

## 256K x 16-Bit Dynamic RAM

HYB 514171BJ-50/-60/-70

## Low Power 256K x 16-Bit Dynamic RAM with Self Refresh

HYB 514171BJL-50/-60/-70

### Advanced Information

- 262 144 words by 16-bit organization
- 0 to 70 °C operating temperature
- Fast access and cycle time
- $\overline{\text{RAS}}$  access time:
  - 50 ns (-50 version)
  - 60 ns (-60 version)
  - 70 ns (-70 version)
- $\overline{\text{CAS}}$  access time:
  - 15ns (-50,-60 version)
  - 20 ns (-70 version)
- Cycle time:
  - 95 ns (-50 version)
  - 110 ns (-60 version)
  - 130 ns (-70 version)
- Fast page mode cycle time
  - 35 ns (-50 version)
  - 40 ns (-60 version)
  - 45 ns (-70 version)
- Single + 5.0 V ( $\pm 10\%$ ) supply with a built-in VBB generator
- Low Power dissipation
  - max. 1045 mW active (-50 version)
  - max. 935 mW active (-60 version)
  - max. 880 mW active (-70 version)
- Standby power dissipation
  - 11 mW standby (TTL)
  - 5.5 mW max. standby (CMOS)
  - 1.1 mW max. standby (CMOS) for Low Power Version
- Output unlatched at cycle end allows two-dimensional chip selection
- Read, write, read-modify write, CAS-before-RAS refresh, RAS-only refresh, hidden-refresh and fast page mode capability
- 2  $\overline{\text{CAS}}$  / 1  $\overline{\text{WE}}$  control
- Self Refresh (L-Version)
- All inputs and outputs TTL-compatible
- 512 refresh cycles / 16 ms
- 512 refresh cycles / 128 ms Low Power Version only
- Plastic Packages:
  - P-SOJ-40-1 400mil width

The HYB 514171BJ/BJL is a 4 MBit dynamic RAM organized as 262 144 words by 16-bit. The HYB 514171BJ/BJL utilizes CMOS silicon gate process as well as advanced circuit techniques to provide wide operation margins, both internally and for the system user. Multiplexed address inputs permit the HYB 514171BJ/BJL to be packed in a standard plastic 400mil wide P-SOJ-40-1 package. This package size provides high system bit densities and is compatible with commonly used automatic testing and insertion equipment. System oriented features include Self Refresh (L-Version), single + 5 V ( $\pm 10\%$ ) power supply, direct interfacing with high performance logic device families such as Schottky TTL.

**Ordering Information**

Type	Ordering Code	Package	Description
HYB 514171BJ-50	Q67100-Q2021	P-SOJ-40-1	50ns 256 K x 16 DRAM
HYB 514171BJ-60	Q67100-Q727	P-SOJ-40-1	60 ns 256 K x 16 DRAM
HYB 514171BJ-70	Q67100-Q728	P-SOJ-40-1	70 ns 256 K x 16 DRAM
HYB 514171BJL-50	on request	P-SOJ-40-1	50 ns 256 K x 16 DRAM
HYB 514171BJL-60	Q67100-Q932	P-SOJ-40-1	60 ns 256 K x 16 DRAM
HYB 514171BJL-70	Q67100-Q931	P-SOJ-40-1	70 ns 256 K x 16 DRAM

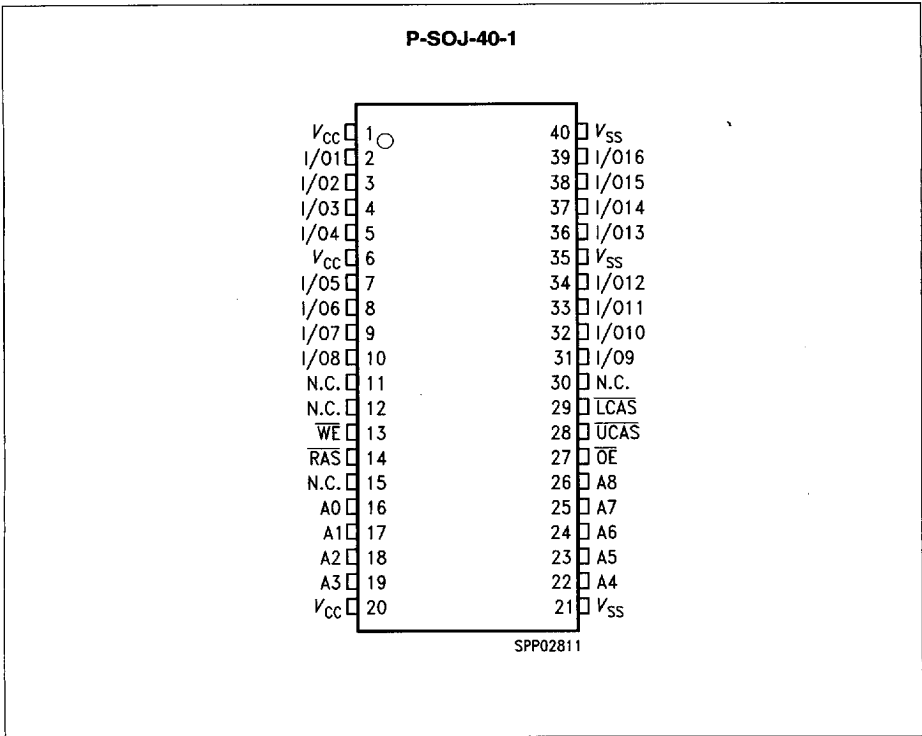
**Truth Table**

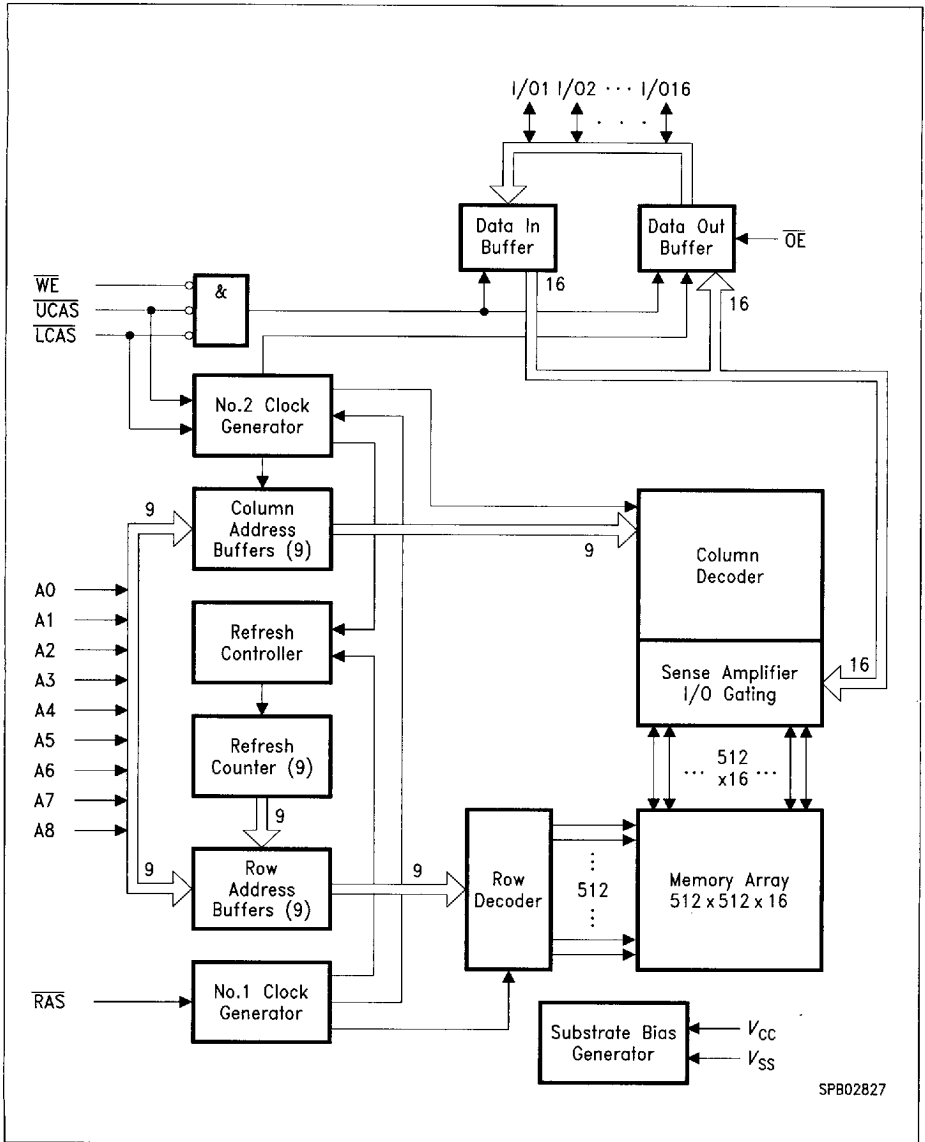
RAS	LCAS	UCAS	WE	OE	I/O1-I/O8	I/O9-I/O16	Operation
H	H	H	H	H	High-Z	High-Z	Standby
L	H	H	H	H	High-Z	High-Z	Refresh
L	L	H	H	L	Dout	High-Z	Lower byte read
L	H	L	H	L	High-Z	Dout	Upper byte read
L	L	L	H	L	Dout	Dout	Word read
L	L	H	L	H	Din	Don't care	Lower byte write
L	H	L	L	H	Don't care	Din	Upper byte write
L	L	L	L	H	Din	Din	Word write
L	L	L	H	H	High-Z	High-Z	

**Pin Names**

A0-A8	Address Inputs
RAS	Row Address Strobe
UCAS, LCAS	Column Address Strobe
WE	Read/Write Input
OE	Output Enable
I/O1 – I/O16	Data Input/Output
V <sub>cc</sub>	Power Supply (+ 5 V)
V <sub>ss</sub>	Ground (0 V)
N.C.	No Connection

Pin Configuration  
(top view)





Block Diagram

**Absolute Maximum Ratings**

Operating temperature range ..... 0 to + 70 °C  
 Storage temperature range..... - 55 to + 150 °C  
 Input/output voltage ..... - 1 to 7 V  
 Power supply voltage..... - 1 to 7 V  
 Data out current (short circuit) ..... 50 mA

**Note:** Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage of the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**DC Characteristics**

$T_A = 0$  to  $70$  °C;  $V_{SS} = 0$  V;  $V_{CC} = 5$  V  $\pm$  10 %,  $t_T = 5$  ns

Parameter	Symbol	Limit Values		Unit	Notes
		min.	max.		
Input high voltage	$V_{IH}$	2.4	$V_{CC} + 0.5$	V	1
Input low voltage	$V_{IL}$	- 1.0	0.8	V	1
TTL Output high voltage ( $I_{OUT} = - 5.0$ mA)	$V_{OH}$	2.4	-	V	1
TTL Output low voltage ( $I_{OUT} = 4.2$ mA)	$V_{OL}$	-	0.4	V	1
input leakage current, any input ( $0$ V < $V_{IN}$ < $V_{CC} + 0.3$ V, all other inputs = $0$ V)	$I_{I(L)}$	- 10	10	$\mu$ A	1
Output leakage current (DO is disabled, $0$ V < $V_{OUT}$ < $V_{CC}$ )	$I_{O(L)}$	- 10	10	$\mu$ A	1
Average $V_{CC}$ supply current: -50 version -60 version -70 version	$I_{CC1}$	-	190 170 160	mA	2, 3, 4
Standby $V_{CC}$ supply current (RAS = LCAS = UCAS = WE = $V_{IH}$ )	$I_{CC2}$	-	2	mA	
Average $V_{CC}$ supply current during RAS-only refresh cycles: -50 version -60 version -70 version	$I_{CC3}$	-	190 170 160	mA	2, 4

**DC Characteristics (cont'd)**

Parameter	Symbol	Limit Values		Unit	Notes
		min.	max.		
Average $V_{CC}$ supply current during fast page mode operation: -50 version -60 version -70 version	$I_{CC4}$	–	160 150 140	mA	2, 3, 4
Standby $V_{CC}$ supply current ( $\overline{RAS} = \overline{LCAS} = \overline{UCAS} = \overline{WE} = V_{CC} - 0.2 V$ )	$I_{CC5}$	–	1	mA	1
Average $V_{CC}$ supply current during CAS-before-RAS refresh mode: -50 version -60 version -70 version	$I_{CC6}$	–	190 170 160	mA	2, 4
Standby $V_{CC}$ current (L-version) ( $\overline{RAS} = \overline{LCAS} = \overline{UCAS} = \overline{WE} = V_{CC} - 0.2 V$ )	$I_{CC5}$	–	200	$\mu A$	
Self Refresh Current (L-version) ( $\overline{RAS}, \overline{LCAS}, \overline{UCAS} = 0.2V$ $A0 - A8 = V_{CC} - 0.2 V$ or $0.2 V$ )	$I_{CC5}$	–	250	$\mu A$	

**Capacitance**

$T_A = 0$  to  $70^\circ C$ ;  $V_{CC} = 5 V \pm 10 \%$ ,  $f = 1 MHz$

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Input capacitance (A0 to A8)	$C_{11}$	–	6	pF
Input capacitance ( $\overline{RAS}, \overline{UCAS}, \overline{LCAS}, \overline{WE}, \overline{OE}$ )	$C_{12}$	–	7	pF
Output capacitance (I/O1 to I/O16)	$C_{10}$	–	7	pF

■ 8235605 0086490 T38 ■

**AC Characteristics** <sup>5)6)</sup>

$T_A = 0$  to  $70$  °C;  $V_{SS} = 0$  V;  $V_{CC} = 5$  V  $\pm$  10 %,  $t_T = 5$  ns

Parameter	Symbol	Limit Values						Unit	Note
		- 50		- 60		- 70			
		min.	max.	min.	max.	min.	max.		

**Common Parameters**

Random read or write cycle time	$t_{RC}$	95	–	110	–	130	–	ns	
RAS precharge time	$t_{RP}$	35	–	40	–	50	–	ns	
RAS pulse width	$t_{RAS}$	50	10k	60	10k	70	10k	ns	
CAS pulse width	$t_{CAS}$	15	10k	15	10k	20	10k	ns	
Row address setup time	$t_{ASR}$	0	–	0	–	0	–	ns	
Row address hold time	$t_{RAH}$	10	–	10	–	10	–	ns	
Column address setup time	$t_{ASC}$	0	–	0	–	0	–	ns	
Column address hold time	$t_{CAH}$	10	–	15	–	15	–	ns	
RAS to CAS delay time	$t_{RCD}$	20	35	20	45	20	50	ns	
RAS to column address delay time	$t_{RAD}$	15	25	15	30	15	35	ns	
RAS hold time	$t_{RSH}$	15	–	15	–	20	–	ns	
CAS hold time	$t_{CSH}$	50	–	60	–	70	–	ns	
CAS to RAS precharge time	$t_{CRP}$	5	–	5	–	5	–	ns	
Transition time (rise and fall)	$t_T$	3	50	3	50	3	50	ns	7
Refresh period	$t_{REF}$	–	16	–	16	–	16	ms	
Refresh period (L-version)	$t_{REF}$	–	128	–	128	–	128	ms	

**Read Cycle**

Access time from RAS	$t_{RAC}$	–	50	–	60	–	70	ns	8, 9
Access time from CAS	$t_{CAC}$	–	15	–	15	–	20	ns	8, 9
Access time from column address	$t_{AA}$	–	25	–	30	–	35	ns	8,10
OE access time	$t_{OEA}$	–	15	–	15	–	20	ns	
Column address to RAS lead time	$t_{RAL}$	25	–	30	–	35	–	ns	
Read command setup time	$t_{RCS}$	0	–	0	–	0	–	ns	
Read command hold time	$t_{RCH}$	0	–	0	–	0	–	ns	11
Read command hold time ref. to RAS	$t_{RRH}$	0	–	0	–	0	–	ns	11

■ 8235605 0086491 974 ■

Parameter	Symbol	Limit Values						Unit	Note
		- 50		- 60		- 70			
		min.	max.	min.	max.	min.	max.		
$\overline{\text{CAS}}$ to output inlow-Z	$t_{\text{CLZ}}$	0	–	0	–	0	–	ns	8
Output buffer turn-off delay from $\overline{\text{CAS}}$	$t_{\text{OFF}}$	0	15	0	20	0	20	ns	12
Output buffer turn-off delay from $\overline{\text{OE}}$	$t_{\text{OEZ}}$	0	15	0	20	0	20	ns	12
Data to $\overline{\text{OE}}$ low delay	$t_{\text{DZO}}$	0	–	0	–	0	–	ns	13
$\overline{\text{CAS}}$ high to datadelay	$t_{\text{CDD}}$	15	–	20	–	20	–	ns	14
$\overline{\text{OE}}$ high to data delay	$t_{\text{ODD}}$	15	–	20	–	20	–	ns	14

**Write Cycle**

Write command hold time	$t_{\text{WCH}}$	10	–	10	–	15	–	ns	
Write command pulse width	$t_{\text{WCP}}$	10	–	10	–	15	–	ns	
Write command setup time	$t_{\text{WCS}}$	0	–	0	–	0	–	ns	15
Write command to $\overline{\text{RAS}}$ lead time	$t_{\text{RWL}}$	15	–	15	–	20	–	ns	
Write command to $\overline{\text{CAS}}$ lead time	$t_{\text{CWL}}$	15	–	15	–	20	–	ns	
Data setup time	$t_{\text{DS}}$	0	–	0	–	0	–	ns	16
Data hold time	$t_{\text{DH}}$	10	–	15	–	15	–	ns	16
Data to $\overline{\text{CAS}}$ lowdelay	$t_{\text{DZC}}$	0	–	0	–	0	–	ns	13

**Read-modify-Write Cycle**

Read-write cycle time	$t_{\text{RWC}}$	140	–	160	–	185	–	ns	
$\overline{\text{RAS}}$ to $\overline{\text{WE}}$ delay time	$t_{\text{RWD}}$	75	–	90	–	100	–	ns	15
$\overline{\text{CAS}}$ to $\overline{\text{WE}}$ delay time	$t_{\text{CWD}}$	40	–	45	–	50	–	ns	15
Column address to $\overline{\text{WE}}$ delay time	$t_{\text{AWD}}$	50	–	60	–	65	–	ns	15
$\overline{\text{OE}}$ command hold time	$t_{\text{OEH}}$	15	–	20	–	20	–	ns	

**Fast Page Mode Cycle**

Fast page mode cycle time	$t_{\text{PC}}$	35	–	40	–	45	–	ns	
$\overline{\text{CAS}}$ precharge time	$t_{\text{CP}}$	10	–	10	–	10	–	ns	
Access time from $\overline{\text{CAS}}$ precharge	$t_{\text{CPA}}$	–	30	–	35	–	40	ns	7
$\overline{\text{RAS}}$ pulse width	$t_{\text{RASP}}$	50	200k	60	200k	70	200k	ns	

■ 8235605 0086492 800 ■



Parameter	Symbol	Limit Values						Unit	Note
		- 50		- 60		- 70			
		min.	max.	min.	max.	min.	max.		
$\overline{\text{RAS}}$ hold time from $\overline{\text{CAS}}$ precharge	$t_{\text{RHCP}}$	30	–	35	–	40	–	ns	

**Fast Page Mode Read Modify Write Cycle**

Fast page mode read/write cycle time	$t_{\text{PRWC}}$	80	–	90	–	100	–	ns	
$\overline{\text{CAS}}$ precharge to $\overline{\text{WE}}$ delay time	$t_{\text{CPWD}}$	55	–	60	–	65	–	ns	

**$\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  Refresh Cycle**

$\overline{\text{CAS}}$ setup time	$t_{\text{CSR}}$	5	–	5	–	5	–	ns	
$\overline{\text{CAS}}$ hold tim	$t_{\text{CHR}}$	10	–	10	–	10	–	ns	
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ precharge time	$t_{\text{RPC}}$	0	–	0	–	0	–	ns	
Write to $\overline{\text{RAS}}$ precharge time	$t_{\text{WRP}}$	10	–	10	–	10	–	ns	
Write to $\overline{\text{RAS}}$ hold time	$t_{\text{WRH}}$	10	–	10	–	10	–	ns	

**$\overline{\text{CAS}}$ -before  $\overline{\text{RAS}}$  Counter Test Cycle**

$\overline{\text{CAS}}$ precharge time	$t_{\text{CPT}}$	25	–	30	–	40	–	ns	
--	------------------	----	---	----	---	----	---	----	--

**Self Refresh Cycle (L-Version only)**

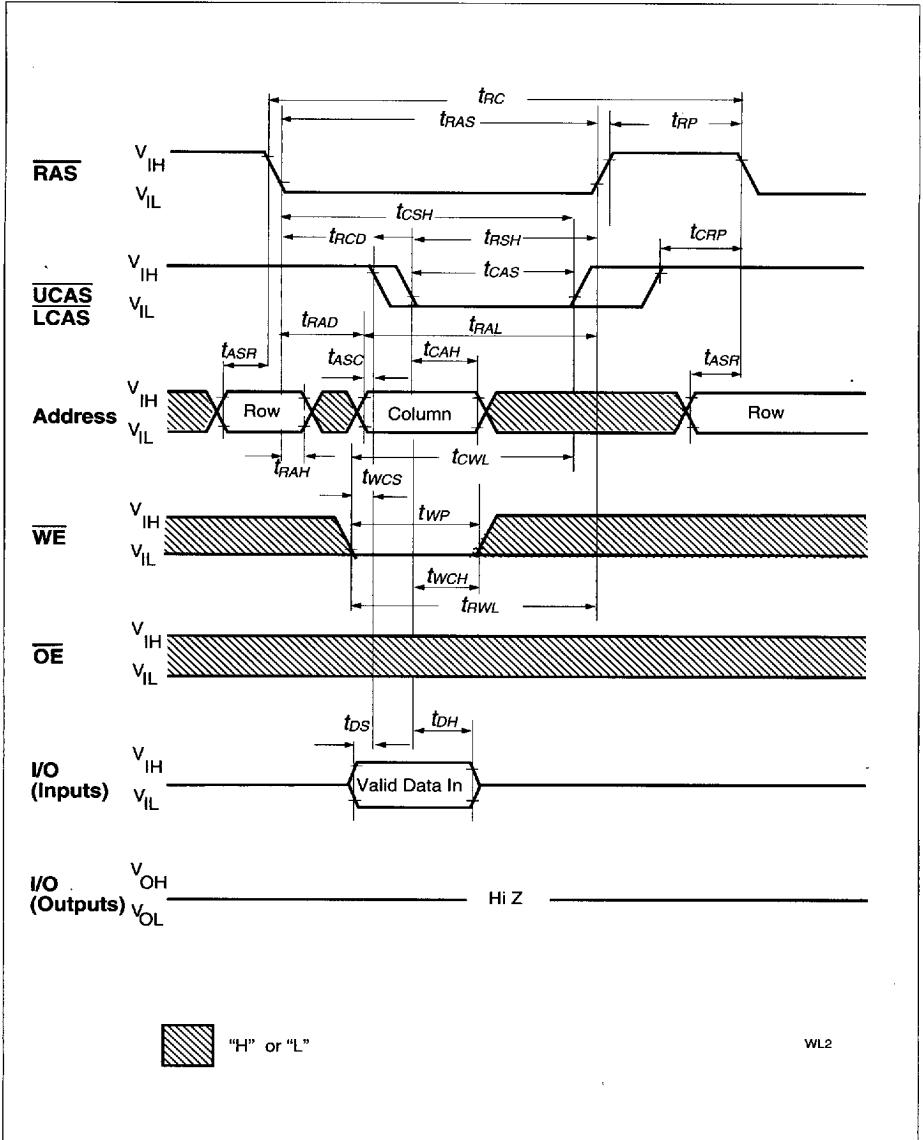
$\overline{\text{RAS}}$ pulse width	$t_{\text{RASS}}$	100	–	100	–	100	–	$\mu\text{s}$	
$\overline{\text{RAS}}$ precharge time	$t_{\text{RPS}}$	95	–	110	–	130	–	ns	
$\overline{\text{CAS}}$ hold time Self Refresh	$t_{\text{CHS}}$	35	–	40	–	50	–	ns	

■ 8235605 0086493 747 ■

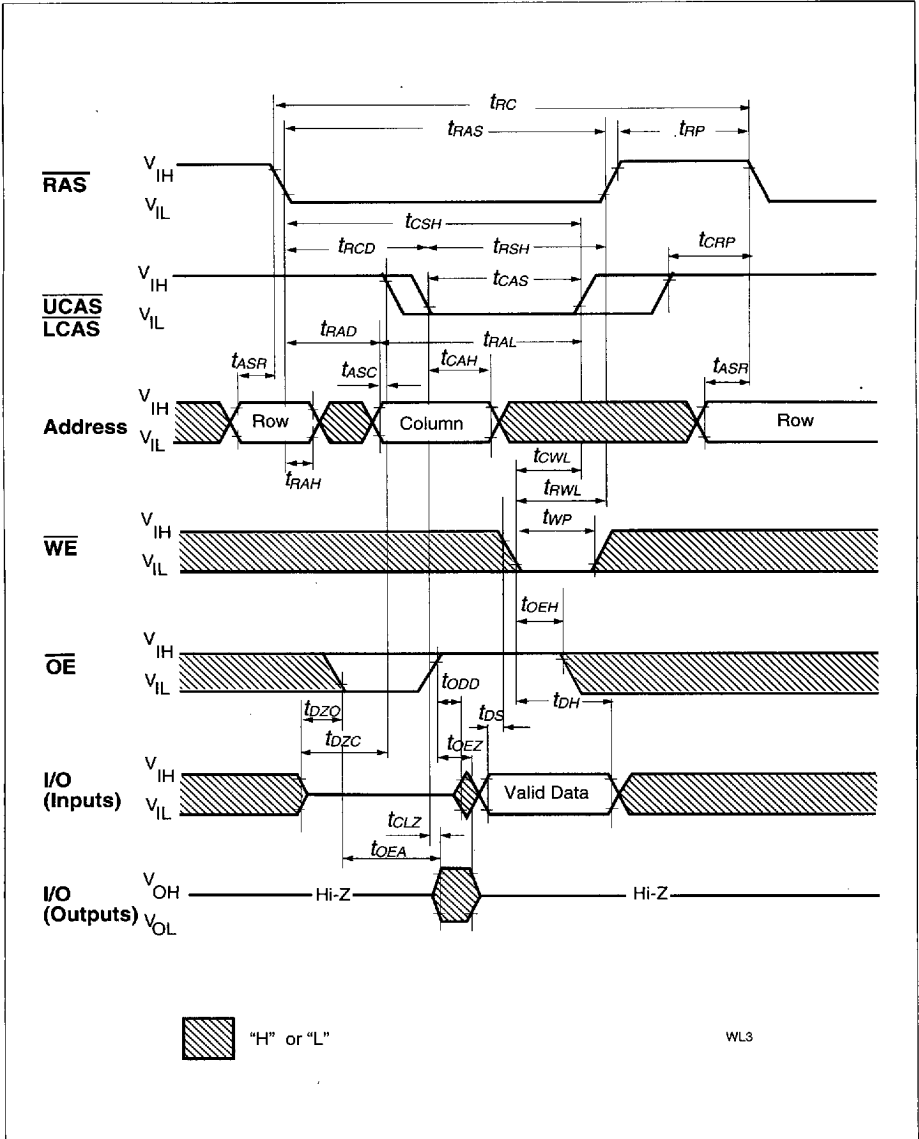
**Notes:**

- 1) All voltages are referenced to  $V_{SS}$ .
- 2)  $I_{CC1}$ ,  $I_{CC3}$ ,  $I_{CC4}$  and  $I_{CC6}$  depend on cycle rate.
- 3)  $I_{CC1}$  and  $I_{CC4}$  depend on output loading. Specified values are obtained with the output open.
- 4) Address can be changed once or less while  $RAS = V_{it}$ . In case of  $I_{CC4}$  it can be changed once or less during a page mode cycle
- 5) An initial pause of 200  $\mu s$  is required after power-up followed by 8  $\overline{RAS}$  cycles of which at least one cycle has to be a refresh cycle, before proper device operation is achieved. In case of using the internal refresh counter, a minimum of 8 CAS-before-RAS initialization cycles instead of 8 RAS cycles are required.
- 6) AC measurements assume  $t_T = 5$  ns.
- 7)  $V_{IH (min.)}$  and  $V_{IL (max.)}$  are reference levels for measuring timing of input signals. Transition times are also measured between  $V_{IH}$  and  $V_{IL}$ .
- 8) Measured with a load equivalent to 2 TTL loads and 100 pF.
- 9) Operation within the  $t_{RCD (max.)}$  limit ensures 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 by  $t_{CAC}$ .
- 10) Operation within the  $t_{RAD (max.)}$  limit ensures 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  $t_{AA}$ .
- 11) Either  $t_{RCH}$  or  $t_{RRH}$  must be satisfied for a read cycle.
- 12)  $t_{OFF (max.)}$ ,  $t_{OEZ (max.)}$  define the time at which the output achieves the open-circuit conditions and are not referenced to output voltage levels.
- 13) Either  $t_{DZC}$  or  $t_{DZO}$  must be satisfied.
- 43) Either  $t_{CDD}$  or  $t_{ODD}$  must be satisfied.
- 15)  $t_{WCS}$ ,  $t_{RWD}$ ,  $t_{CWD}$  and  $t_{AWD}$  are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only. If  $t_{WCS} > t_{WCS (min.)}$ , the cycle is an early write cycle and data out pin will remain open-circuit (high impedance) through the entire cycle; if  $t_{RWD} > t_{RWD (min.)}$ ,  $t_{CWD} > t_{CWD (min.)}$  and  $t_{AWD} > t_{AWD (min.)}$ , the cycle is a read-write cycle and I/O will contain data read from the selected cells. If neither of the above sets of conditions is satisfied, the condition of I/O (at access time) is indeterminate.
- 16) These parameters are referenced to the  $\overline{CAS}$  leading edge in early write cycles and to the  $\overline{WE}$  leading edge in read-write cycles.



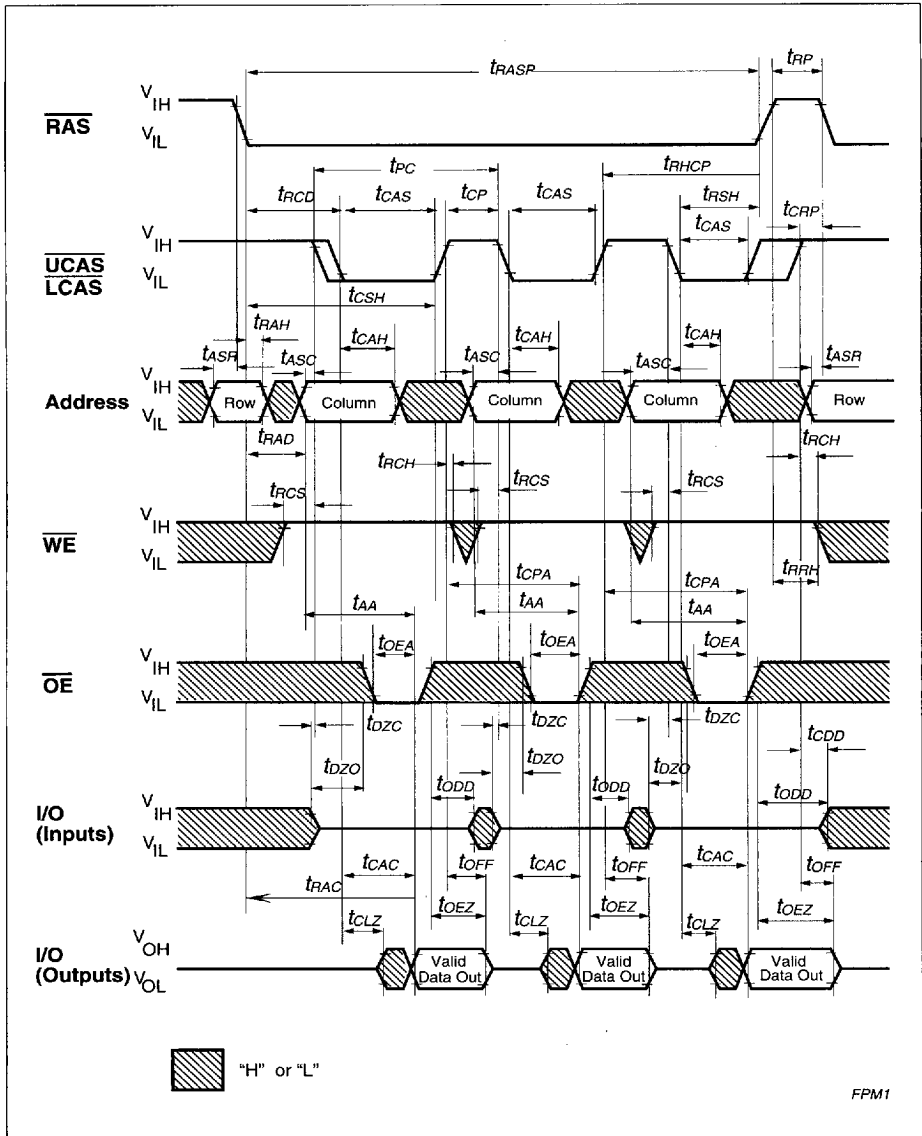


Write Cycle (Early Write)



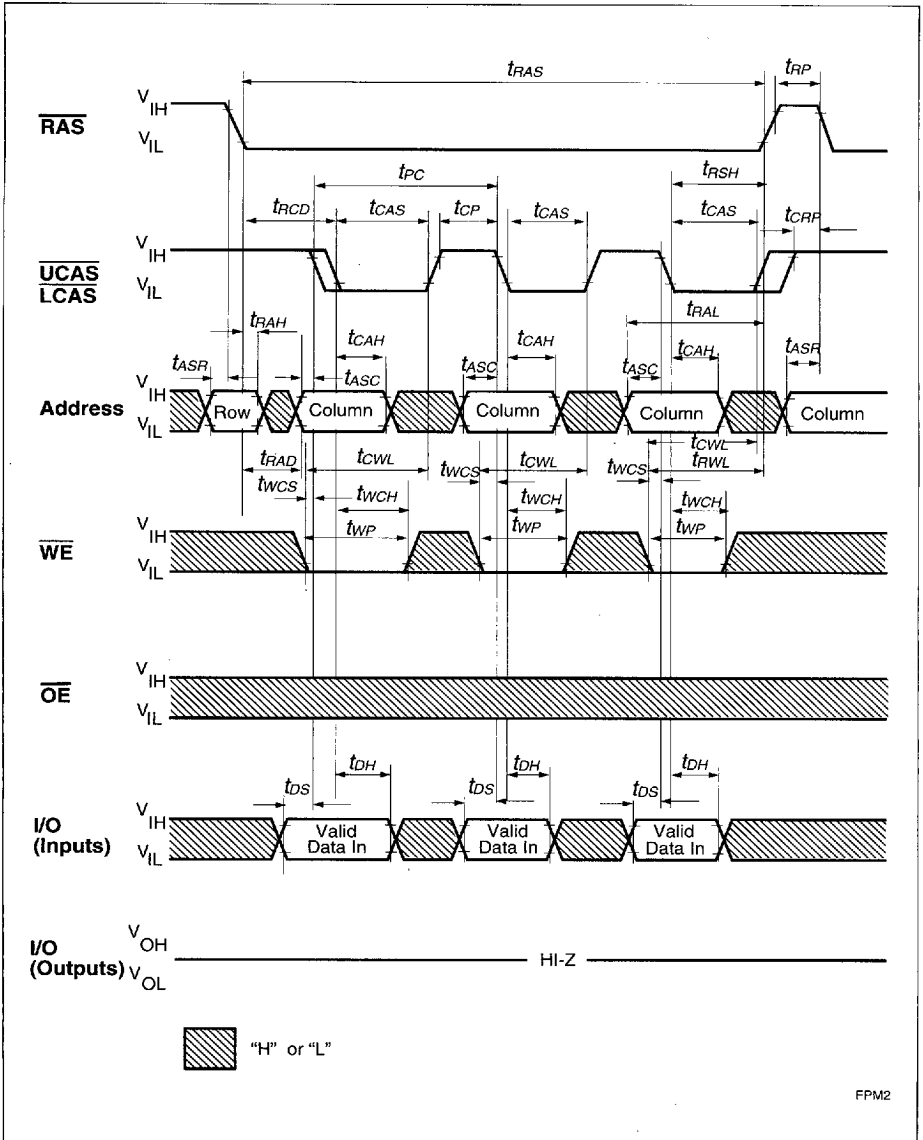
Write Cycle ( $\overline{OE}$  Controlled Write)





Fast Page Mode Read Cycle

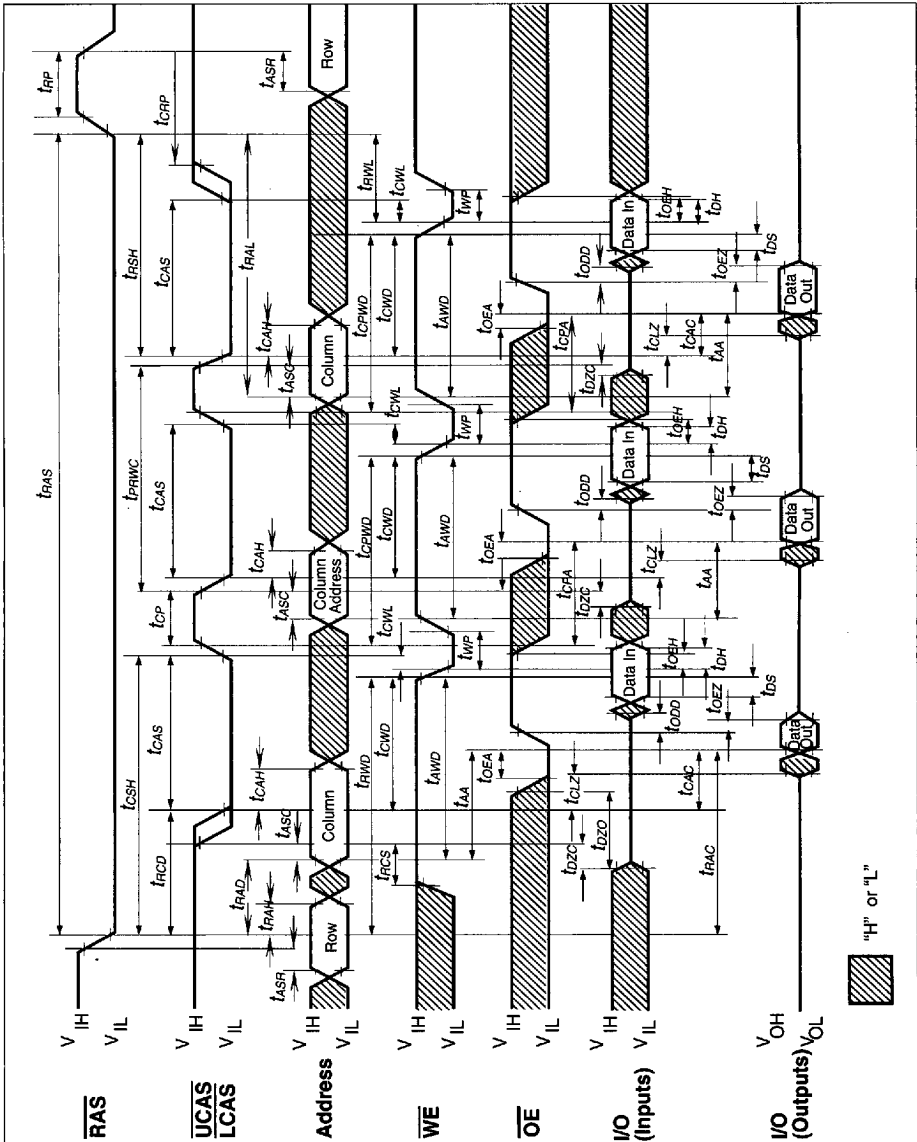
8235605 0086499 165



Fast Page Mode Early Write Cycle

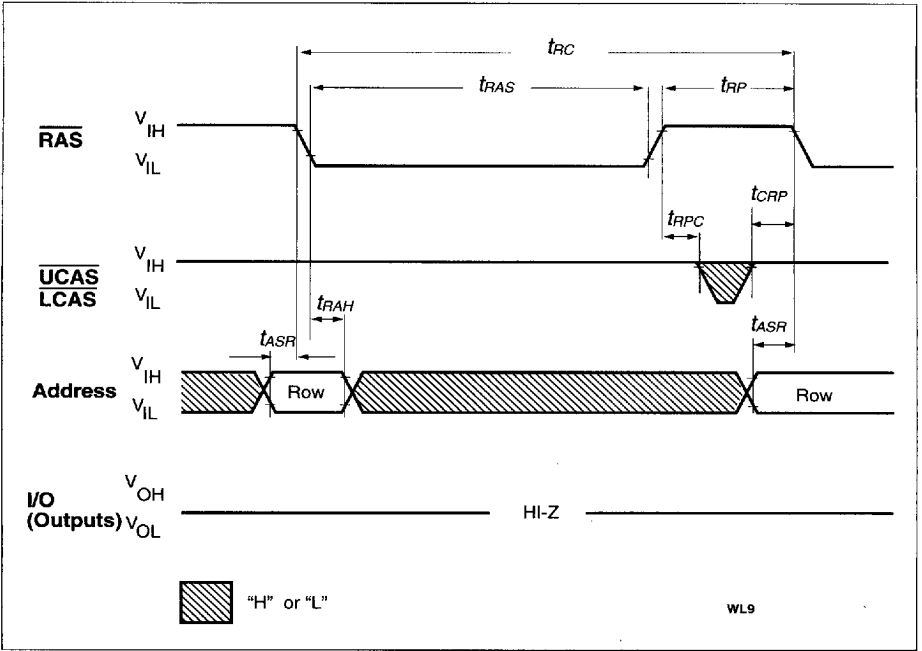
■ 8235605 0086500 707 ■



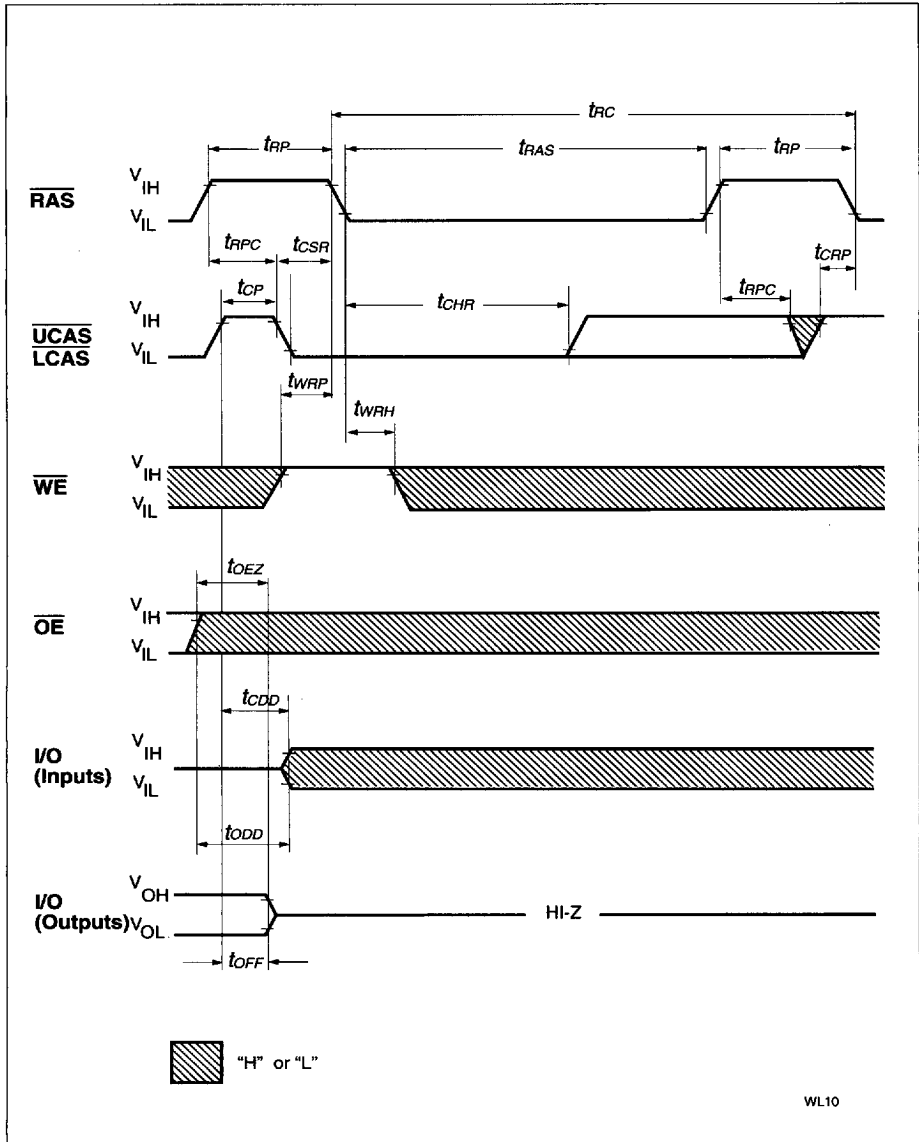


Fast Page Mode Read-Modify-Write Cycle

■ 8235605 0086501 643 ■

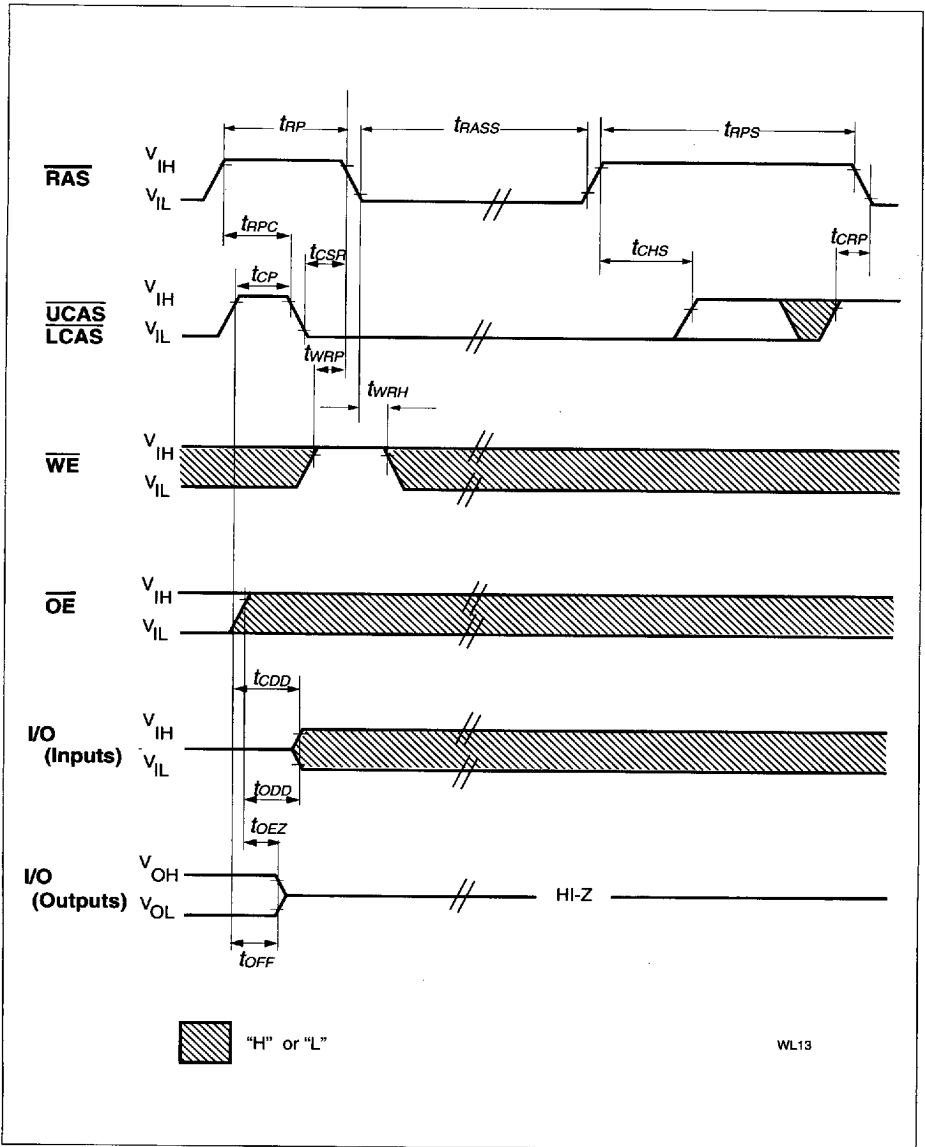


**$\overline{\text{RAS}}$ -Only Refresh Cycle**

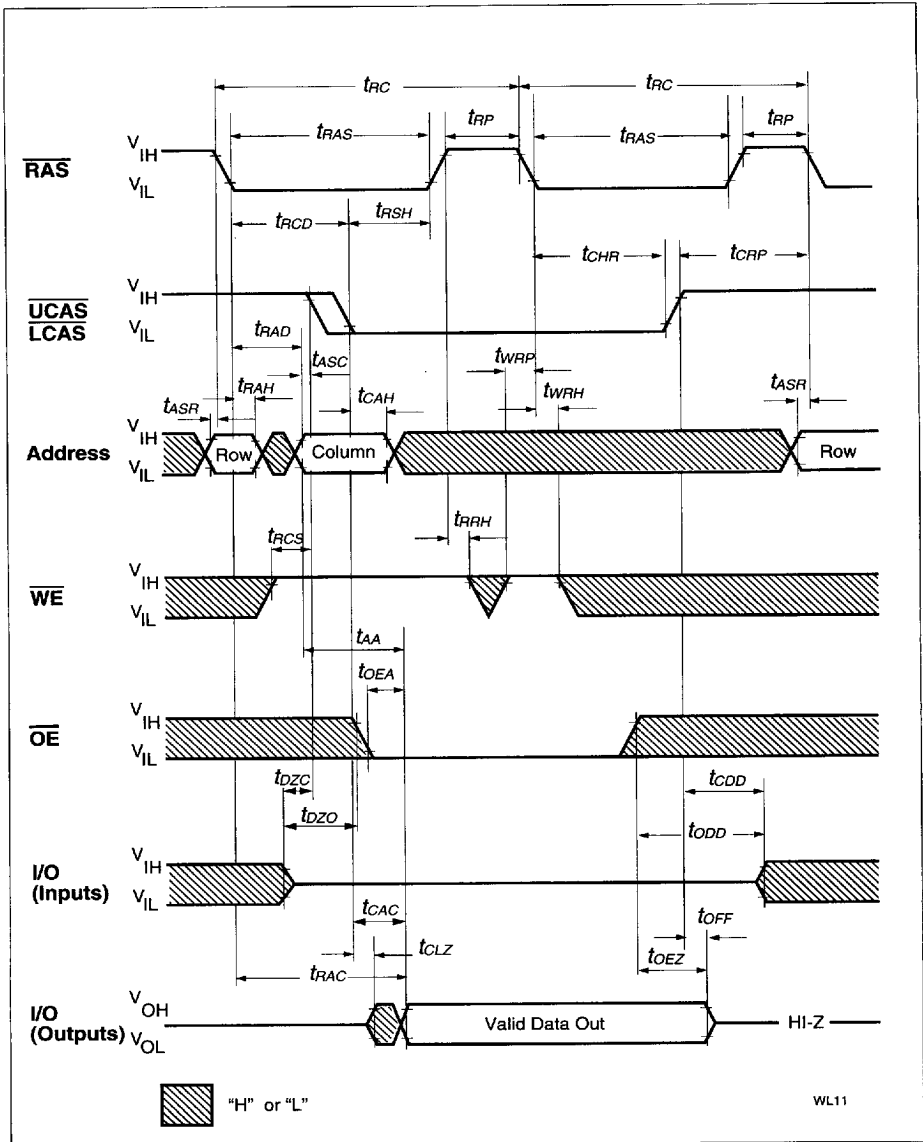


WL10

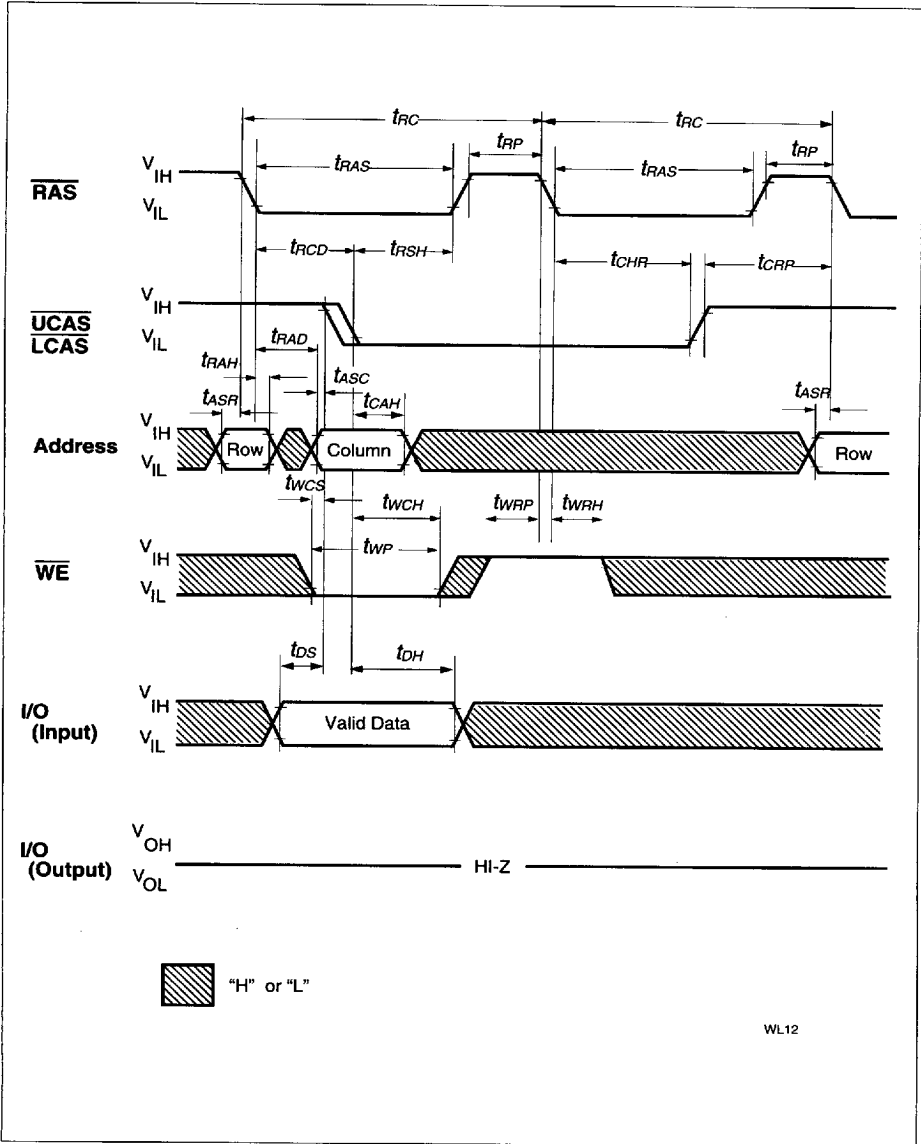
CAS-Before-RAS Refresh Cycle



CAS before RAS Self Refresh Cycle

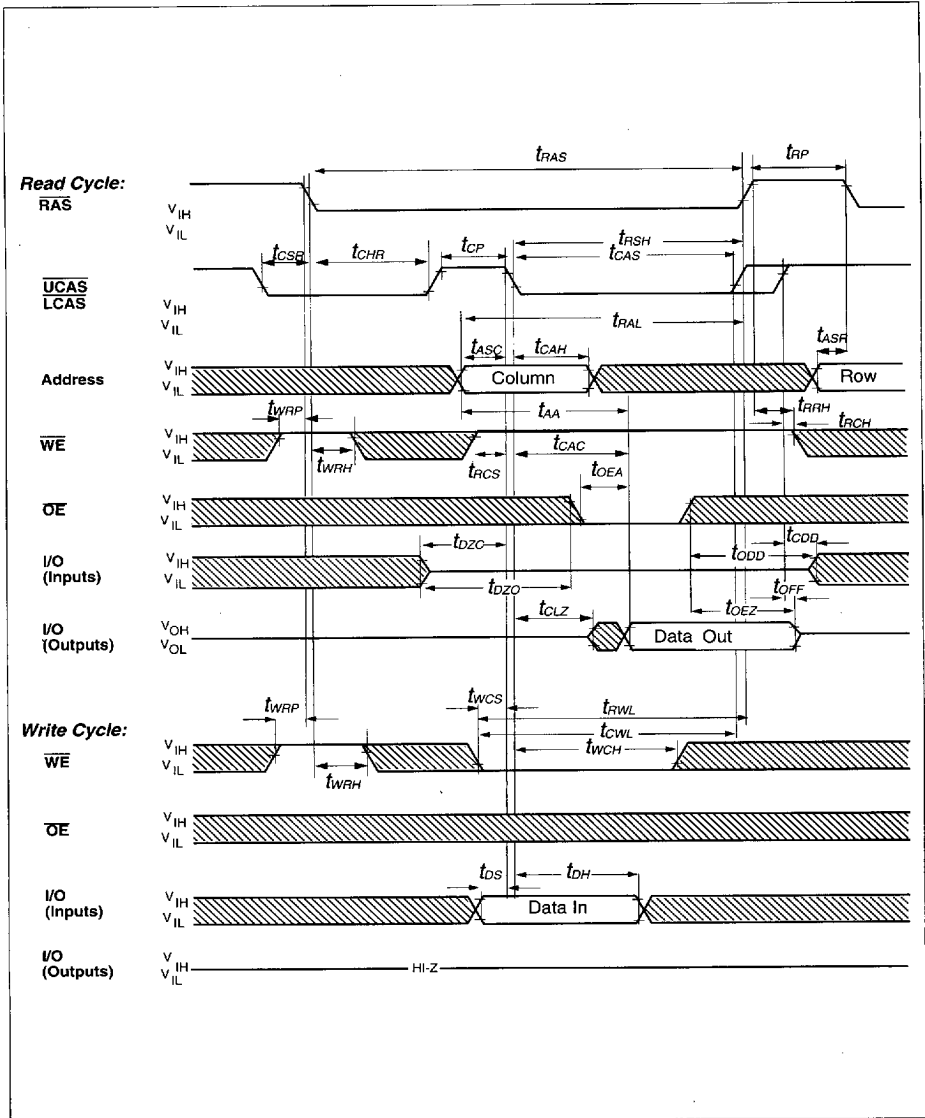


Hidden Refresh Cycle (Read)



Hidden Refresh Cycle (Early Write)

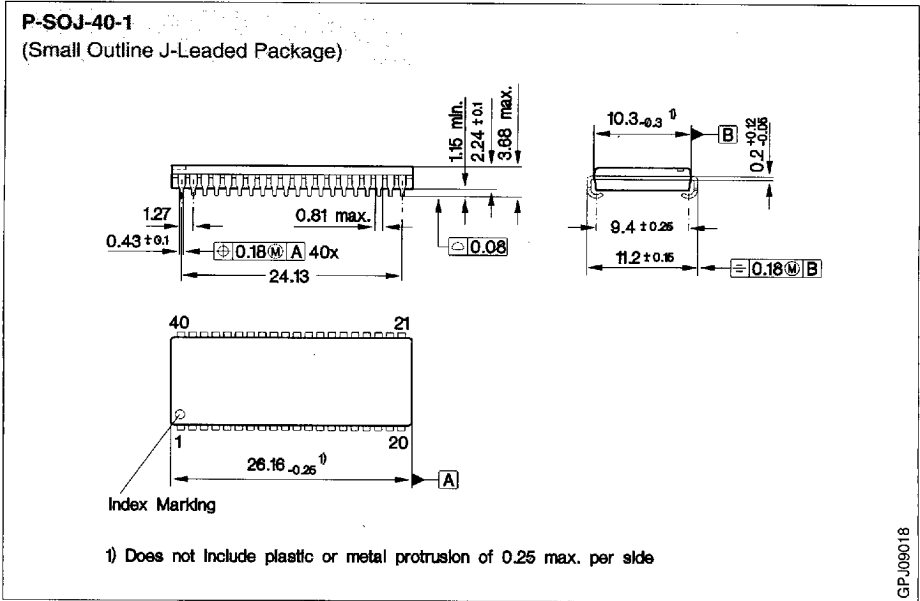
8235605 0086506 125



CAS/Before-RAS Refresh Counter Test Cycle

■ 8235605 0086507 061 ■

Package Outlines



**Sorts of Packing**

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm

■ 8235605 0086508 TT8 ■

Semiconductor Group

213