

**Features :**

- \* 524,288 words by 8 bits organization.
- \* Fast access time and cycle time.
- \* Low power dissipation.  
 Operating Current-150mA max.  
 TTL Standby Current-2mA max.
- \* Read-Modify-Write,  $\overline{\text{RAS}}$ -Only Refresh,  $\overline{\text{CAS}}$ -Before- $\overline{\text{RAS}}$  Refresh, Hidden Refresh and Test Mode Capability.
- \* 1024 refresh cycles/16ms.
- \* Available in 28pin 400 mil SOJ
- \* Single +5.0V±10% Power Supply.
- \* All inputs and Outputs are TTL-compatible.
- \* Fast Page Mode supports sustained data rates up to 50MHZ.

**Description :**

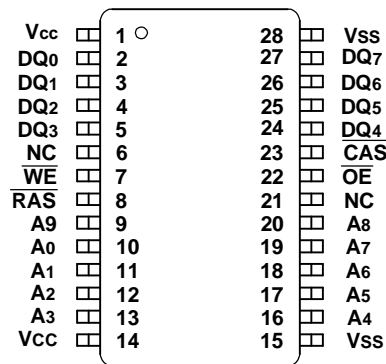
The GLT44108 is a 524,288 x 8 bit high-performance CMOS dynamic random access memory. The GLT44108 offers Fast Page mode with asymmetric address and accepts 512-cycle refresh in 8ms interval.

All inputs are TTL compatible. Fast Page Mode operation allows random access up to 512 x 8 bits within a page, with cycle times as short as 22ns.

The GLT44108 is best suited for graphics, digital signal processing and high performance peripherals.

**PIN CONFIGURATION :**

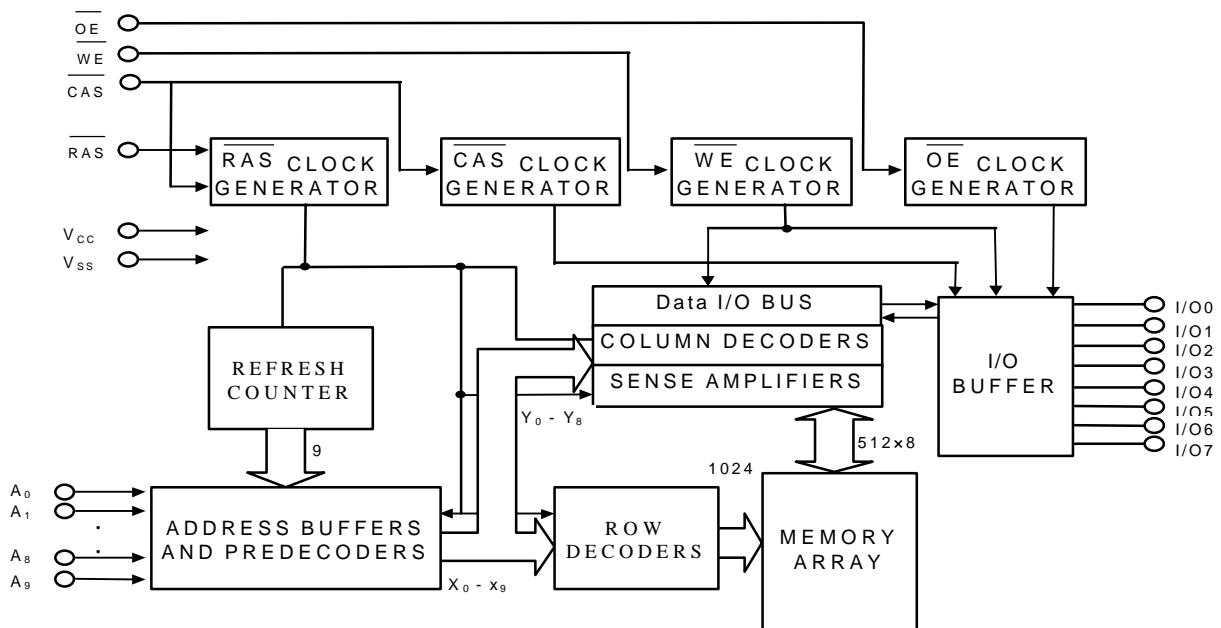
**GLT44108**  
**28 Lead SOJ**



<b>HIGH PERFORMANCE</b>	<b>-40</b>	<b>-50</b>	<b>-60</b>
Max. $\overline{\text{RAS}}$ Access Time, ( $t_{\text{RAC}}$ )	40 ns	50 ns	60 ns
Max. Column Address Access Time, ( $t_{\text{AA}}$ )	20 ns	25 ns	30 ns
Min. Fast Page Mode Cycle Time, ( $t_{\text{PC}}$ )	22 ns	31 ns	40 ns
Min. Read/Write Cycle Time, ( $t_{\text{RC}}$ )	75 ns	90 ns	110 ns
Max. $\overline{\text{CAS}}$ Access Time ( $t_{\text{CAC}}$ )	12 ns	13 ns	15 ns

**Pin Descriptions:**

<b>Name</b>	<b>Function</b>
$A_0 - A_9$	Address Inputs
$\overline{\text{RAS}}$	Row Address Strobe
$\overline{\text{CAS}}$	Column Address Strobe
$\overline{\text{WE}}$	Write Enable
$\overline{\text{OE}}$	Output Enable
$DQ_0 - DQ_7$	Data Inputs / Outputs
$V_{\text{CC}}$	+5V Power Supply
$V_{\text{SS}}$	Ground

**Block Diagram:**




**Absolute Maximum Ratings\***

Operating Temperature, T<sub>A</sub> (ambient)  
 .....-10°C to +80°C  
 Storage Temperature(plastic)....-55°C to +150°C  
 Voltage Relative to V<sub>SS</sub>.....-1.0V to + 7.0V  
 Short Circuit Output Current.....50mA  
 Power Dissipation.....1.0W

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

**Capacitance\***

T<sub>A</sub>=25°C, V<sub>CC</sub>=5V±10%, V<sub>SS</sub>=0V

Symbol	Parameter	Max.	Unit
C <sub>IN1</sub>	Address Input	5	pF
C <sub>IN2</sub>	$\overline{\text{RAS}}$ , $\overline{\text{CAS}}$ , $\overline{\text{WE}}$ , $\overline{\text{OE}}$	7	pF
C <sub>OUT</sub>	Data Input/Output	7	pF

\*Note: Capacitance is sampled and not 100% tested

**Electrical Specifications**

- All voltages are referenced to GND.
- After power up, wait more than 200µs and then, execute eight  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  or  $\overline{\text{RAS}}$  only refresh cycles as dummy cycles to initialize internal circuit.

**DC and Operating Characteristics (1-2)**

 TA = 0°C to 70°C, V<sub>CC</sub>=5V±10%, V<sub>SS</sub>=0V, unless otherwise specified.

Sym.	Parameter	Test Conditions	Access Time	Min.	Typ	Max.	Unit	Notes
I <sub>LI</sub>	Input Leakage Current (any input pin)	0V ≤ V <sub>IN</sub> ≤ 5.5V (All other pins not under test=0V)		-10		+10	μA	
I <sub>LO</sub>	Output Leakage Current (for High-Z State)	0V ≤ V <sub>out</sub> ≤ 5.5V Output is disabled (Hiz)		-10		+10	μA	
I <sub>CC1</sub>	Operating Current, Random READ/WRITE	t <sub>RC</sub> = t <sub>RC</sub> (min.)	t <sub>RAC</sub> = 40ns t <sub>RAC</sub> = 50ns t <sub>RAC</sub> = 60ns			150 140 120	mA	1,2
I <sub>CC2</sub>	Standby Current,(TTL)	RAS, CAS, at V <sub>IH</sub> other inputs ≥ V <sub>SS</sub>				2	mA	
I <sub>CC3</sub>	Refresh Current, RAS -Only	RAS cycling, CAS at V <sub>IH</sub> t <sub>RC</sub> = t <sub>RC</sub> (min.)	t <sub>RAC</sub> = 40ns t <sub>RAC</sub> = 50ns t <sub>RAC</sub> = 60ns			150 140 120	mA	2
I <sub>CC4</sub>	Operating Current, FAST Page Mode	RAS at V <sub>IL</sub> , CAS ,address cycling;t <sub>PC</sub> =t <sub>PC</sub> (min.)	t <sub>RAC</sub> = 40ns t <sub>RAC</sub> = 50ns t <sub>RAC</sub> = 60ns			150 140 120	mA	1,2
I <sub>CC5</sub>	Refresh Current, CAS Before RAS	RAS, CAS, address cycling: t <sub>RC</sub> =t <sub>RC</sub> (min.)	t <sub>RAC</sub> = 40ns t <sub>RAC</sub> = 50ns t <sub>RAC</sub> = 60ns			150 140 120	mA	1
I <sub>CC6</sub>	Standby Current, (CMOS)	RAS ≥ V <sub>CC</sub> -0.2V, CAS ≥ V <sub>CC</sub> -0.2V, All other inputs ≥ V <sub>SS</sub>				1	mA	
V <sub>IL</sub>	Input Low Voltage			-1		+0.8	V	3
V <sub>IH</sub>	Input High Voltage			2.4		V <sub>CC</sub> +1	V	3
V <sub>OL</sub>	Output Low Voltage	I <sub>OL</sub> = 4.2mA				0.4	V	
V <sub>OH</sub>	Output High Voltage	I <sub>OH</sub> = -5mA		2.4			V	

**Notes:**

- I<sub>CC</sub> is dependent on output loading when the device output is selected. Specified I<sub>CC(max.)</sub> is measured with the output open.
- I<sub>CC</sub> is dependent upon the number of address transitions specified. I<sub>CC(max.)</sub> is measured with a maximum of one transition per address cycle in random Read/Write and Fast Page Mode.
- Specified V<sub>IL(min.)</sub> is steady state operation. During transitions, V<sub>IL(min.)</sub> may undershoot to -1.0V for a period not to exceed 20ns. All AC parameters are measured with V<sub>IL(min.)</sub> ≥ V<sub>SS</sub> and V<sub>IH(max.)</sub> ≤ V<sub>CC</sub>.

**AC Characteristics (0°C ≤ T<sub>A</sub> ≤ 70°C, See note 1,2)**

 Test condition: V<sub>CC</sub>=5.0V±10%, V<sub>IH</sub>/V<sub>IL</sub>=2.4V/0.8V, V<sub>OH</sub>/V<sub>OL</sub>=2.0V/0.8V

Parameter	Symbol	40 ns		50 ns		60 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Read/Write Cycle Time	t <sub>RC</sub>	75	-	90	-	110	-	ns	
Read Midify Write Cycle Time	t <sub>RWC</sub>	120	-	140	-	160	-	ns	
Access Time from $\overline{\text{RAS}}$	t <sub>RAC</sub>	-	40	-	50	-	60	ns	3,4
Access Time from CAS	t <sub>CAC</sub>	-	12	-	13	-	15	ns	3,4
Access Time from Column Address	t <sub>AA</sub>	-	20	-	25	-	30	ns	3,4
CAS to Output in Low-Z	t <sub>CLZ</sub>	0	-	0	-	0	-	ns	3
Output Buffer Turn-off Delay from $\overline{\text{CAS}}$	t <sub>OFF</sub>	0	8	0	10	0	13	ns	7
Transition Time(Rise and Fall)	t <sub>T</sub>	3	50	3	50	3	50	ns	2
RAS Precharge Time	t <sub>RP</sub>	25	-	30	-	40	-	ns	
RAS Pulse Width	t <sub>RAS</sub>	40	10000	50	10000	60	10000	ns	
RAS Hold Time	t <sub>RSH</sub>	12	-	13	-	15	-	ns	
CAS Hold Time	t <sub>CSH</sub>	40	-	50	-	60	-	ns	
CAS Pulse Width	t <sub>CAS</sub>	12	10000	13	10000	15	10000	ns	
RAS to CAS Delay Time	t <sub>RCD</sub>	16	30	18	37	20	45	ns	4
RAS to Column Address Delay Time	t <sub>RAD</sub>	11	22	13	25	15	30	ns	4
CAS to RAS Precharge Time	t <sub>CRP</sub>	5	-	5	-	5	-	ns	8
Row Address Setup Time	t <sub>ASR</sub>	0	-	0	-	0	-	ns	
Row Address Hold Time	t <sub>RAH</sub>	6	-	8	-	10	-	ns	
Column Address Setup Time	t <sub>ASC</sub>	0	-	0	-	0	-	ns	
Column Address Hold Time	t <sub>CAH</sub>	6	-	8	-	10	-	ns	
Column Address Hold Time Referenced to $\overline{\text{RAS}}$	t <sub>AR</sub>	30	-	40	-	45	-	ns	
Column Address Lead Time Referenced to $\overline{\text{RAS}}$	t <sub>RAL</sub>	20	-	25	-	30	-	ns	
Read Command Setup Time	t <sub>RCS</sub>	0	-	0	-	0	-	ns	
Read Command Hold Time Referenced to $\overline{\text{RAS}}$	t <sub>RRH</sub>	0	-	0	-	0	-	ns	9
Read Command Hold Time Referenced to CAS	t <sub>RCH</sub>	0	-	0	-	0	-	ns	9
WE Hold Time Referenced to CAS	t <sub>WCH</sub>	6	-	7	-	10	-	ns	10
Write Command Hold Time Referenced to $\overline{\text{RAS}}$	t <sub>WCR</sub>	30	-	40	-	45	-	ns	5

Parameter	Symbol	40 ns		50 ns		60 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
$\overline{\text{WE}}$ Pulse Width	$t_{\text{WP}}$	6	-	7	-	10	-	ns	10
$\overline{\text{WE}}$ Lead Time Referenced to $\overline{\text{RAS}}$	$t_{\text{RWL}}$	13	-	17	-	15	-	ns	
$\overline{\text{WE}}$ Lead Time Referenced to $\overline{\text{CAS}}$	$t_{\text{CWL}}$	13	-	14	-	15	-	ns	
Data-In Setup Time	$t_{\text{DS}}$	0	-	0	-	0	-	ns	11
Data-In Hold Time	$t_{\text{DH}}$	6	-	7	-	10	-	ns	11
Data Hold Time Referenced to $\overline{\text{RAS}}$	$t_{\text{DHR}}$	33	-	40	-	45	-	ns	6
Refresh Time(256cycles)	$t_{\text{REF}}$	-	8	-	8	-	8	ms	
$\overline{\text{WE}}$ Setup Time	$t_{\text{WCS}}$	0	-	0	-	0	-	ns	5
$\overline{\text{RAS}}$ to $\overline{\text{WE}}$ Delay Time	$t_{\text{RWD}}$	60	-	70	-	85	-	ns	5
$\overline{\text{CAS}}$ to $\overline{\text{WE}}$ Delay Time	$t_{\text{CWD}}$	28	-	33	-	38	-	ns	5
Column Address to $\overline{\text{WE}}$ Delay Time	$t_{\text{AWD}}$	38	-	43	-	53	-	ns	5
$\overline{\text{CAS}}$ Setup Time( $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh)	$t_{\text{CSR}}$	5	-	5	-	5	-	ns	
$\overline{\text{CAS}}$ Hold Time( $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh)	$t_{\text{CHR}}$	10	-	10	-	10	-	ns	
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ Precharge Time	$t_{\text{RPC}}$	5	-	5	-	5	-	ns	
$\overline{\text{CAS}}$ Precharge Time(CBR Counter Test Cycle)	$t_{\text{CPT}}$	20	-	20	-	20	-	ns	
Access Time from $\overline{\text{CAS}}$ Precharge	$t_{\text{CPA}}$	-	25	-	30	-	35	ns	3
Fast Page mode Read/Write Cycle Time	$t_{\text{PC}}$	30	-	35	-	40	-	ns	
Fast Page mode Read Modify Write Cycle Time	$t_{\text{PRWC}}$	65	-	80	-	90	-	ns	
$\overline{\text{CAS}}$ Precharge Time(Fast Page mode)	$t_{\text{CP}}$	7	-	8	-	10	-	ns	
$\overline{\text{RAS}}$ Pulse Width(Fast Page mode)	$t_{\text{RASP}}$	40	125000	50	125000	60	125000	ns	
$\overline{\text{RAS}}$ Hold Time from $\overline{\text{CAS}}$ Precharge	$t_{\text{RHCP}}$	25	-	30	-	35	-	ns	
Access Time from $\overline{\text{OE}}$	$t_{\text{OEA}}$	-	10	-	13	-	15	ns	
$\overline{\text{OE}}$ to Delay Time	$t_{\text{OED}}$	8	-	10	-	13	-	ns	
Output Buffer Turn-off Delay Time from $\overline{\text{OE}}$	$t_{\text{OEZ}}$	0	8	0	10	0	13	ns	7
$\overline{\text{OE}}$ Hold Time	$t_{\text{OEH}}$	0	-	0	-	0	-	ns	
$\overline{\text{WE}}$ Hold Time(Hidden Refresh Cycle)	$t_{\text{WHR}}$	15	-	15	-	15	-	ns	

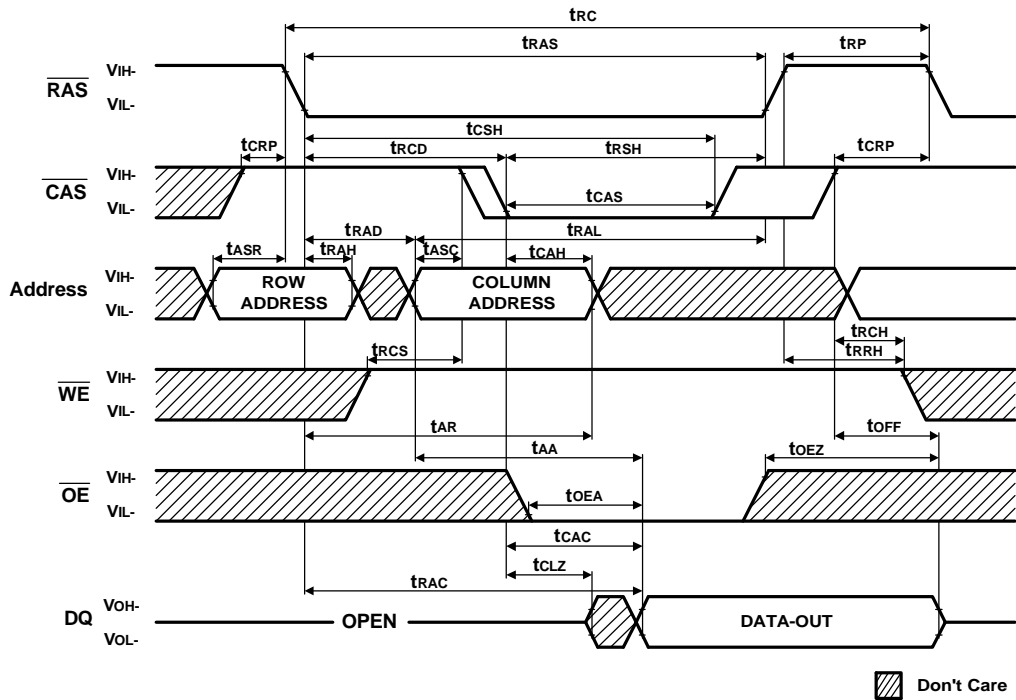
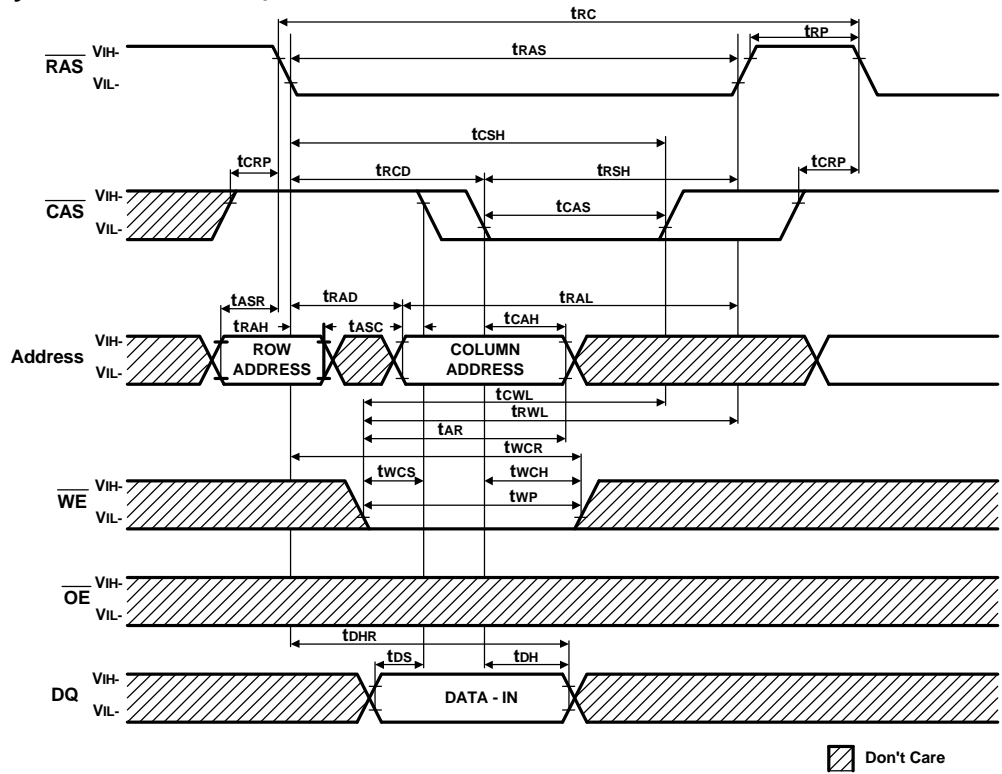
**Notes**

1. An initial pause of 200 $\mu$ s is required after power-up followed by any 8  $\overline{\text{RAS}}$  only Refresh or  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  Refresh cycles to initialize the internal circuit.
2.  $V_{IH(\text{min.})}$  and  $V_{IL(\text{min.})}$  are reference levels for measuring timing of input signals. Transition times are measured between  $V_{IH(\text{min.})}$  and  $V_{IL(\text{max.})}$  are assumed to be 5ns for all inputs.
3. Measured with an equivalent to 1 TTL loads and 50pF.
4. For read cycles, the access time is defined as follows:

Input Conditions	Access Time
$t_{\text{RAD}} \leq t_{\text{RAD}(\text{MAX.})}$ and $t_{\text{RCD}} \leq t_{\text{RCD}(\text{MAX.})}$	$t_{\text{RAC}(\text{MAX.})}$
$t_{\text{RAD}(\text{max.})} < t_{\text{RAD}}$ and $t_{\text{RCD}} \leq t_{\text{RCD}(\text{MAX.})}$	$t_{\text{AA}(\text{MAX.})}$
$t_{\text{RCD}(\text{max.})} < t_{\text{RCD}}$	$t_{\text{CAC}(\text{MAX.})}$

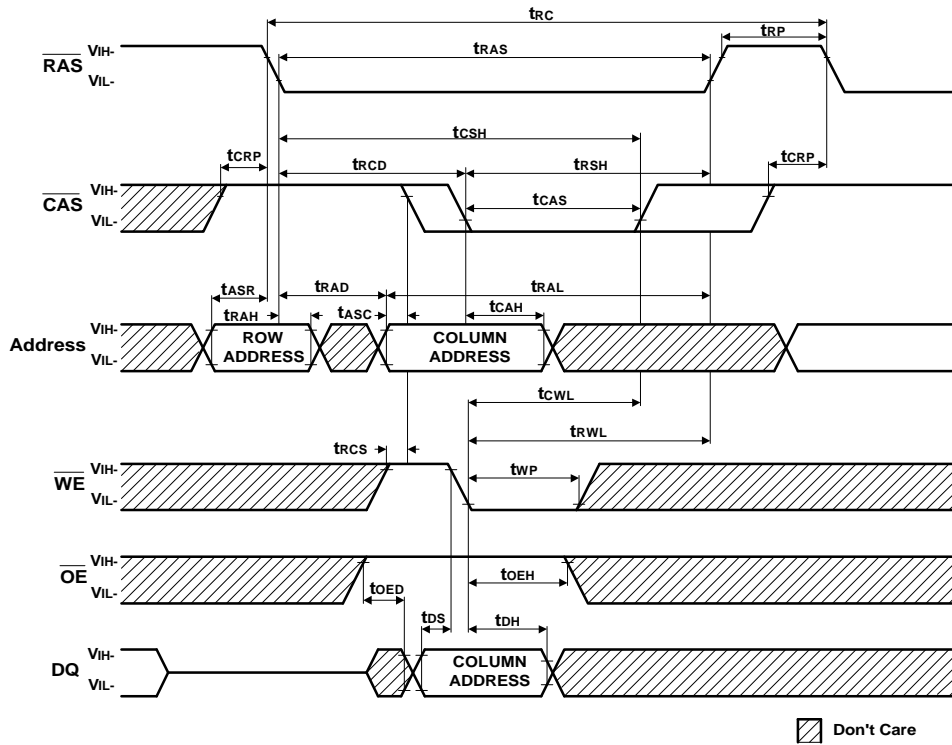
$t_{\text{RAD}(\text{MAX.})}$  and  $t_{\text{RCD}(\text{MAX.})}$  indicate the points which the access time changes and are not the limits of operation.

5.  $t_{\text{WCS}}, t_{\text{RWD}}, t_{\text{CWD}}$  and  $t_{\text{AWD}}$  are non restrictive operating parameters. They are included in the data sheet as electric characteristics only. If  $t_{\text{WCS}} \geq t_{\text{WCS}(\text{min.})}$ , the cycle is an early write cycle and the data output will remain high impedance for the duration of the cycle. If  $t_{\text{CWD}} \geq t_{\text{CWD}(\text{min.})}, t_{\text{RWD}} \geq t_{\text{RWD}(\text{min.})}$  and  $t_{\text{AWD}} \geq t_{\text{AWD}(\text{min.})}$ , then the cycle is a read-modify-write cycle and the data output will contain the data read from the selected address. If neither of the above conditions is satisfied, the condition of the data out is indeterminate.
6.  $t_{\text{AR}}, t_{\text{WCR}},$  and  $t_{\text{DHR}}$  are referenced to  $t_{\text{RAD}(\text{max.})}$ .
7.  $t_{\text{OFF}(\text{max.})}$  and  $t_{\text{OEZ}(\text{max.})}$  define the time at which the output achieves the open circuit condition and are not referenced to  $V_{\text{OH}}$  or  $V_{\text{OL}}$ .
8.  $t_{\text{CRP}(\text{min.})}$  requirement should be applicable for  $\overline{\text{RAS}}$ ,  $\overline{\text{CAS}}$  cycle preceded by any cycles.
9. Either  $t_{\text{RCH}(\text{min.})}$  or  $t_{\text{RRH}(\text{min.})}$  must be satisfied for a read cycle.
10.  $t_{\text{WP}(\text{min.})}$  is applicable for late write cycle or read modify write cycle. In early write cycles,  $t_{\text{WCH}(\text{min.})}$  should be satisfied.
11. This specification is referenced to  $\overline{\text{CAS}}$  falling edge in early write cycles and to  $\overline{\text{WE}}$  falling edge in late write or read modify write cycles.

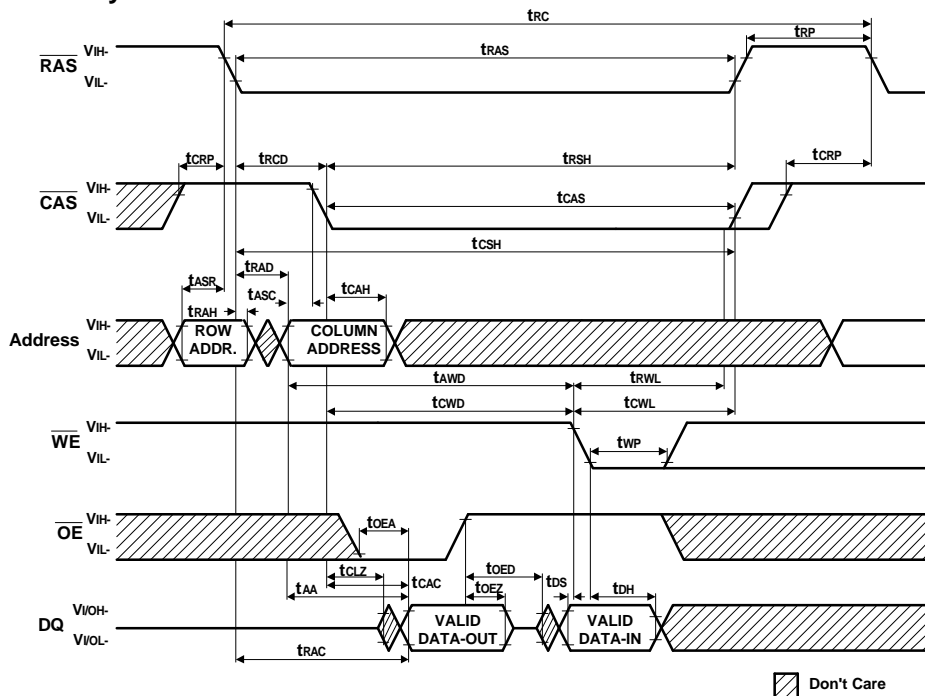
**Read Cycle**

**Early Write Cycle NOTE :  $D_{OUT} = \text{Open}$** 


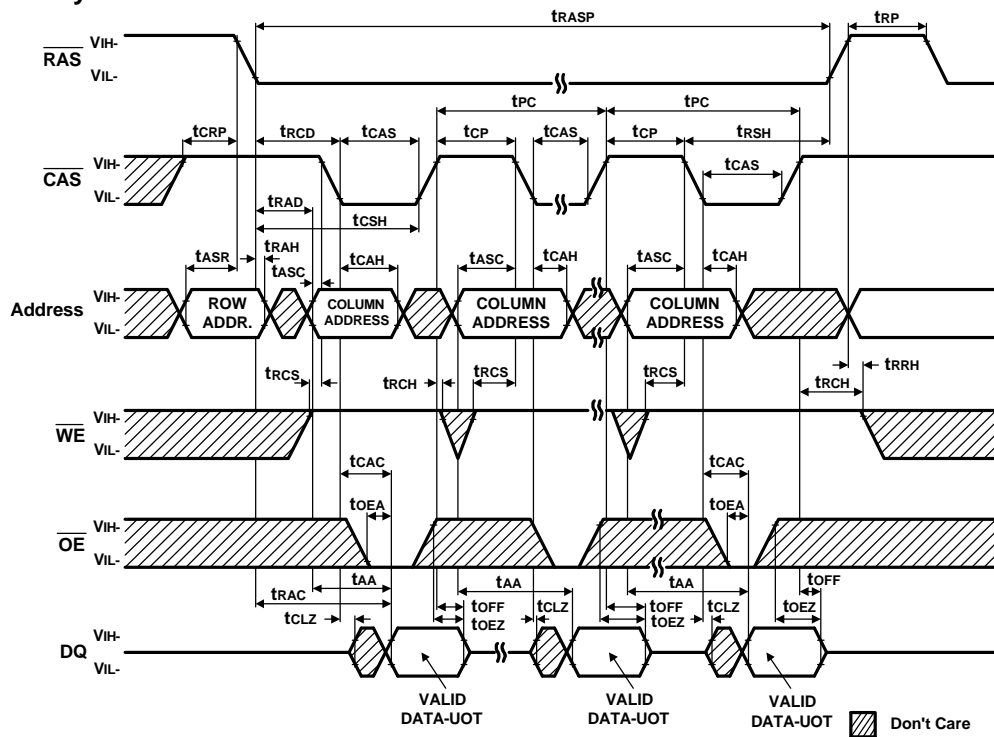
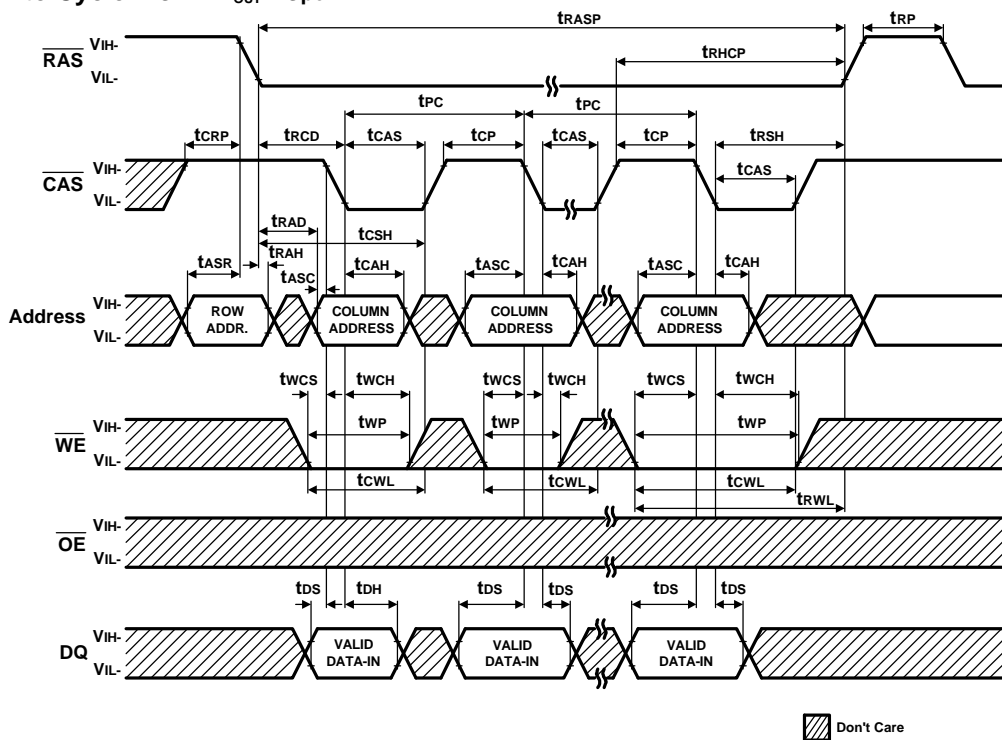


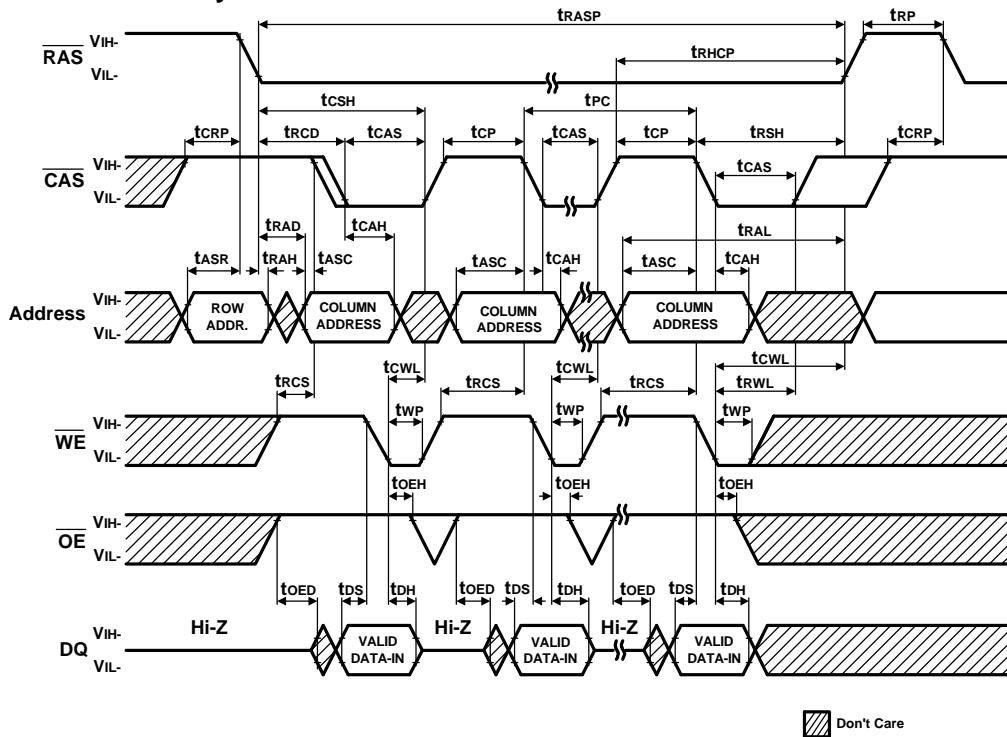
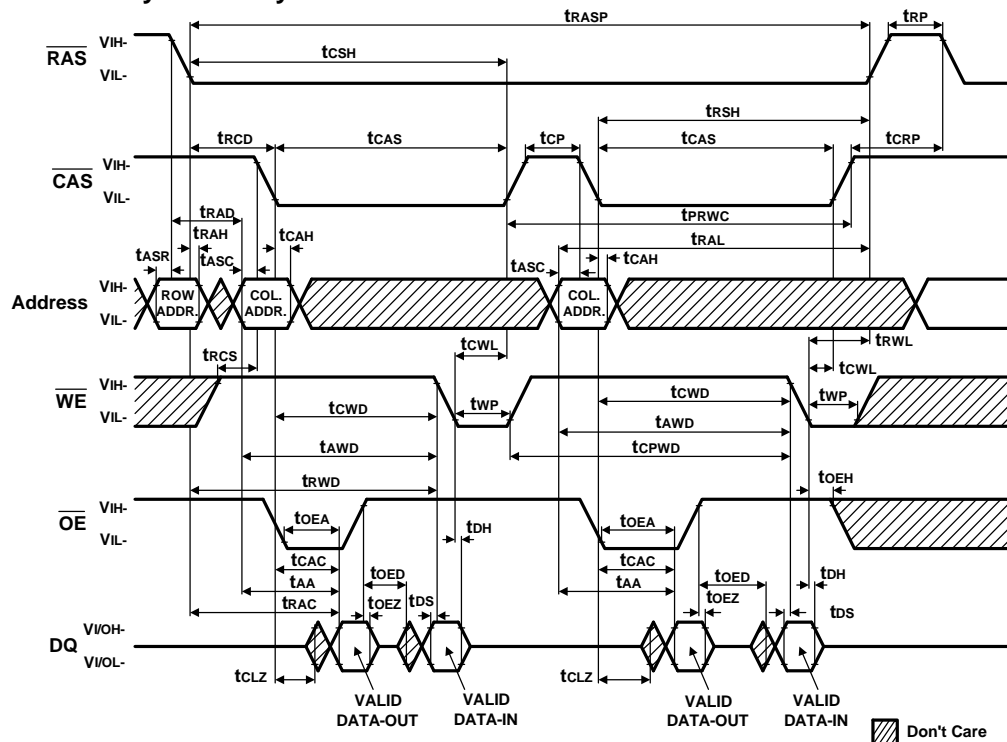
**Late Write Cycle (  $\overline{OE}$  Controlled Write )** NOTE :  $D_{OUT} = \text{Open}$



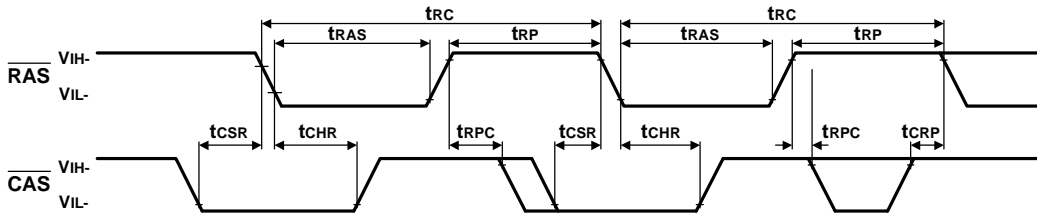
**Read - Modify - Write Cycle**



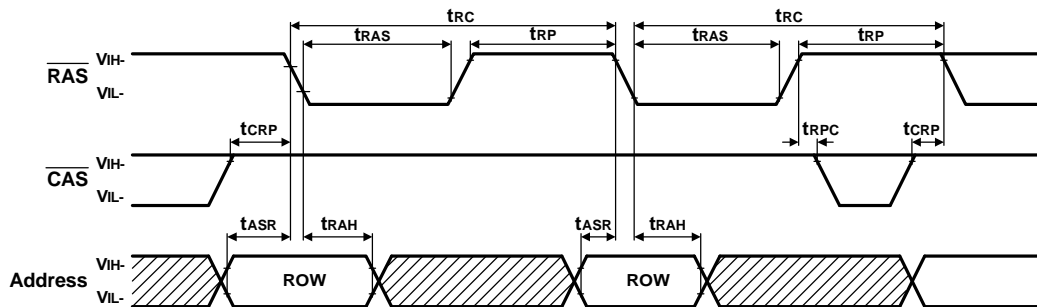
**Fast Page Read Cycle**

**Fast Page Write Cycle** NOTE :  $D_{OUT} = \text{Open}$ 


**Fast Page Mode Late Write Cycle**

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


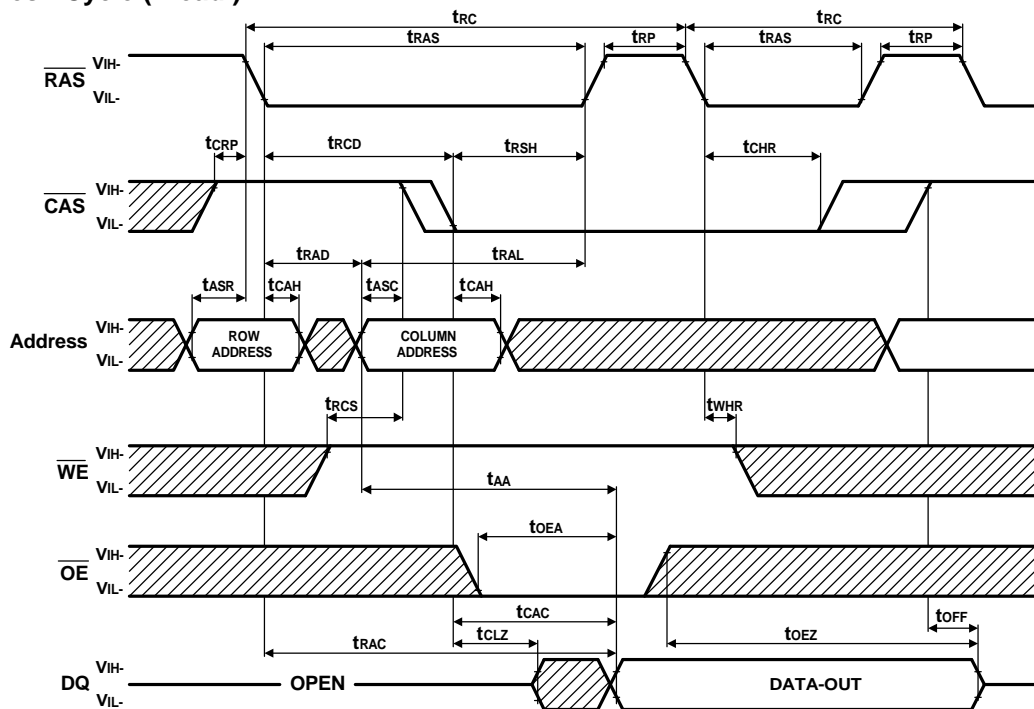
**CAS Before RAS Refresh Cycle**



**RAS -Only Refresh Cycle**

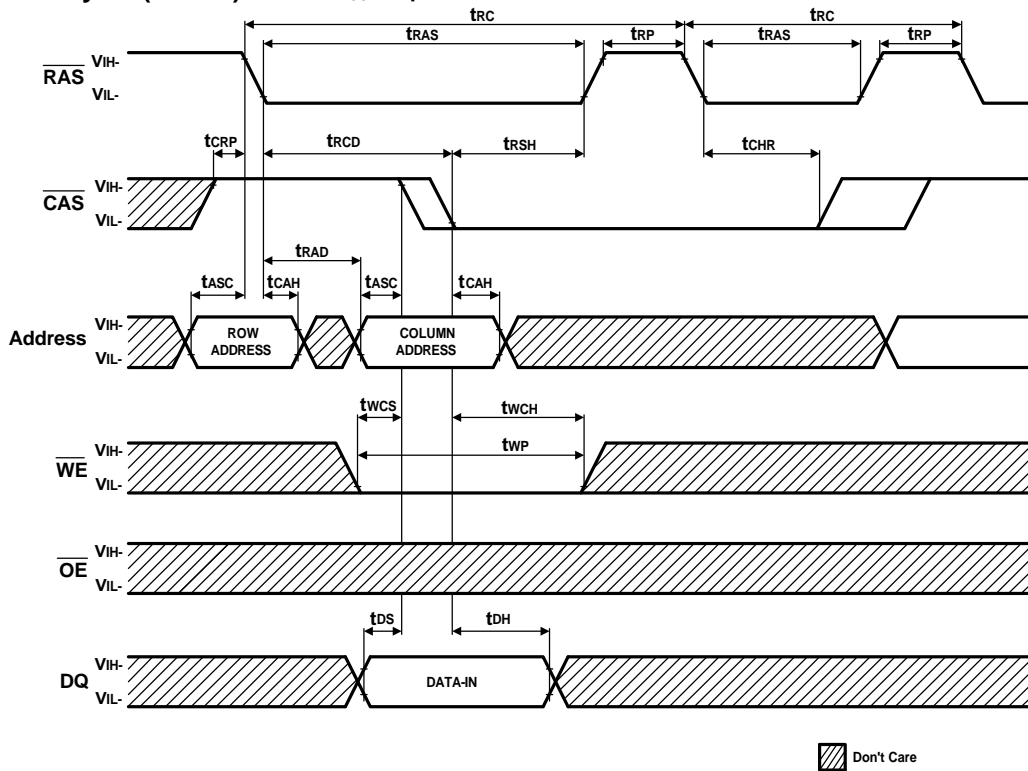


**Hidden Refresh Cycle ( Read )**

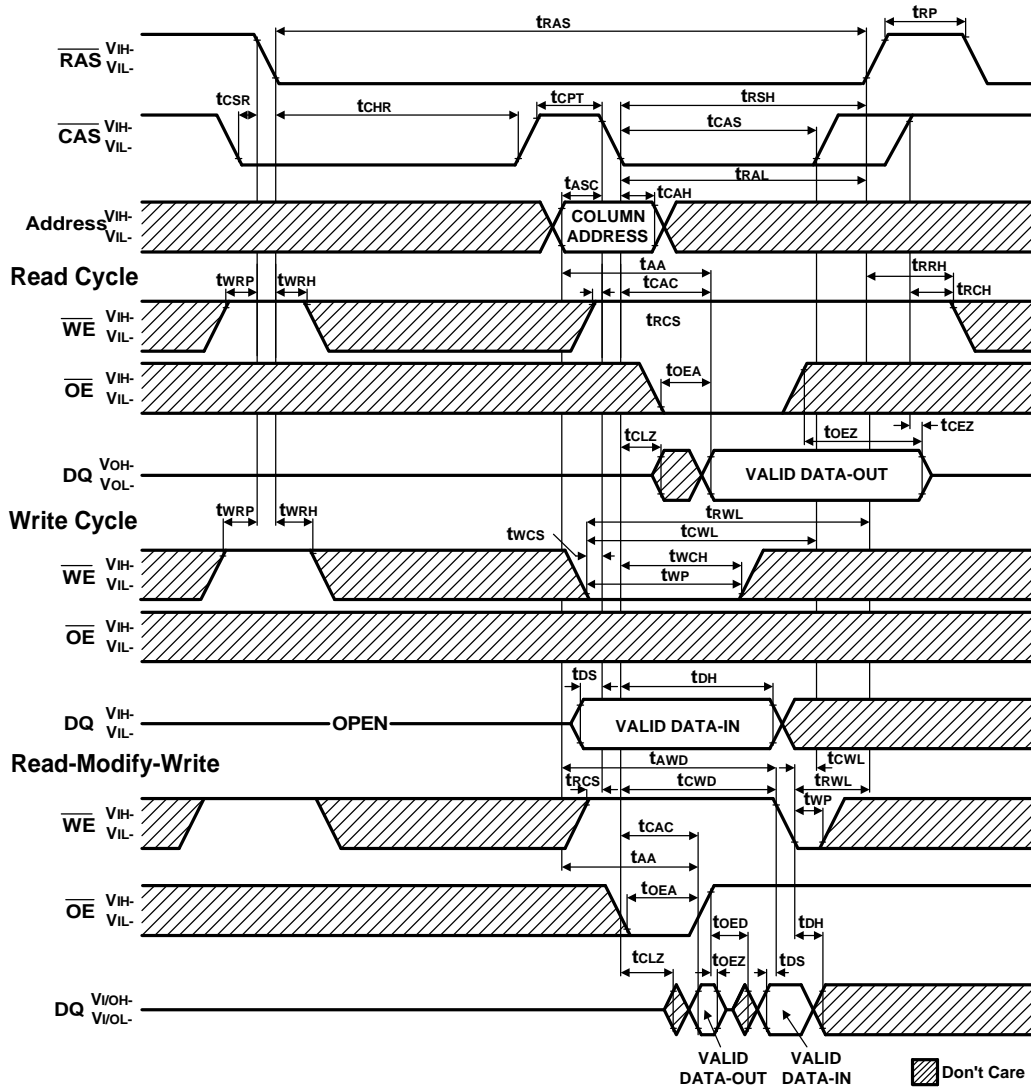


 Don't Care

**Hidden Refresh Cycle ( Write ) NOTE : D<sub>OUT</sub> =Open**

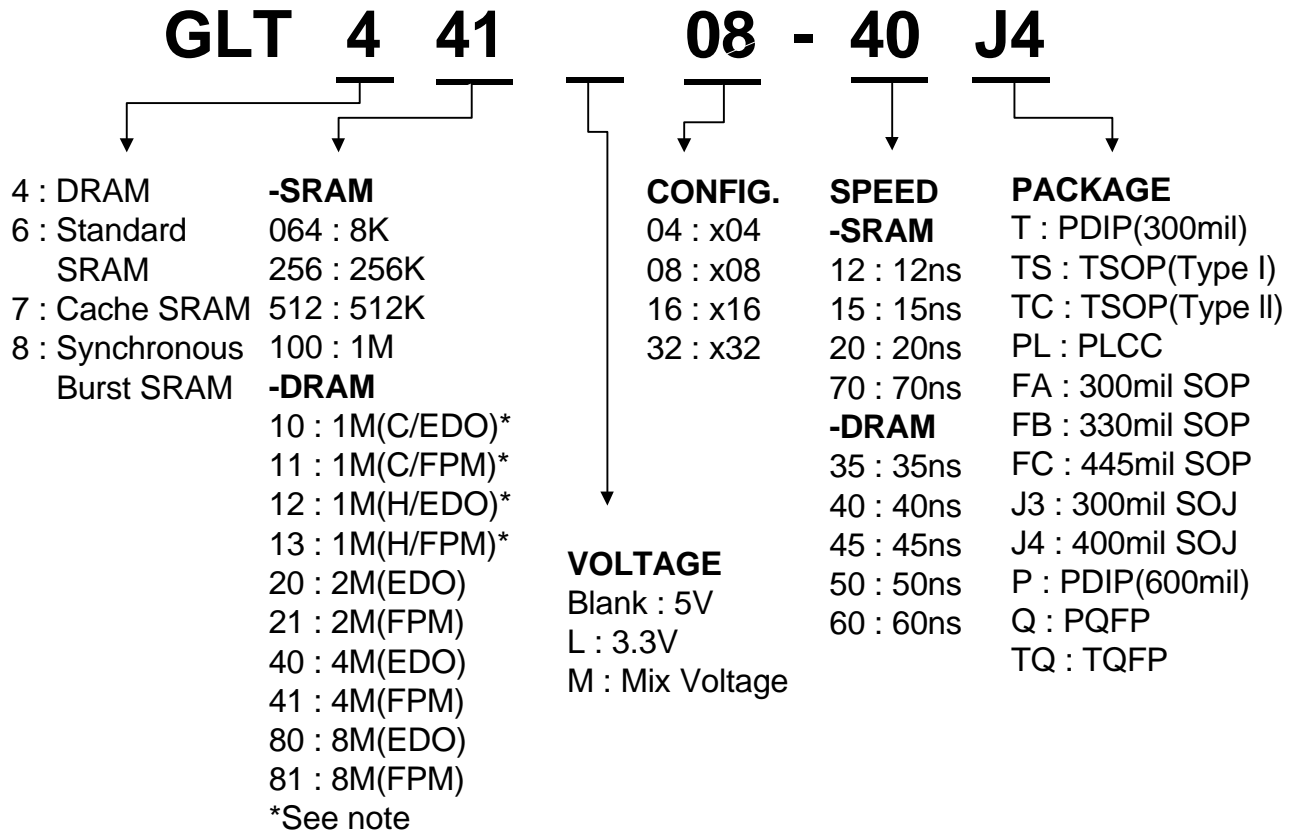


CAS - Before RAS Refresh Counter Test Cycle



**Ordering Information**

<b>Part Number</b>	<b>SPEED</b>	<b>POWER</b>	<b>FEATURE</b>	<b>PACKAGE</b>
GLT44108-40J4	40ns	Normal	FPM	SOJ 400mil 28L
GLT44108-50J4	50ns	Normal	FPM	SOJ 400mil 28L
GLT44108-60J4	60ns	Normal	FPM	SOJ 400mil 28L

**Parts Numbers (Top Mark) Definition :**


Note : C→CDROM , H→HDD.

Example :

1. GLT710008-15T    1Mbit(128Kx8)15ns 5V SRAM PDIP(300mil)Package type.
2. GLT44016-40J4    4Mbit(256Kx16)40ns 5V DRAM SOJ(400mil)Package type.

**Package Information**

400mil 28 Lead Small Outline J-form Package (SOJ)

