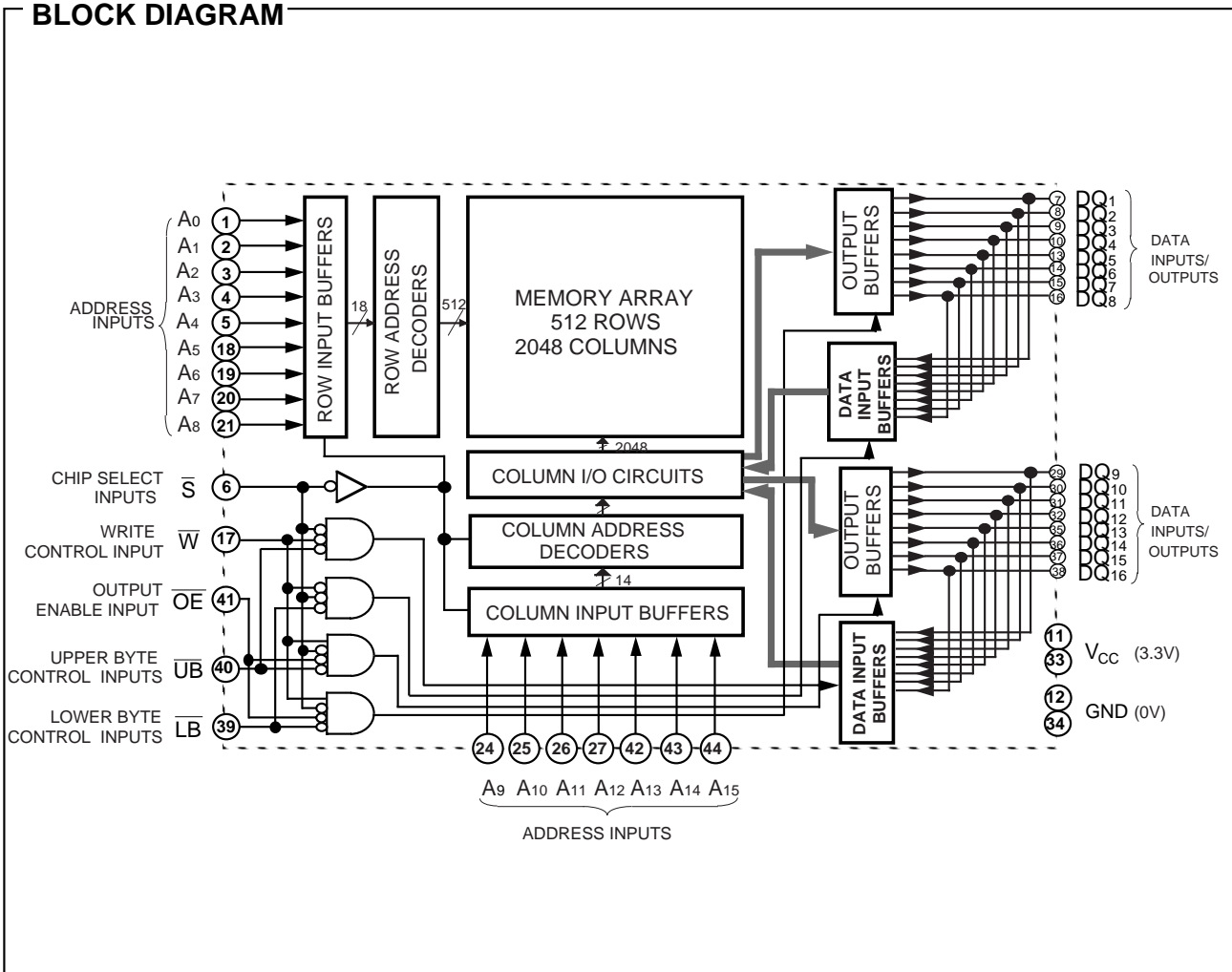
M5M564R16DJ, TP-10, -12, -15

1048576-BIT (65536-WORD BY 16-BIT) CMOS STATIC RAM

FUNCTION TABLE

\bar{S}	\bar{W}	\overline{OE}	\bar{LB}	\bar{UB}	Mode	DQ1~8	DQ9~16	I _{cc}
L	H	L	L	L	Read cycle All Bytes	D _{OUT}	D _{OUT}	Active
L	H	L	H	L	Read cycle Upper Bytes	High-impedance	D _{OUT}	Active
L	H	L	L	H	Read cycle Lower Bytes	D _{OUT}	High-impedance	Active
L	L	X	L	L	Write cycle All Bytes	D _{IN}	D _{IN}	Active
L	L	X	H	L	Write cycle Upper Bytes	High-impedance	D _{IN}	Active
L	L	X	L	H	Write cycle Lower Bytes	D _{IN}	High-impedance	Active
L	H	H	X	X	Output disable	High-impedance	High-impedance	Active
L	X	X	H	H				
H	X	X	X	X	Non selection	High-impedance	High-impedance	Stand by

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Ratings	Unit
V _{cc}	Supply voltage		- 2.0* ~ 4.6	V
V _I	Input voltage	With respect to GND	- 2.0* ~ V _{cc} +0.5	V
V _O	Output voltage		- 2.0* ~ V _{cc}	V
P _d	Power dissipation	T _a =25°C	1000	mW
T _{opr}	Operating temperature		0 ~ 70	°C
T _{stg(bias)}	Storage temperature(bias)		- 10 ~ 85	°C
T _{stg}	Storage temperature		- 65 ~ 150	°C

*Pulse width ≤5ns, In case of DC: - 0.5V

DC ELECTRICAL CHARACTERISTICS (T_a=0~70°C, V_{cc}=3.3V ^{+10%}/_{-5%}, unless otherwise noted)

Symbol	Parameter	Condition	Limits			Unit
			Min	Typ	Max	
V _{IH}	High-level input voltage		2.0		V _{cc} +0.3	V
V _{IL}	Low-level input voltage				0.8	V
V _{OH}	High-level output voltage	I _{OH} = - 4mA	2.4			V
V _{OL}	Low-level output voltage	I _{OL} = 8mA			0.4	V
I _I	Input current	V _I = 0 ~ V _{cc}			2	uA
I _{oz}	Output current in off-state	V _I (\bar{s}) = V _{IH} V _O = 0 ~ V _{cc}			2	uA
I _{cc1}	Active supply current (TTL level)	V _I (\bar{s}) = V _{IL} other inputs V _{IH} or V _{IL} Output-open(duty 100%)	AC(10ns cycle)		200	mA
			AC(12ns cycle)		195	
			AC(15ns cycle)		190	
			DC	110	140	
I _{cc2}	Stand-by supply current (TTL level)	V _I (\bar{s}) = V _{IH}	AC(10ns cycle)		70	mA
			AC(12ns cycle)		65	
			AC(15ns cycle)		60	
			DC		40	
I _{cc3}	Stand-by current (MOS level)	V _I (\bar{s}) = V _{cc} - 0.2V other inputs V _I ≤ 0.2V or V _I ≥ V _{cc} - 0.2V			10	mA

Note 1: Direction for current flowing into an IC is positive (no mark).

CAPACITANCE (T_a=0~70°C, V_{cc}=3.3V ^{+10%}/_{-5%}, unless otherwise noted)

Symbol	Parameter	Test Condition	Limit			Unit
			Min	Typ	Max	
C _I	Input capacitance	V _I = GND, V _i = 25mVrms, f = 1MHz			6	pF
C _O	Output capacitance	V _O = GND, V _o = 25mVrms, f = 1MHz			8	pF

Note 2: C_I, C_O are periodically sampled and are not 100% tested.

AC ELECTRICAL CHARACTERISTICS (T_a = 0~70 °C, V_{cc}=3.3V ^{+10%}/_{-5%}, unless otherwise noted)

(1) MEASUREMENT CONDITION

Input pulse levels V_{IH}=3.0V, V_{IL}=0.0V
 Input rise and fall time 3ns
 Input timing reference levels V_{IH}=1.5V, V_{IL}=1.5V
 Output timing reference levels V_{OH}=1.5V, V_{OL}=1.5V
 Output loads Fig1, Fig2

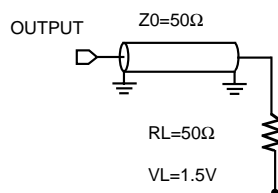


Fig.1 Output load

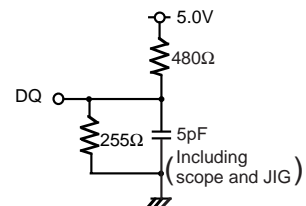


Fig.2 Output load for t_{en}, t_{dis}

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READ CYCLE

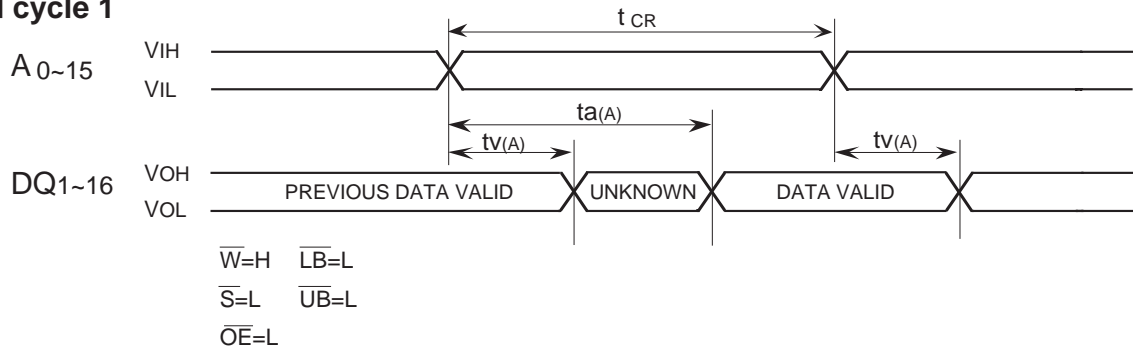
Symbol	Parameter	Limits						Unit
		M5M564R16D-10		M5M564R16D-12		M5M564R16D-15		
		Min	Max	Min	Max	Min	Max	
t _{CR}	Read cycle time	10		12		15		ns
t _{a(A)}	Address access time		10		12		15	ns
t _{a(S)}	Chip select access time		10		12		15	ns
t _{a(OE)}	Output enable access time		5		6		7	ns
t _{a(B)}	$\overline{LB}, \overline{UB}$ access time		5		6		7	ns
t _{dis(S)}	Output disable time after \overline{S} high	0	5	0	6	0	7	ns
t _{dis(OE)}	Output disable time after \overline{OE} high	0	5	0	6	0	7	ns
t _{dis(B)}	Output disable time after $\overline{LB}, \overline{UB}$ high	0	5	0	6	0	7	ns
t _{en(S)}	Output enable time after \overline{S} low	4		4		4		ns
t _{en(OE)}	Output enable time after \overline{OE} low	3		3		3		ns
t _{en(B)}	Output enable time after $\overline{LB}, \overline{UB}$ low	3		3		3		ns
t _{v(A)}	Data valid time after address change	4		4		4		ns
t _{PU}	Power-up time after chip selection	0		0		0		ns
t _{PD}	Power down time after chip selection		10		12		15	ns

Write cycle

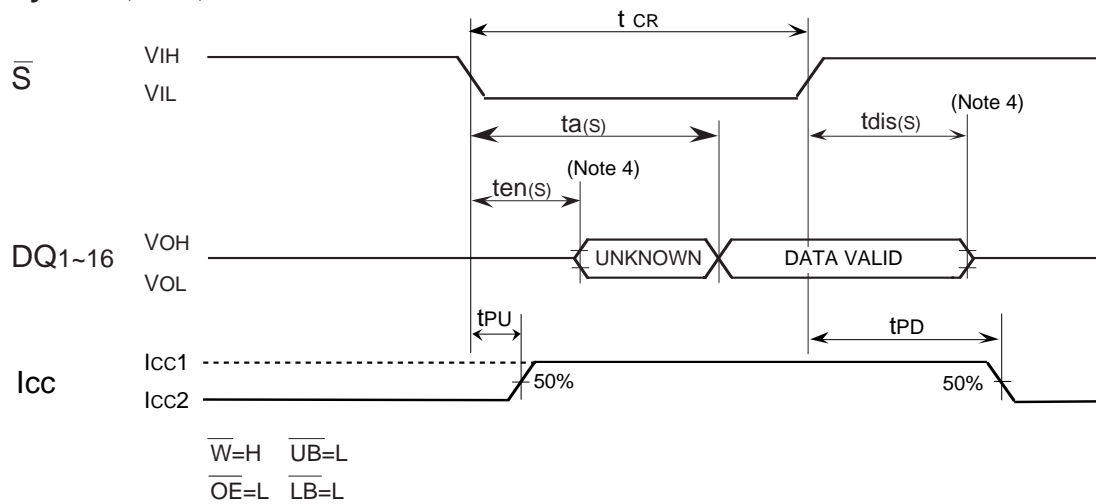
Symbol	Parameter	Limits						Unit
		M5M564R16D-10		M5M564R16D-12		M5M564R16D-15		
		Min	Max	Min	Max	Min	Max	
t _{CW}	Write cycle time	10		12		15		ns
t _{w(W)}	Write pulse width	9		10		12		ns
t _{su(B)}	$\overline{LB}, \overline{UB}$ setup time	9		10		12		ns
t _{su(A)1}	Address setup time(\overline{W})	0		0		0		ns
t _{su(A)2}	Address setup time(\overline{S})	0		0		0		ns
t _{su(S)}	Chip select setup time	9		10		12		ns
t _{su(D)}	Data setup time	5		6		7		ns
t _{h(D)}	Data hold time	0		0		0		ns
t _{rec(W)}	Write recovery time	0		0		0		ns
t _{dis(W)}	Output disable time after \overline{W} low	0	5	0	6	0	7	ns
t _{dis(OE)}	Output disable time after \overline{OE} high	0	5	0	6	0	7	ns
t _{en(W)}	Output enable time after \overline{W} high	0		0		0		ns
t _{en(OE)}	Output enable time after \overline{OE} low	0		0		0		ns
t _{en(B)}	Output enable time after $\overline{LB}, \overline{UB}$ low	0		0		0		ns
t _{su(A-\overline{WH})}	Address to \overline{W} High	9		10		12		ns
t _{su(A-\overline{SH})}	Address to \overline{S} High	9		10		12		ns
t _{su(A-\overline{BH})}	Address to $\overline{LB}, \overline{UB}$ High	9		10		12		ns

(4)TIMING DIAGRAMS

Read cycle 1



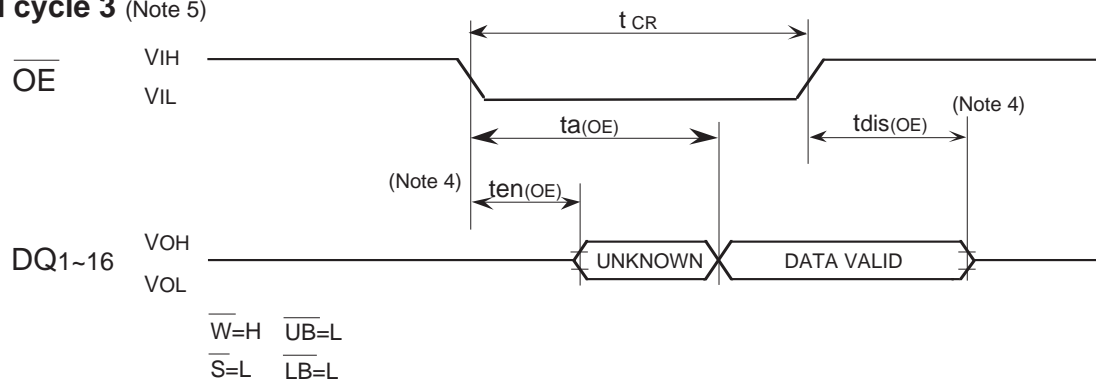
Read cycle 2 (Note 3)



Note 3. Addresses valid prior to or coincident with \overline{S} transition low.

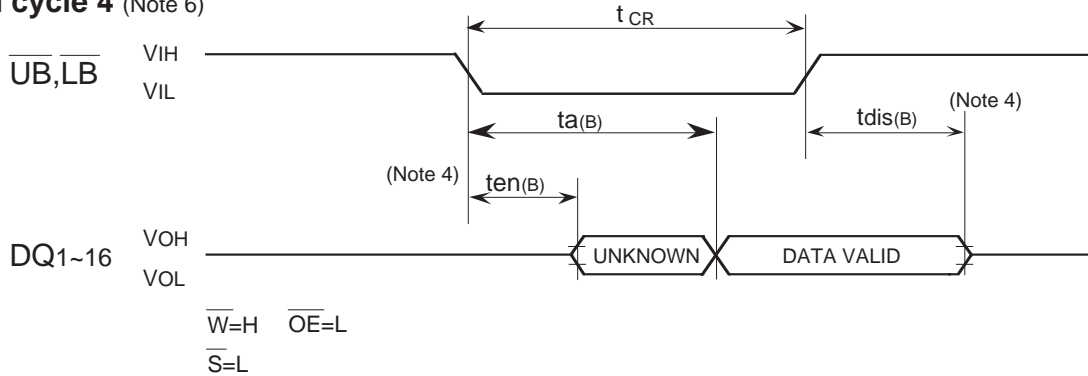
4. Transition is measured $\pm 500\text{mV}$ from steady state voltage with specified loading in Figure 2.

Read cycle 3 (Note 5)



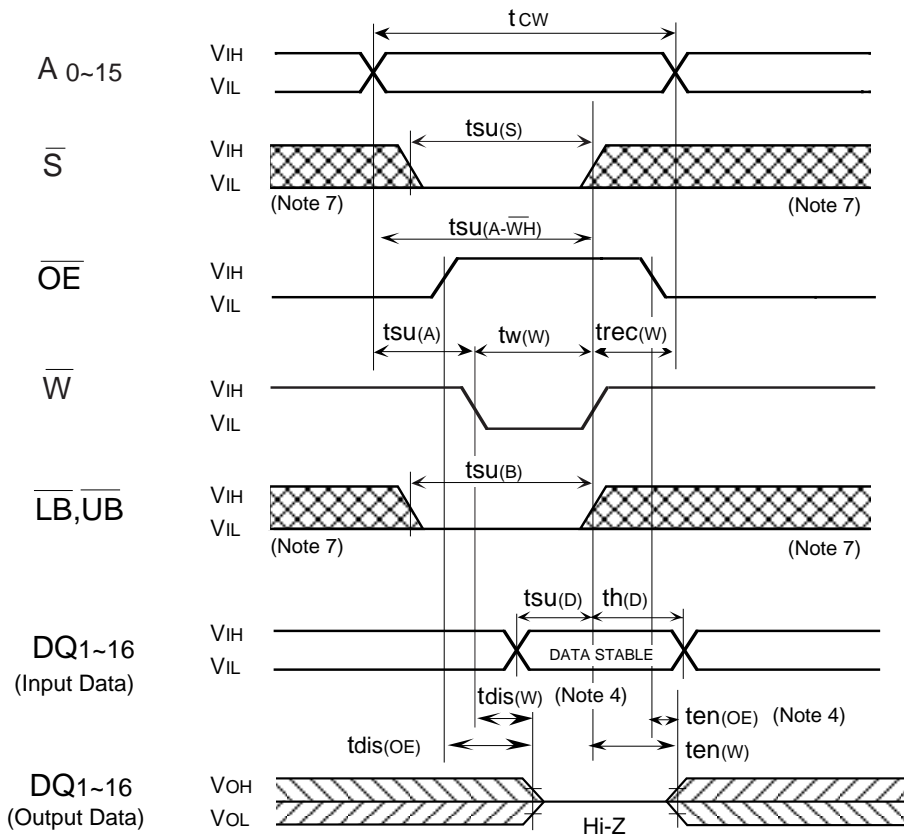
Note 5. Addresses and \overline{S} valid prior to \overline{OE} transition low by $(t_{a(A)}-t_{a(OE)})$, $(t_{a(S)}-t_{a(OE)})$

Read cycle 4 (Note 6)



Note 6. Addresses \overline{S} and \overline{OE} valid prior to $\overline{LB}, \overline{UB}$ transition low by $(t_{a(A)}-t_{a(B)})$, $(t_{a(S)}-t_{a(B)})$, $(t_{a(OE)}-t_{a(B)})$.

Write cycle (\overline{W} control mode)



Note 7: Hatching indicates the state is don't care.

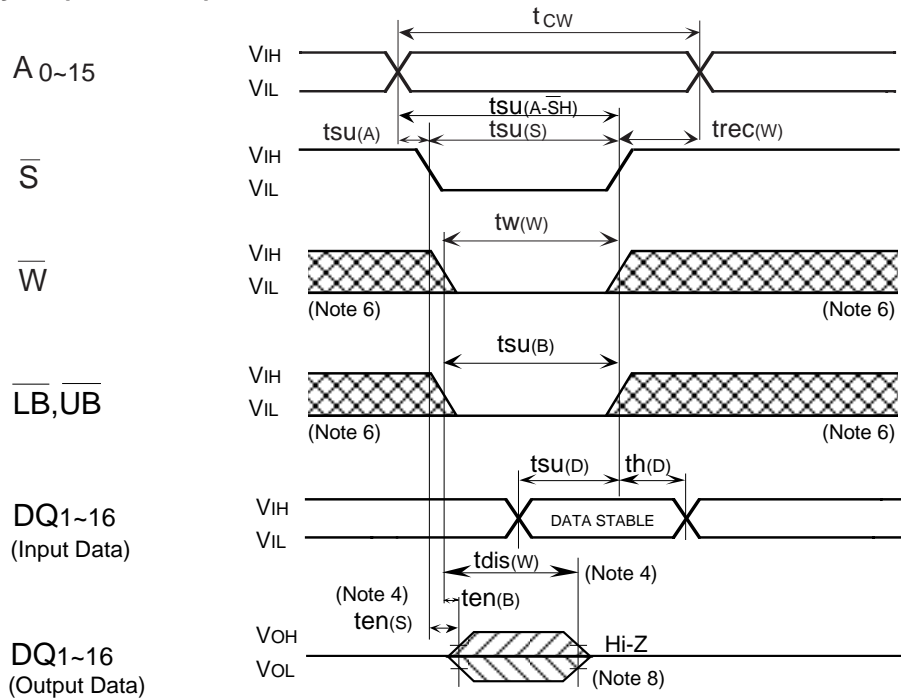
8: When the falling edge of \overline{W} is simultaneous or prior to the falling edge of \overline{S} , the output is maintained in the high impedance.

9: t_{en}, t_{dis} are periodically sampled and are not 100% tested.

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Write cycle(\overline{S} control)



Write cycle($\overline{LB}, \overline{UB}$ control)

