

### 262,144 WORD X 16 BIT DYNAMIC RAM

#### DESCRIPTION

The TC514260BJ/BFT is the new generation dynamic RAM organized 262,144 word by 16 bit. The TC514260BJ/BFT utilizes Toshiba's CMOS silicon gate process technology as well as advanced circuit techniques to provide wide operating margins, both internally and to the system user. Multiplexed address inputs permit the TC514273BJ to be packaged in a standard 40 pin plastic SOJ, and 44/40 pin plastic TSOP. The package size provides high system bit densities and is compatible with widely available automated testing and insertion equipment. System oriented features include single power supply of  $5V \pm 10\%$  tolerance, direct interfacing capability with high performance logic families such as Schottky TTL.

#### FEATURES

- 262,144 word by 16 bit organization
- Fast access time and cycle time
- Single power supply of  $5V \pm 10\%$  with a built-in  $V_{BB}$  generator
- Low Power
  - 550mW MAX. Operating (TC514273BJ-70)
  - 468mW MAX. Operating (TC514273BJ-80)
  - 5.5mW MAX. Standby
- Outputs unlatched at cycle end allows two-dimensional chip selection
- Read-Modify-Write,  $\overline{CAS}$  before  $\overline{RAS}$  refresh,  $\overline{RAS}$ -only refresh, Hidden refresh, Fast Page Mode and Test Mode capability
- All inputs and outputs TTL compatible
- 512refresh cycles/8ms
- Package TC514260BJ : SOJ40-P-400  
TC514260BFT : TSOP44-P-400B

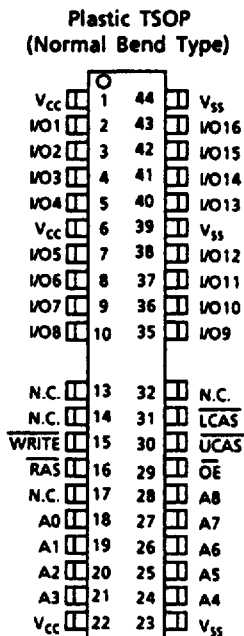
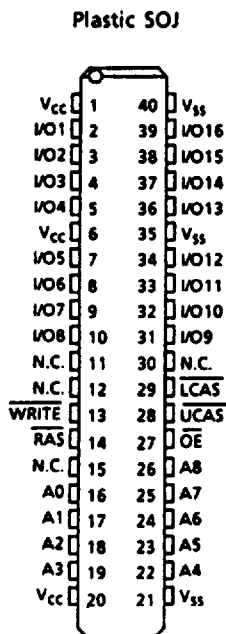
#### KEY PARAMETERS

ITEM	TC514260BJ	
	-70	-80
$t_{RAC}$ $\overline{RAS}$ Access Time	70ns	80ns
$t_{AA}$ Column Address Access Time	35ns	40ns
$t_{CAC}$ $\overline{CAS}$ Access Time	20ns	20ns
$t_{RC}$ Cycle Time	130ns	150ns
$t_{PC}$ Fast Page Mode Cycle Time	45ns	50ns

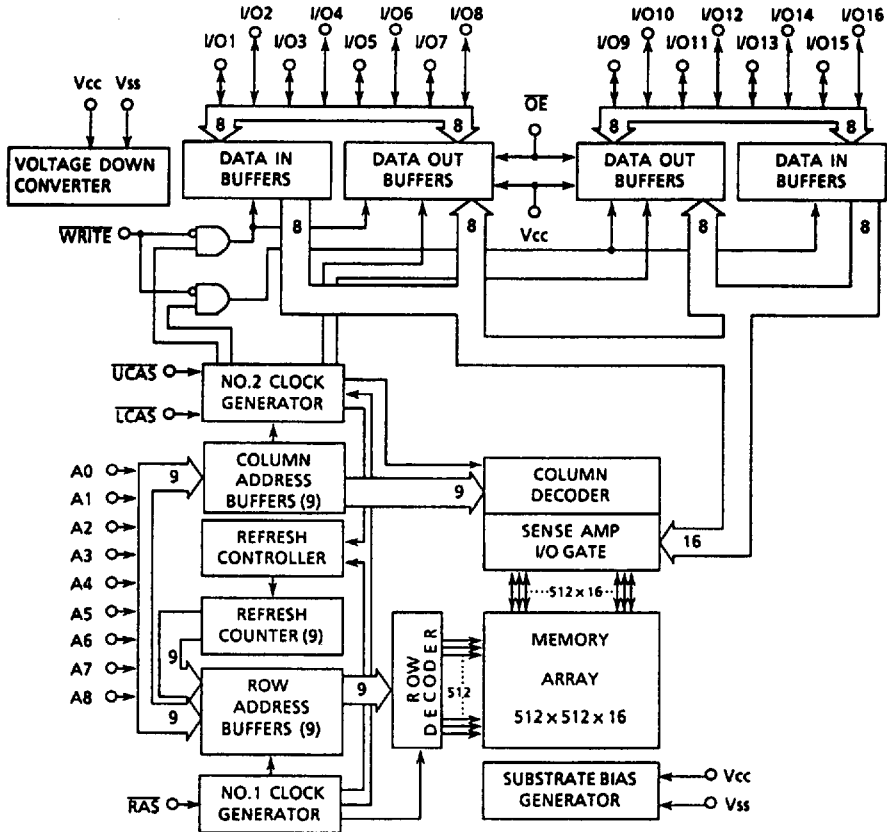
**PIN NAME**

A0~A8	Address Inputs
RAS	Row Address Strobe
UCAS	Column Address Strobe/Upper Byte Control
LCAS	Column Address Strobe/Lower Byte Control
WRITE	Read/Write Input
OE	Output Enable
I/O1~I/O16	Write Section/ Data Input/Output
V <sub>CC</sub>	Power (+5V)
V <sub>SS</sub>	Ground
N.C.	No Connection

**PIN CONNECTION (TOP VIEW)**



**BLOCK DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS**

ITEM	SYMBOL	RATING	UNIT	NOTE
Input Voltage	$V_{IN}$	-1~7	V	1
Output Voltage	$V_{OUT}$	-1~7	V	1
Power Supply Voltage	$V_{CC}$	-1~7	V	1
Operating Temperature	$T_{OPR}$	0~70	°C	1
Storage Temperature	$T_{STG}$	-55~150	°C	1
Soldering Temperature • Time	$T_{SOLDER}$	260 • 10	°C • sec	1
Power Dissipation	$P_D$	700	mW	1
Short Circuit Output Current	$I_{OUT}$	50	mA	1

RECOMMENDED D.C. OPERATING CONDITION ( $T_a = 0\text{--}70^\circ\text{C}$ )

SYMBOL	PARAMETER	MIN.	TYP	MAX	UNIT	NOTE
$V_{CC}$	Supply Voltage	4.5	5.0	5.5	V	2
$V_{IH}$	Input High Voltage	2.4	-	$V_{CC}+0.5$	V	2
$V_{IL}$	Input Low Voltage	-0.5	-	0.8	V	2

\*-2.0V at pulse width  $\leq 20\text{ns}$ D.C. OPERATING CHARACTERISTICS ( $V_{CC} = 5V \pm 10\%$ ,  $T_a = 0\text{--}70^\circ\text{C}$ )

SYMBOL	PARAMETER	MIN.	MAX	UNIT	NOTE	
$I_{CC1}$	OPERATING CURRENT Average Power Supply Operating Current (RAS, UCAS, LCAS, Address Cycling: $t_{RC}=t_{RC}$ MIN.)	TC514260BJ/BFT-70	-	100	mA	3, 4 5
		TC514260BJ/BFT-80	-	85		
$I_{CC2}$	STANDBY CURRENT Power Supply Standby Current (RAS=UCAS=LCAS= $V_{IH}$ )		2	mA		
$I_{CC3}$	RAS ONLY REFRESH CURRENT Average Power Supply Current, RAS Only Mode(RAS Cycling, UCAS=LCAS= $V_{IH}$ : $t_{RC}=t_{RC}$ MIN.)	TC514260BJ/BFT-70	-	100	mA	3, 5
		TC514260BJ/BFT-80	-	85		
$I_{CC4}$	FAST PAGE MODE CURRENT Average Power Supply Current, Fast Page Mode(RAS= $V_{IL}$ , UCAS, LCAS, Address Cycling: $t_{PC}=t_{PC}$ MIN.)	TC514260BJ/BFT-70	-	70	mA	3, 4 5
		TC514260BJ/BFT-80	-	60		
$I_{CC5}$	STANDBY CURRENT Power Supply Standby Current (RAS=UCAS=LCAS= $V_{CC}-0.2V$ )		1	mA		
$I_{CC6}$	CAS BEFORE RAS REFRESH CURRENT Average Power Supply Current, CAS Before RAS Mode (RAS, UCAS, LCAS Cycling: $t_{RC}=t_{PC}$ MIN.)	TC514260BJ/BFT-70	-	100	mA	3, 5
		TC514260BJ/BFT-80	-	85		
$I_{I(L)}$	INPUT LEAKAGE CURRENT Input Leakage Current, any input ( $0V \leq V_{IN} \leq 6.5V$ , All Other Pins Not Under Test= $0V$ )	-10	10	$\mu\text{A}$		
$I_{O(L)}$	OUTPUT LEAKAGE CURRENT ( $D_{OUT}$ is disabled, $0V \leq V_{OUT} \leq 5.5V$ )	-10	10	$\mu\text{A}$		
$V_{OH}$	OUTPUT CURRENT Output "H" Level Voltage ( $I_{OUT}=-5\text{mA}$ )	2.4	-	V		
$V_{OL}$	OUTPUT CURRENT Output "L" Level Voltage ( $I_{OUT}=4.2\text{mA}$ )	-	0.4	V		

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED A.C. OPERATING CONDITIONS ( $V_{CC} = 5V \pm 10\%$ ,  $T_a = 0\text{--}70^\circ\text{C}$ )(Notes 6,7,8)**

SYMBOL	PARAMETER	TC514260BJ/BFT				UNIT	NOTES
		-70		-80			
		MIN	MAX.	MIN	MAX.		
$t_{RC}$	Random Read or Write Cycle Time	130	-	150	-	ns	
$t_{RMW}$	Read-Modify-Write Cycle	185	-	205	-	ns	
$t_{PC}$	Fast Page Mode Cycle Time	45	-	50	-	ns	
$t_{PRMW}$	Fast Page Mode Read-Modify-Write Cycle Time	100	-	105	-	ns	
$t_{RAC}$	Access Time from RAS	-	70	-	80	ns	9,14,15
$t_{CAC}$	Access Time from CAS	-	20	-	20	ns	9,14
$t_{AA}$	Access Time from Column Address	-	35	-	40	ns	9,15
$t_{CPA}$	Access Time from CAS Precharge	-	40	-	45	-	9
$t_{CLZ}$	CAS to Output in Low-Z	0	-	0	-	ns	9
$t_{OFF}$	Output Buffer Turn-off Delay	0	15	0	15	ns	10
$t_T$	Transition Time (Rise and Fall)	3	50	3	50	ns	
$t_{RP}$	RAS Presharge Time	50	-	60	-	ns	
$t_{RAS}$	RAS Pulse Width	70	10,000	80	10,000	ns	
$t_{RASP}$	RAS Pulse Width (Fast Page Mode)	70	100,000	80	100,000	ns	
$t_{RSH}$	RAS Hold Time	20	-	20	-	ns	
$t_{RHCP}$	RAS Hold Time From CAS Precharge (Fast Page Mode)	40	-	45	-	ns	
$t_{CSH}$	CAS Hold Time	70	-	80	-	ns	
$t_{CAS}$	CAS Pulse Width	20	10,000	20	10,000	ns	
$t_{RCD}$	RAS to CAS Delay Time	20	50	20	60	ns	14
$t_{RAD}$	RAS to Column Address Delay Time	15	35	15	40	ns	15
$t_{CRP}$	CAS to RAS Precharge Time	5	-	5	-	ns	
$t_{CP}$	CAS Precharge Time	10	-	10	-	ns	
$t_{ASR}$	Row Address Set-Up Time	0	-	0	-	ns	
$t_{RAH}$	Row Address Hold Time	10	-	10	-	ns	
$t_{ASC}$	Column Address Set-Up Time	0	-	0	-	ns	
$t_{CAH}$	Column Address Hold Time	10	-	15	-	ns	
$t_{RAL}$	Column Address To RAS Lead Time	35	-	40	-	ns	
$t_{RCS}$	Read Command Set-Up Time	0	-	0	-	ns	
$t_{RCH}$	Read Command Hold Time	0	-	0	-	ns	11
$t_{RRH}$	Read Command Hold Time referenced to RAS	0	-	0	-	ns	11
$t_{WCH}$	Write Command Hold Time	15	-	15	-	ns	

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED A.C.  
OPERATING CONDITIONS (CONT)**

SYMBOL	PARAMETER	TC514260BJ/BFT				UNIT	NOTES
		-70		-80			
		MIN	MAX	MIN	MAX		
$t_{WP}$	Write Command Pulse Width	15	-	15	-	ns	
$t_{RWL}$	Write Command to RAS Lead Time	20	-	20	-	ns	
$t_{CWL}$	Write Command to CAS Lead Time	20	-	20	-	ns	
$t_{DS}$	Data Set-Up Time	0	-	0	-	ns	12
$t_{DH}$	Data Hold Time	15	-	15	-	ns	12
$t_{REF}$	Refresh Period	-	8	-	8	ns	
$t_{WCS}$	Write Command Set-Up Time	0	-	0	-	ns	13
$t_{CWD}$	CAS to WRITE Delay Time	50	-	50	-	ns	13
$t_{RWD}$	RAS to WRITE Delay Time	100	-	110	-	ns	13
$t_{AWD}$	Column Address to WE Delay Time	65	-	70	-	ns	13
$t_{CPWD}$	CAS Precharge to WRITE Delay Time	70	-	75	-	ns	13
$t_{CSR}$	CAS Set-Up Time (CAS before RAS Cycle)	5	-	5	-	ns	
$t_{CHR}$	CAS Hold Time (CAS before RAS Cycle)	15	-	15	-	ns	
$t_{RPC}$	RAS to CAS Precharge Time	5	-	5	-	ns	
$t_{CPT}$	CAS Precharge Time (CAS before RAS Counter Test Cycle)	30	-	30	-	ns	
$t_{ROH}$	RAS Hold Time referenced to OE	10	-	10	-	ns	
$t_{OEA}$	OE Access Time	-	20	0	20	ns	9
$t_{OED}$	OE to Data Delay	20	-	20	-	ns	
$t_{OEZ}$	Output buffer turn off Delay Time from OE	0	20	0	20	ns	10
$t_{OEH}$	OE Command Hold Time	20	-	20	-	ns	
$t_{ODS}$	Output Disable Set-Up Time	0	-	0	-	ns	

**CAPACITANCE ( $V_{CC} = 5V \pm 10\%$ ,  $f = 1MHz$ ,  $T_a = 0\text{-}70^\circ C$ )**

SYMBOL	PARAMETER	MIN	MAX	UNIT
$C_{I1}$	Input Capacitance (A0~A8)	-	5	pF
$C_{I2}$	Input Capacitance (RAS, UCAS, LCAS, OE))	-	7	pF
$C_O$	Input Capacitance(I/O1~I/O16)	-	7	pF

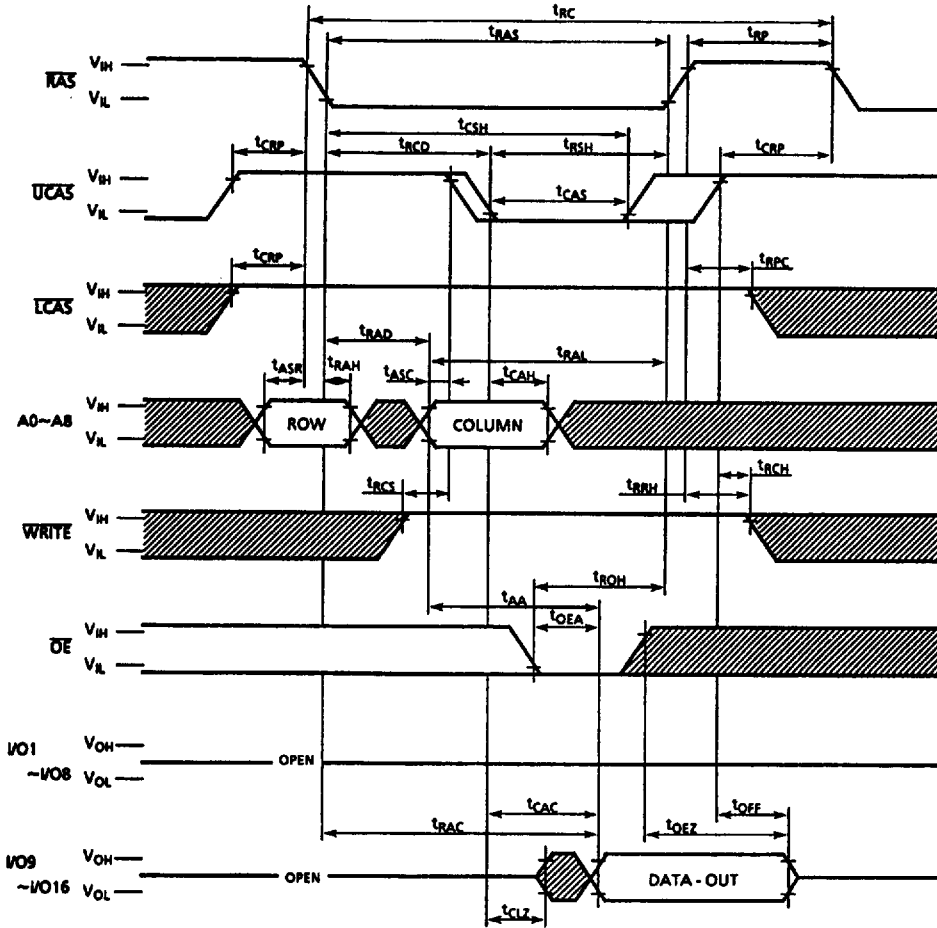
**NOTES:**

1. Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.
2. All voltages are referenced to  $V_{SS}$ .
3.  $I_{CC1}$ ,  $I_{CC3}$ ,  $I_{CC4}$ ,  $I_{CC6}$  depend on cycle rate.
4.  $I_{CC1}$ ,  $I_{CC4}$  depend on output loading. Specified values are obtained with the output open.
5. Address can be changed one or less while  $\overline{RAS}=V_{IL}$ . In case of  $I_{CC4}$ , it can be changed once or less during a fast page mode cycle ( $t_{PC}$ ).
6. An initial pause of 200 $\mu$ s is required after power-up followed by 8  $\overline{RAS}$  only refresh cycles before proper device operation is achieved. In case of using internal refresh counter, a minimum of 8  $\overline{CAS}$  before  $\overline{RAS}$  refresh cycles instead of 8  $\overline{RAS}$  only refresh cycles are required.
7. AC measurements assume  $t_f=5$ ns.
8.  $V_{IH}$  (min.) and  $V_{IL}$  (max.) are reference levels for measuring timing of input signals. Also, transition times are measured between  $V_{IH}$  and  $V_{IL}$ .
9. Measured with a load equivalent to 2 TTL loads and 100pF.
10.  $t_{OFF}$  (max.) and  $t_{OEZ}$  (max.) define the time at which the output achieves the open circuit condition and are not referenced to output voltage levels.
11. Either  $t_{RCH}$  or  $t_{RRH}$  must be satisfied for a read cycle.
12. These parameters are referenced to  $\overline{UCAS}$ ,  $\overline{LCAS}$  leading edge in early write cycles and to  $\overline{WRITE}$ , leading edge in Read-Modify-Write cycles.
13.  $t_{WCS}$ ,  $t_{RWD}$ ,  $t_{CWD}$ ,  $t_{AWD}$  and  $t_{CPWD}$  are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only. If  $t_{WCS} \geq t_{WCS}$  (min.), the cycle is an early write cycle and the data output will remain open circuit (high impedance) through the entire cycle; If  $t_{RWD} \geq t_{RWD}$  (min.),  $t_{CWD} \geq t_{CWD}$  (min.),  $t_{AWD} \geq t_{AWD}$  (min.) and  $t_{CPWD} \geq t_{CPWD}$  (min.), (Fast Page Mode), the cycle is a Read-Modify-Write cycle and the data out will contain data read from the selected cell; If neither of the above sets of condition is satisfied, the condition of the data out (at access time) is indeterminate.
14. Operation within the  $t_{RCD}$  (max.) limit insures that  $t_{RAC}$  can be met.  $t_{RCD}$  (max.) is specified as a reference point only: If  $t_{RCD}$  is greater than the specified  $t_{RCD}$  (max.) limit, then access time is controlled by  $t_{CAC}$ .
15. Operation within the  $t_{RAD}$  (max.) limit insures that  $t_{RAC}$  (max.) can be met.  $t_{RAD}$  (max.) is specified as a reference point only: If  $t_{RAD}$  is greater than the specified  $t_{RAD}$  (max.) limit, then access time is controlled by  $t_{AA}$ .





UPPER BYTE READ CYCLE

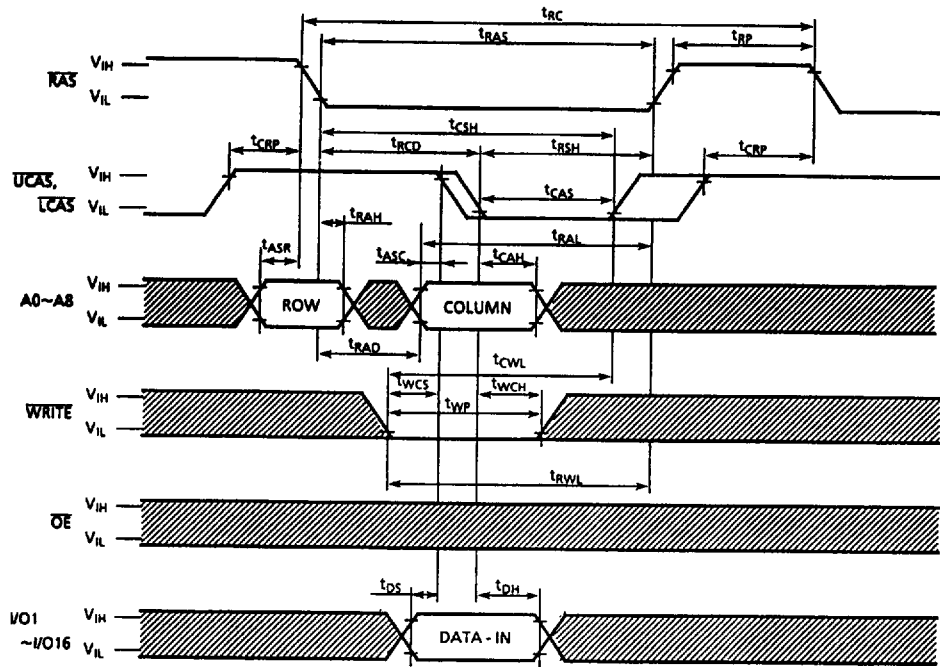


Note:  $D_{IN}(I/O1-I/O8) = \text{Don't Care}$   
 $D_{IN}(I/O9-I/O16) = \text{OPEN}$

■ : "H" or "L"



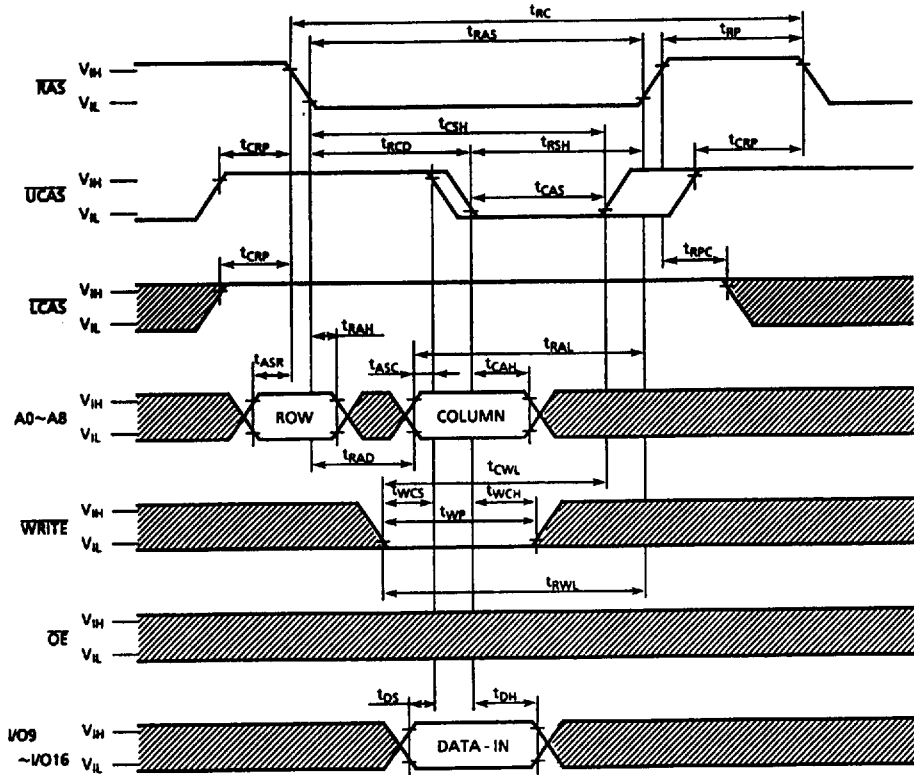
**WRITE CYCLE (EARLY WRITE)**



▨ : "H" or "L"

Note: D<sub>OUT</sub> = OPEN

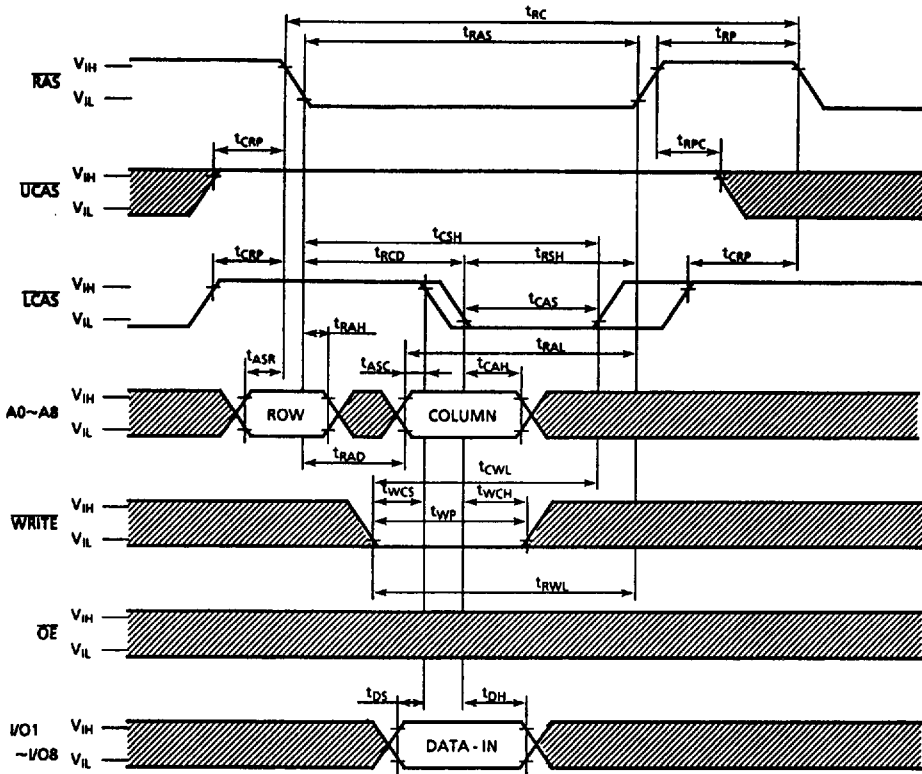
UPPER BYTE WRITE CYCLE (EARLY WRITE)



■ : "H" or "L"

Note:  $D_{IN}$  (I/O1 ~ I/O8) = Don't Care  
 $D_{OUT}$  = OPEN

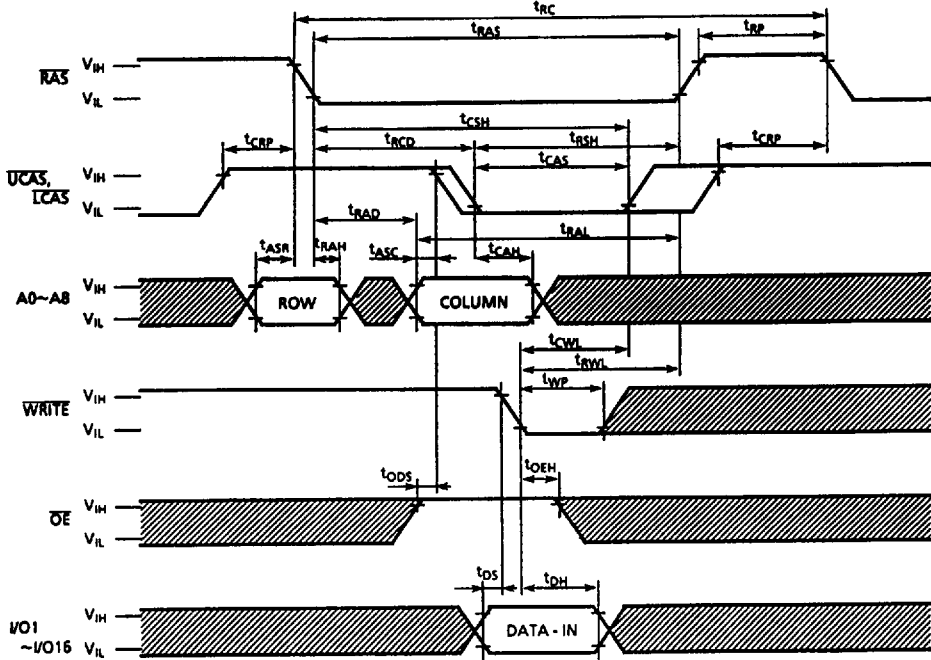
LOWER BYTE WRITE CYCLE (EARLY WRITE)



■ : "H" or "L"

Note:  $D_{IN}$  (I/O9-I/O16) = Don't Care  
 $D_{OUT}$  = OPEN

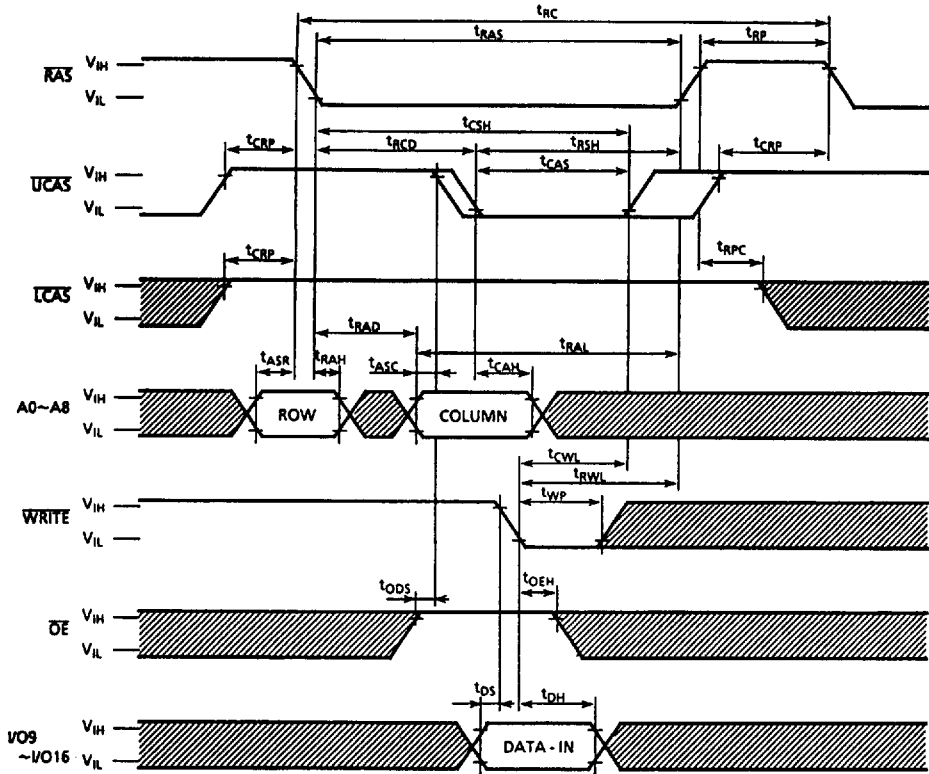
**WRITE CYCLE (OE CONTROLLED WRITE)**



Note:  $D_{OUT}$  = OPEN

■ : "H" or "L"

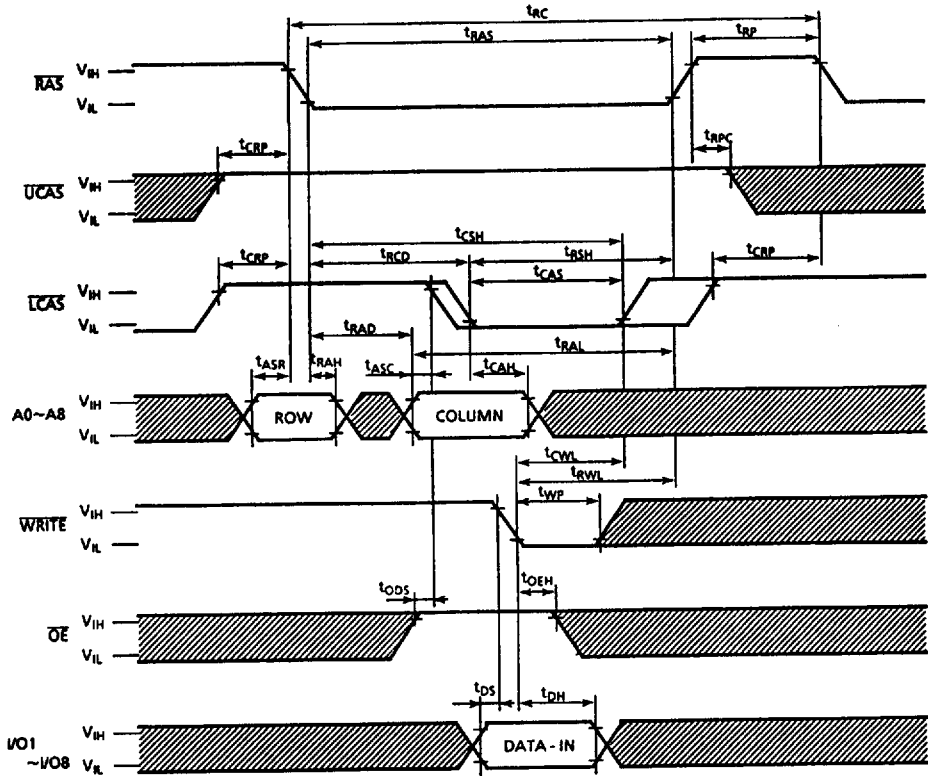
UPPER BYTE WRITE CYCLE (OE CONTROLLED WRITE)



Note:  $D_{IN}$  (I/O1-I/O8) = Don't Care  
 $D_{OUT}$  = OPEN

▨ : "H" or "L"

LOWER BYTE WRITE CYCLE (OE CONTROLLED WRITE)

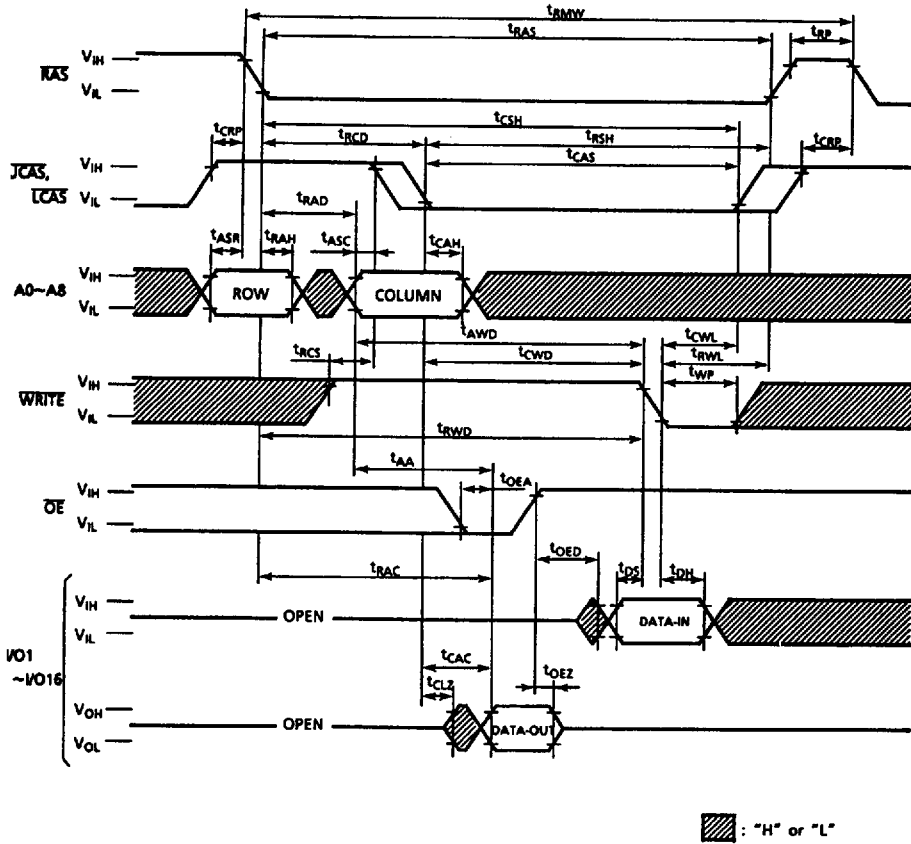


Note:  $D_{IN}$  (I/O9-I/O16) = Don't Care  
 $D_{OUT}$  = OPEN

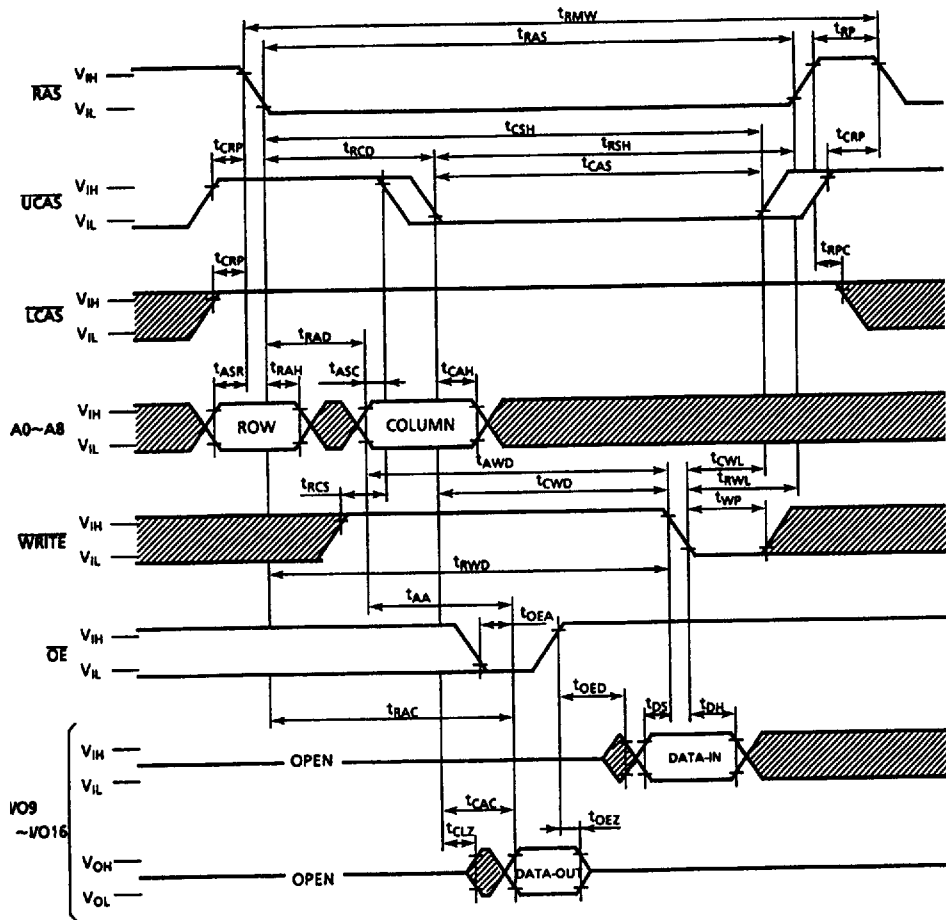
▨ : "H" or "L"



READ-MODIFY-WRITE CYCLE



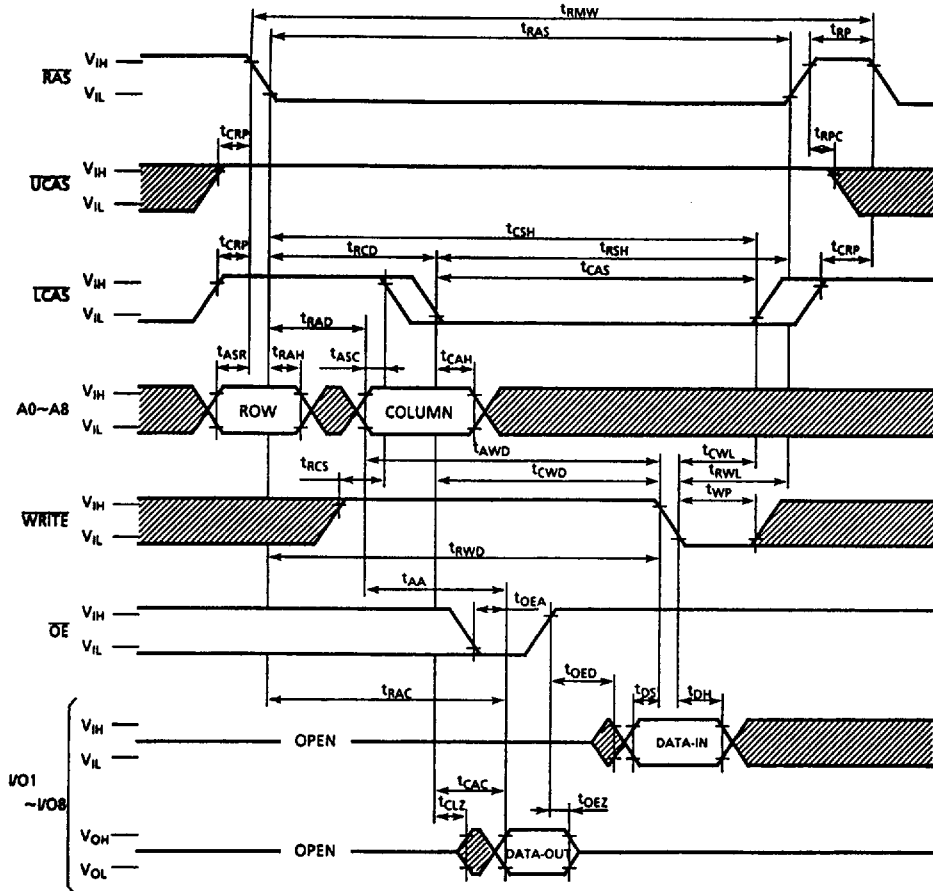
UPPER BYTE READ-MODIFY-WRITE CYCLE



▨ : "H" or "L"

Note:  $D_{IN}(I/O1 \sim I/O8)$  = Don't Care  
 $D_{OUT}(I/O1 \sim I/O8)$  = OPEN

LOWER BYTE READ-MODIFY-WRITE CYCLE

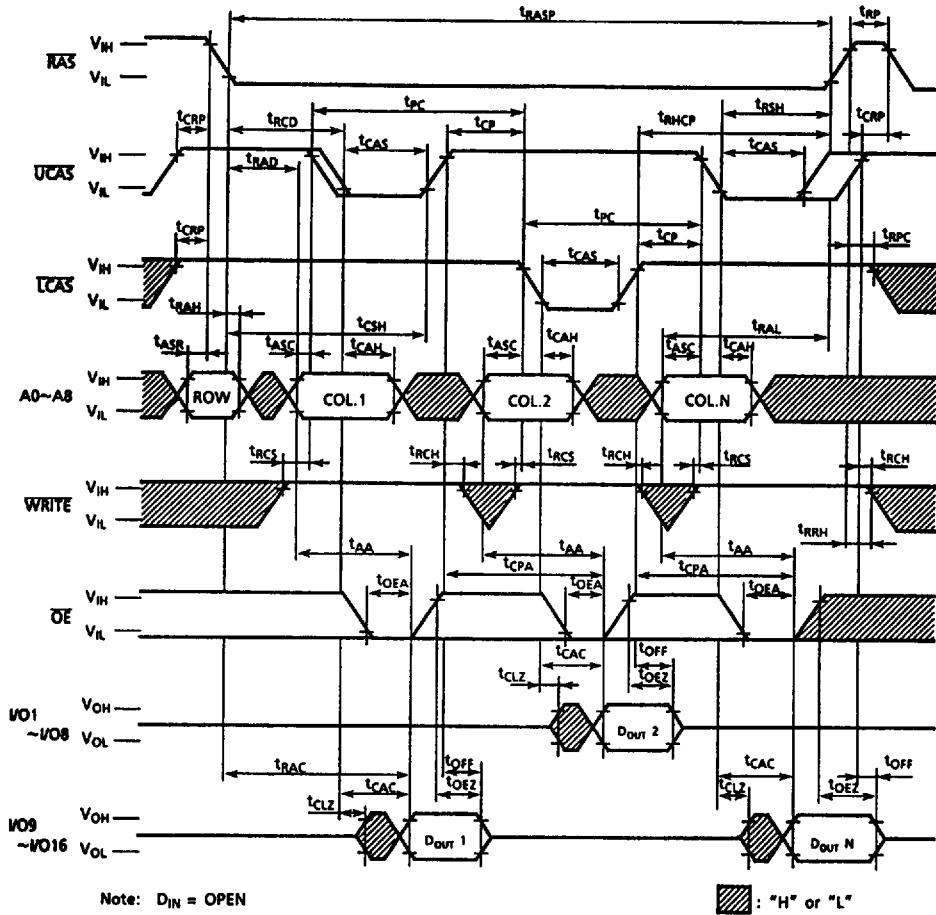


▨: "H" or "L"

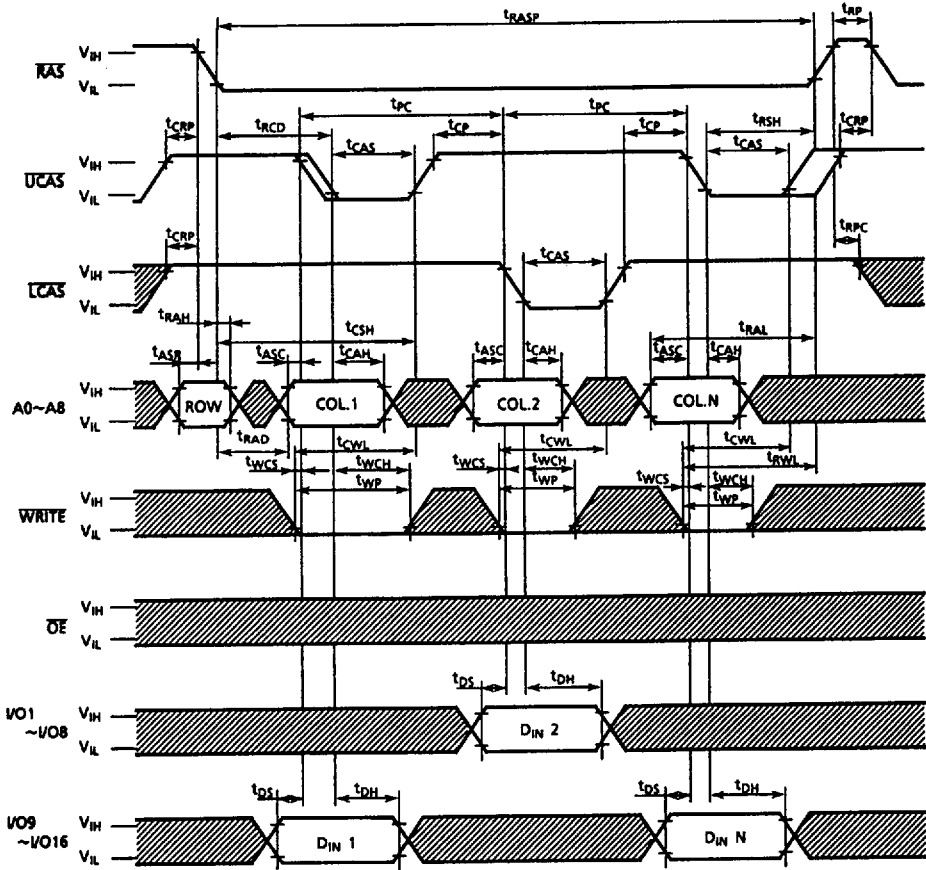
Note:  $D_{IN}(VO9 \sim VO16) = \text{Don't Care}$   
 $D_{OUT}(VO9 \sim VO16) = \text{OPEN}$



**FAST PAGE MODE BYTE READ CYCLE**



**FAST PAGE MODE BYTE WRITE CYCLE (EARLY WRITE)**

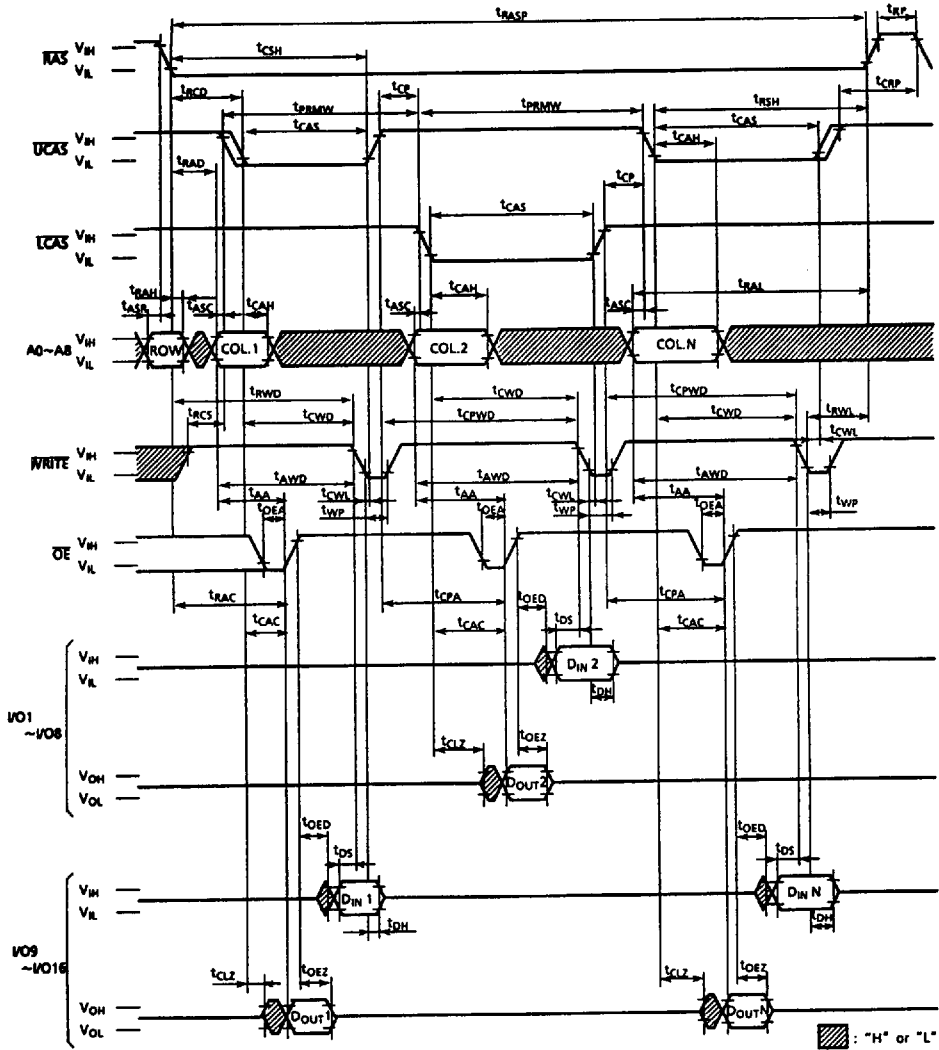


Note: D<sub>OUT</sub> = OPEN

■ : "H" or "L"

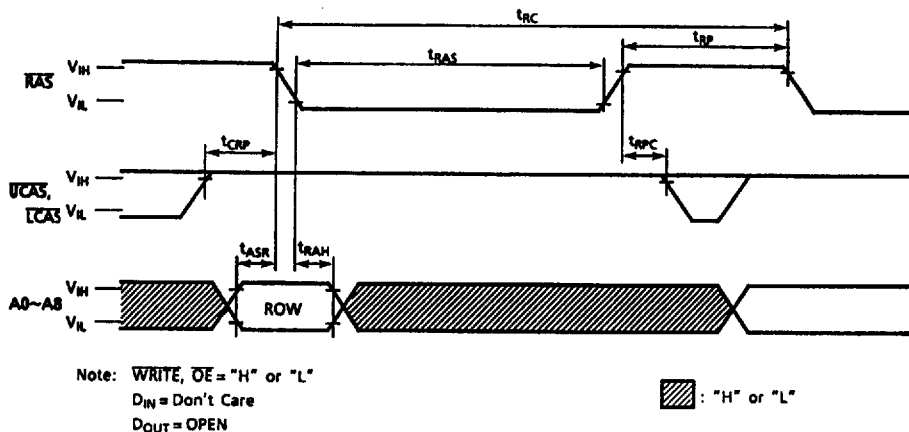


FAST PAGE MODE BYTE READ-MODIFY-WRITE CYCLE

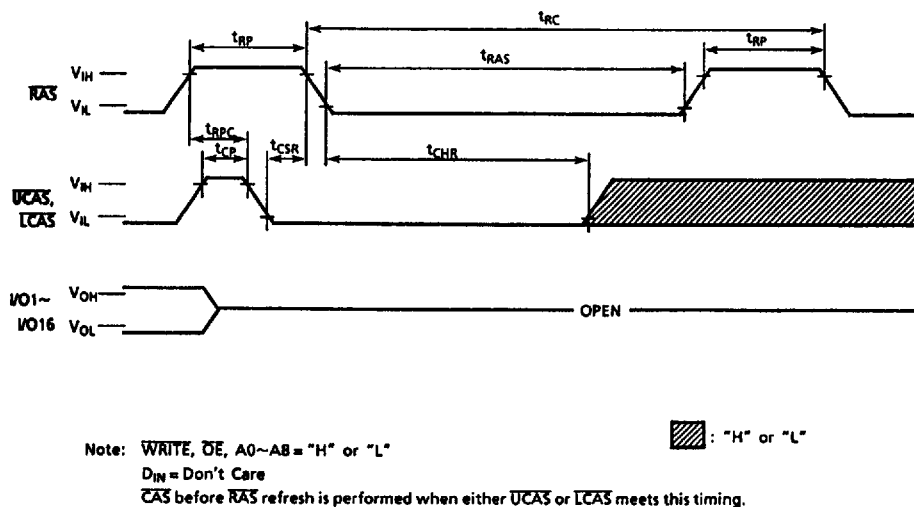




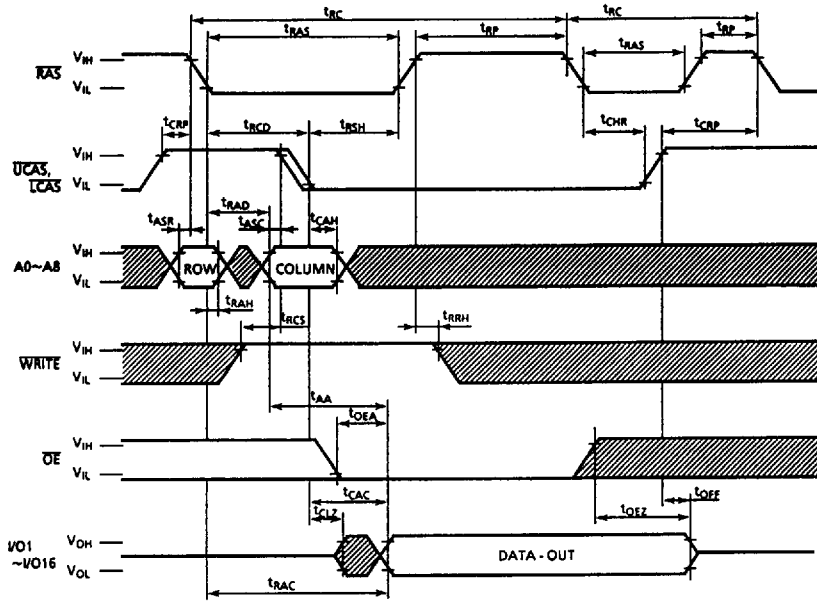
**RAS ONLY REFRESH CYCLE**



**CAS BEFORE RAS REFRESH CYCLE**



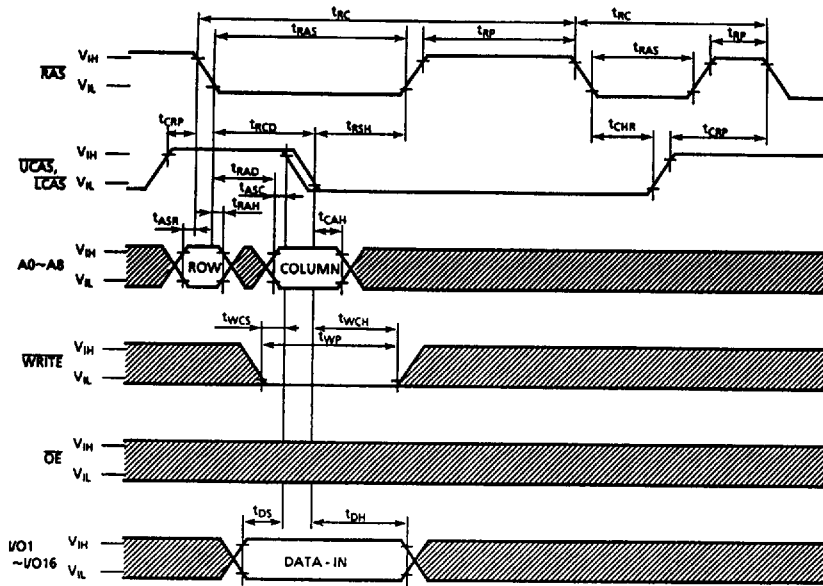
**HIDDEN REFRESH CYCLE (READ)**



Note:  $D_{IN} = OPEN$

▨ : "H" or "L"

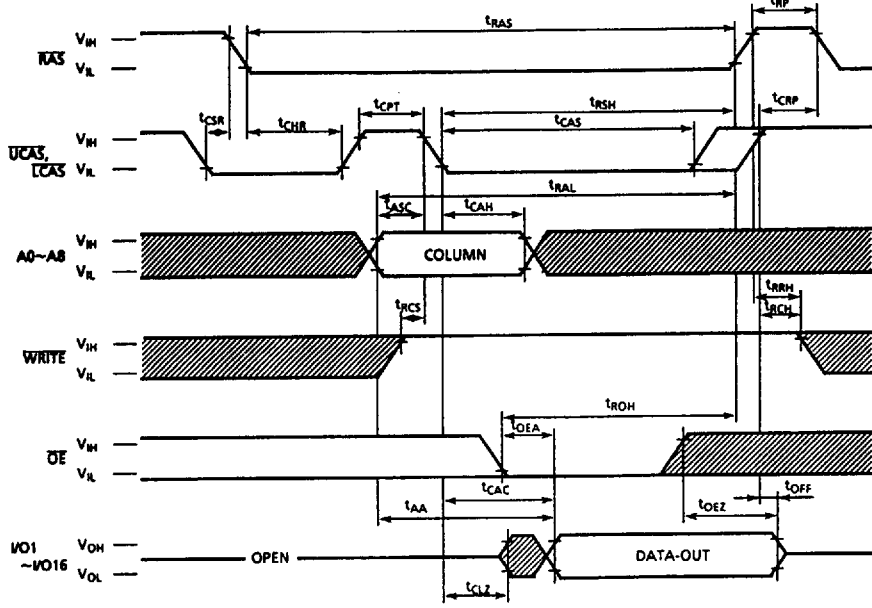
**HIDDEN REFRESH CYCLE (WRITE)**



Note: D<sub>OUT</sub> = OPEN

▨ : "H" or "L"

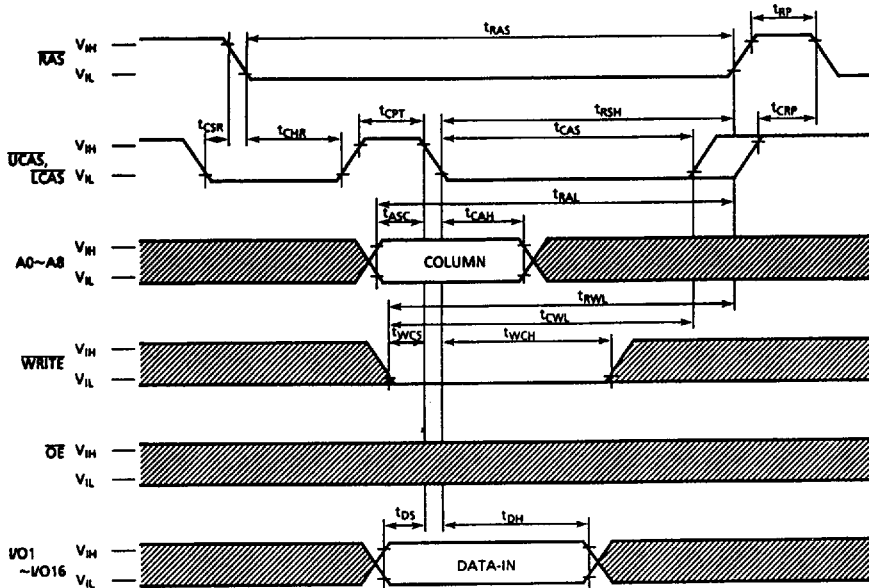
**CAS BEFORE RAS REFRESH COUNTER TEST READ CYCLE**



Note:  $D_{IN} = OPEN$

■: "H" or "L"

**CAS BEFORE RAS REFRESH COUNTER TEST WRITE CYCLE**



Note:  $D_{OUT} = OPEN$

■: "H" or "L"

**CAS BEFORE RAS REFRESH COUNTER TEST READ-MODIFY-WRITE CYCLE**

