

### 4 M-BIT DYNAMIC RAM 1 M-WORD BY 4-BIT, FAST PAGE MODE

#### Description

The  $\mu$ PD424400-L is a 1,048,576 words by 4 bits dynamic CMOS RAM. The fast page mode capability realize high speed access and low power consumption.

These are packaged in 26-pin plastic TSOP(II) and 26-pin plastic SOJ.

#### Features

- 1,048,576 words by 4 bits organization
- Single +5.0 V  $\pm$  10 % power supply
- Fast page mode
- Fast access and cycle time

Part number	Power consumption		Access time (MAX.)	R/W cycle time (MIN.)	Fast page mode cycle time (MIN.)
	Active (MAX.)	Standby (MAX.)			
$\mu$ PD424400-60L	660 mW	1.1 mW (CMOS level input)	60 ns	120 ns	40 ns
$\mu$ PD424400-70L	550 mW		70 ns	140 ns	45 ns
$\mu$ PD424400-80L	495 mW		80 ns	160 ns	50 ns
$\mu$ PD424400-10L	440 mW		100 ns	190 ns	60 ns

- 1,024 refresh cycles/128 ms
- $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  refresh,  $\overline{\text{RAS}}$  only refresh, Hidden refresh
- Multiplexed address inputs ..... Row address: A0-A9, Column address: A0-A9

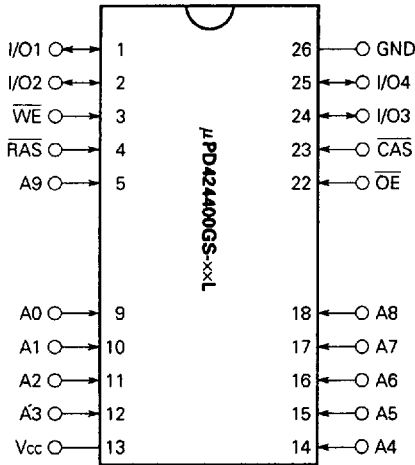
#### Ordering Information

Part number	Access time (MAX.)	Package	Refresh
$\mu$ PD424400GS-60L	60 ns	26-pin Plastic TSOP (II) (300 mil)	$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh $\overline{\text{RAS}}$ only refresh Hidden refresh
$\mu$ PD424400GS-70L	70 ns		
$\mu$ PD424400GS-80L	80 ns		
$\mu$ PD424400GS-10L	100 ns		
$\mu$ PD424400LA-60L	60 ns	26-pin Plastic SOJ (300 mil)	
$\mu$ PD424400LA-70L	70 ns		
$\mu$ PD424400LA-80L	80 ns		
$\mu$ PD424400LA-10L	100 ns		

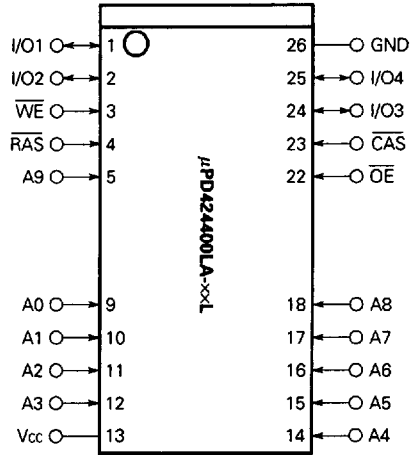
The information in this document is subject to change without notice.

Pin Configurations (Marking Side)

26-pin Plastic TSOP (II) (300 mil)

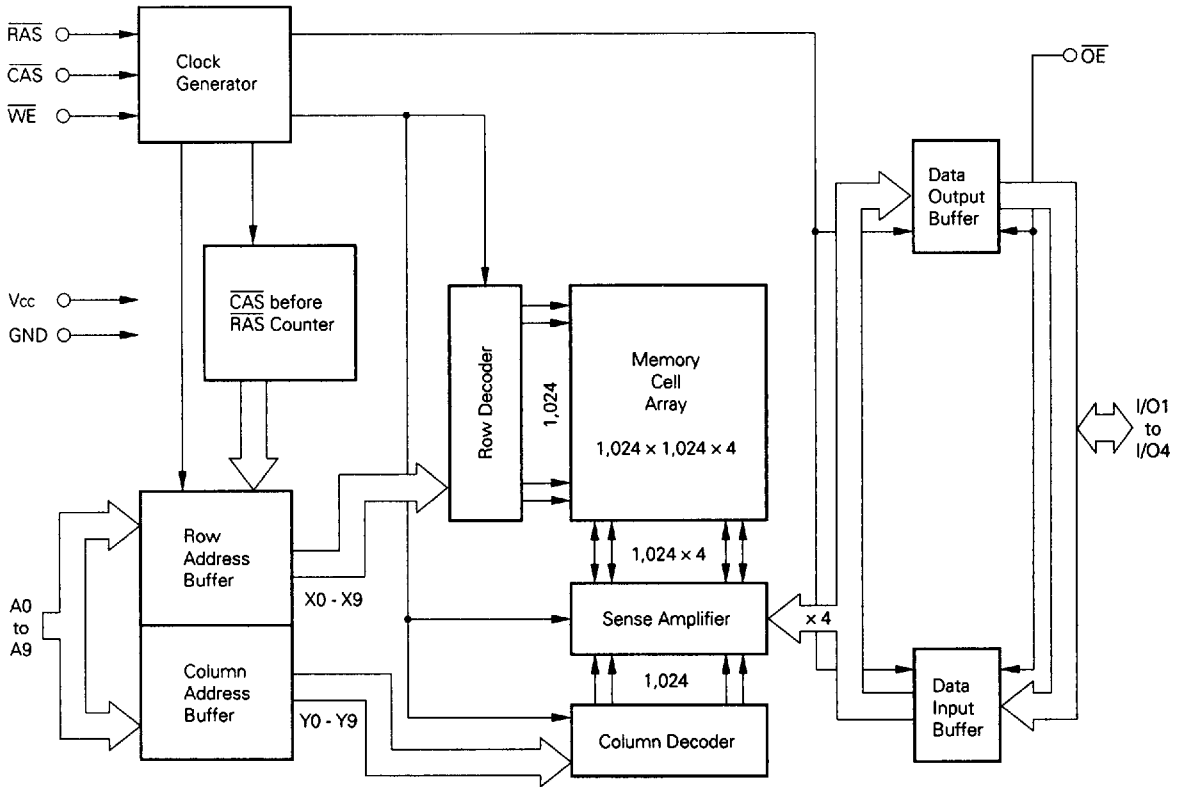


26-pin Plastic SOJ (300 mil)



- A0 to A9 : Address Inputs
- I/O1 to I/O4 : Data Inputs/Outputs
- $\overline{\text{RAS}}$  : Row Address Strobe
- $\overline{\text{CAS}}$  : Column Address Strobe
- $\overline{\text{WE}}$  : Write Enable
- $\overline{\text{OE}}$  : Output Enable
- Vcc : Power Supply
- GND : Ground

Block Diagram



### Input/Output Pin Functions

The  $\mu$ PD424400-L has input pins  $\overline{\text{RAS}}$ ,  $\overline{\text{CAS}}$ ,  $\overline{\text{WE}}$ ,  $\overline{\text{OE}}$ , A0 to A9 and input/output pins I/O1 to I/O4.

Pin name	Input/Output	Function
$\overline{\text{RAS}}$ (Row address strobe)	Input	$\overline{\text{RAS}}$ activates the sense amplifier by latching a row address and selecting a corresponding word line. It refreshes memory cell array of one line selected by the row address. It also selects the following function. <ul style="list-style-type: none"> <li>• <math>\overline{\text{CAS}}</math> before <math>\overline{\text{RAS}}</math> refresh</li> </ul>
$\overline{\text{CAS}}$ (Column address strobe)	Input	$\overline{\text{CAS}}$ activates data input/output circuit by latching column address and selecting a digit line connected with the sense amplifier.
A0 to A9 (Address inputs)	Input	Address bus. Input total 20-bit of address signal, upper 10-bit and lower 10-bit in sequence (address multiplex method). Therefore, one word is selected from 1,048,576-word by 4-bit memory cell array. In actual operation, latch row address by specifying row address and activating $\overline{\text{RAS}}$ . Then, switch the address bus to column address and activate $\overline{\text{CAS}}$ . Each address is taken into the device when $\overline{\text{RAS}}$ and $\overline{\text{CAS}}$ are activated. Therefore, the address input setup time ( $t_{\text{ASR}}$ , $t_{\text{ASC}}$ ) and hold time ( $t_{\text{RAH}}$ , $t_{\text{CAH}}$ ) are specified for the activation of $\overline{\text{RAS}}$ and $\overline{\text{CAS}}$ .
$\overline{\text{WE}}$ (Write enable)	Input	Write control signal. Write operation is executed by activating $\overline{\text{RAS}}$ , $\overline{\text{CAS}}$ and $\overline{\text{WE}}$ .
$\overline{\text{OE}}$ (Output enable)	Input	Read control signal. Read operation can be executed by activating $\overline{\text{RAS}}$ , $\overline{\text{CAS}}$ and $\overline{\text{OE}}$ . If $\overline{\text{WE}}$ is activated during read operation, $\overline{\text{OE}}$ is to be ineffective in the device. Therefore, read operation cannot be executed.
I/O1 to I/O4 (Data inputs/outputs)	Input/Output	4-bit data bus. I/O1 to I/O4 are used to input/output data.

**Electrical Specifications**

- All voltages are referenced to GND.
- After power up, wait more than 100 μs 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.

**Absolute Maximum Ratings**

Parameter	Symbol	Condition	Rating	Unit
Voltage on any pin relative to GND	$V_T$		-1.0 to +7.0	V
Supply voltage	$V_{CC}$		-1.0 to +7.0	V
Output current	$I_O$		50	mA
Power dissipation	$P_D$		1	W
Operating ambient temperature	$T_A$		0 to +70	°C
Storage temperature	$T_{STG}$		-55 to +125	°C

**Caution** Exposing the device to stress above those listed in Absolute Maximum Ratings could cause permanent damage. The device is not meant to be operated under conditions outside the limits described in the operational section of this specification. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

**Recommended Operating Conditions**

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Supply voltage	$V_{CC}$		4.5	5.0	5.5	V
High level input voltage	$V_{IH}$		2.4		$V_{CC} + 1.0$	V
Low level input voltage	$V_{IL}$		-1.0		+0.8	V
Operating ambient temperature	$T_A$		0		70	°C

**Capacitance ( $T_A = 25\text{ °C}$ ,  $f = 1\text{ MHz}$ )**

Parameter	Symbol	Test Condition	MIN.	TYP.	MAX.	Unit
Input capacitance	$C_{I1}$	Address			5	pF
	$C_{I2}$	$\overline{\text{RAS}}$ , $\overline{\text{CAS}}$ , $\overline{\text{WE}}$ , $\overline{\text{OE}}$			7	
Data input/output capacitance	$C_{I/O}$	I/O			7	pF

DC Characteristics (Recommended operating conditions unless otherwise noted)

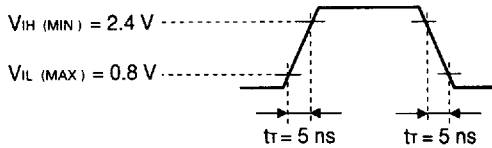
Parameter	Symbol	Test Condition	MIN.	MAX.	Unit	Notes
Operating current	I <sub>CC1</sub>	$\overline{RAS}, \overline{CAS}$ Cycling $t_{RC} = t_{RC(MIN)}$ $I_o = 0 \text{ mA}$	$t_{RAC} = 60 \text{ ns}$	120	mA	1, 2, 3
			$t_{RAC} = 70 \text{ ns}$	100		
			$t_{RAC} = 80 \text{ ns}$	90		
			$t_{RAC} = 100 \text{ ns}$	80		
Standby current	I <sub>CC2</sub>	$\overline{RAS}, \overline{CAS} \geq V_{IH(MIN)}$ , $I_o = 0 \text{ mA}$ $\overline{RAS}, \overline{CAS} \geq V_{CC} - 0.2 \text{ V}$ , $I_o = 0 \text{ mA}$		2.0	mA	
				0.2		
$\overline{RAS}$ only refresh current	I <sub>CC3</sub>	$\overline{RAS}$ Cycling, $\overline{CAS} \geq V_{IH(MIN)}$ $t_{RC} = t_{RC(MIN)}$ , $I_o = 0 \text{ mA}$	$t_{RAC} = 60 \text{ ns}$	120	mA	1, 2, 3, 4
			$t_{RAC} = 70 \text{ ns}$	100		
			$t_{RAC} = 80 \text{ ns}$	90		
			$t_{RAC} = 100 \text{ ns}$	80		
Operating current (Fast page mode)	I <sub>CC4</sub>	$\overline{RAS} \leq V_{IL(MAX)}$ , $\overline{CAS}$ Cycling $t_{PC} = t_{PC(MIN)}$ , $I_o = 0 \text{ mA}$	$t_{RAC} = 60 \text{ ns}$	90	mA	1, 2, 5
			$t_{RAC} = 70 \text{ ns}$	80		
			$t_{RAC} = 80 \text{ ns}$	70		
			$t_{RAC} = 100 \text{ ns}$	60		
$\overline{CAS}$ before $\overline{RAS}$ refresh current	I <sub>CC5</sub>	$\overline{RAS}$ Cycling $t_{RC} = t_{RC(MIN)}$ $I_o = 0 \text{ mA}$	$t_{RAC} = 60 \text{ ns}$	120	mA	1, 2
			$t_{RAC} = 70 \text{ ns}$	100		
			$t_{RAC} = 80 \text{ ns}$	90		
			$t_{RAC} = 100 \text{ ns}$	80		
$\overline{CAS}$ before $\overline{RAS}$ long refresh current (1,024 Cycles / 128 ms)	I <sub>CC6</sub>	$\overline{CAS}$ before $\overline{RAS}$ refresh : $t_{RC} = 125.0 \mu\text{s}$ $\overline{RAS}, \overline{CAS}$ : $V_{CC} - 0.2 \text{ V} \leq V_{IH} \leq V_{IH(MAX)}$ $0 \text{ V} \leq V_{IL} \leq 0.2 \text{ V}$  Standby : $\overline{RAS}, \overline{CAS} \geq V_{CC} - 0.2 \text{ V}$ Address : $V_{IH}$ or $V_{IL}$ WE, OE: $V_{IH}$ $I_o = 0 \text{ mA}$	$t_{RAS} \leq 200 \text{ ns}$	300	μA	1, 2
			$t_{RAS} \leq 1 \mu\text{s}$	500		
Input leakage current	I <sub>I(L)</sub>	$V_I = 0 \text{ to } 5.5 \text{ V}$ All other pins not under test = 0 V	-10	+10	μA	
Output leakage current	I <sub>O(L)</sub>	$V_O = 0 \text{ to } 5.5 \text{ V}$ Output is disabled (Hi-Z)	-10	+10	μA	
High level output voltage	V <sub>OH</sub>	$I_o = -5.0 \text{ mA}$	2.4		V	
Low level output voltage	V <sub>OL</sub>	$I_o = +4.2 \text{ mA}$		0.4	V	

- Notes**
- I<sub>CC1</sub>, I<sub>CC3</sub>, I<sub>CC4</sub>, I<sub>CC5</sub> and I<sub>CC6</sub> depend on cycle rates (t<sub>RC</sub> and t<sub>PC</sub>).
  - Specified values are obtained with outputs unloaded.
  - I<sub>CC1</sub> and I<sub>CC3</sub> are measured assuming that address can be changed once or less during  $\overline{RAS} \leq V_{IL(MAX)}$  and  $\overline{CAS} \geq V_{IH(MIN)}$ .
  - I<sub>CC3</sub> is measured assuming that all column address inputs are held at either high or low.
  - I<sub>CC4</sub> is measured assuming that all column address inputs are switched only once during each fast page cycle.

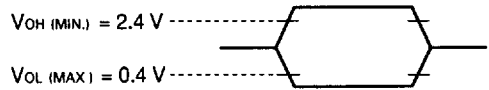
**AC Characteristics (Recommended Operating Conditions unless otherwise noted)**

**AC Characteristics Test Conditions**

(1) Input timing specification



(2) Output timing specification



(3) Loading conditions are 100 pF + 2 TTLs.

**Common to Read, Write, Read Modify Write Cycle**

Parameter	Symbol	trac = 60 ns		trac = 70 ns		trac = 80 ns		trac = 100 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Read / Write Cycle Time	trc	120	-	140	-	160	-	190	-	ns	
RAS Precharge Time	trp	50	-	60	-	70	-	80	-	ns	
CAS Precharge Time	tcpn	10	-	10	-	10	-	10	-	ns	
RAS Pulse Width	trās	60	10,000	70	10,000	80	10,000	100	10,000	ns	
CAS Pulse Width	tcās	15	10,000	20	10,000	20	10,000	25	10,000	ns	
RAS Hold Time	trsh	20	-	20	-	20	-	25	-	ns	
CAS Hold Time	tcsH	60	-	70	-	80	-	100	-	ns	
RAS to CAS Delay Time	trcd	20	40	20	50	25	60	25	75	ns	1
RAS to Column Address Delay Time	trad	15	30	15	35	17	40	17	50	ns	1
CAS to RAS Precharge Time	tcp	10	-	10	-	10	-	10	-	ns	2
Row Address Setup Time	tasr	0	-	0	-	0	-	0	-	ns	
Row Address Hold Time	traH	10	-	10	-	12	-	12	-	ns	
Column Address Setup Time	tasc	0	-	0	-	0	-	0	-	ns	
Column Address Hold Time	tcaH	15	-	15	-	15	-	20	-	ns	
OE Lead Time Referenced to RAS	toes	0	-	0	-	0	-	0	-	ns	
CAS to Data Setup Time	tclz	0	-	0	-	0	-	0	-	ns	
OE to Data Setup Time	tolz	0	-	0	-	0	-	0	-	ns	
OE to Data Delay Time	toed	15	-	15	-	20	-	25	-	ns	
Transition Time (Rise and Fall)	tt	3	50	3	50	3	50	3	50	ns	
Refresh Time	trf	-	128	-	128	-	128	-	128	ms	

Notes 1. For read cycles, access time is defined as follows:

Input Conditions	Access Time	Access Time from $\overline{\text{RAS}}$
$\text{trAD} \leq \text{trAD (MAX.)}$ and $\text{trCD} \leq \text{trCD (MAX.)}$	$\text{trAC (MAX.)}$	$\text{trAC (MAX.)}$
$\text{trAD} > \text{trAD (MAX.)}$ and $\text{trCD} \leq \text{trCD (MAX.)}$	$\text{tAA (MAX.)}$	$\text{trAD} + \text{tAA (MAX.)}$
$\text{trCD} > \text{trCD (MAX.)}$	$\text{tCAC (MAX.)}$	$\text{trCD} + \text{tCAC (MAX.)}$

$\text{trAD (MAX.)}$  and  $\text{trCD (MAX.)}$  are specified as reference points only ; they are not restrictive operating parameters. They are used to determine which access time ( $\text{trAC}$ ,  $\text{tAA}$  or  $\text{tCAC}$ ) is to be used for finding out when output data will be available. Therefore, the input conditions  $\text{trAD} \geq \text{trAD (MAX.)}$  and  $\text{trCD} \geq \text{trCD (MAX.)}$  will not cause any operation problems.

2.  $\text{tCRP (MIN.)}$  requirement is applied to  $\overline{\text{RAS}}$ ,  $\overline{\text{CAS}}$  cycles preceded by any cycle.

Read Cycle

Parameter	Symbol	$\text{trAC} = 60 \text{ ns}$		$\text{trAC} = 70 \text{ ns}$		$\text{trAC} = 80 \text{ ns}$		$\text{trAC} = 100 \text{ ns}$		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Access Time from $\overline{\text{RAS}}$	$\text{trAC}$	-	60	-	70	-	80	-	100	ns	1
Access Time from $\overline{\text{CAS}}$	$\text{tCAC}$	-	15	-	20	-	20	-	25	ns	1
Access Time from Column Address	$\text{tAA}$	-	30	-	35	-	40	-	50	ns	1
Access Time from $\overline{\text{OE}}$	$\text{tOEA}$	-	20	-	20	-	20	-	25	ns	
Column Address Lead Time Referenced to $\overline{\text{RAS}}$	$\text{trAL}$	30	-	35	-	40	-	50	-	ns	
Read Command Setup Time	$\text{trCS}$	0	-	0	-	0	-	0	-	ns	
Read Command Hold Time Referenced to $\overline{\text{RAS}}$	$\text{trRH}$	10	-	10	-	10	-	10	-	ns	2
Read Command Hold Time Referenced to $\overline{\text{CAS}}$	$\text{trCH}$	0	-	0	-	0	-	0	-	ns	2
Output Buffer Turn-off Delay Time from $\overline{\text{OE}}$	$\text{tOEZ}$	0	15	0	15	0	20	0	25	ns	3
Output Buffer Turn-off Delay Time from $\overline{\text{CAS}}$	$\text{tOFF}$	0	15	0	15	0	20	0	25	ns	3

Notes 1. For read cycles, access time is defined as follows:

Input Conditions	Access Time	Access Time from $\overline{\text{RAS}}$
$\text{trAD} \leq \text{trAD (MAX.)}$ and $\text{trCD} \leq \text{trCD (MAX.)}$	$\text{trAC (MAX.)}$	$\text{trAC (MAX.)}$
$\text{trAD} > \text{trAD (MAX.)}$ and $\text{trCD} \leq \text{trCD (MAX.)}$	$\text{tAA (MAX.)}$	$\text{trAD} + \text{tAA (MAX.)}$
$\text{trCD} > \text{trCD (MAX.)}$	$\text{tCAC (MAX.)}$	$\text{trCD} + \text{tCAC (MAX.)}$

$\text{trAD (MAX.)}$  and  $\text{trCD (MAX.)}$  are specified as reference points only; they are not restrictive operating parameters. They are used to determine which access time ( $\text{trAC}$ ,  $\text{tAA}$  or  $\text{tCAC}$ ) is to be used for finding out when output data will be available. Therefore, the input conditions  $\text{trAD} \geq \text{trAD (MAX.)}$  and  $\text{trCD} \geq \text{trCD (MAX.)}$  will not cause any operation problems.

2. Either  $\text{trCH (MIN.)}$  or  $\text{trRH (MIN.)}$  should be met in read cycles.
3.  $\text{tOFF (MAX.)}$  and  $\text{tOEZ (MAX.)}$  define the time when the output achieves the condition of Hi-Z and is not referenced to  $\text{V}_{OH}$  or  $\text{V}_{OL}$ .



**Write Cycle**

Parameter	Symbol	t <sub>RAC</sub> = 60 ns		t <sub>RAC</sub> = 70 ns		t <sub>RAC</sub> = 80 ns		t <sub>RAC</sub> = 100 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
$\overline{\text{WE}}$ Hold Time Referenced to $\overline{\text{CAS}}$	twch	15	-	15	-	15	-	20	-	ns	1
$\overline{\text{WE}}$ Pulse Width	twp	15	-	15	-	15	-	20	-	ns	1
$\overline{\text{WE}}$ Lead Time Referenced to $\overline{\text{RAS}}$	trwl	20	-	20	-	20	-	25	-	ns	
$\overline{\text{WE}}$ Lead Time Referenced to $\overline{\text{CAS}}$	tcwl	15	-	15	-	15	-	20	-	ns	
$\overline{\text{WE}}$ Setup Time	twcs	0	-	0	-	0	-	0	-	ns	2
$\overline{\text{OE}}$ Hold Time	toeh	0	-	0	-	0	-	0	-	ns	
Data-in Setup Time	t <sub>DS</sub>	0	-	0	-	0	-	0	-	ns	3
Data-in Hold Time	t <sub>DH</sub>	15	-	15	-	15	-	20	-	ns	3

- Notes**
1. t<sub>WP</sub>(MIN) is applied to late write cycles or read modify write cycles. In early write cycles, t<sub>WCH</sub>(MIN.) should be met.
  2. If t<sub>WCS</sub> ≥ t<sub>WCS</sub>(MIN.), the cycle is an early write cycle and the data out will remain Hi-Z through the entire cycle.
  3. t<sub>DS</sub>(MIN.) and t<sub>DH</sub>(MIN.) are referenced to the  $\overline{\text{CAS}}$  falling edge in early write cycles. In late write cycles and read modify write cycles, they are referenced to the  $\overline{\text{WE}}$  falling edge.

**Read Modify Write Cycle**

Parameter	Symbol	t <sub>RAC</sub> = 60 ns		t <sub>RAC</sub> = 70 ns		t <sub>RAC</sub> = 80 ns		t <sub>RAC</sub> = 100 ns		Unit	Note
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Read Modify Write Cycle Time	trwc	165	-	185	-	210	-	250	-	ns	
$\overline{\text{RAS}}$ to $\overline{\text{WE}}$ Delay Time	trwd	80	-	90	-	105	-	130	-	ns	1
$\overline{\text{CAS}}$ to $\overline{\text{WE}}$ Delay Time	tcwd	40	-	40	-	45	-	55	-	ns	1
Column Address to $\overline{\text{WE}}$ Delay Time	tawd	50	-	55	-	65	-	80	-	ns	1

- Note**
1. If t<sub>WCS</sub> ≥ t<sub>WCS</sub>(MIN.), the cycle is an early write cycle and the data out will remain Hi-Z through the entire cycle. If t<sub>TRWD</sub> ≥ t<sub>TRWD</sub>(MIN.), t<sub>TCWD</sub> ≥ t<sub>TCWD</sub>(MIN.), t<sub>TAWD</sub> ≥ t<sub>TAWD</sub>(MIN.) and t<sub>CPWD</sub> ≥ t<sub>CPWD</sub>(MIN.), 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 conditions is met, the state of the data out is indeterminate.

**Fast Page Mode**

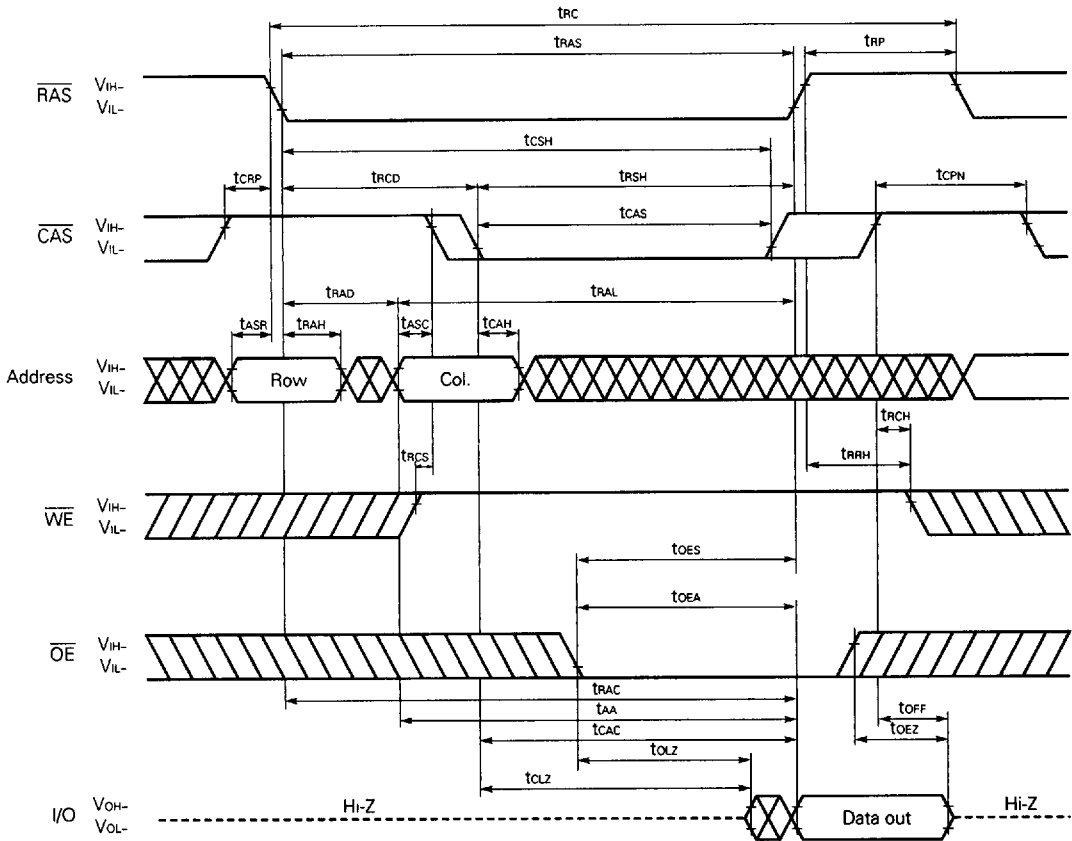
Parameter	Symbol	trac = 60 ns		trac = 70 ns		trac = 80 ns		trac = 100 ns		Unit	Note
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Fast Page Mode Cycle Time	tpc	40	-	45	-	50	-	60	-	ns	
Access Time from CAS Precharge	tACP	-	35	-	40	-	45	-	55	ns	
RAS Pulse Width	trASP	60	125,000	70	125,000	80	125,000	100	125,000	ns	
CAS Precharge Time	tcp	10	-	10	-	10	-	10	-	ns	
RAS Hold Time from CAS Precharge	trHCP	35	-	40	-	45	-	55	-	ns	
Read Modify Write Cycle Time	tPRWC	85	-	90	-	100	-	120	-	ns	
CAS Precharge to WE Delay Time	tcpWD	55	-	60	-	70	-	85	-	ns	1

**Note 1.** If  $twcs \geq twcs(MIN.)$ , the cycle is an early write cycle and the data out will remain Hi-Z through the entire cycle. If  $trwd \geq trwd(MIN.)$ ,  $tcwd \geq tcwd(MIN.)$ ,  $tawd \geq tawd(MIN.)$  and  $tcpwd \geq tcpwd(MIN.)$ , 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 conditions is met, the state of the data out is indeterminate.

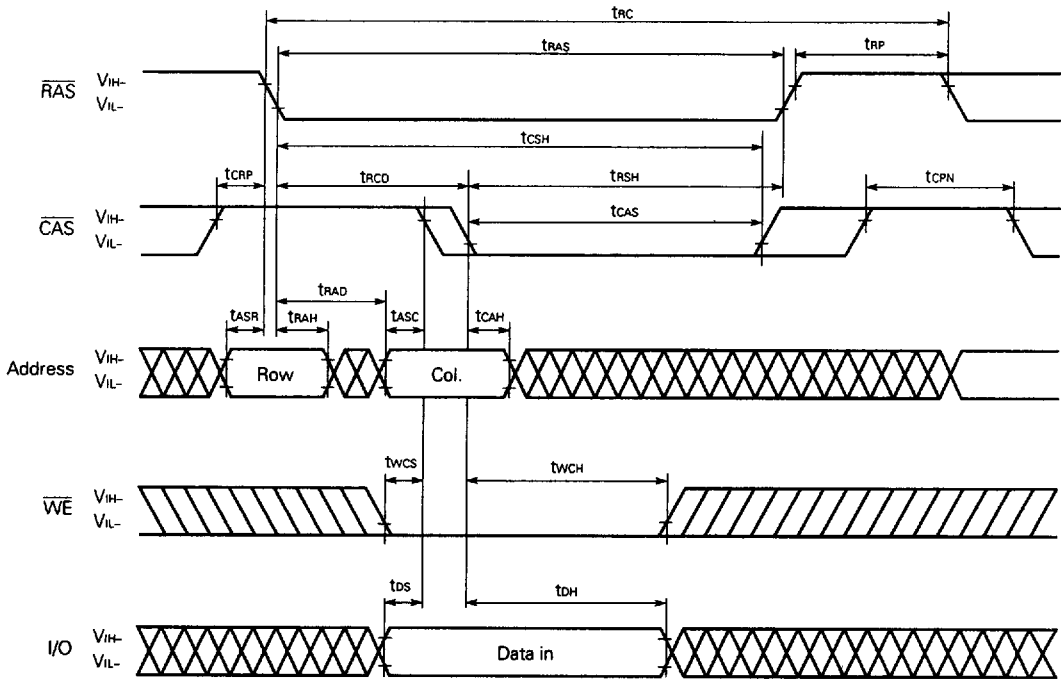
**Refresh Cycle**

Parameter	Symbol	trac = 60 ns		trac = 70 ns		trac = 80 ns		trac = 100 ns		Unit	Note
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
CAS Setup Time	tCSR	10	-	10	-	10	-	10	-	ns	
CAS Hold Time (CAS before RAS Refresh)	tCHR	15	-	15	-	15	-	20	-	ns	
RAS Precharge CAS Hold Time	trPC	10	-	10	-	10	-	10	-	ns	
WE Setup Time	tWSR	10	-	10	-	10	-	10	-	ns	
WE Hold Time	tWHR	15	-	15	-	15	-	20	-	ns	

Read Cycle

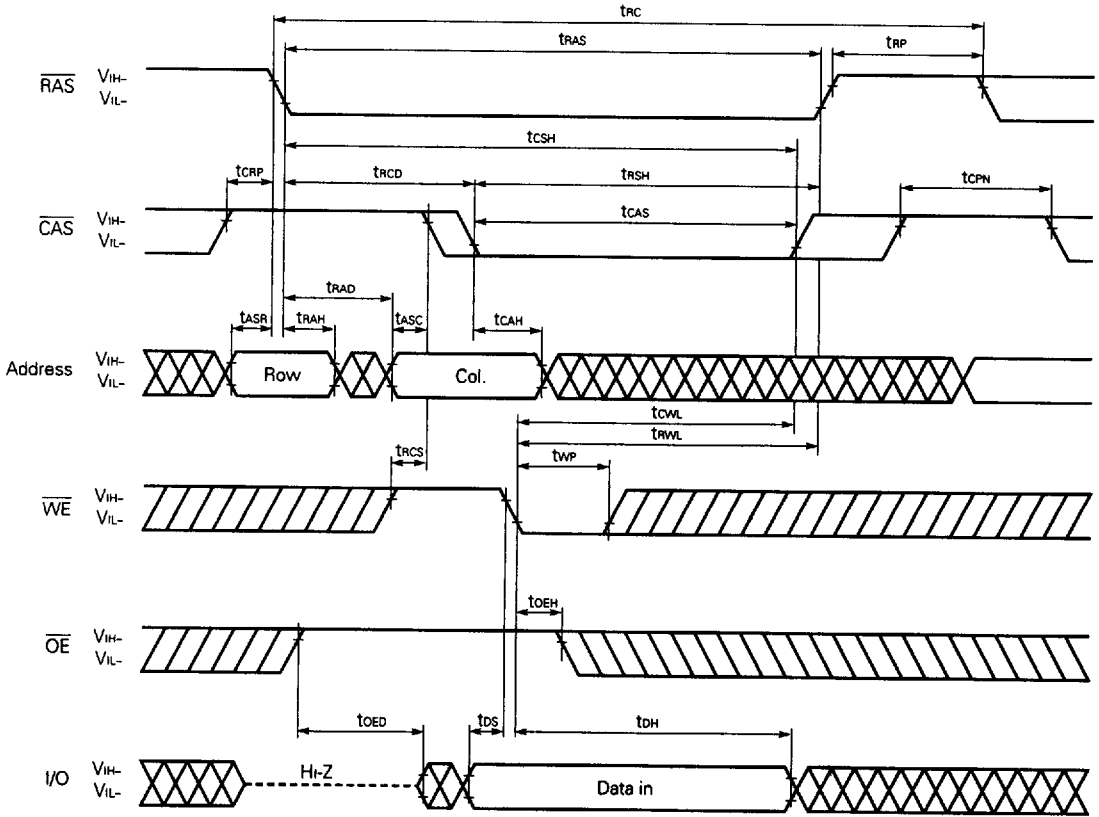


Early Write Cycle

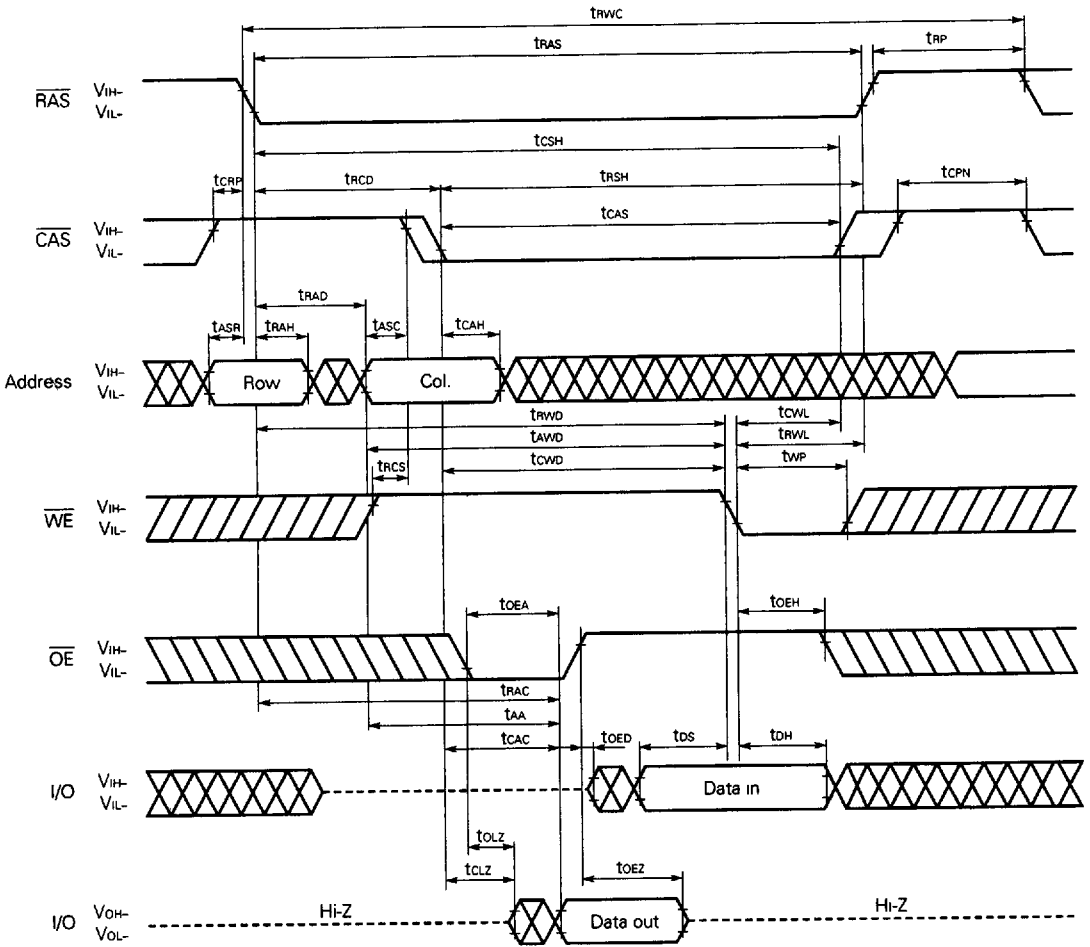


Remark  $\overline{OE}$ : Don't care

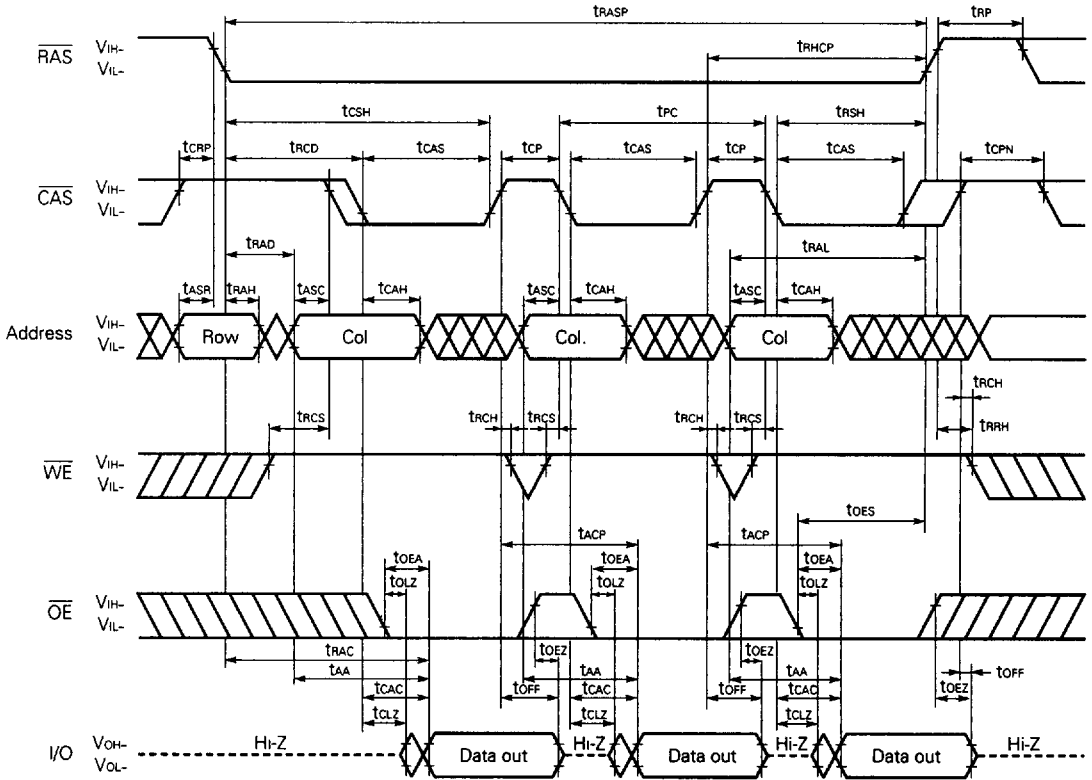
Late Write Cycle



Read Modify Write Cycle

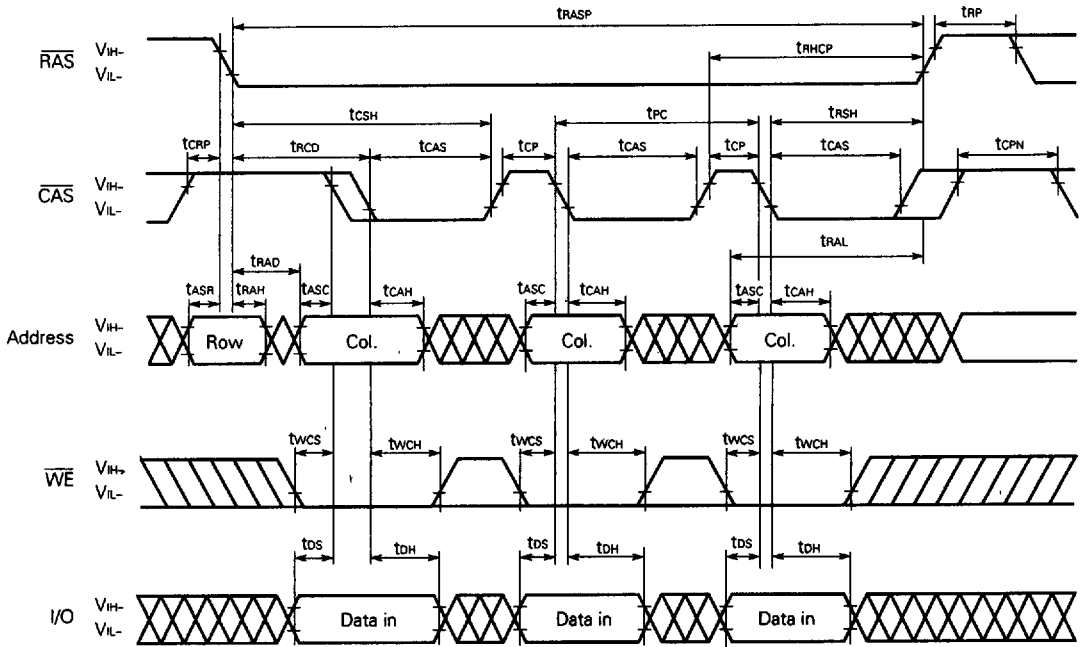


Fast Page Mode Read Cycle



**Remark** In the fast page mode, read, write and read modify write cycles are available for each of the consecutive  $\overline{\text{CAS}}$  cycles within the same  $\overline{\text{RAS}}$  cycle.

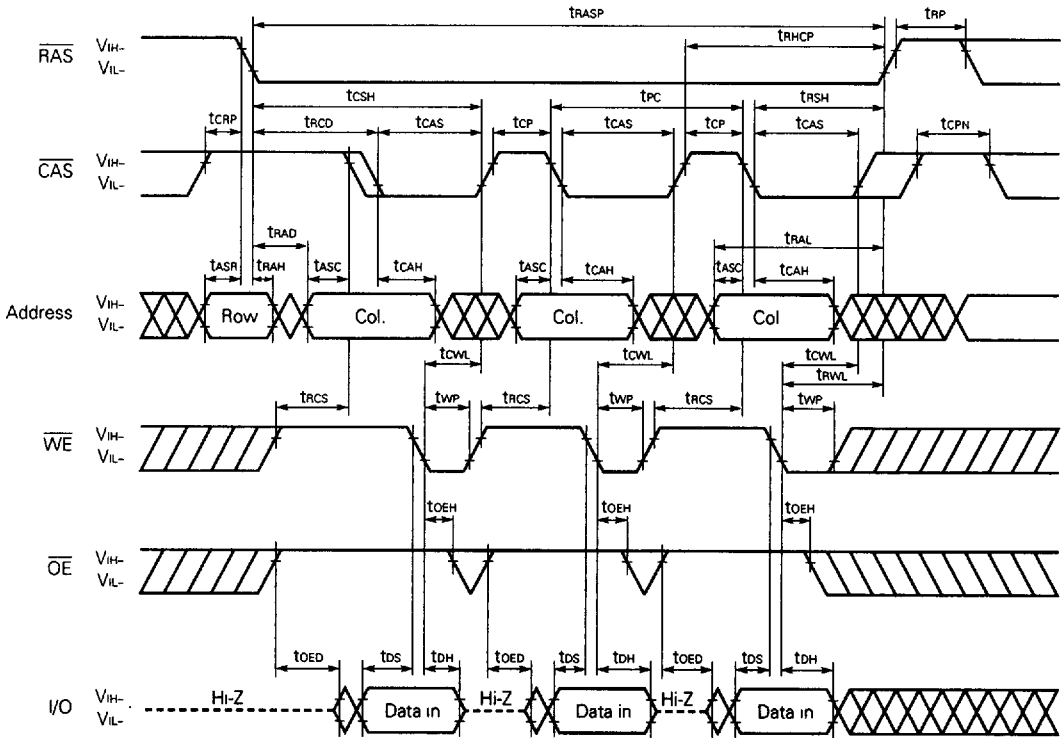
**Fast Page Mode Early Write Cycle**



- Remarks**
- 1.  $\overline{OE}$  : Don't care
  - 2. In the fast page mode, read, write and read modify write cycles are available for each of the consecutive  $\overline{CAS}$  cycles within the same  $\overline{RAS}$  cycle.

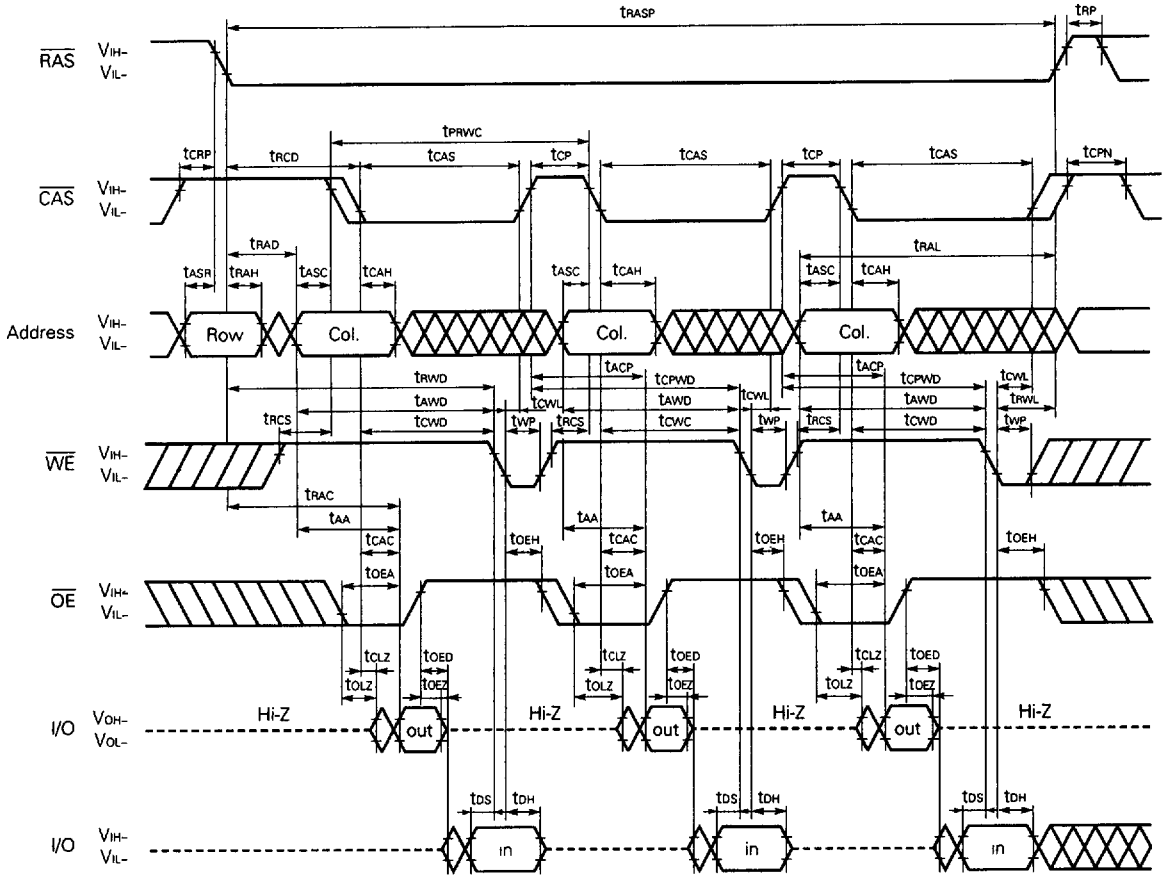


Fast Page Mode Late Write Cycle



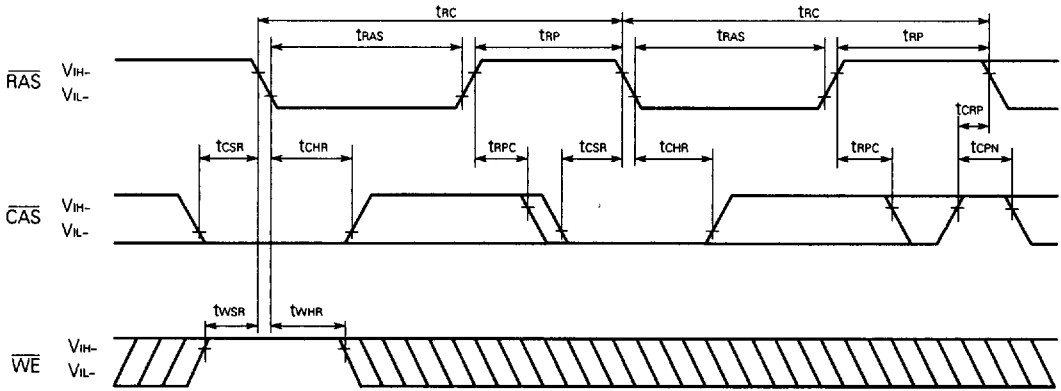
**Remark** In the fast page mode, read, write and read modify write cycles are available for each of the consecutive  $\overline{\text{CAS}}$  cycles within the same  $\overline{\text{RAS}}$  cycle.

Fast Page Mode Read Modify Write Cycle



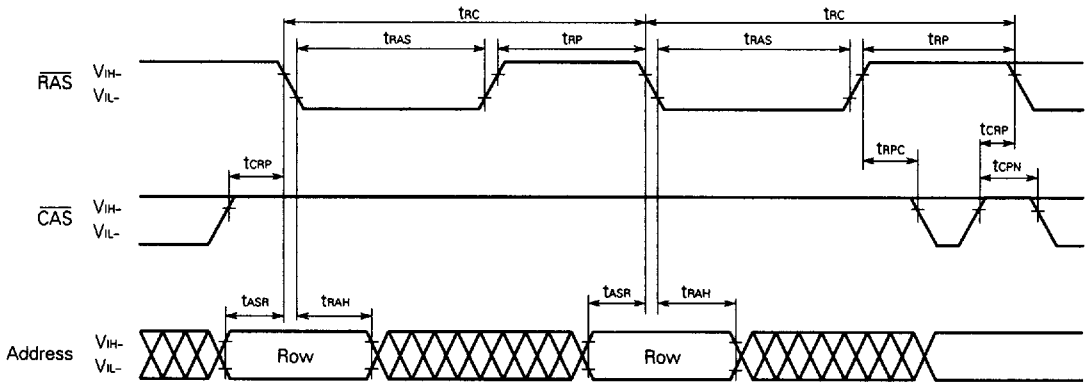
**Remark** In the fast page mode, read, write and read modify write cycles are available for each of the consecutive CAS cycles within the same RAS cycle.

**CAS Before RAS Refresh Cycle**



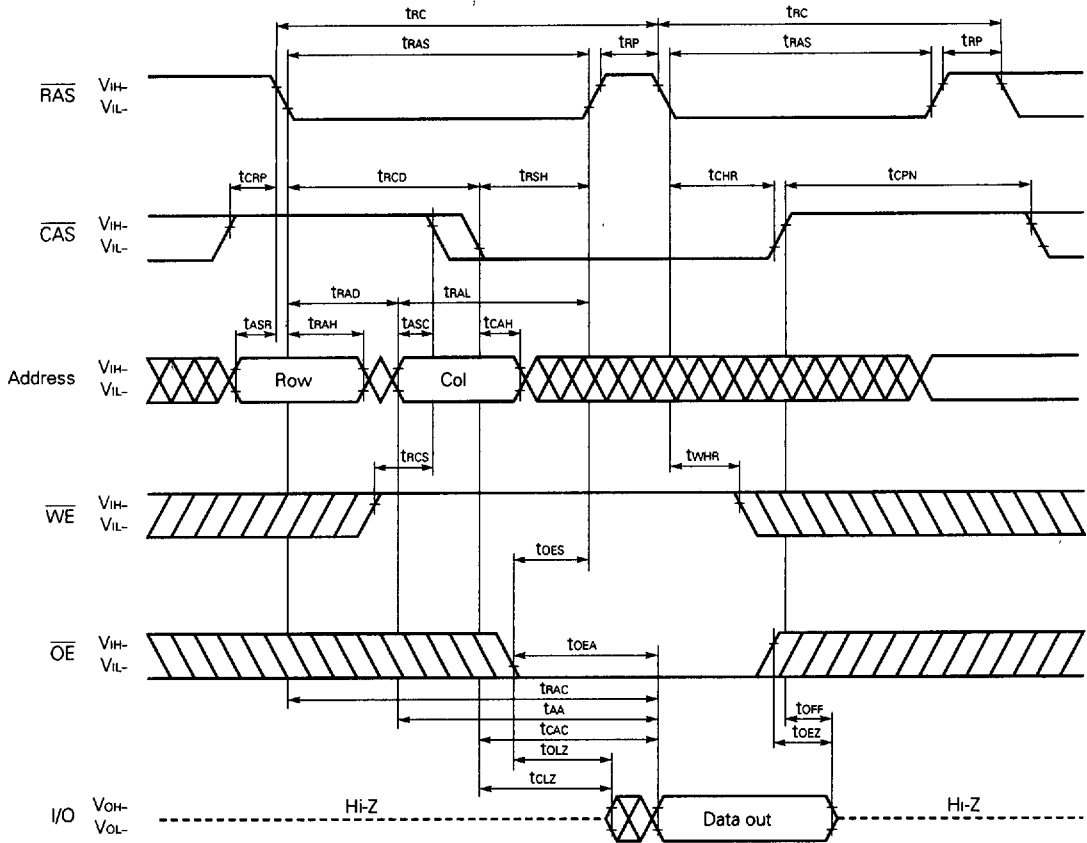
**Remark** Address,  $\overline{OE}$ : Don't care I/O: Hi-Z

**RAS Only Refresh Cycle**

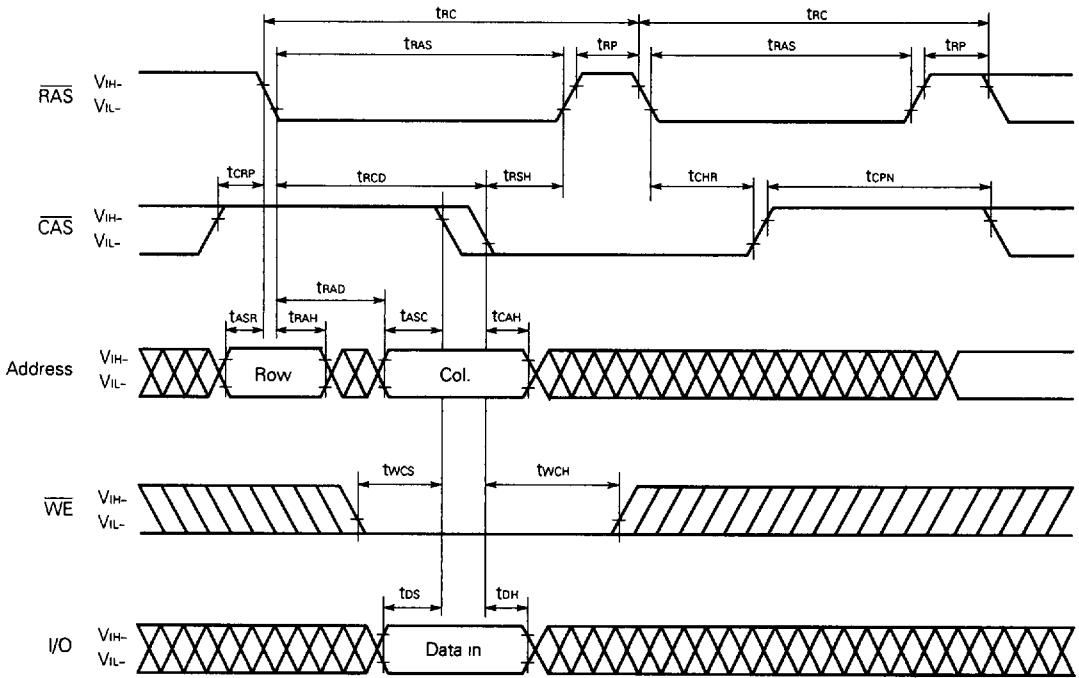


**Remark**  $\overline{WE}$ ,  $\overline{OE}$ : Don't care I/O: Hi-Z

Hidden Refresh Cycle (Read)

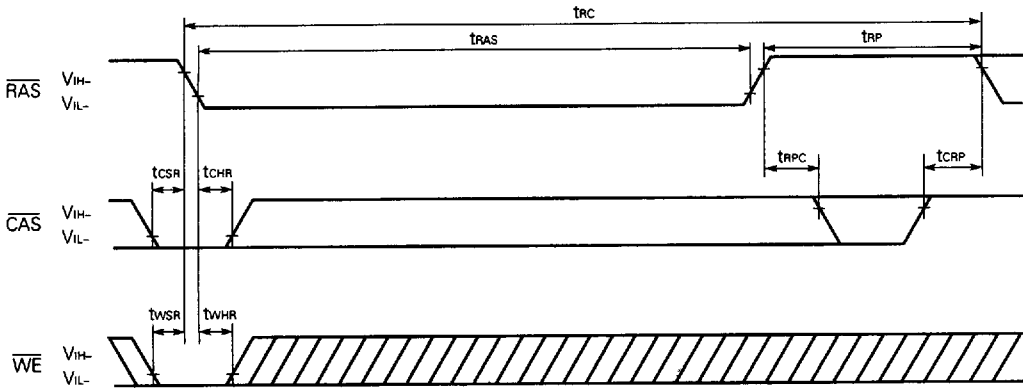


**Hidden Refresh Cycle (Write)**



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

**Test Mode Set Cycle ( $\overline{WE}$ ,  $\overline{CAS}$  Before  $\overline{RAS}$  Refresh Cycle)**



**Remark** Address,  $\overline{OE}$ : Don't care I/O: Hi-Z

**Test Mode**

By using the test mode, the test time can be reduced. The reason for this is that, the memory emulates the  $\times 8$ -bit structure during test mode.

**(1) Setting the mode**

Executing the test mode cycle ( $\overline{WE}$ ,  $\overline{CAS}$  before  $\overline{RAS}$  refresh cycle) sets the test mode.

**(2) Write/read operation**

When either a "0" or a "1" is written to the input pin in test mode, this data is written to 8 bits of memory cell.

Next, when the data is read from the output pin at the same address, the cell can be checked.

Output = "1": Normal write (all memory cells)

Output = "0": Abnormal write

**(3) Refresh**

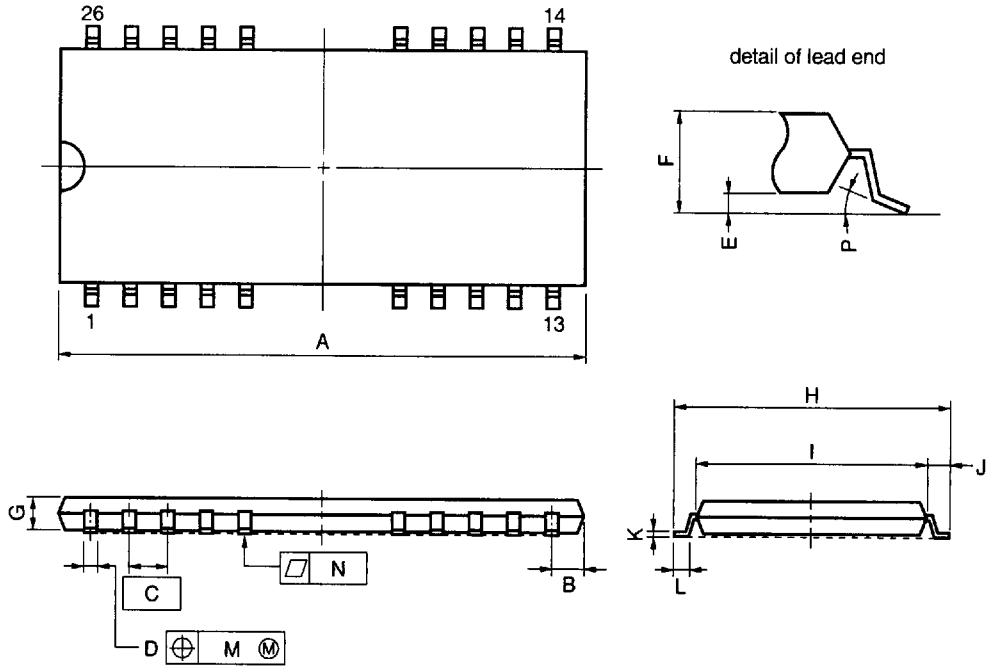
Refresh in the test mode must be performed with the  $\overline{RAS}$  /  $\overline{CAS}$  cycle or with the  $\overline{WE}$ ,  $\overline{CAS}$  before  $\overline{RAS}$  refresh cycle. The  $\overline{WE}$ ,  $\overline{CAS}$  before  $\overline{RAS}$  refresh cycle use the same counter as the  $\overline{CAS}$  before  $\overline{RAS}$  refresh's internal counter.

**(4) Mode Cancellation**

The test mode is cancelled by executing one cycle of  $\overline{RAS}$  only refresh cycle or  $\overline{CAS}$  before  $\overline{RAS}$  refresh cycle.

Package Drawings

26 PIN PLASTIC TSOP (II) (300 mil)



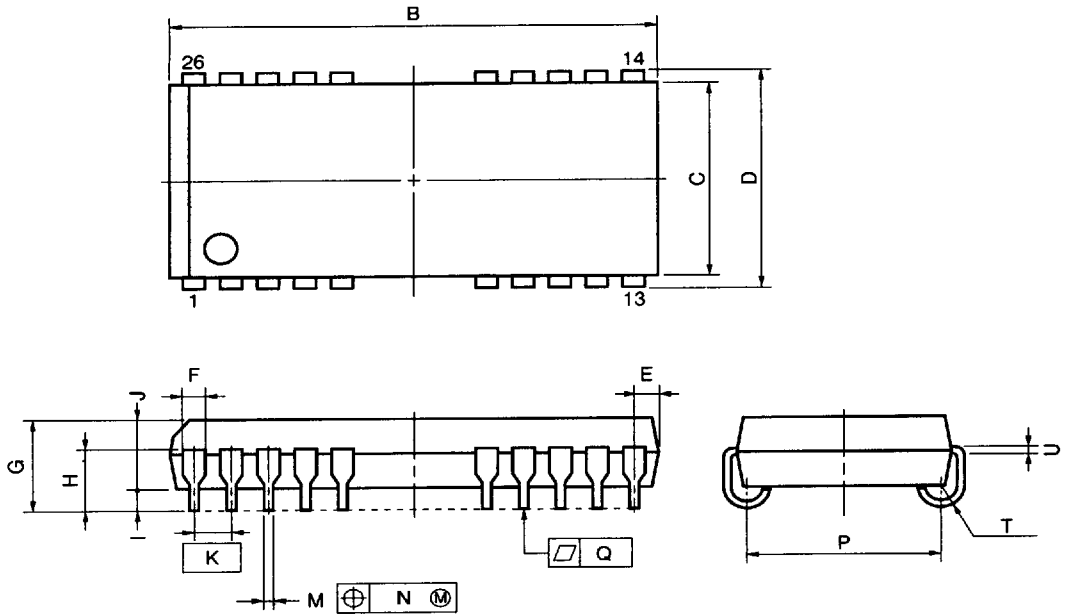
NOTE

Each lead centerline is located within 0.21 mm (0.009 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	17.36 MAX.	0.684 MAX.
B	1.06 MAX.	0.042 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.42 <sup>+0.08</sup> <sub>-0.07</sub>	0.017±0.003
E	0.1±0.05	0.004±0.002
F	1.2 MAX.	0.048 MAX.
G	1.0	0.039
H	9.22±0.2	0.363±0.008
I	7.62±0.1	0.300±0.004
J	0.8±0.2	0.031 <sup>+0.009</sup> <sub>-0.008</sub>
K	0.145 <sup>+0.025</sup> <sub>-0.015</sub>	0.006±0.001
L	0.5±0.1	0.020 <sup>+0.004</sup> <sub>-0.005</sub>
M	0.21	0.009
N	0.10	0.004
P	3° <sup>+7°</sup> <sub>-3°</sub>	3° <sup>+7°</sup> <sub>-3°</sub>

S26G3-50-9JD

26 PIN PLASTIC SOJ (300 mil)



**NOTE**  
 Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
B	17.4 <sup>+0.2</sup> <sub>-0.35</sub>	0.685 <sup>+0.008</sup> <sub>-0.013</sub>
C	7.57	0.298
D	8.47±0.2	0.333 <sup>+0.009</sup> <sub>-0.008</sub>
E	1.08±0.15	0.043 <sup>+0.006</sup> <sub>-0.007</sub>
F	0.6	0.024
G	3.5±0.2	0.138±0.008
H	2.4±0.2	0.094 <sup>+0.009</sup> <sub>-0.008</sub>
I	0.8 MIN.	0.031 MIN.
J	2.6	0.102
K	1.27(T.P.)	0.050(T.P.)
M	0.40±0.10	0.016 <sup>+0.004</sup> <sub>-0.005</sub>
N	0.12	0.005
P	6.73±0.20	0.265±0.008
Q	0.15	0.006
T	R 0.85	R0.033
U	0.20 <sup>+0.10</sup> <sub>-0.05</sub>	0.008 <sup>+0.004</sup> <sub>-0.002</sub>

P26LA-50A-2



**Recommended Soldering Conditions**

The following conditions (see tables below and next page) must be met for soldering conditions of the μPD424400-L.

For more details, refer to our document "SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (IEI-1207).

Please consult with our sales offices in case other soldering process is used, or in case the soldering is done under different conditions.

**Types of Surface Mount Device**

μPD424400GS-xxL: 26-pin plastic TSOP (II) (300 mil)

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak temperature of package surface: 235 °C or lower, Reflow time: 30 seconds or less (210 °C or higher), Number of reflow processes: MAX. 2 Exposure limit: 7 days <sup>Note</sup> (10 hours pre-baking is required at 125 °C afterwards)  <b>Cautions</b> 1. After the first reflow process, cool the package down to room temperature, then start the second reflow process. 2. After the first reflow process, do not use water to remove residual flux (water can be used in the second process).	IR35-107-2
VPS	Peak temperature of package: 215 °C or lower, Reflow time: 40 seconds or less (200 °C or higher), Number of reflow processes: MAX. 2 Exposure limit :7 days <sup>Note</sup> (10 hours pre-baking is required at 125 °C afterwards)  <b>Cautions</b> 1. After the first reflow process, cool the package down to room temperature, then start the second reflow process. 2. After the first reflow process, do not use water to remove residual flux (water can be used in the second process).	VP15-107-2
Partial heating method	Terminal temperature: 300 °C or lower, Time: 3 seconds or lower (Per side of the package).	—

**Note** Exposure limit before soldering after dry-pack package is opened.  
 Storage conditions: 25 °C and relative humidity at 65 % or less.

**Caution** Do not apply more than one soldering method at any one time, except for "Partial heating method".

μPD424400LA-xxL: 26-pin plastic SOJ (300 mil)

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	<p>Peak temperature of package surface: 235 °C or lower,                      Reflow time: 30 seconds or less (210 °C or higher),                      Number of reflow processes: MAX. 2                      Exposure limit: 7 days<sup>Note</sup>                      (20 hours pre-baking is required at 125 °C afterwards)</p> <p><b>Cautions</b></p> <ol style="list-style-type: none"> <li>1. After the first reflow process, cool the package down to room temperature, then start the second reflow process.</li> <li>2. After the first reflow process, do not use water to remove residual flux (water can be used in the second process).</li> </ol>	IR35-207-2
VPS	<p>Peak temperature of package: 215 °C or lower,                      Reflow time: 40 seconds or less (200 °C or higher),                      Number of reflow processes: MAX. 2                      Exposure limit :7 days<sup>Note</sup>                      (20 hours pre-baking is required at 125 °C afterwards)</p> <p><b>Cautions</b></p> <ol style="list-style-type: none"> <li>1. After the first reflow process, cool the package down to room temperature, then start the second reflow process.</li> <li>2. After the first reflow process, do not use water to remove residual flux (water can be used in the second process).</li> </ol>	VP15-207-2
Partial heating method	<p>Terminal temperature: 300 °C or lower,                      Time: 3 seconds or less (Per side of the package).</p>	—

**Note** Exposure limit before soldering after dry-pack package is opened.  
 Storage conditions: 25 °C and relative humidity at 65 % or less.

**Caution** Do not apply more than one soldering method at any one time, except for "Partial heating method".