

**Description**

The GM71C4256B/BL is the new generation dynamic RAM organized 262,144 x 4 bit. GM71C4256B/BL has realized higher density, higher performance and various functions by utilizing advanced CMOS process technology. The GM71C4256B/BL offers Fast Page Mode as a high speed access mode. Multiplexed address inputs permit the GM71C4256B/BL to be packaged in a standard 20 pin DIP, SOJ and ZIP. 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 Words x 4 Bit Organization
- Fast Page Mode Capability
- Single Power Supply ( $5V \pm 10\%$ )
- Fast Access Time & Cycle Time

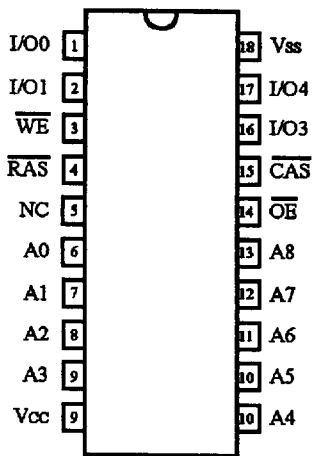
(Unit: ns)

	t <sub>TRAC</sub>	t <sub>CAC</sub>	t <sub>RC</sub>	t <sub>PC</sub>
GM71C4256B/BL-60	60	20	120	45
GM71C4256B/BL-70	70	20	130	50
GM71C4256B/BL-80	80	25	160	55

- Low Power  
Active : 495/440/385mW (MAX)  
Standby : 5.5mW (CMOS level : MAX)  
1.1mW (L-series)
- $\overline{\text{RAS}}$  Only Refresh,  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  Refresh, Hidden Refresh Capability
- All inputs and outputs TTL Compatible
- 512 Refresh Cycles/8ms
- 512 Refresh Cycles/64ms (L-series)
- Battery Back Up Operation (L-series)

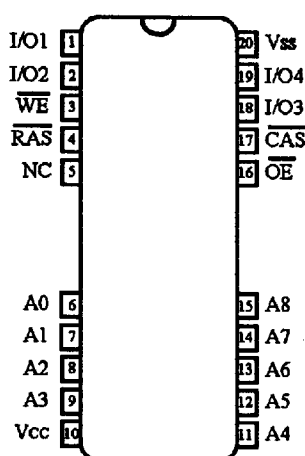
**Pin Configuration**

**20 DIP**



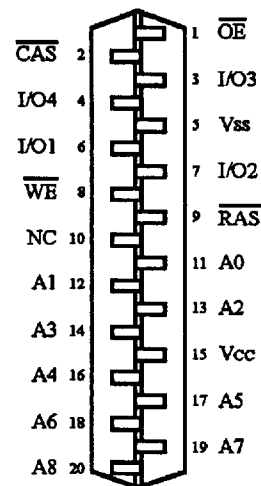
**(Top View)**

**20 (26) SOJ**



**(Top View)**

**20 ZIP**



**(Bottom View)**

**Pin Description**

Pin	Function	Pin	Function
A0-A8	Address Inputs	I/O1-I/O4	Data Input/Output
$\overline{\text{RAS}}$	Row Address Strobe	V <sub>cc</sub>	Power (+5V)
$\overline{\text{CAS}}$	Column Address Strobe	V <sub>ss</sub>	Ground
$\overline{\text{WE}}$	Read/Write Enable	NC	No Connection
$\overline{\text{OE}}$	Output Enable		

**Ordering Information**

Type No.	Access Time	Package
GM71C4256B/BL-60 GM71C4256B/BL-70 GM71C4256B/BL-80	60ns 70ns 80ns	300 Mil 20 Pin Plastic DIP
GM71C4256BJ/BLJ-60 GM71C4256BJ/BLJ-70 GM71C4256BJ/BLJ-80	60ns 70ns 80ns	300 Mil 20 (26) Pin Plastic SOJ
GM71C4256BZ/BLZ-60 GM71C4256BZ/BLZ-70 GM71C4256BZ/BLZ-80	60ns 70ns 80ns	400 Mil 20 Pin Plastic ZIP

**Absolute Maximum Ratings\***

Symbol	Parameter	Rating	Unit
T <sub>A</sub>	Ambient Temperature under Bias	0 ~ 70	°C
T <sub>STG</sub>	Storage Temperature (Plastic)	-55 ~ 125	°C
V <sub>IN</sub> /V <sub>OUT</sub>	Voltage on any Pin Relative to V <sub>ss</sub>	-1.0 ~ 7.0	V
V <sub>CC</sub>	Voltage on V <sub>CC</sub> Relative to V <sub>ss</sub>	-1.0 ~ 7.0	V
I <sub>OUT</sub>	Short Circuit Output Current	50	mA
P <sub>D</sub>	Power Dissipation	1.0	W

\*Note: Operation at or above Absolute Maximum Ratings can adversely affect device reliability.

**Recommended DC Operating Conditions (T<sub>A</sub> = 0 ~ 70°C)**

Symbol	Parameter	Min	Typ	Max	Unit
V <sub>CC</sub>	Supply Voltage	4.5	5.0	5.5	V
V <sub>IH</sub>	Input High Voltage	2.4	-	6.5	V
V <sub>IL</sub>	Input Low Voltage (I/O Pin)	-1.0	-	0.8	V
V <sub>IL</sub>	Input Low Voltage (Others)	-2.0	-	0.8	V

**DC Electrical Characteristics ( $V_{CC} = 5V \pm 10\%$ ,  $T_A = 0 \sim 70^\circ C$ )**

Symbol	Parameter	Min	Max	Unit	Note	
$V_{OH}$	Output Level Output "H" Level Voltage ( $I_{OUT} = -5mA$ )	2.4	$V_{CC}$	V		
$V_{OL}$	Output Level Output "L" Level Voltage ( $I_{OUT} = 4.2mA$ )	0	0.4	V		
$I_{CC1}$	Operating Current Average Power Supply Operating Current (RAS, CAS, Address Cycling: $t_{RC} = t_{AC} \text{ min}$ )	60ns	-	90	mA	1, 2
		70ns	-	80		
		80ns	-	70		
$I_{CC2}$	Standby Current (TTL) Power Supply Standby Current (RAS, CAS = $V_{IH}$ , DOUT = High-Z)	-	2	mA		
$I_{CC3}$	RAS-Only Refresh Current Average Power Supply Current RAS-Only Refresh Mode (RAS Cycling, CAS = $V_{IH}$ , $t_{RC} = t_{RC} \text{ min}$ )	60ns	-	90	mA	2
		70ns	-	80		
		80ns	-	70		
$I_{CC4}$	Fast Page Mode Current Average Power Supply Current Fast Page Mode (RAS = $V_{IL}$ , CAS, Address Cycling: $t_{RC} = t_{RC} \text{ min}$ )	60ns	-	80	mA	1, 3
		70ns	-	70		
		80ns	-	60		
$I_{CC5}$	Standby Current (CMOS) Power Supply Standby Current (RAS, CAS = $V_{CC} - 0.2V$ )	-	1	mA		
		-	200	μA	5	
$I_{CC6}$	CAS-before-RAS Refresh Current ( $t_{RC} = t_{RC} \text{ min}$ )	60ns	-	80	mA	
		70ns	-	70		
		80ns	-	70		
$I_{CC7}$	Battery Back Up Current (Standby with CBR Refresh) ( $t_{RC} = 125\mu s$ , $t_{RAS} \leq 1\mu s$ , $\overline{WE} = V_{IH}$ , $\overline{CAS} = V_{IL}$ , $\overline{OE}$ , Address and $D_{IN} = V_{IH}$ or $V_{IL}$ , DOUT = High-Z)	-	300	μA	4, 5	
$I_{CC8}$	Standby Current $\overline{RAS} = V_{IH}$ $\overline{CAS} = V_{IL}$ DOUT = Enable	-	5	mA	1	
$I_{IL}$	Input Leakage Current Any Input ( $0V \leq V_{IN} \leq 7V$ )	-10	10	μA		
$I_{OL}$	Output Leakage Current (DOUT is Disabled, $0V \leq V_{OUT} \leq 7V$ )	-10	10	μA		

Note: 1.  $I_{CC}$  depends on output load condition when the device is selected.  $I_{CC}(\text{max})$  is specified at the output open condition.

2. Address can be changed once or less while  $\overline{RAS} = V_{IL}$ .

3. Address can be changed once or less while  $\overline{CAS} = V_{IH}$ .

4. L Series.

5.  $t_{RAS}(\text{max}) = 1\mu s$  is applied to refresh of battery back up.

**Capacitance** ( $V_{CC} = 5V \pm 10\%$ ,  $T_A = 25^\circ C$ )

Symbol	Parameter	Min	Max	Unit	Note
C <sub>11</sub>	Input Capacitance (Address, D <sub>IN</sub> )	-	5	pF	1
C <sub>12</sub>	Input Capacitance (Clocks)	-	7	pF	1
C <sub>0</sub>	Output Capacitance (Data-In/Out)	-	10	pF	1, 2

Note: 1. Capacitance measured with Boonton Meter or effective capacitance measuring method.  
 2.  $\overline{CAS} = V_{IH}$  to disable DOUT.

**AC Characteristics** ( $V_{CC} = 5V \pm 10\%$ ,  $T_A = 0 \sim 70^\circ C$ , Notes 1, 14)

**Test Conditions**

Input rise and fall times: 5ns

Input timing reference levels: 0.8V, 2.4V

 Output load : 2 TTL gate + C<sub>L</sub> (100pF)  
 (Including scope and jig)

**Read, Write, Read-Modify-Write and Refresh Cycles (Common Parameters)**

Symbol	Parameter	GM71C4256 B/BL-60		GM71C4256 B/BL-70		GM71C4256 B/BL-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t <sub>RC</sub>	Random Read or Write Cycle Time	120	-	130	-	160	-	ns	
t <sub>RP</sub>	$\overline{RAS}$ Precharge Time	50	-	50	-	70	-	ns	
t <sub>RAS</sub>	$\overline{RAS}$ Pulse Width	60	10,000	70	10,000	80	10,000	ns	
t <sub>CAS</sub>	$\overline{CAS}$ Pulse Width	20	10,000	20	10,000	25	10,000	ns	
t <sub>ASR</sub>	Row Address Set-up Time	0	-	0	-	0	-	ns	
t <sub>RAH</sub>	Row Address Hold Time	10	-	10	-	12	-	ns	
t <sub>ASC</sub>	Column Address Set-up Time	0	-	0	-	0	-	ns	
t <sub>CAH</sub>	Column Address Hold Time	15	-	15	-	20	-	ns	
t <sub>RCD</sub>	$\overline{RAS}$ to $\overline{CAS}$ Delay Time	20	40	20	50	22	55	ns	8
t <sub>RAD</sub>	$\overline{RAS}$ to Column Address Delay Time	15	30	15	35	17	40	ns	9
t <sub>RSH</sub>	$\overline{RAS}$ Hold Time	20	-	20	-	25	-	ns	
t <sub>CSH</sub>	$\overline{CAS}$ Hold Time	60	-	70	-	80	-	ns	
t <sub>CRP</sub>	$\overline{CAS}$ to $\overline{RAS}$ Precharge Time	10	-	10	-	10	-	ns	
t <sub>ODD</sub>	$\overline{OE}$ to D <sub>IN</sub> Delay Time	20	-	20	-	20	-	ns	
t <sub>DZO</sub>	$\overline{OE}$ Delay Time from D <sub>IN</sub>	0	-	0	-	0	-	ns	
t <sub>DZC</sub>	$\overline{CAS}$ Dealy Time from D <sub>IN</sub>	0	-	0	-	0	-	ns	
t <sub>r</sub>	Transition Time (Rise and Fall)	3	50	3	50	3	50	ns	7
t <sub>REF</sub>	Refresh Period	-	8	-	8	-	8	ms	
	Refresh Period (L-Series)	-	64	-	64	-	64	ms	

### Read Cycle

Symbol	Parameter	GM71C4256 B/BL-60		GM71C4256 B/BL-70		GM71C4256 B/BL-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t <sub>RAC</sub>	Access Time from $\overline{\text{RAS}}$	-	60	-	70	-	80	ns	2, 3
t <sub>CAC</sub>	Access Time from $\overline{\text{CAS}}$	-	20	-	20	-	25	ns	3, 4
t <sub>AA</sub>	Access Time from Address	-	30	-	35	-	40	ns	3, 5
t <sub>OAC</sub>	Access Time from $\overline{\text{OE}}$	-	20	-	20	-	25	ns	
t <sub>RCS</sub>	Read Command Setup Time	0	-	0	-	0	-	ns	
t <sub>RCH</sub>	Read Command Hold Time to $\overline{\text{CAS}}$	0	-	0	-	0	-	ns	
t <sub>RRH</sub>	Read Command Hold Time to $\overline{\text{RAS}}$	10	-	10	-	10	-	ns	
t <sub>RAL</sub>	Column Address to $\overline{\text{RAS}}$ Lead Time	30	-	35	-	40	-	ns	
t <sub>OFF1</sub>	Output Buffer Turn-off Time	0	20	0	20	0	20	ns	6
t <sub>OFF2</sub>	Output Buffer Turn-off Time from $\overline{\text{OE}}$	0	20	0	20	0	20	ns	6
t <sub>CDD</sub>	$\overline{\text{CAS}}$ to $\text{D}_{\text{IN}}$ Delay Time	20	-	20	-	20	-	ns	

### Write Cycle

Symbol	Parameter	GM71C4256 B/BL-60		GM71C4256 B/BL-70		GM71C4256 B/BL-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t <sub>WCS</sub>	Write Command Setup Time	0	-	0	-	0	-	ns	10
t <sub>WCH</sub>	Write Command Hold Time	15	-	15	-	20	-	ns	
t <sub>WP</sub>	Write Command Pulse Width	10	-	10	-	15	-	ns	
t <sub>RWL</sub>	Write Command to $\overline{\text{RAS}}$ Lead Time	20	-	20	-	25	-	ns	
t <sub>CWL</sub>	Write Command to $\overline{\text{CAS}}$ Lead Time	20	-	20	-	25	-	ns	
t <sub>DS</sub>	Data-in Setup Time	0	-	0	-	0	-	ns	11
t <sub>DH</sub>	Data-in Hold Time	15	-	15	-	20	-	ns	11

**Read-Modify-Write Cycle**

Symbol	Parameter	GM71C4256 B/BL-60		GM71C4256 B/BL-70		GM71C4256 B/BL-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t <sub>rw</sub>	Read-Write Cycle Time	170	-	180	-	220	-	ns	
t <sub>rwd</sub>	RAS to WE Delay Time	85	-	95	-	110	-	ns	10
t <sub>cwd</sub>	CAS to WE Delay Time	45	-	45	-	55	-	ns	10
t <sub>awd</sub>	Column Address to WE Delay Time	55	-	60	-	70	-	ns	10
t <sub>oeh</sub>	OE Hold Time from WE	20	-	20	-	25	-	ns	

**Refresh Cycle**

Symbol	Parameter	GM71C4256 B/BL-60		GM71C4256 B/BL-70		GM71C4256 B/BL-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t <sub>csr</sub>	CAS Set-up Time (CAS-before-RAS Refresh Cycle)	10	-	10	-	10	-	ns	
t <sub>chr</sub>	CAS Hold Time (CAS-before-RAS Refresh Cycle)	15	-	15	-	20	-	ns	
t <sub>rpc</sub>	RAS Precharge to CAS Hold Time	10	-	10	-	10	-	ns	

**Fast Page Mode Cycle**

Symbol	Parameter	GM71C4256 B/BL-60		GM71C4256 B/BL-70		GM71C4256 B/BL-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t <sub>pc</sub>	Fast Page Mode Cycle Time	45	-	50	-	55	-	ns	
t <sub>cp</sub>	Fast Page Mode CAS Precharge Time	10	-	10	-	10	-	ns	
t <sub>rasc</sub>	Fast Page Mode RAS Pulse Width	-	100,000	-	100,000	-	100,000	ns	12
t <sub>acp</sub>	Access Time from CAS Precharge	-	40	-	45	-	50	ns	13
t <sub>rhcp</sub>	RAS Hold Time from CAS Precharge	40	-	45	-	50	-	ns	

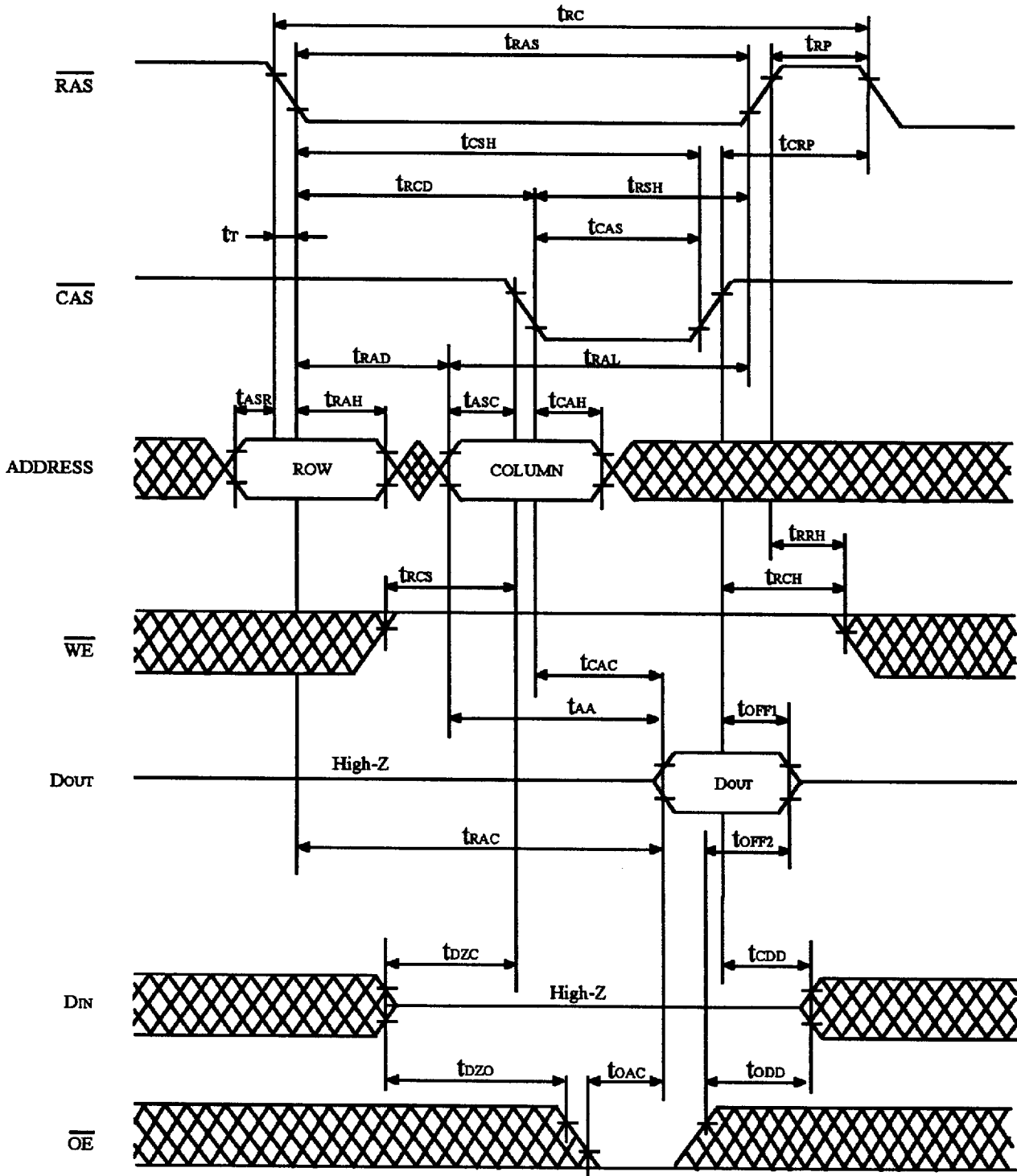
**Fast Page Mode Read-Modify-Write Cycle**


Symbol	Parameter	GM71C4256 B/BL-60		GM71C4256 B/BL-70		GM71C4256 B/BL-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t <sub>pcm</sub>	Fast Page Mode Read-Modify-Write Cycle Time	95	-	100	-	110	-	ns	

**Notes:**

1. AC Measurements assume  $t_r = 5 \text{ ns}$ .
2. Assumes that  $t_{rCD} \leq t_{rCD(\text{max})}$  and  $t_{rAD} \leq t_{rAD(\text{max})}$ . If  $t_{rCD}$  or  $t_{rAD}$  is greater than the maximum recommended value shown in this table,  $t_{rAC}$  exceeds the value shown.
3. Measured with a load circuit equivalent to 2TTL loads and  $100 \text{ pF}$ .
4. Assumes that  $t_{rCD} \geq t_{rCD(\text{max})}$  and  $t_{rAD} \leq t_{rAD(\text{max})}$ .
5. Assumes that  $t_{rCD} \leq t_{rCD(\text{max})}$  and  $t_{rAD} \geq t_{rAD(\text{max})}$ .
6.  $t_{\text{OFF}(\text{max})}$  defines the time at which the output achieves the open circuit condition and is not referenced to output voltage levels.
7.  $V_{\text{IH}(\text{min})}$  and  $V_{\text{IL}(\text{max})}$  are reference levels for measuring timing of input signals. Also, transition times are measured between  $V_{\text{IH}}$  and  $V_{\text{IL}}$ .
8. Operation with the  $t_{rCD(\text{max})}$  limit insures that  $t_{rAC(\text{max})}$  can be met,  $t_{rCD(\text{max})}$  is specified as a reference point only; if  $t_{rCD}$  is greater than the specified  $t_{rCD(\text{max})}$  limit, then access time is controlled exclusively by  $t_{\text{CAC}}$ .
9. Operation with the  $t_{rAD(\text{max})}$  limit insures that  $t_{rAC(\text{max})}$  can be met,  $t_{rAD(\text{max})}$  is specified as a reference point only; if  $t_{rAD}$  is greater than the specified  $t_{rAD(\text{max})}$  limit, then access time is controlled exclusively by  $t_{\text{AA}}$ .
10.  $t_{\text{WCS}}$ ,  $t_{\text{TRWD}}$ ,  $t_{\text{CWD}}$  and  $t_{\text{AWD}}$  are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only if  $t_{\text{WCS}} \geq t_{\text{WCS}(\text{min})}$  the cycle is an early write cycle and the data out pin will remain open circuit (high impedance) throughout the entire cycle; if  $t_{\text{TRWD}} \geq t_{\text{TRWD}(\text{min})}$ ,  $t_{\text{CWD}} \geq t_{\text{CWD}(\text{min})}$ ,  $t_{\text{AWD}} \geq t_{\text{AWD}(\text{min})}$  and  $t_{\text{CPW}} \geq t_{\text{CPW}(\text{min})}$ , the cycle is a read modify write and the data output will contain data read from the selected cell; if neither of the above sets of conditions is satisfied, the condition of the data out (at access time) is indeterminate.
11. These parameters are referenced to  $\overline{\text{CAS}}$  leading edge in early write cycles and to  $\overline{\text{WE}}$  leading edge in delayed write or Read-Modify-Write cycles.
12.  $t_{\text{RASC}}$  defines  $\overline{\text{RAS}}$  pulse width in fast page mode cycles.
13. Access time is determined by the longer of  $t_{\text{AA}}$  or  $t_{\text{CAC}}$  or  $t_{\text{ACP}}$ .
14. An initial pause of  $100 \mu\text{s}$  is required after power up followed by a minimum of eight initialization cycles (any combination of cycles containing  $\overline{\text{RAS}}$  clock such as  $\overline{\text{RAS}}$  only refresh). If the internal refresh counter is used, a minimum of eight  $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$  refresh cycles are required.

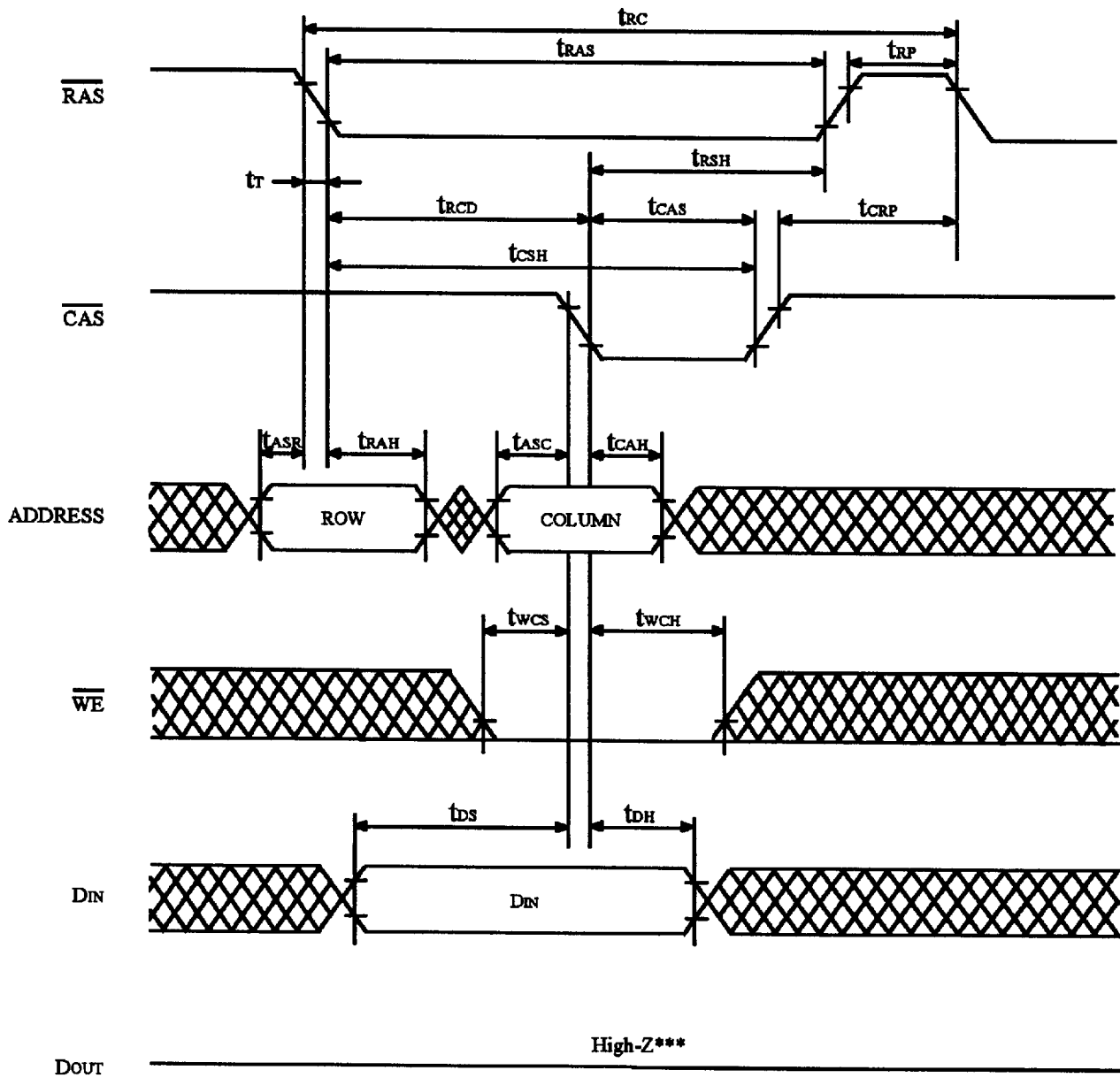
**Timing Waveforms**



\*  : Don't care

**FIGURE 1. READ CYCLE**



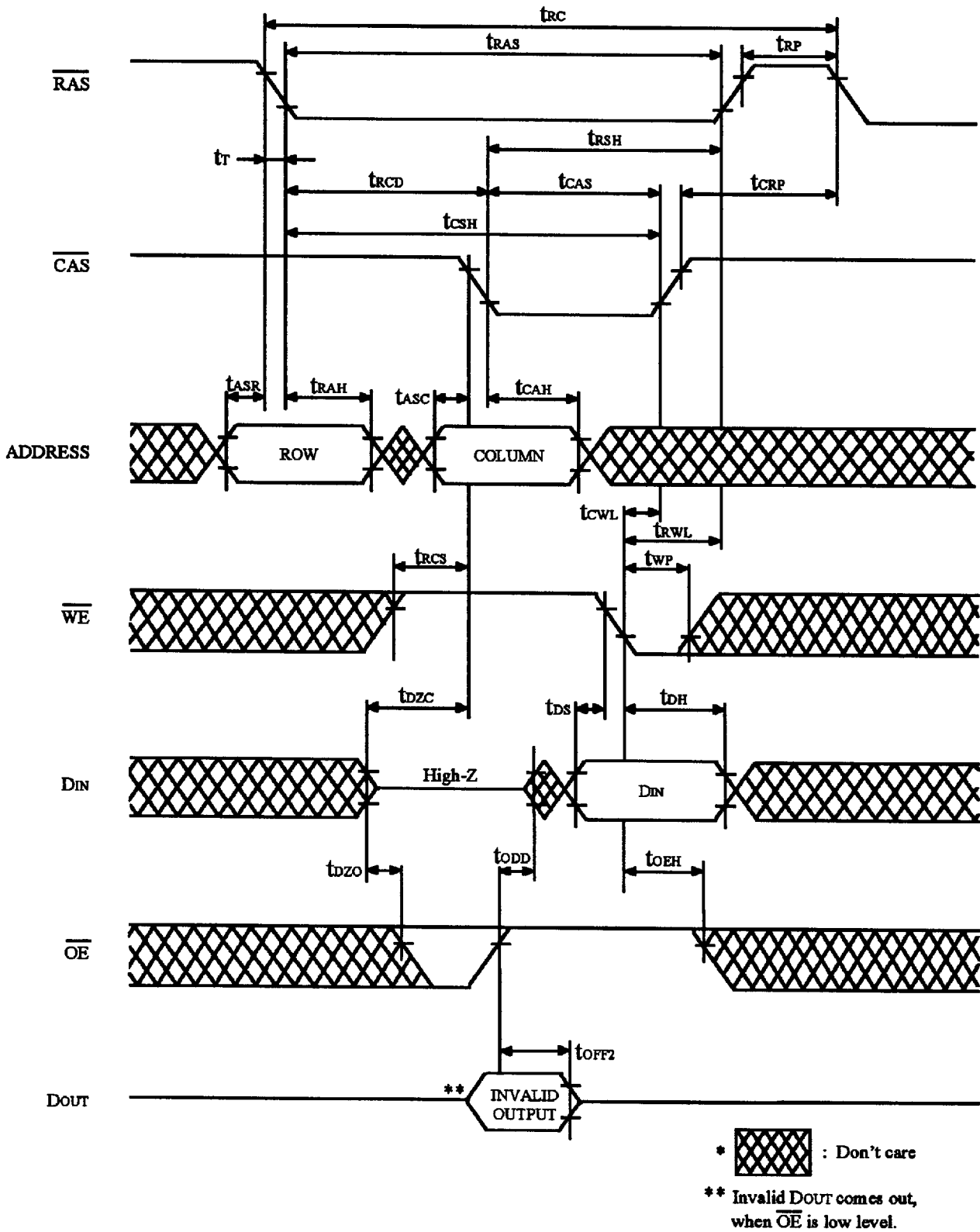


\*  : Don't care

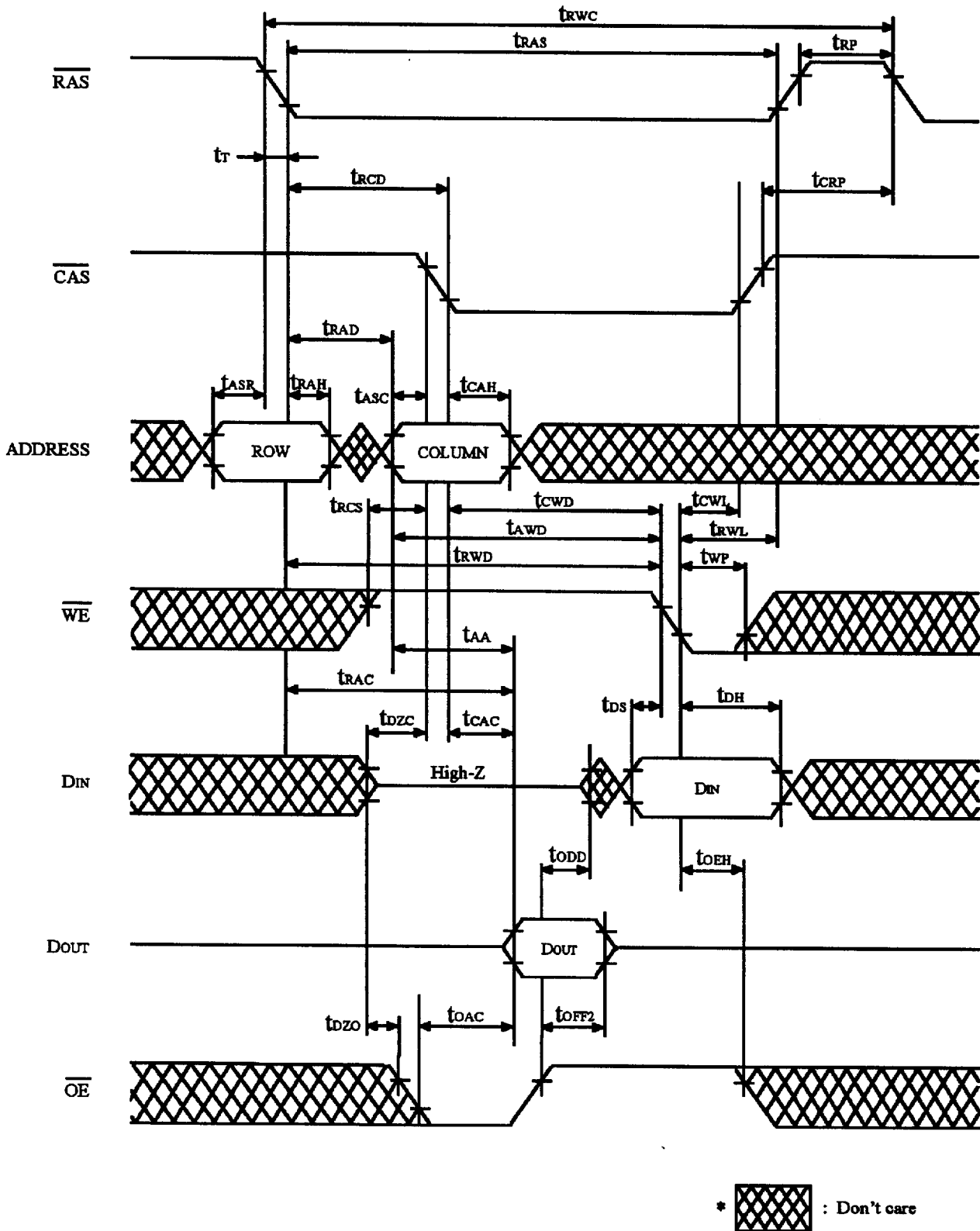
\*\*  $\overline{OE}$  : Don't care

\*\*\*  $t_{wcs} \geq t_{wcs}(\text{min})$

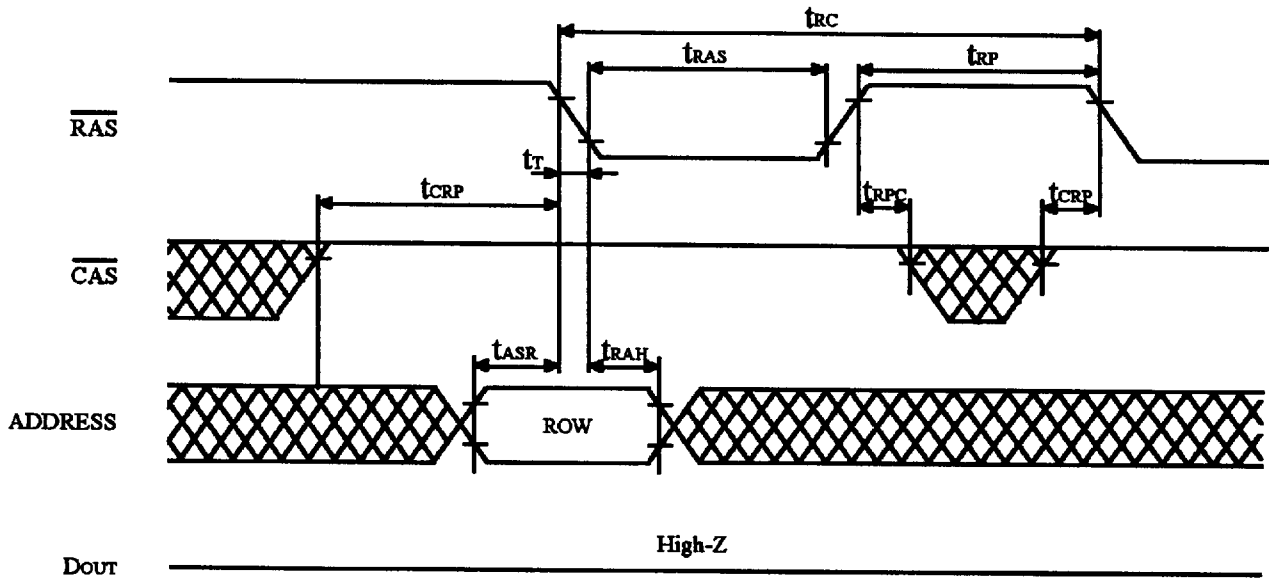
FIGURE 2. EARLY WRITE CYCLE



**FIGURE 3. DELAYED WRITE CYCLE\*18**



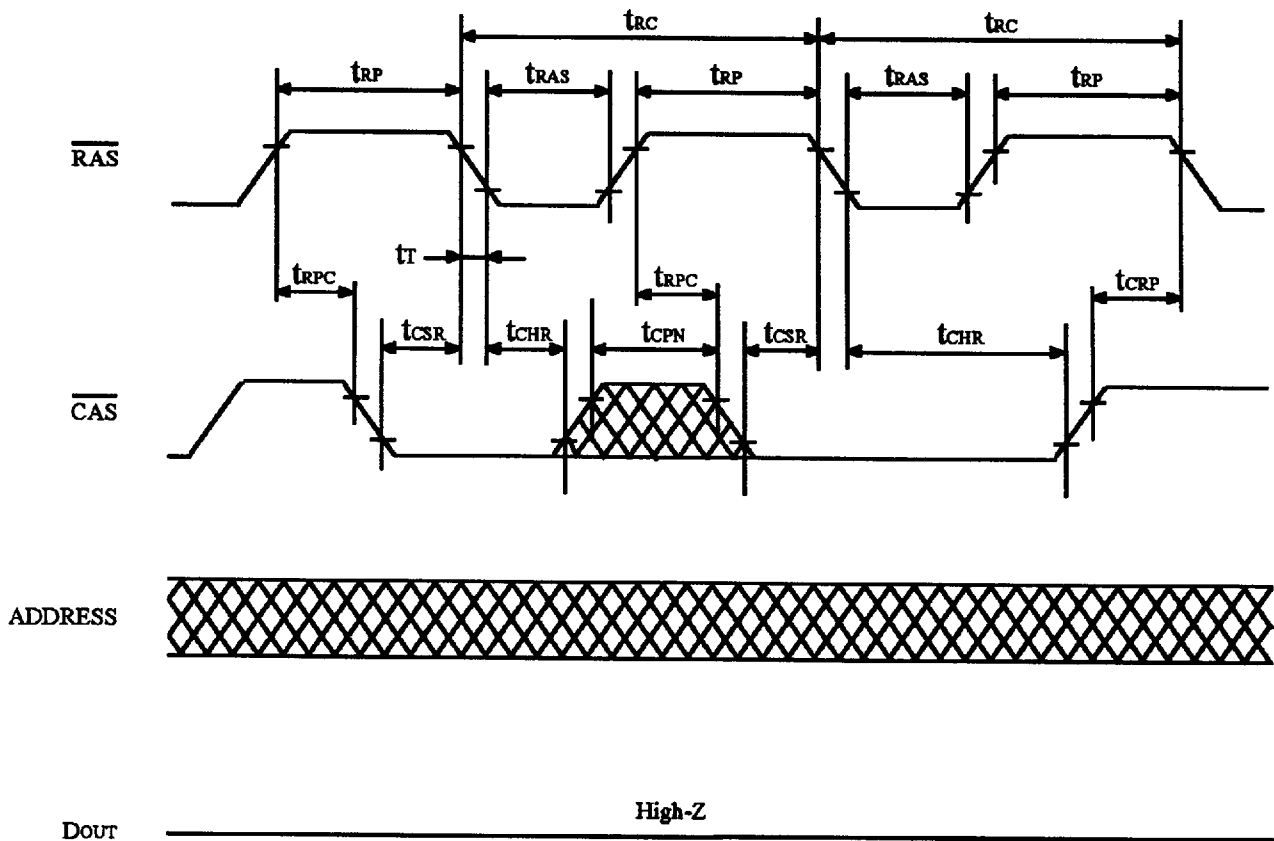
**FIGURE 4. READ MODIFY WRITE CYCLE**



**FIGURE 5. RAS ONLY REFRESH CYCLE**

\*  $\overline{OE}, \overline{WE}$  : Don't care

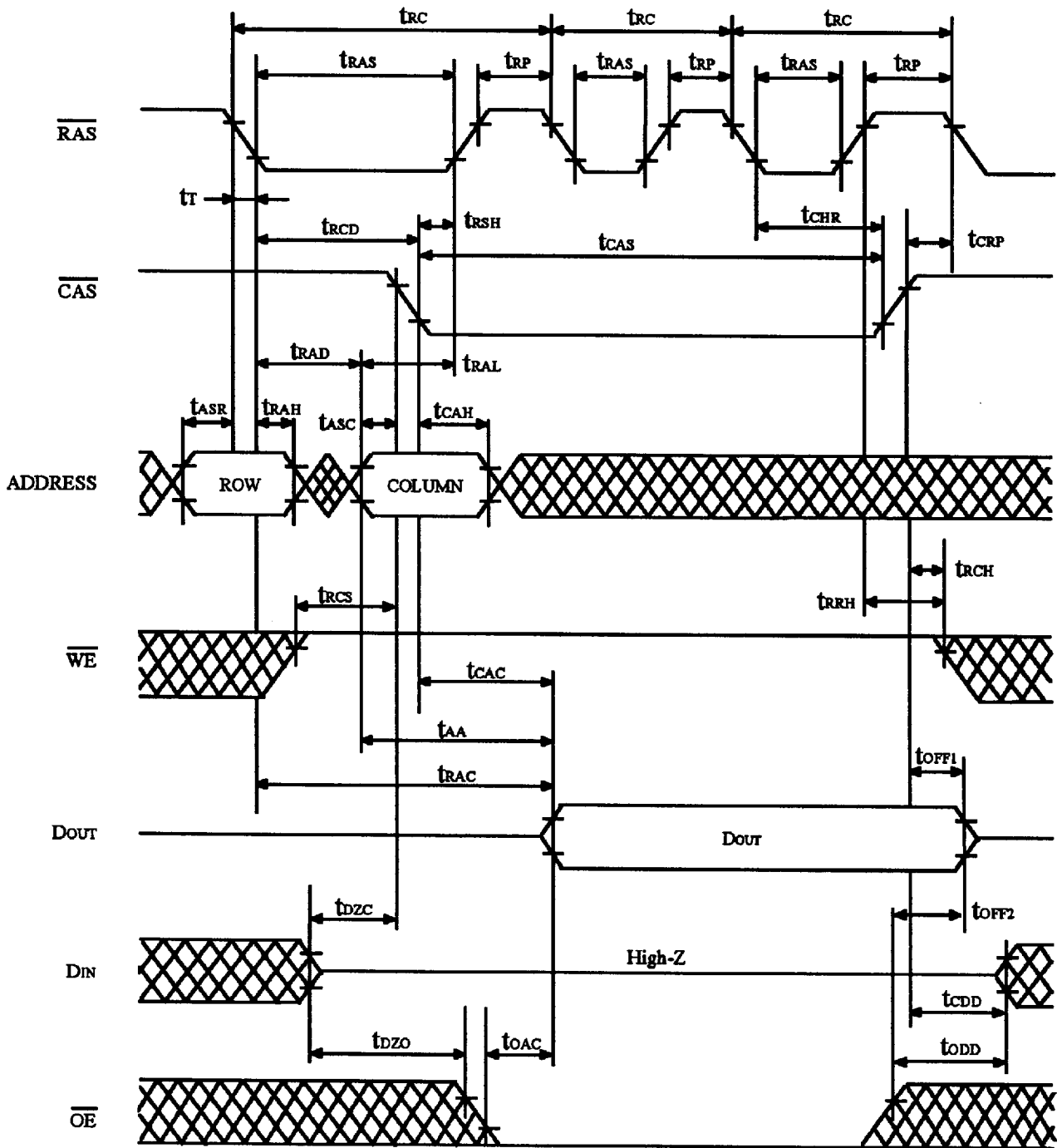
\*\* Refresh address : A0~A9



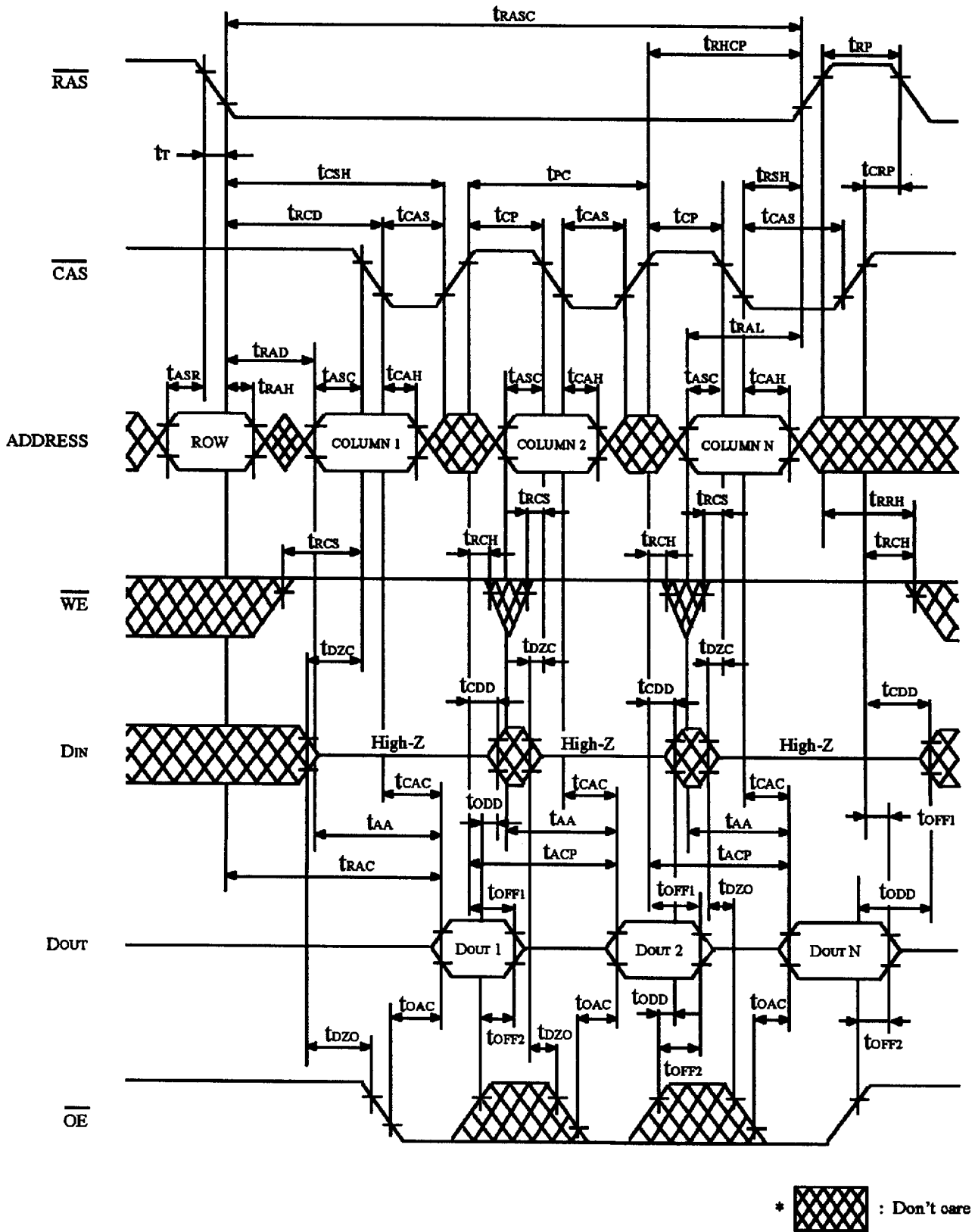
\*  : Don't care

\*\*  $\overline{WE} : V_{IH}$

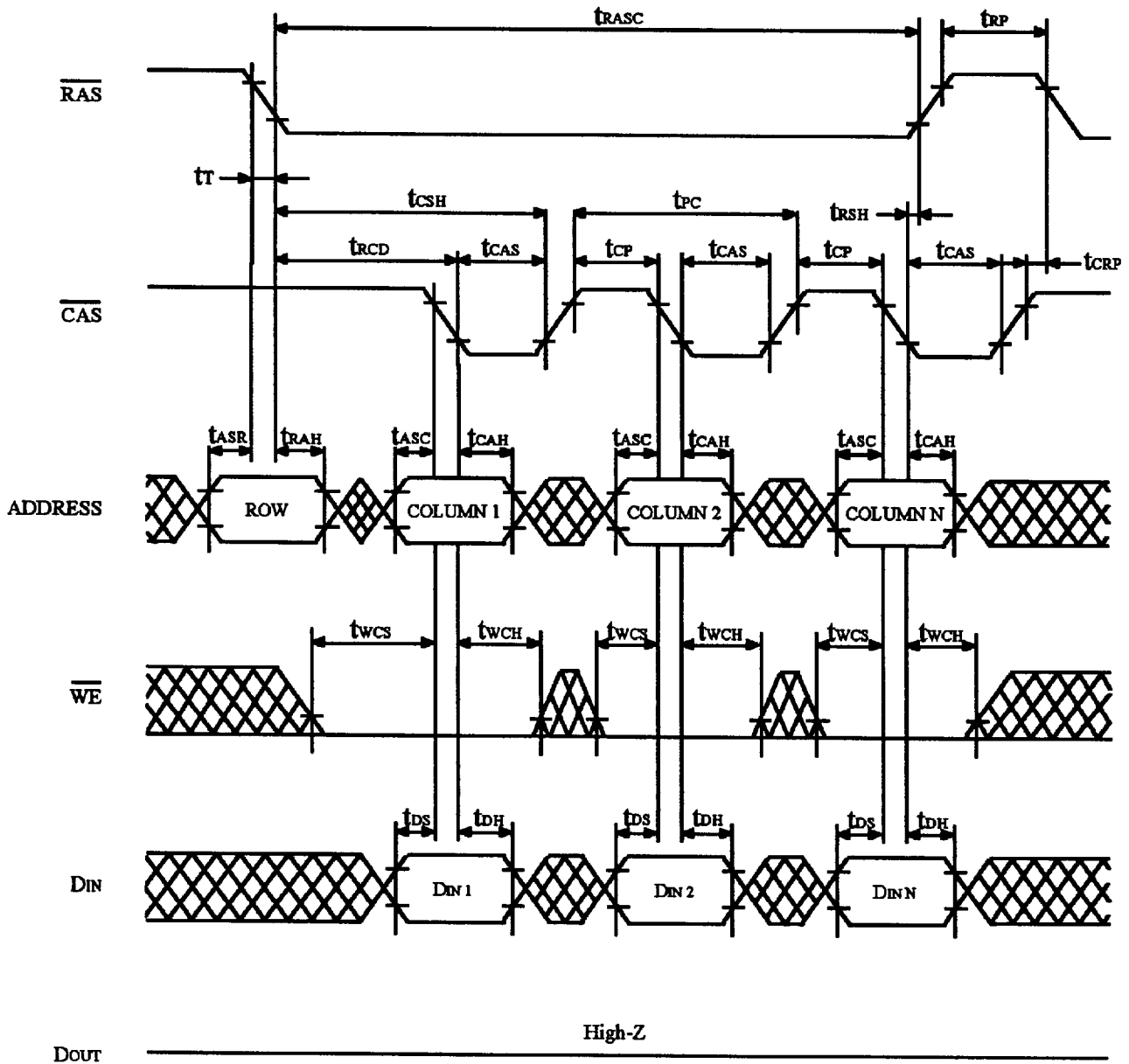
**FIGURE 6. CAS BEFORE RAS REFRESH CYCLE**




**FIGURE 7. HIDDEN REFRESH CYCLE**

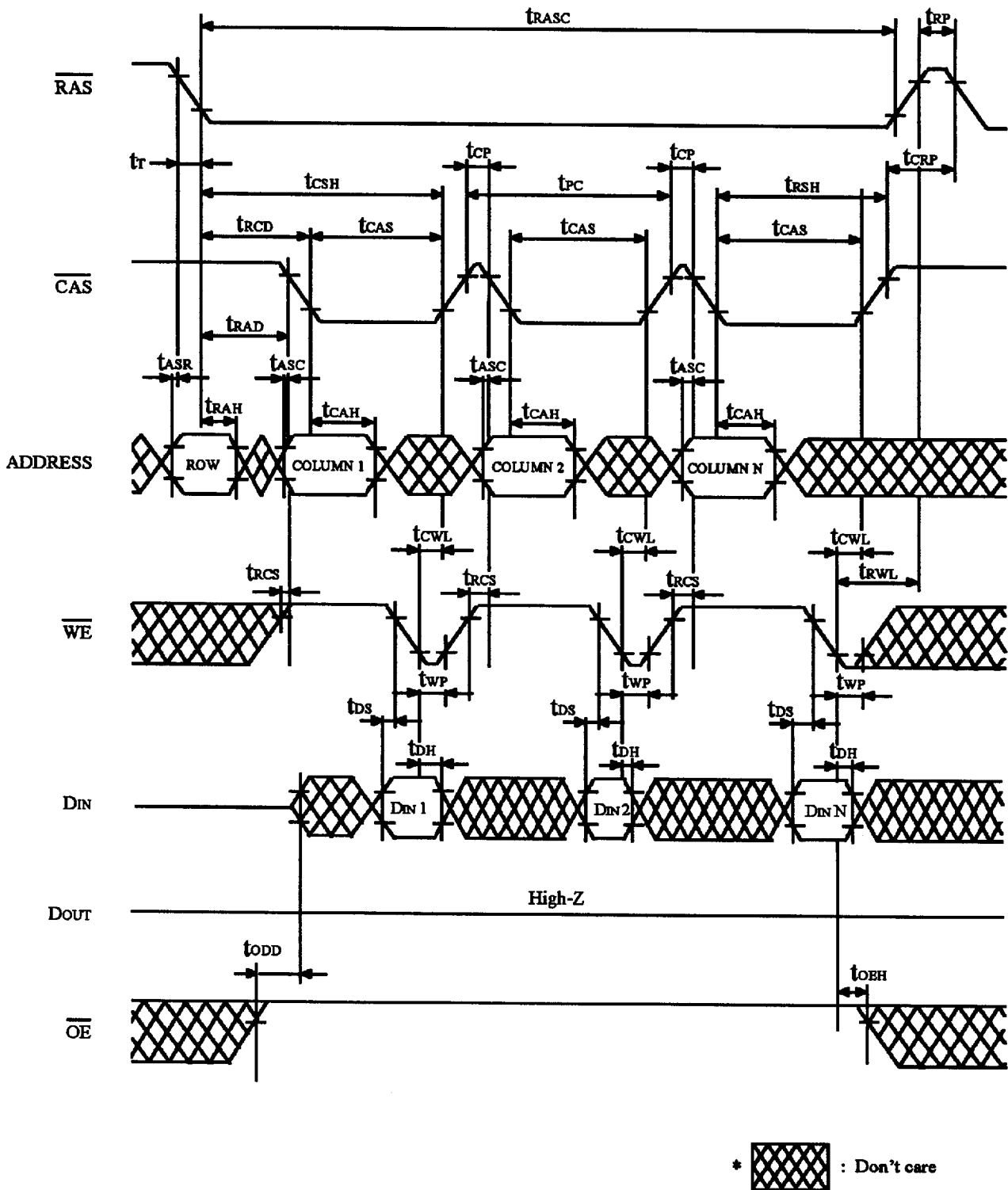


**FIGURE 8. FAST PAGE MODE READ CYCLE**



\*  $\overline{OE}$  : Don't care  
 \*\*  : Don't care

**FIGURE 9. FAST PAGE MODE EARLY WRITE CYCLE**



**FIGURE 10. FAST PAGE MODE DELAYED WRITE CYCLE**



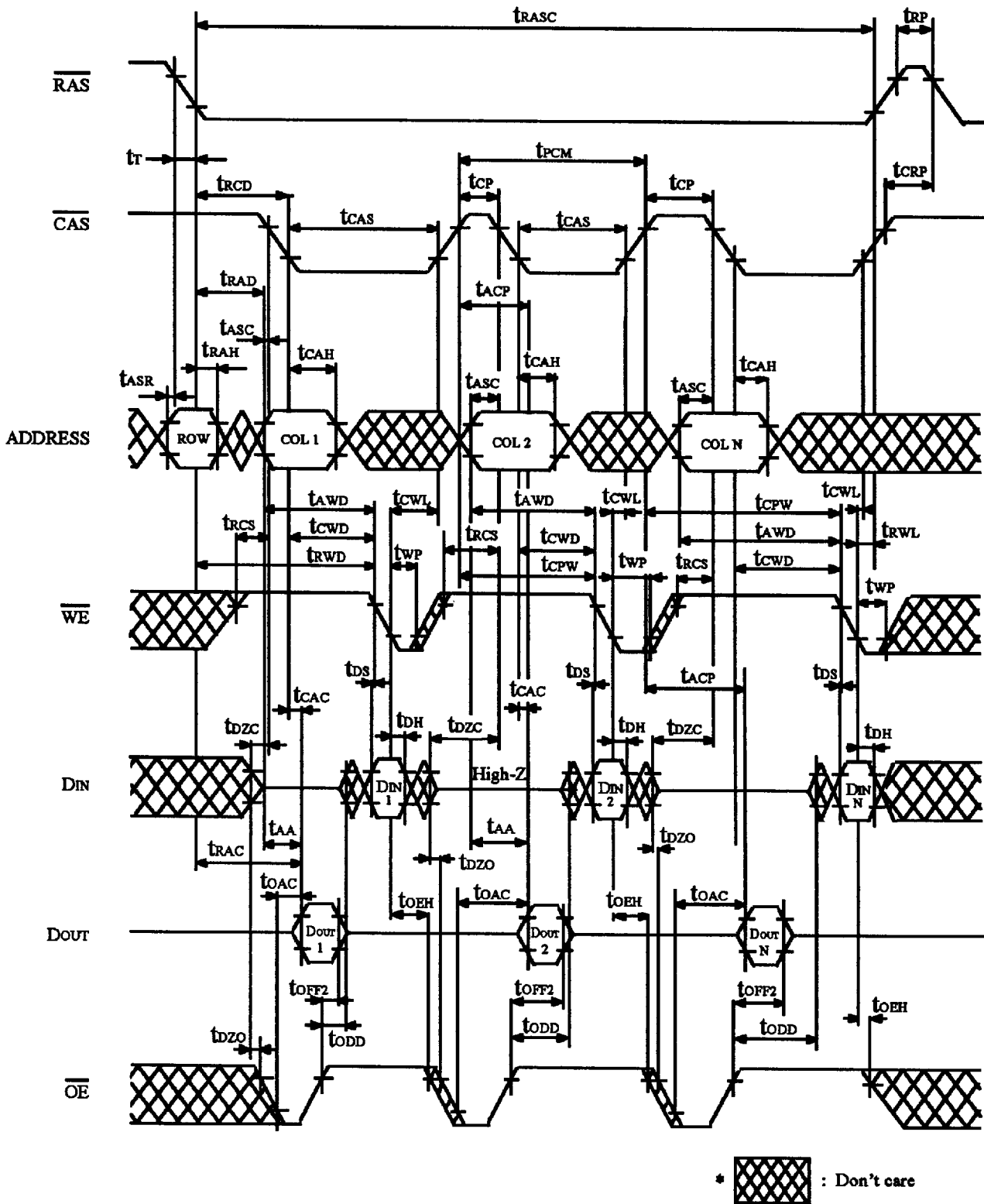
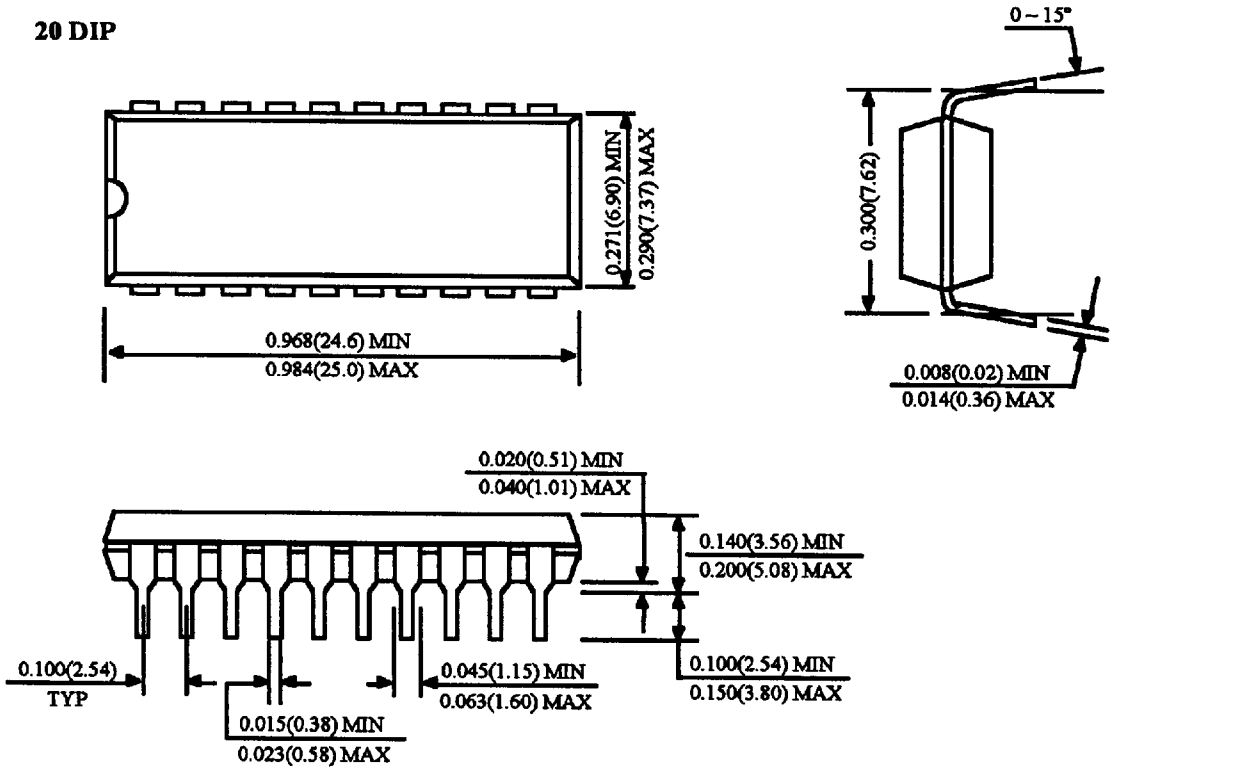


FIGURE 11. FAST PAGE MODE READ MODIFY WRITE CYCLE

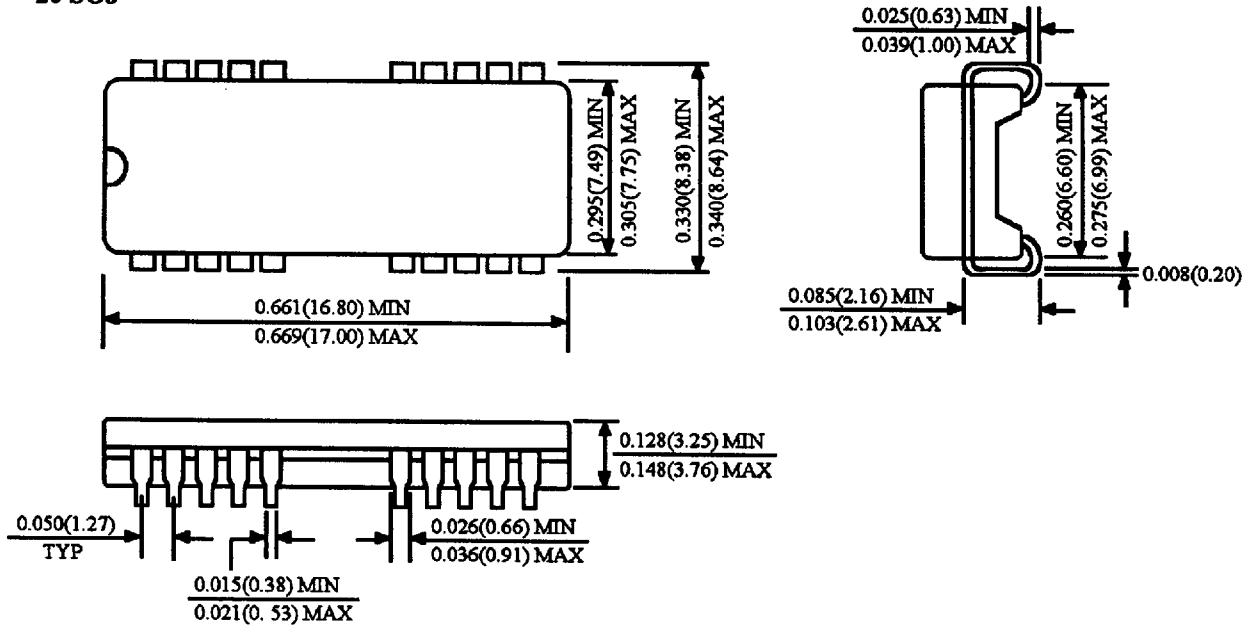
**Package Dimension**

Unit: Inches (mm)

**20 DIP**



**20 SOJ**



Package Dimension

Unit: Inches (mm)

20 ZIP

