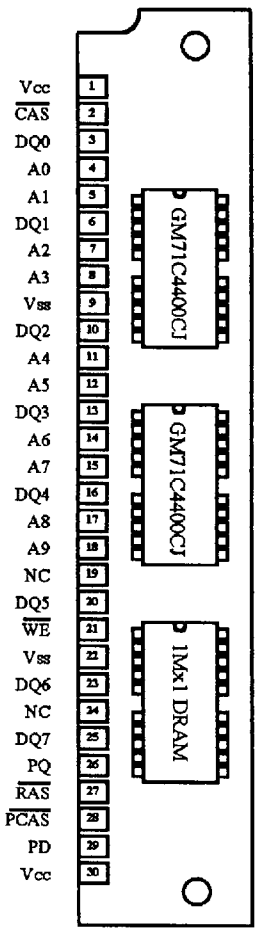
Description

The GMM791000CNS is an 1M x 9 bits Dynamic RAM Module which is assembled 2 pieces of 4M bit DRAM (GM71C4400CJ, 1M x4) sealed in 20 pin SOJ package and 1Mx1 DRAM in 20 pin SOJ package. The GMM791000CNS is a socket type memory module, suitable for easy change or addition of module. The GMM791000CNS provides common data inputs and outputs, and also provides separate I/O on parity bit for parity check. It's module board has decoupling capacitors mounted for each DRAM.

• **GMM791000CNS** (Single Side)



Features

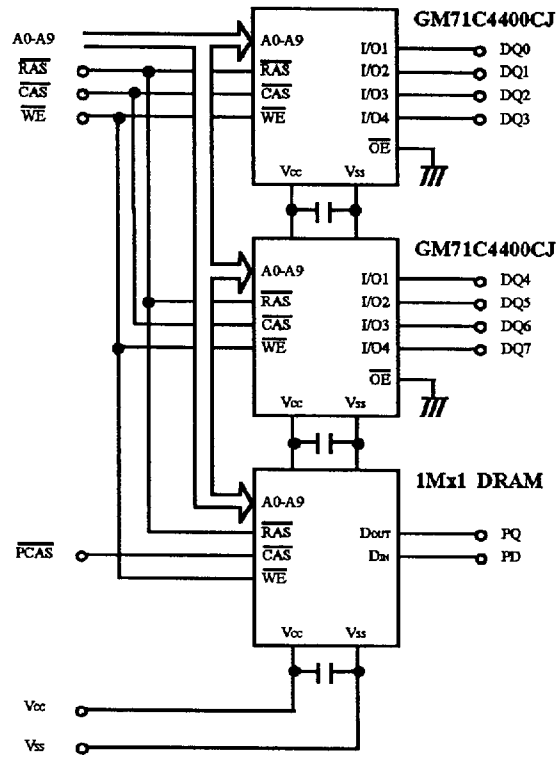
- High Density Standard 30 pin mounting 2 pcs of 4M DRAM and an 1M DRAM
- Fast Page Mode Capability
- Single Power Supply
- Fast Access Time & Cycle Time

(Unit: ns)

	t_{RAC}	t_{CAC}	t_{RC}	t_{PC}
GMM791000CNS-60	60	20	120	45
GMM791000CNS-70	70	20	130	50
GMM791000CNS-80	80	25	160	55

- Low Power
  Active : 1,705/1,540/1,375mW (MAX)
  Standby : 16.5mW (CMOS level : MAX)
- $\overline{RAS}$ Only Refresh, $\overline{CAS}$ before $\overline{RAS}$ Refresh, Hidden Refresh Capability
- All inputs and outputs TTL Compatible
- 1024 Refresh Cycles/16㎳

Block Diagram



Pin Description

Pin	Function	Pin	Function
A0-A9	Address Inputs	$\overline{WE}$	Read/Write Enable
DQ0-DQ7	Data Input/Output	PD	Data in for Parity
$\overline{RAS}$	Row Address Strobe	PQ	Data out for Parity
$\overline{CAS}$	Column Address Strobe	Vcc	Power (+5V)
$\overline{PCAS}$	$\overline{CAS}$ for Parity	Vss	Ground
NC	No Connection		

*Note: 1. Common $\overline{CAS}$ controls for eight common data-in and data-out lines.
2. The common controls for one separate pair of data-in and data-out lines.
3. The common I/O feature dictates the use of only early write operations to prevent contention on data-in and data-out.

Absolute Maximum Ratings*

Symbol	Parameter	Rating	Unit
T_A	Ambient Temperature under Bias	0 ~ 70	℃
T_{STG}	Storage Temperature (Plastic)	-55 ~ 125	℃
V_{IN}/V_{OUT}	Voltage on any Pin Relative to Vss	-1.0 ~ 7.0	V
Vcc	Power Supply Voltage	-1.0 ~ 7.0	V
I_{OUT}	Short Circuit Output Current	50	mA
P_D	Power Dissipation	3.0	W

*Note: 1. Stress greater than above "Absolute Maximum Ratings" may cause permanent damage to the device.

Recommended DC Operating Conditions ($T_A = 0 \sim 70℃$)

Symbol	Parameter	Min	Typ	Max	Unit	Note
Vcc	Supply Voltage	4.5	5.0	5.5	V	1
V_{IH}	Input High Voltage	2.4	-	6.5	V	1
V_{IL}	Input Low Voltage	-1.0	-	0.8	V	1

*Note: 1. All voltages referenced to Vss.

DC Electrical Characteristics (V_{CC} = 5V ± 10%, T_A = 0 ~ 70℃)

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 ($\overline{RAS}$, $\overline{CAS}$, Address Cycling: t_{RC} = t_{RC} min)	60ns	-	310	mA	1, 2
		70ns	-	280		
		80ns	-	250		
I_{CC2}	Standby Current (TTL) Power Supply Standby Current ($\overline{RAS}$, $\overline{CAS}$ = V_{IH})		-	6	mA	
I_{CC3}	$\overline{RAS}$ Only Refresh Current Average Power Supply Current $\overline{RAS}$ Only Mode ($\overline{RAS}$ Cycling, $\overline{CAS}$ = V_{IH}, t_{RC} = t_{RC} min)	60ns	-	310	mA	2
		70ns	-	280		
		80ns	-	240		
I_{CC4}	Fast Page Mode Current Average Power Supply Current Fast Page Mode ($\overline{RAS}$ = V_{IL}, $\overline{CAS}$, Address Cycling : t_{PC} = t_{PC} min)	60ns	-	300	mA	1, 3
		70ns	-	270		
		80ns	-	230		
I_{CC5}	Standby Current (CMOS) Power Supply Standby Current ($\overline{RAS}$, $\overline{CAS}$ ≥ V_{CC}-0.2V)		-	3	mA	
I_{CC6}	$\overline{CAS}$ before $\overline{RAS}$ Refresh Current (t_{RC} = t_{RC} min)	60ns	-	300	mA	
		70ns	-	270		
		80ns	-	240		
I_{CC7}	Standby Current $\overline{RAS}$ = V_{IH} $\overline{CAS}$ = V_{IL} D_{OUT} = Enable		-	15	mA	1
$I_{I(L)}$	Input Leakage Current Any Input (0V ≤ V_{IN} ≤ 7V) All Other Pins Not Under Test = 0V	PD, $\overline{PCAS}$	-10	10	μA	
		ADDR, $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$	-30	30		
$I_{O(L)}$	Output Leakage Current (D_{OUT} is Disabled, 0V ≤ V_{OUT} ≤ 7V)		-10	10	μA	

Note: 1. I_{CC} depends on output load condition when the device is selected. I_{CC}(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}.

Capacitance (V_{CC} = 5V ± 10%, T_A = 25℃, f = 1MHz)

Symbol	Parameter	Min	Max	Unit	Note
C_{I1}	Input Capacitance (Address)	-	25	pF	1
C_{I2}	Input Capacitance (Clocks)	-	25	pF	1, 2
C_{I3}	Input Capacitance (PD)	-	10	pF	1
$C_{I/O}$	I/O Capacitance (DQ0~DQ7)	-	15	pF	1, 2
C_O	Output Capacitance (PQ)	-	10	pF	1, 2

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

AC Electrical Characteristics (V_{CC} = 5V ± 10%, T_A = 0 ~ 70℃, Notes 1, 14)

The GMM791000CNS writes data only in early write cycle ($t_{WCS} \geq t_{WCS(min)}$).
Delayed write cycle is not available because of I/O common.

Read, Write and Refresh Cycle (Common Parameters)

Symbol	Parameter	GMM791000 CNS-60		GMM791000 CNS-70		GMM791000 CNS-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t_{RC}	Random Read or Write Cycle Time	120	-	130	-	160	-	ns	
t_{RP}	$\overline{RAS}$ Precharge Time	50	-	50	-	70	-	ns	
t_{RAS}	$\overline{RAS}$ Pulse Width	60	10,000	70	10,000	80	10,000	ns	
t_{CAS}	$\overline{CAS}$ Pulse Width	20	10,000	20	10,000	25	10,000	ns	
t_{ASR}	Row Address Setup Time	0	-	0	-	0	-	ns	
t_{RAH}	Row Address Hold Time	10	-	10	-	12	-	ns	
t_{ASC}	Column Address Setup Time	0	-	0	-	0	-	ns	
t_{CAH}	Column Address Hold Time	15	-	15	-	20	-	ns	
t_{RCD}	$\overline{RAS}$ to $\overline{CAS}$ Delay Time	20	40	20	50	22	55	ns	8
t_{RAD}	$\overline{RAS}$ to Column Address Delay Time	15	30	15	35	17	40	ns	9
t_{RSH}	$\overline{RAS}$ Hold Time	20	-	20	-	25	-	ns	
t_{CSH}	$\overline{CAS}$ Hold Time	60	-	70	-	80	-	ns	
t_{CRP}	$\overline{CAS}$ to $\overline{RAS}$ Precharge Time	10	-	10	-	10	-	ns	
t_T	Transition Time (Rise and Fall)	3	50	3	50	3	50	ns	7
t_{REF}	Refresh Period (1024 Cycles)	-	16	-	16	-	16	ms	

Read Cycle

Symbol	Parameter	GMM791000 CNS-60		GMM791000 CNS-70		GMM791000 CNS-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t_{RAC}	Access Time from $\overline{RAS}$	-	60	-	70	-	80	ns	2, 3
t_{CAC}	Access Time from $\overline{CAS}$	-	20	-	20	-	25	ns	3, 4
t_{AA}	Access Time from Column Address	-	30	-	35	-	40	ns	3, 5
t_{RCS}	Read Command Setup Time	0	-	0	-	0	-	ns	
t_{RCH}	Read Command Hold Time to $\overline{CAS}$	0	-	0	-	0	-	ns	
t_{RRH}	Read Command Hold Time to $\overline{RAS}$	10	-	10	-	10	-	ns	
t_{RAL}	Column Address to $\overline{RAS}$ Lead Time	30	-	35	-	40	-	ns	
t_{OFF}	Output Buffer Turn-off Time	0	20	0	20	0	20	ns	6

Write Cycle

Symbol	Parameter	GMM791000 CNS-60		GMM791000 CNS-70		GMM791000 CNS-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t_{WCS}	Write Command Setup Time	0	-	0	-	0	-	ns	10
t_{WCH}	Write Command Hold Time	15	-	15	-	20	-	ns	
t_{WP}	Write Command Pulse Width	10	-	10	-	10	-	ns	
t_{RWL}	Write Command to $\overline{RAS}$ Lead Time	20	-	20	-	25	-	ns	
t_{CWL}	Write Command to $\overline{CAS}$ Lead Time	20	-	20	-	25	-	ns	
t_{DS}	Data-in Setup Time	0	-	0	-	0	-	ns	11
t_{DH}	Data-in Hold Time	15	-	15	-	20	-	ns	11

Refresh Cycle

Symbol	Parameter	GMM791000 CNS-60		GMM791000 CNS-70		GMM791000 CNS-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t_{CSR}	$\overline{CAS}$ Setup Time ($\overline{CAS}$-before-$\overline{RAS}$ Refresh Cycle)	10	-	10	-	10	-	ns	
t_{CHR}	$\overline{CAS}$ Hold Time ($\overline{CAS}$-before-$\overline{RAS}$ Refresh Cycle)	15	-	15	-	20	-	ns	
t_{RPC}	$\overline{RAS}$ Precharge to $\overline{CAS}$ Hold Time	10	-	10	-	10	-	ns	
t_{CPN}	$\overline{CAS}$ Precharge Time in Normal Mode	10	-	10	-	10	-	ns	

Fast Page Mode Cycle

Symbol	Parameter	GMM791000 CNS-60		GMM791000 CNS-70		GMM791000 CNS-80		Unit	Note
		Min	Max	Min	Max	Min	Max		
t_{PC}	Fast Page Mode Cycle Time	45	-	50	-	55	-	ns	
t_{CP}	Fast Page Mode $\overline{CAS}$ Precharge Time	10	-	10	-	10	-	ns	
t_{RASP}	Fast Page Mode $\overline{RAS}$ Pulse Width	-	100,000	-	100,000	-	100,000	ns	12
t_{ACP}	Access Time from $\overline{CAS}$ Precharge	-	40	-	45	-	50	ns	13
t_{RHCP}	$\overline{RAS}$ Hold Time from $\overline{CAS}$ Precharge	40	-	45	-	50	-	ns	

Notes:

1. AC measurements assume $t_T = 5$ns.
2. Assumes that $t_{RCD} \leq t_{RCD}(max)$ and $t_{RAD} \leq t_{RAD}(max)$. 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 100pF.
4. Assumes that $t_{RCD} \geq t_{RCD}(max)$ and $t_{RAD} \leq t_{RAD}(max)$.
5. Assumes that $t_{RCD} \leq t_{RCD}(max)$ and $t_{RAD} \geq t_{RAD}(max)$.
6. $t_{OFF}(max)$ defines the time at which the outputs achieve the open circuit condition and is not referenced to output voltage levels.
7. $V_{IH}(min)$ and $V_{IL}(max)$ are reference levels for measuring timing of input signals. Also, transition times are measured between V_{IH} and V_{IL}.
8. Operation with the $t_{RCD}(max)$ limit insures that $t_{RAC}(max)$ 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 exclusively by t_{CAC}.
9. Operation with 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 exclusively by t_{AA}.
10. t_{WCS} is not restrictive operating parameter. It is 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 out pin will remain open circuit (high impedance) throughout the entire cycle.
11. These parameters are referenced to $\overline{CAS}$ leading edge in early write cycles.
12. t_{RASP} is defines $\overline{RAS}$ pulse width in Fast Page Mode cycles.
13. Access time is determined by the longer of t_{AA} or t_{CAC} or t_{ACP}.
14. An initial pause of 100μs is required after power up followed by a minimum of eight initialization cycles (any combination of cycles containing $\overline{RAS}$ clock such as $\overline{RAS}$ only refresh). If the internal refresh counter is used, a minimum of eight $\overline{CAS}$ before $\overline{RAS}$ refresh cycles are required.

Timing Waveforms

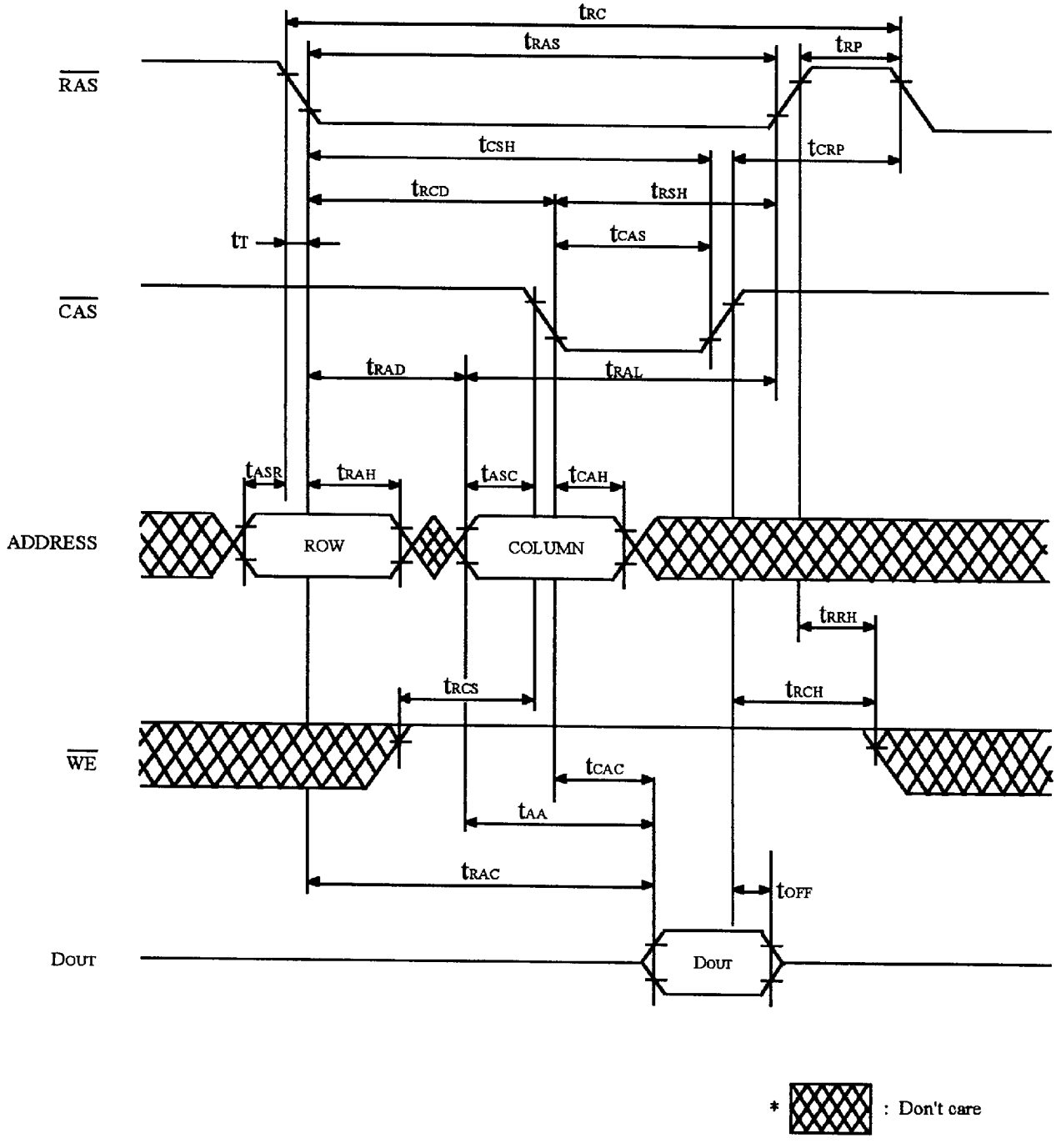


FIGURE 1. READ CYCLE

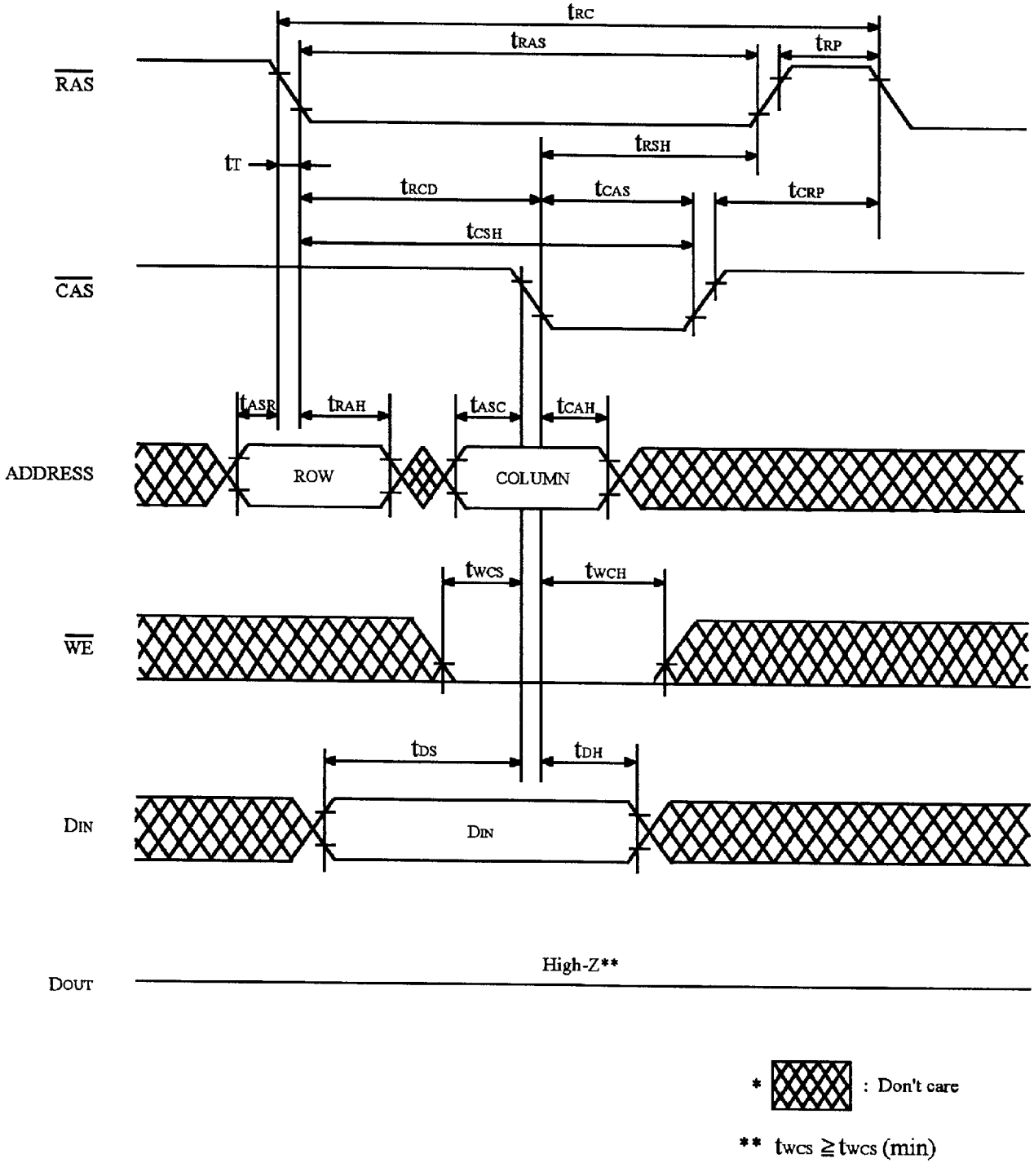
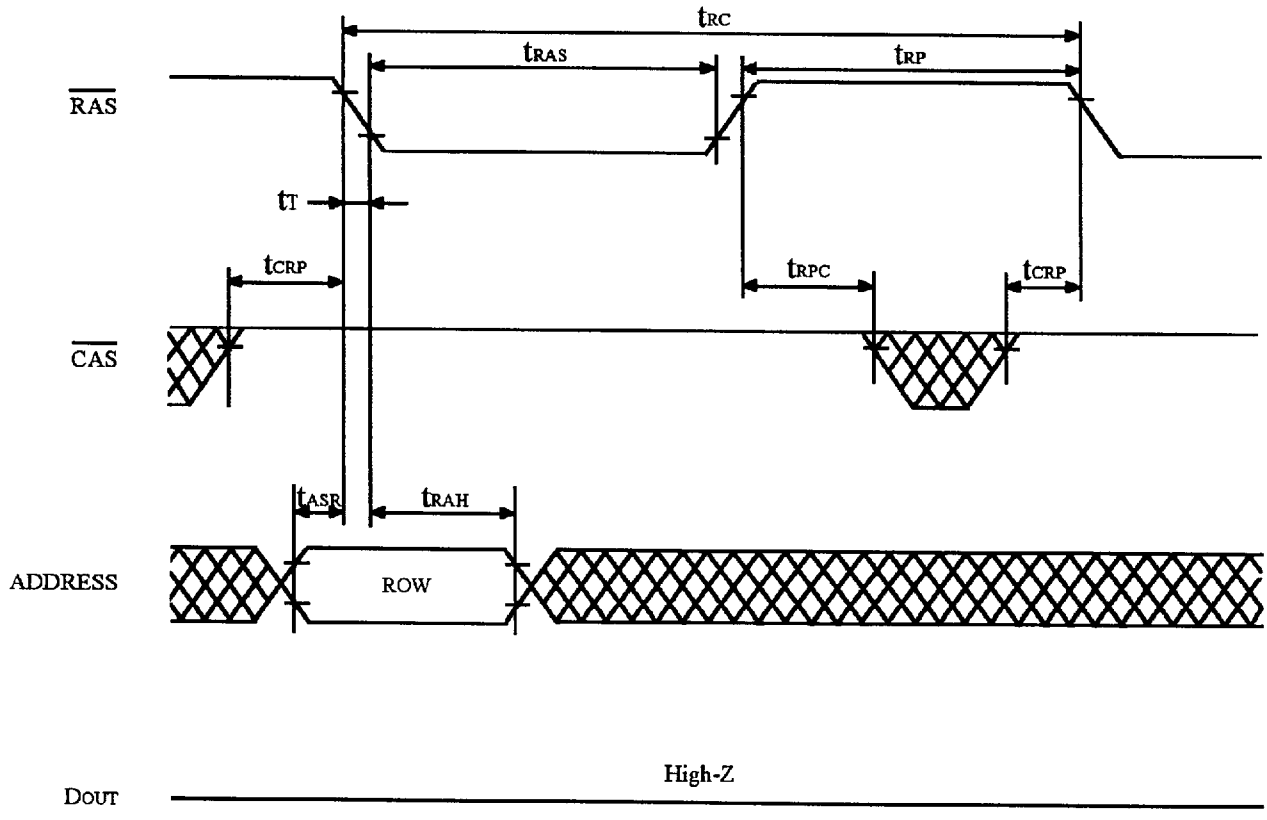


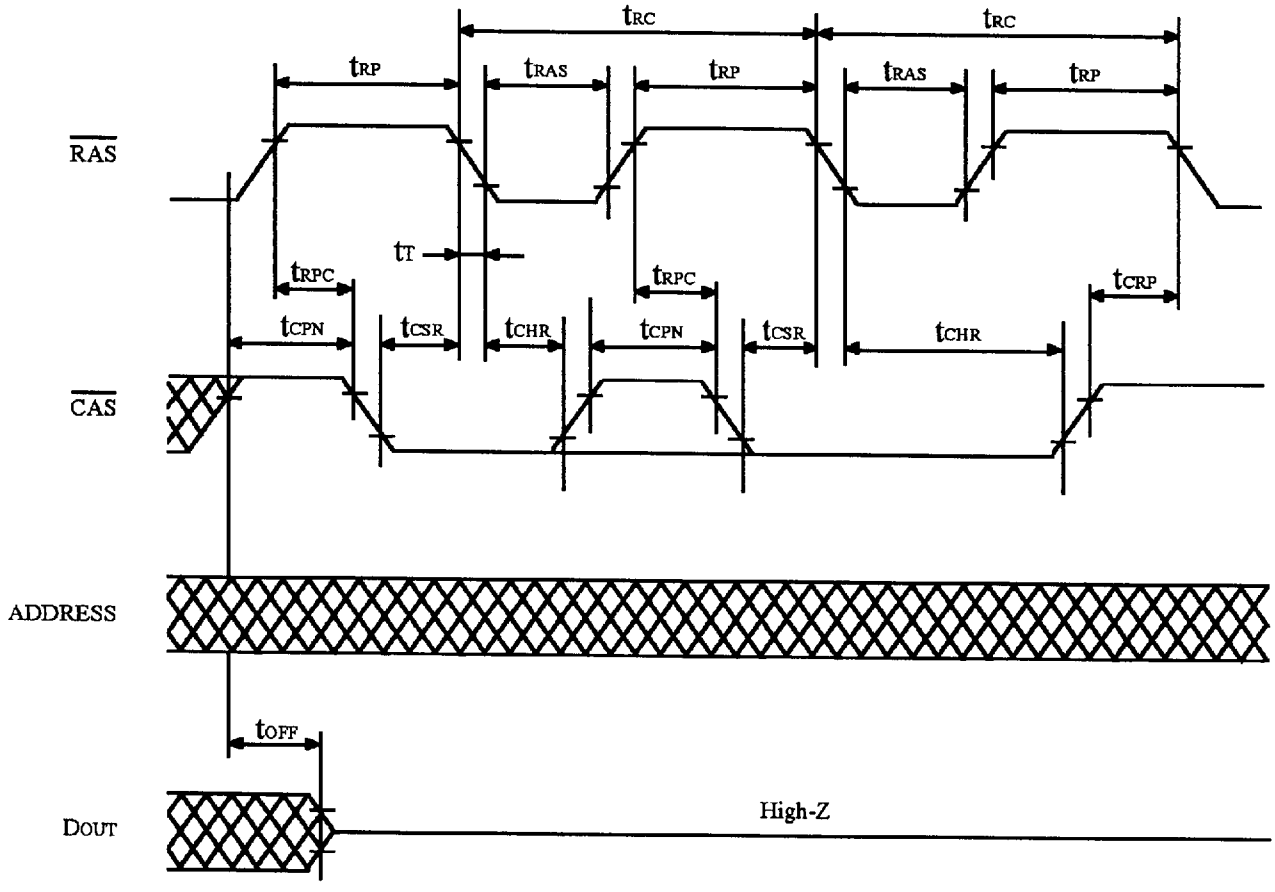
FIGURE 2. EARLY WRITE CYCLE



* : Don't care

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

FIGURE 3. $\overline{RAS}$ ONLY REFRESH CYCLE



* : Don't care

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

FIGURE 4. $\overline{CAS}$ BEFORE $\overline{RAS}$ REFRESH CYCLE

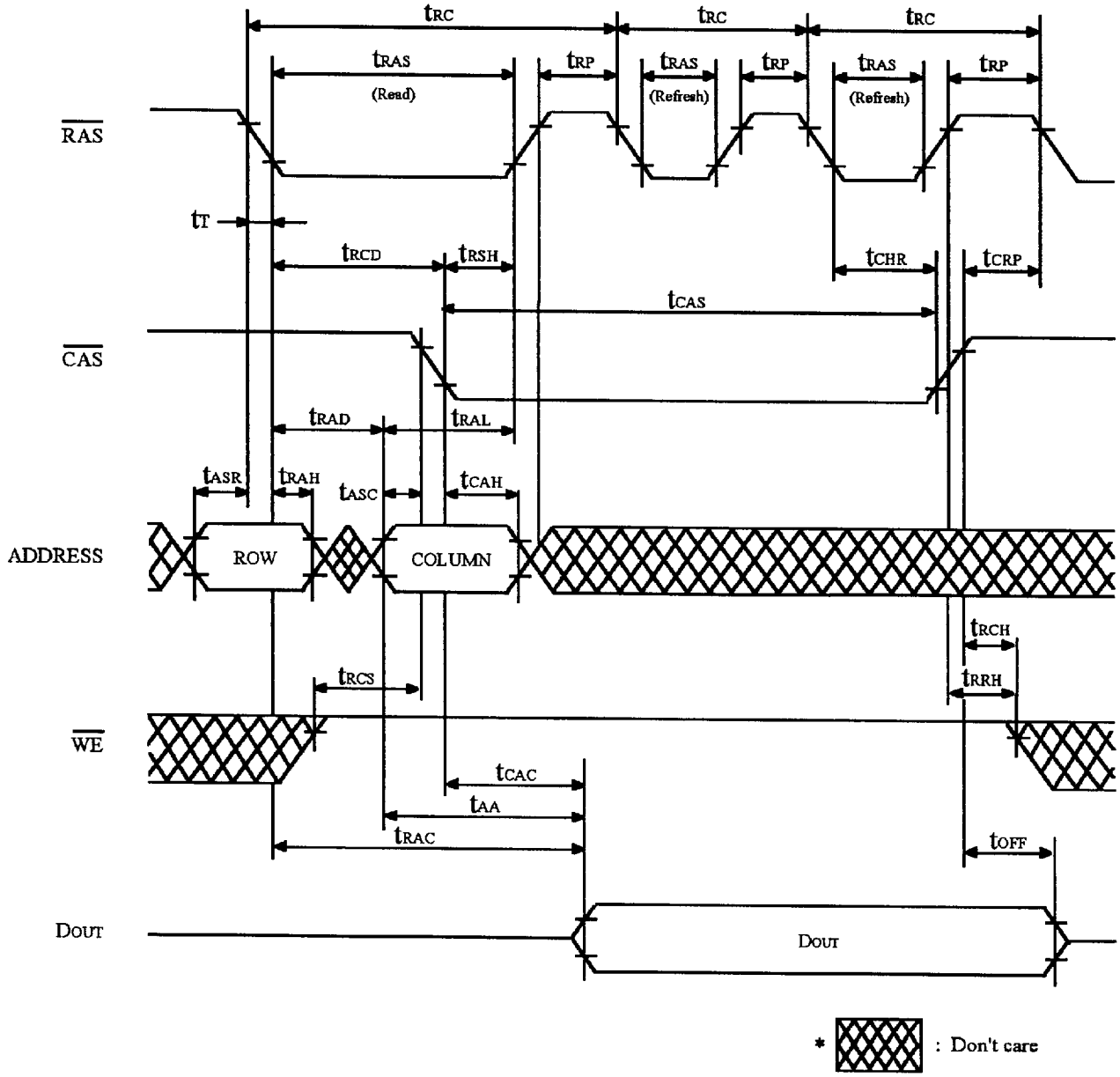


FIGURE 5. HIDDEN REFRESH CYCLE

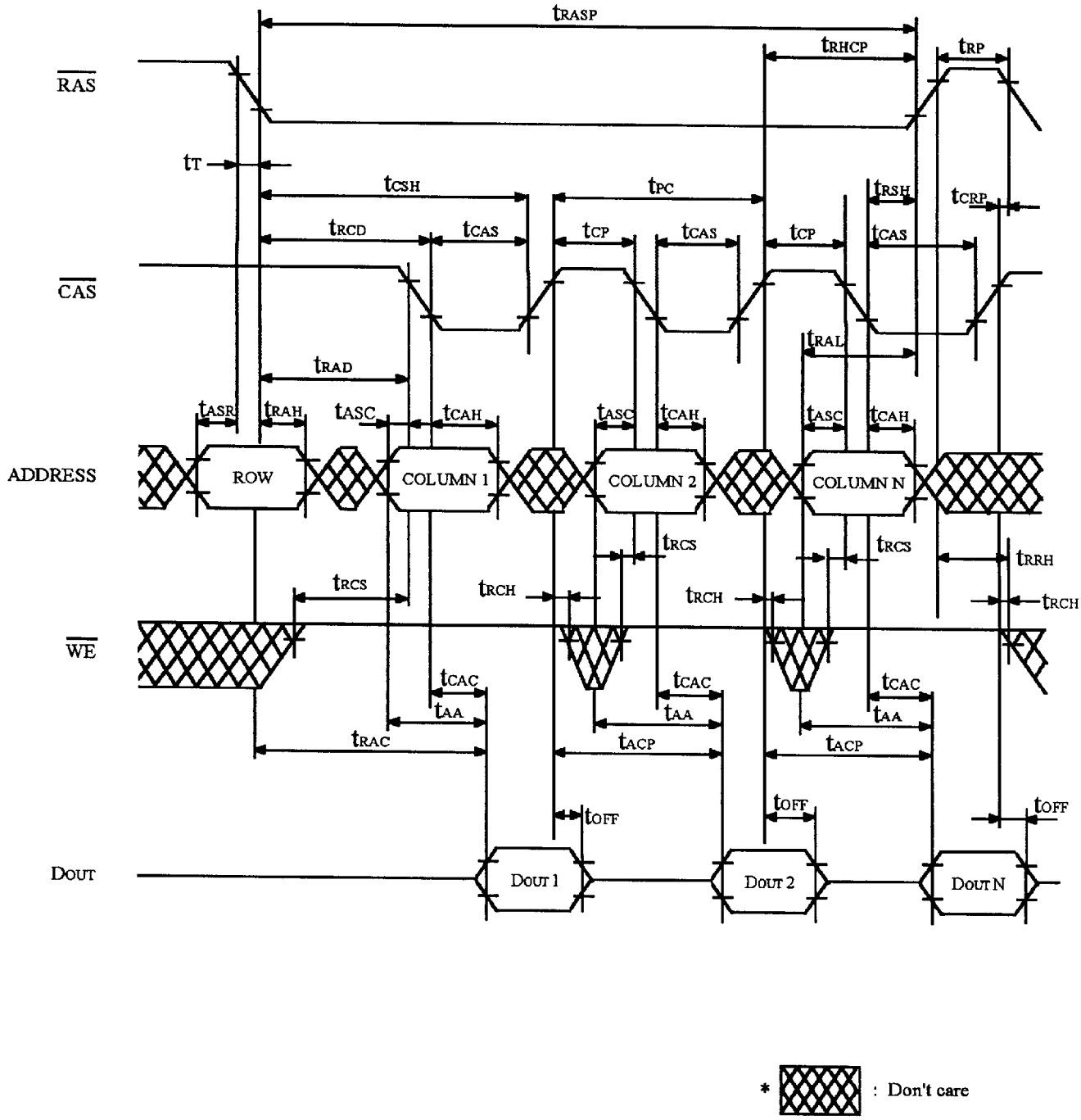


FIGURE 6. FAST PAGE MODE READ CYCLE

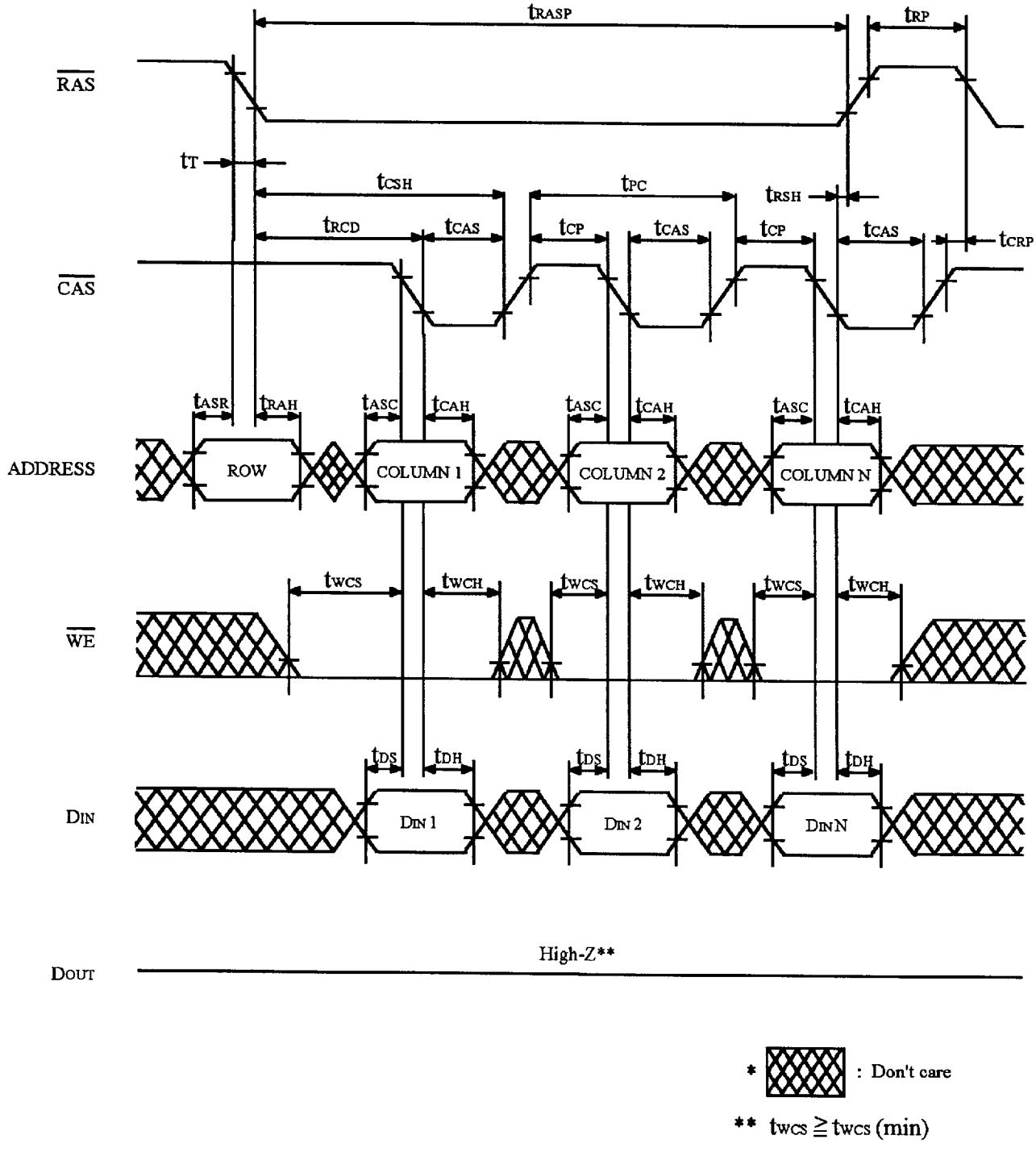


FIGURE 7. FAST PAGE MODE EARLY WRITE CYCLE

Package Dimension

Unit: inches (mm)