

#### 3.3 V OPERATION 16 M-BIT DYNAMIC RAM 2 M-WORD BY 8-BIT, FAST PAGE MODE

#### DESCRIPTION

The  $\mu$ PD42S16800L, 4216800L, 42S17800L, 4217800L are 2 097 152 words by 8 bits dynamic CMOS RAMs.

These differ in refresh cycle and the  $\mu$ PD42S16800L, 42S17800L can execute  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  self refresh (see the table below).

These are packed in 28-pin plastic TSOP(II) (400 mil) and 28-pin plastic SOJ (400 mil).

#### FEATURES

- 2 097 152 words by 8 bits organization
- Single +3.3 V $\pm$ 0.3 V power supply
- Fast page mode
- The  $\mu$ PD42S16800L,  $\mu$ PD42S17800L can execute  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  self refresh.

Part number	Refresh cycle	Refresh	Power consumption at standby (MAX.)
$\mu$ PD42S16800L	4 096 cycles/128 ms	$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ self refresh, $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh, $\overline{\text{RAS}}$ only refresh, Hidden refresh	0.54 mW (CMOS level input)
$\mu$ PD42S17800L	2 048 cycles/128 ms		
$\mu$ PD4216800L	4 096 cycles/64 ms	$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh, $\overline{\text{RAS}}$ only refresh, Hidden refresh	1.8 mW (CMOS level input)
$\mu$ PD4217800L	2 048 cycles/32 ms		

- Fast access and cycle time

Part number	Power consumption Active (MAX.)	Access time (MAX.)	R/W cycle time (MIN.)	Fast page mode cycle time (MIN.)
$\mu$ PD42S16800L-A60, 4216800L-A60	288 mW	60 ns	110 ns	40 ns
$\mu$ PD42S17800L-A60, 4217800L-A60	360 mW			
$\mu$ PD42S16800L-A70, 4216800L-A70	252 mW	70 ns	130 ns	45 ns
$\mu$ PD42S17800L-A70, 4217800L-A70	324 mW			
$\mu$ PD42S16800L-A80, 4216800L-A80	216 mW	80 ns	150 ns	50 ns
$\mu$ PD42S17800L-A80, 4217800L-A80	288 mW			

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

**ORDERING INFORMATION**

Part number	Access time (MAX.)	Package	Refresh
μPD42S16800LG5-A60	60 ns	28-pin plastic TSOP (III) (400 mil)	$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ self refresh $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh $\overline{\text{RAS}}$ only refresh Hidden refresh
μPD42S17800LG5-A60			
μPD42S16800LG5-A70	70 ns		
μPD42S17800LG5-A70			
μPD42S16800LG5-A80	80 ns		
μPD42S17800LG5-A80			
μPD42S16800LLE-A60	60 ns	28-pin plastic SOJ (400 mil)	
μPD42S17800LLE-A60			
μPD42S16800LLE-A70	70 ns		
μPD42S17800LLE-A70			
μPD42S16800LLE-A80	80 ns		
μPD42S17800LLE-A80			
μPD4216800LG5-A60	60 ns	28-pin plastic TSOP (III) (400 mil)	$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh $\overline{\text{RAS}}$ only refresh Hidden refresh
μPD4217800LG5-A60			
μPD4216800LG5-A70	70 ns		
μPD4217800LG5-A70			
μPD4216800LG5-A80	80 ns		
μPD4217800LG5-A80			
μPD4216800LLE-A60	60 ns	28-pin plastic SOJ (400 mil)	
μPD4217800LLE-A60			
μPD4216800LLE-A70	70 ns		
μPD4217800LLE-A70			
μPD4216800LLE-A80	80 ns		
μPD4217800LLE-A80			

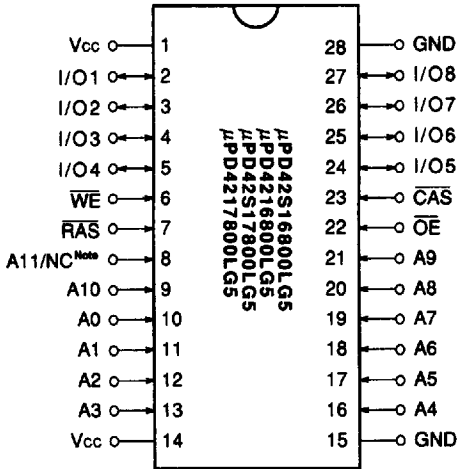
**QUALITY GRADE**

STANDARD

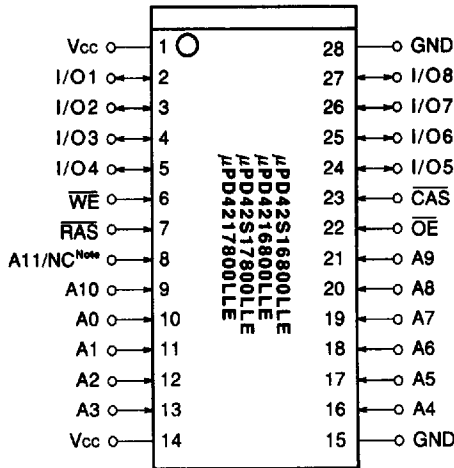
Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

PIN CONFIGURATIONS (Marking Side)

28-pin Plastic TSOP (II)



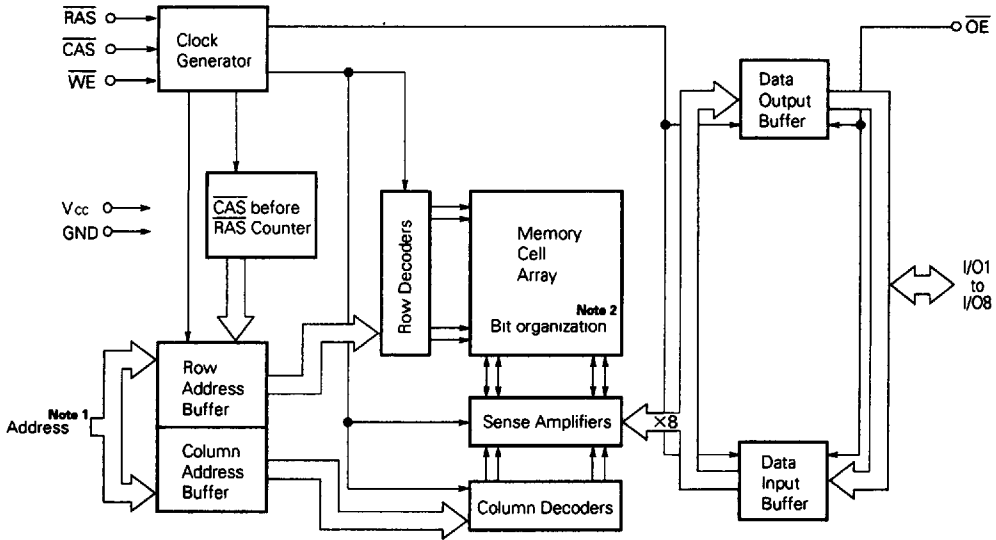
28-pin Plastic SOJ



- A0 to A11 : Address inputs
- I/O1 to I/O8 : 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 : Supply voltage
- GND : Ground
- NC : No connection

**Note** A11 ...μPD42S16800L, 4216800L  
 NC ...μPD42S17800L, 4217800L (No connection)

**BLOCK DIAGRAM**



**Notes 1.**

Part number	Row address	Column address
$\mu$ PD42S16800L, 4216800L	A0 to A11	A0 to A8
$\mu$ PD42S17800L, 4217800L	A0 to A10	A0 to A9

2.  $\mu$ PD42S16800L, 4216800L...4 096  $\times$  512  $\times$  8

$\mu$ PD42S17800L, 4217800L...2 048  $\times$  1 024  $\times$  8

**INPUT/OUTPUT PIN FUNCTIONS**

The μPD42S16800L, 4216800L, 42S17800L, 4217800L have input pins  $\overline{\text{RAS}}$ ,  $\overline{\text{CAS}}$ ,  $\overline{\text{WE}}$ ,  $\overline{\text{OE}}$ , A0 to A11/A10<sup>Note1</sup> and input/output pins I/O1 to I/O8.

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. • $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh.
$\overline{\text{CAS}}$ (Column address strobe)		$\overline{\text{CAS}}$ activates data input/output circuit by latching column address and selecting a digit line connected with the sense amplifier.
A0 to A11/A10 <sup>Note1</sup> (Address input)		Address bus. Input total 21-bit of address signal, upper 12/11 <sup>Note2</sup> -bit and lower 9/10 <sup>Note3</sup> -bit in sequence (address multiplex method). Therefore, one word is selected from 2 097 152-word by 8-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 ( $t_{ASR}$ , $t_{ASC}$ ) and hold time ( $t_{RAH}$ , $t_{CAH}$ ) are specified for the activation of $\overline{\text{RAS}}$ and $\overline{\text{CAS}}$ .
$\overline{\text{WE}}$ (Write enable)		Write control signal. Write operation is executed by activating $\overline{\text{RAS}}$ , $\overline{\text{CAS}}$ and $\overline{\text{WE}}$ .
$\overline{\text{OE}}$ (Output enable)		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/O8 (Data input/output)	Input/Output	8-bit data bus. I/O1 to I/O8 are used to input/output data.

**Notes 1.** A11...μPD42S16800L, 4216800L

A10...μPD42S17800L, 4217800L

**2.** 12...μPD42S16800L, 4216800L

11...μPD42S17800L, 4217800L

**3.** 9...μPD42S16800L, 4216800L

10...μPD42S17800L, 4217800L

**ELECTRICAL SPECIFICATIONS** Notes 1, 2

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Condition	Rating	Unit
Voltage on any pin relative to GND	$V_T$		-0.5 to +4.6	V
Supply voltage	$V_{CC}$		-0.5 to +4.6	V
Output current	$I_O$		20	mA
Power dissipation	$P_D$		1	W
Operating temperature	$T_{OP}$		0 to +70	°C
Storage temperature	$T_{STG}$		-55 to +125	°C

**Remark** 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	$V_{CC}$		3.0	3.3	3.6	V
High level input voltage	$V_{IH}$		2.0		$V_{CC} + 0.3$	V
Low level input voltage	$V_{IL}$		-0.3		+0.8	V
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	$C_{I1}$	A0 to A11			5	pF
	$C_{I2}$	RAS, CAS, WE, OE			7	pF
Data Input/Output capacitance	$C_{I/O}$	I/O1 to I/O8			7	pF

DC CHARACTERISTICS (Recommended Operating Conditions unless otherwise noted)

[μPD42S16800L, 4216800L]

Parameter		Symbol	Test condition	MIN.	MAX.	Unit	Notes
Operating current		I <sub>CC1</sub>	$\overline{\text{RAS}}, \overline{\text{CAS}}$ Cycling $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 60 \text{ ns}$	80	mA	3,4
				$t_{\text{RAC}} = 70 \text{ ns}$	70		
				$t_{\text{RAC}} = 80 \text{ ns}$	60		
Standby current	μPD42S16800L	I <sub>CC2</sub>	$V_{\text{IH}(\text{MIN.})} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$ $V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$ $V_{\text{IH}(\text{MIN.})} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$ $V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	0.5	mA	
				$I_o = 0 \text{ mA}$	0.15		
	μPD4216800L			$I_o = 0 \text{ mA}$	2		
				$I_o = 0 \text{ mA}$	0.5		
$\overline{\text{RAS}}$ only refresh current		I <sub>CC3</sub>	$\overline{\text{RAS}}$ Cycling $V_{\text{IH}(\text{MIN.})} \leq \overline{\text{CAS}}$ $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 60 \text{ ns}$	80	mA	3,4
				$t_{\text{RAC}} = 70 \text{ ns}$	70		
				$t_{\text{RAC}} = 80 \text{ ns}$	60		
Operating current (Fast page mode)		I <sub>CC4</sub>	$\overline{\text{CAS}}$ Cycling $\overline{\text{RAS}} \leq V_{\text{IL}(\text{MAX.})}$ $t_{\text{PC}} = t_{\text{PC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 60 \text{ ns}$	70	mA	3,4
				$t_{\text{RAC}} = 70 \text{ ns}$	60		
				$t_{\text{RAC}} = 80 \text{ ns}$	50		
$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh current		I <sub>CC5</sub>	$\overline{\text{RAS}}$ Cycling, $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 60 \text{ ns}$	80	mA	3,4
				$t_{\text{RAC}} = 70 \text{ ns}$	70		
				$t_{\text{RAC}} = 80 \text{ ns}$	60		
$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ long refresh current (4 096 cycles/128 ms, only for μPD42S16800L)		I <sub>CC6</sub>	Standby : $V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}$ $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh : 4 096 cycles/128 ms $\overline{\text{RAS}}, \overline{\text{CAS}} : 0 \text{ V} \leq V_{\text{IL}} \leq 0.2 \text{ V}$ $V_{\text{CC}} - 0.2 \text{ V} \leq V_{\text{IH}} \leq V_{\text{IH}(\text{MAX.})}$ $\overline{\text{WE}}, \overline{\text{OE}} : V_{\text{IH}}$ Address input : Don't care Output : Open	$t_{\text{RAS}} \leq 1 \mu\text{s}$	220	μA	3,4
Self refresh current ( $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ self refresh, only for μPD42S16800L)		I <sub>CC7</sub>	$I_o = 0 \text{ mA}$ $\overline{\text{RAS}}, \overline{\text{CAS}} : 0 \text{ V} \leq V_{\text{IL}} \leq 0.2 \text{ V}$ $V_{\text{CC}} - 0.2 \text{ V} \leq V_{\text{IH}} \leq V_{\text{IH}(\text{MAX.})}$		150	μA	
Input leakage current		I <sub>I(L)</sub>	$V_i = 0 \text{ to } 3.6 \text{ V}$ all other pins not under test = 0 V	-5	+5	μA	
Output leakage current		I <sub>O(L)</sub>	Outputs are disabled (Hi-Z) $V_o = 0 \text{ to } 3.6 \text{ V}$	-5	+5	μA	
High level output voltage		V <sub>OH</sub>	$I_o = -2.0 \text{ mA}$	2.4		V	
Low level output voltage		V <sub>OL</sub>	$I_o = +2.0 \text{ mA}$		0.4	V	

[μPD42S17800L, 4217800L]

Parameter		Symbol	Test condition	MIN.	MAX.	Unit	Notes
Operating current	I <sub>CC1</sub>	$\overline{\text{RAS}}, \overline{\text{CAS}}$ Cycling $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 60 \text{ ns}$		100	mA	3,4
			$t_{\text{RAC}} = 70 \text{ ns}$		90		
			$t_{\text{RAC}} = 80 \text{ ns}$		80		
Standby current	μPD42S17800L	I <sub>CC2</sub>	$V_{\text{IH}(\text{MIN})} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$ $I_o = 0 \text{ mA}$		0.5	mA	
			$V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$ $I_o = 0 \text{ mA}$		0.15		
	μPD4217800L		$V_{\text{IH}(\text{MIN})} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$ $I_o = 0 \text{ mA}$		2		
	$V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$ $I_o = 0 \text{ mA}$			0.5			
RAS only refresh current	I <sub>CC3</sub>	$\overline{\text{RAS}}$ Cycling $V_{\text{IH}(\text{MIN})} \leq \overline{\text{CAS}}$ $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 60 \text{ ns}$		100	mA	3,4
			$t_{\text{RAC}} = 70 \text{ ns}$		90		
			$t_{\text{RAC}} = 80 \text{ ns}$		80		
Operating current (Fast page mode)	I <sub>CC4</sub>	$\overline{\text{CAS}}$ Cycling $\overline{\text{RAS}} \leq V_{\text{IL}(\text{MAX})}$ $t_{\text{PC}} = t_{\text{PC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 60 \text{ ns}$		70	mA	3,4
			$t_{\text{RAC}} = 70 \text{ ns}$		60		
			$t_{\text{RAC}} = 80 \text{ ns}$		50		
CAS before RAS refresh current	I <sub>CC5</sub>	$\overline{\text{RAS}}$ Cycling, $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 60 \text{ ns}$		100	mA	3,4
			$t_{\text{RAC}} = 70 \text{ ns}$		90		
			$t_{\text{RAC}} = 80 \text{ ns}$		80		
CAS before RAS long refresh current (2 048 cycles/128 ms, only for μPD42S17800L)	I <sub>CC8</sub>	Standby : $V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}$ CAS before RAS Refresh : 2 048 cycles/128 ms $\overline{\text{RAS}}, \overline{\text{CAS}} : 0 \text{ V} \leq V_{\text{IL}} \leq 0.2 \text{ V}$ $V_{\text{CC}} - 0.2 \text{ V} \leq V_{\text{IH}} \leq V_{\text{IH}(\text{MAX})}$ $\overline{\text{WE}}, \overline{\text{OE}} : V_{\text{IH}}$ Address input : Don't care Output : Open	$t_{\text{RAS}} \leq 1 \mu\text{s}$		200	μA	3,4
Self refresh current (CAS before RAS self refresh, only for μPD42S17800L)	I <sub>CC7</sub>	$I_o = 0 \text{ mA}$ $\overline{\text{RAS}}, \overline{\text{CAS}} : 0 \text{ V} \leq V_{\text{IL}} \leq 0.2 \text{ V}$ $V_{\text{CC}} - 0.2 \text{ V} \leq V_{\text{IH}} \leq V_{\text{IH}(\text{MAX})}$			150	μA	
Input leakage current	I <sub>I(L)</sub>	$V_i = 0 \text{ to } 3.6 \text{ V}$ all other pins not under test = 0 V		-5	+5	μA	
Output leakage current	I <sub>O(L)</sub>	Outputs are disabled (Hi-Z) $V_o = 0 \text{ to } 3.6 \text{ V}$		-5	+5	μA	
High level output voltage	V <sub>OH</sub>	$I_o = -2.0 \text{ mA}$		2.4		V	
Low level output voltage	V <sub>OL</sub>	$I_o = +2.0 \text{ mA}$			0.4	V	



AC CHARACTERISTICS

(Recommended Operating Conditions unless otherwise noted) Notes 5, 6

(1/2)

Parameter	Symbol	t <sub>RAC</sub> = 60 ns		t <sub>RAC</sub> = 70 ns		t <sub>RAC</sub> = 80 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Random Read or Write Cycle Time	t <sub>RC</sub>	110		130		150		ns	7
Read Write Cycle Time	t <sub>RWC</sub>	160		180		200		ns	7
Fast Page Mode Cycle Time (Read or Write)	t <sub>PC</sub>	40		45		50		ns	7
Read Modify Write Cycle Time (Fast Page Mode)	t <sub>PRWC</sub>	85		90		100		ns	7
Access Time from RAS	t <sub>RAC</sub>		60		70		80	ns	8, 9
Access Time from CAS (Falling Edge)	t <sub>CAC</sub>		15		18		20	ns	8, 9
Access Time from Column Address	t <sub>AA</sub>		30		35		40	ns	8, 9
Access Time from CAS Precharge	t <sub>ACP</sub>		35		40		45	ns	9
Access Time from OE	t <sub>OEa</sub>		15		18		20	ns	9
RAS to Column Address Delay Time	t <sub>RAD</sub>	15	30	15	35	17	40	ns	8
CAS to Data Setup Time	t <sub>CLZ</sub>	0		0		0		ns	9
OE to Data Setup Time	t <sub>OLZ</sub>	0		0		0		ns	9
Output Buffer Turn-off Delay Time (CAS)	t <sub>OFF</sub>	0	13	0	15	0	15	ns	10
OE to Data Delay Time	t <sub>ODD</sub>	13		15		15		ns	
Output Buffer Turn-off Delay Time (OE)	t <sub>OEZ</sub>	0	13	0	15	0	15	ns	10
OE Command Hold Time	t <sub>OEH</sub>	0		0		0		ns	
OE to RAS inactive Setup Time	t <sub>OES</sub>	0		0		0		ns	
Transition Time (Rise and Fall)	t <sub>T</sub>	3	50	3	50	3	50	ns	
RAS Precharge Time	t <sub>RP</sub>	40		50		60		ns	
RAS Pulse Width (Random Read, Write Cycle)	t <sub>RAS</sub>	60	10 000	70	10 000	80	10 000	ns	
RAS Pulse Width (Fast Page Mode)	t <sub>RASP</sub>	60	125 000	70	125 000	80	125 000	ns	
RAS Hold Time	t <sub>RSH</sub>	15		18		20		ns	
CAS Pulse Width	t <sub>CAS</sub>	15	10 000	18	10 000	20	10 000	ns	
CAS Hold Time	t <sub>CSH</sub>	60		70		80		ns	
RAS to CAS Delay Time	t <sub>RCD</sub>	20	45	20	50	25	60	ns	8
CAS to RAS Precharge Time	t <sub>CRP</sub>	5		5		5		ns	11
CAS Precharge Time	t <sub>CPN</sub>	10		10		10		ns	
CAS Precharge Time (Fast Page Mode)	t <sub>CP</sub>	10		10		10		ns	
RAS Precharge CAS Hold Time	t <sub>RPC</sub>	5		5		5		ns	
RAS Hold Time from CAS Precharge	t <sub>RHCP</sub>	35		40		45		ns	
Row Address Setup Time	t <sub>ASR</sub>	0		0		0		ns	
Row Address Hold Time	t <sub>RAH</sub>	10		10		12		ns	

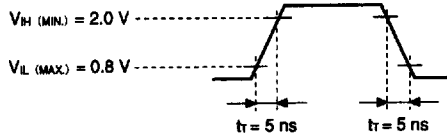
(2/2)

Parameter	Symbol	t <sub>RAC</sub> = 60 ns		t <sub>RAC</sub> = 70 ns		t <sub>RAC</sub> = 80 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Column Address Setup Time	t <sub>ASC</sub>	0		0		0		ns	
Column Address Hold Time	t <sub>CAH</sub>	15		15		15		ns	
Column Address Lead Time Referenced to $\overline{\text{RAS}}$	t <sub>RAL</sub>	30		35		40		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	12
Read Command Hold Time Referenced to $\overline{\text{CAS}}$	t <sub>RCH</sub>	0		0		0		ns	12
Write Command Hold Time Referenced to $\overline{\text{CAS}}$	t <sub>WCH</sub>	10		10		15		ns	13
Write Command Pulse Width	t <sub>WP</sub>	10		10		15		ns	13
Data-In Setup Time	t <sub>DS</sub>	0		0		0		ns	14
Data-in Hold Time	t <sub>DH</sub>	10		15		15		ns	14
$\overline{\text{WE}}$ Command Setup Time	t <sub>WCS</sub>	0		0		0		ns	15
$\overline{\text{CAS}}$ to $\overline{\text{WE}}$ Delay Time	t <sub>CWD</sub>	38		43		45		ns	15
$\overline{\text{RAS}}$ to $\overline{\text{WE}}$ Delay Time	t <sub>RWD</sub>	83		95		105		ns	15
$\overline{\text{CAS}}$ Precharge Delay Time Referenced to $\overline{\text{WE}}$ (Fast Page Mode)	t <sub>CPWD</sub>	58		65		70		ns	15
Column Address Delay Time Referenced to $\overline{\text{WE}}$	t <sub>AWD</sub>	53		60		65		ns	15
Write Command Lead Time Referenced to $\overline{\text{RAS}}$	t <sub>RWL</sub>	20		20		20		ns	
Write Command Lead Time Referenced to $\overline{\text{CAS}}$	t <sub>CWL</sub>	15		15		15		ns	
$\overline{\text{CAS}}$ Setup Time for $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh	t <sub>CSR</sub>	5		5		5		ns	
$\overline{\text{CAS}}$ Hold Time for $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh	t <sub>CHR</sub>	10		10		10		ns	
$\overline{\text{RAS}}$ Pulse Width ( $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Self Refresh Cycle)	t <sub>RASS</sub>	100		100		100		μs	16
$\overline{\text{RAS}}$ Precharge Time ( $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Self Refresh Cycle)	t <sub>RPS</sub>	110		130		150		ns	16
$\overline{\text{CAS}}$ Hold Time ( $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Self Refresh Cycle)	t <sub>CHS</sub>	-50		-50		-50		ns	16
$\overline{\text{WE}}$ Setup Time	t <sub>WSR</sub>	10		10		10		ns	
$\overline{\text{WE}}$ Hold Time	t <sub>WHR</sub>	15		15		15		ns	
Refresh Time	μPD42S16800L, 42S17800L		128		128		128	ms	16
	μPD4216800L		64		64		64		
	μPD4217800L		32		32		32		

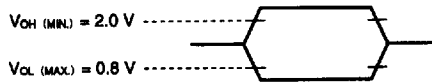
Notes

1. All voltages are referenced to GND.
2. After power-up, wait more than 100  $\mu$ s and then, execute 8  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  refresh cycles or 8  $\overline{\text{RAS}}$  only refresh cycles to initialize the internal circuit.
3.  $t_{CC1}$ ,  $t_{CC3}$ ,  $t_{CC4}$ ,  $t_{CC5}$ , and  $t_{CC6}$  depend on  $t_{\text{RAC}}$  and  $t_{\text{RWC}}$ . Specified values are obtained with outputs open.
4. Address can be changed once or less while  $\overline{\text{RAS}} = \text{VIL}$  and  $\overline{\text{CAS}} = \text{VIH}$ .
5. AC measurements assume  $t_{\text{T}} = 5 \text{ ns}$ .
6. AC Characteristics test condition

(1) Input timing specification



(2) Output timing specification



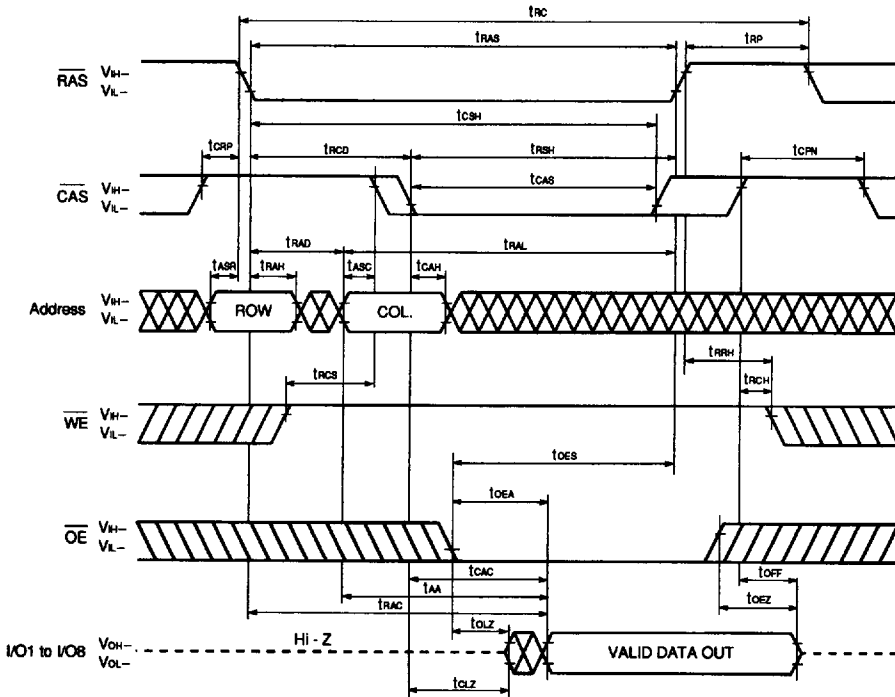
7. The minimum specifications are used only to indicate cycle time at which proper operation over the full temperature range ( $T_{\text{a}} = 0 \text{ to } 70 \text{ }^{\circ}\text{C}$ ) is assured.
8. In random read cycle, the access time is changed by the conditions of  $t_{\text{RAD}}$  and  $t_{\text{RCD}}$  as follows.

CONDITION	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 $t_{\text{RCD}} \leq t_{\text{RCD}}(\text{MAX.})$	$t_{\text{AA}}(\text{MAX.})$
$t_{\text{RCD}}(\text{MAX.}) < t_{\text{RCD}}$	$t_{\text{CAC}}(\text{MAX.})$

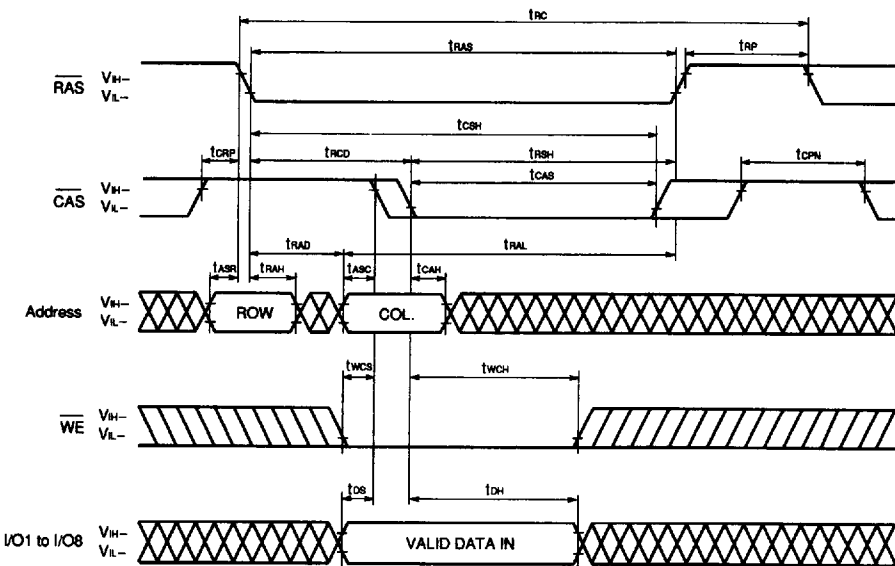
$t_{\text{RAD}}(\text{MAX.})$  and  $t_{\text{RCD}}(\text{MAX.})$  indicate the points which the access time changes and are not the limits of operation.

9. Loading conditions are 1 TTL and 100 pF.
10.  $t_{\text{OFF}}(\text{MAX.})$  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  $V_{\text{OL}}$ .
11.  $t_{\text{CRP}}(\text{MIN.})$  requirement should be applicable for  $\overline{\text{RAS}} / \overline{\text{CAS}}$  cycles preceded by any cycles.
12. Either  $t_{\text{RCH}}(\text{MIN.})$  or  $t_{\text{RRH}}(\text{MIN.})$  must be satisfied for a read cycle.
13.  $t_{\text{WP}}(\text{MIN.})$  is applicable for late write cycle or read modify write cycle. In early write cycles,  $t_{\text{WCH}}(\text{MIN.})$  should be satisfied.
14. 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.
15. If  $t_{\text{WCS}} \geq t_{\text{WCS}}(\text{MIN.})$ , the cycle is an early write cycle and the data out will remain Hi-Z through the entire cycle. If  $t_{\text{RWD}} \geq t_{\text{RWD}}(\text{MIN.})$ ,  $t_{\text{CWD}} \geq t_{\text{CWD}}(\text{MIN.})$ ,  $t_{\text{AWD}} \geq t_{\text{AWD}}(\text{MIN.})$ ,  $t_{\text{CPWD}} \geq t_{\text{CPWD}}(\text{MIN.})$ , 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 condition of the data out is indeterminate.
16. This specification is applicable only for  $\mu$ PD42S16800L and  $\mu$ PD42S17800L.

READ CYCLE

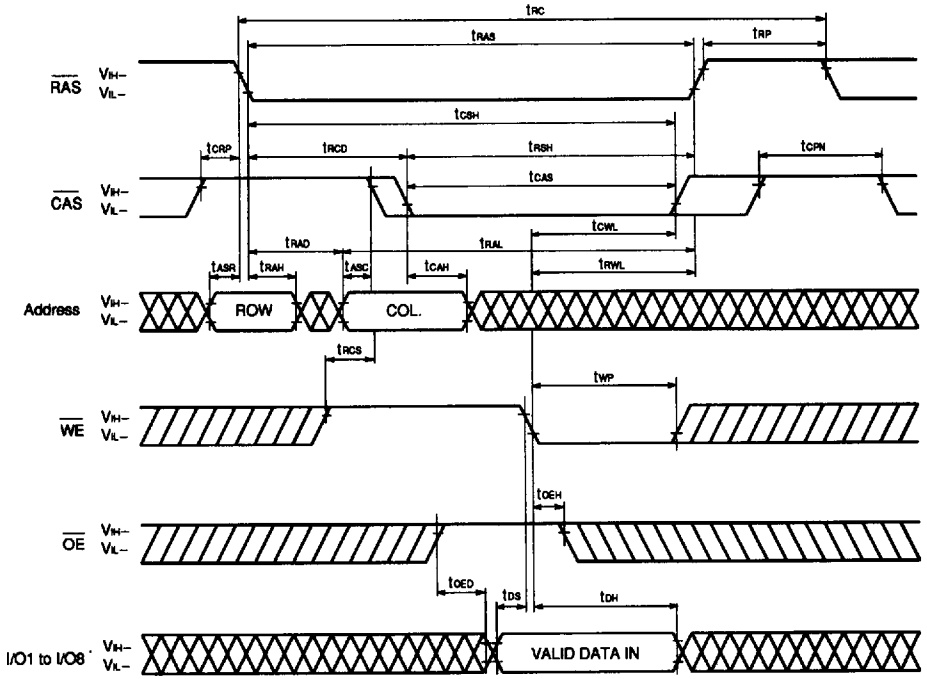


EARLY WRITE CYCLE

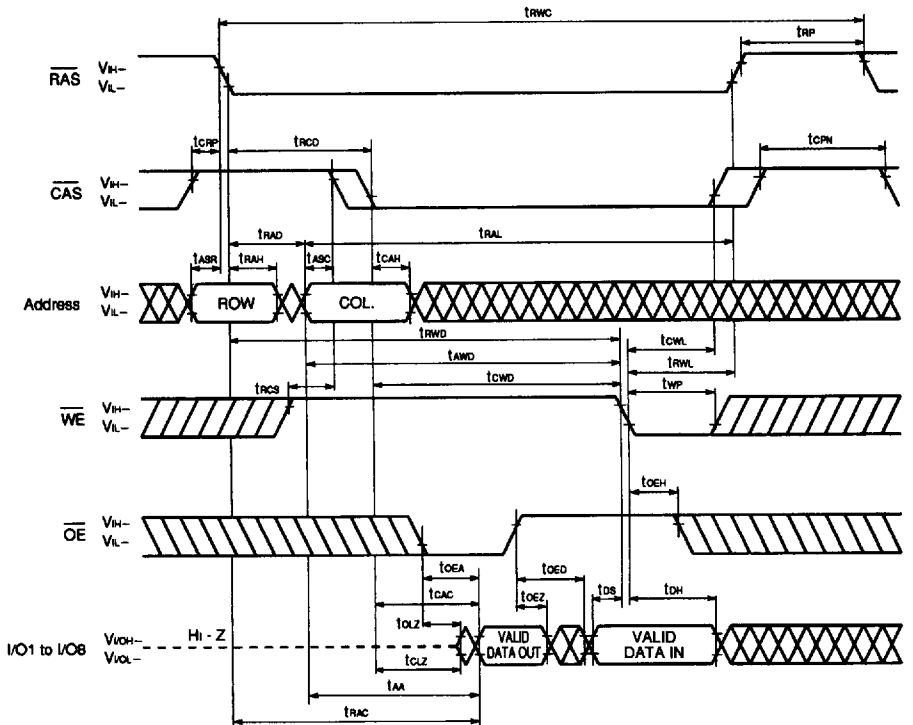


Remark  $\overline{OE}$  = Don't Care

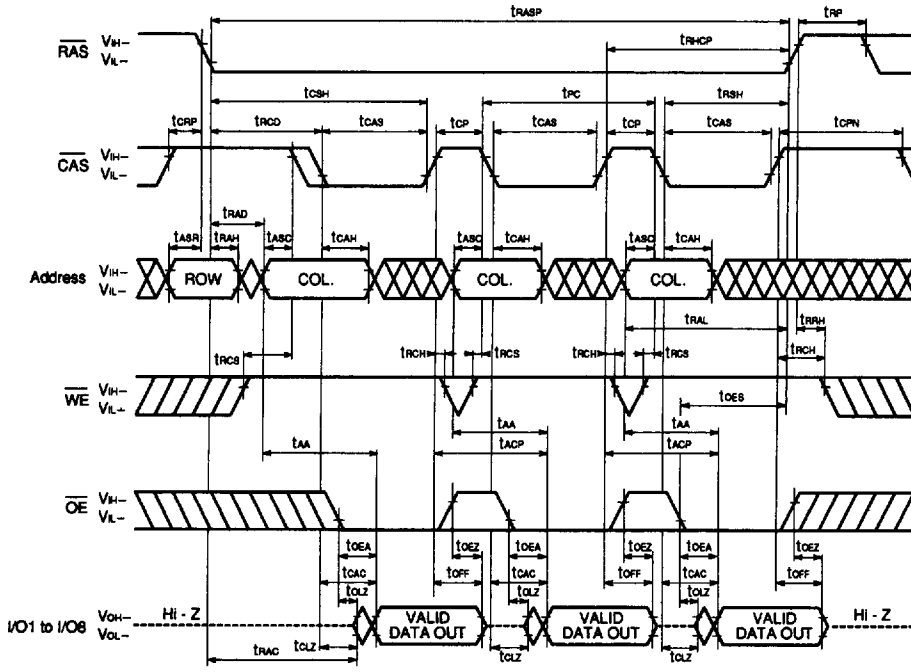
LATE WRITE CYCLE



READ MODIFY WRITE CYCLE

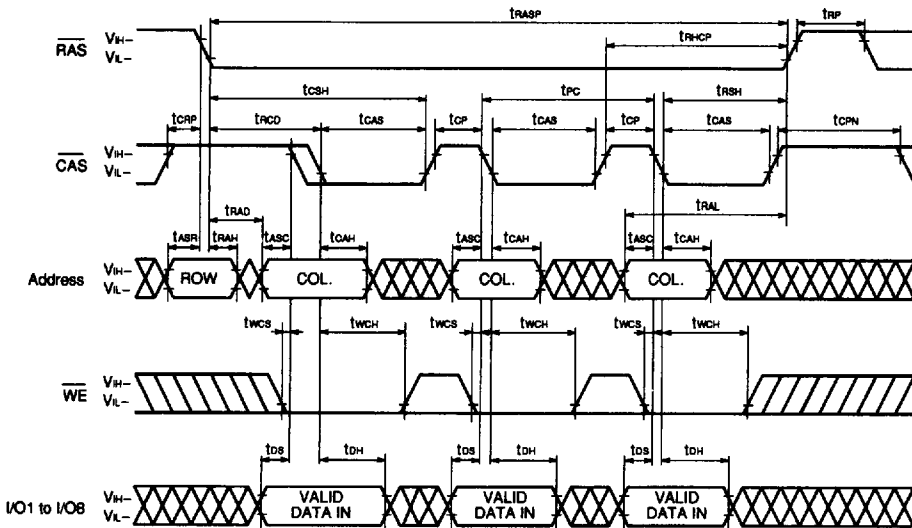


**FAST PAGE MODE READ CYCLE**



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

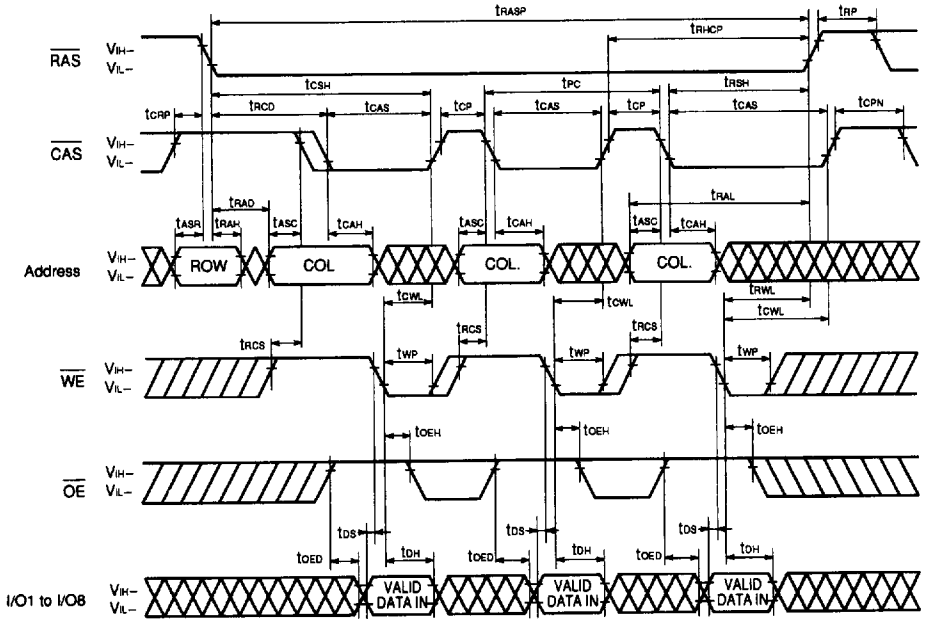
**FAST PAGE MODE EARLY WRITE CYCLE**



**Remark**  $\overline{OE}$  = Don't Care

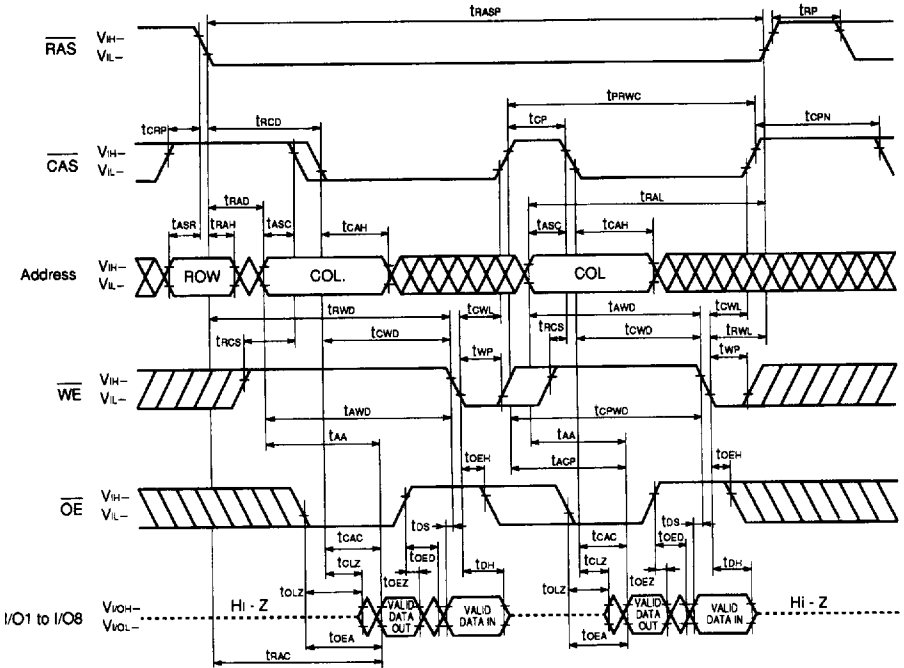
In the fast page mode, read, write and read modify write cycles are available for each of the consecutive CAS cycles within the same RAS cycle.

**FAST PAGE MODE LATE WRITE CYCLE**



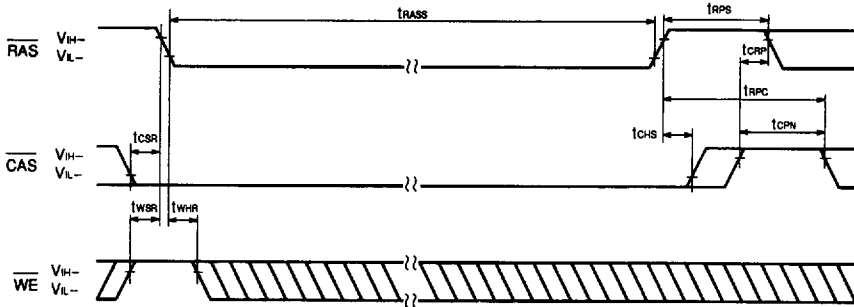
**Remark** In the fast page mode, read, write and read modify write cycles are available for each of the consecutive CAS cycles within the same RAS cycle

**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 SELF REFRESH CYCLE (Only for  $\mu$ PD42S16800L, 42S17800L)**



Remark Address,  $\overline{OE}$  = Don't care I/O1 to I/O8 = Hi - Z

**How to use CAS before RAS self refresh mode**

CAS before RAS self refresh mode can't be used by itself. It must be used with performing one of 3 refreshes below.

• **When using distributed CAS before RAS refresh**

Refresh 4 096 times ( $\mu$ PD42S16800L) or 2 048 times ( $\mu$ PD42S17800L) during 128 ms before set into the CAS before RAS self refresh mode and after reset.

• **When using burst CAS before RAS refresh**

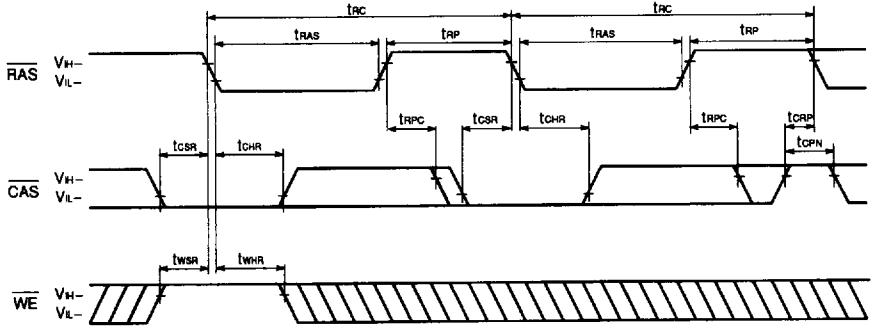
Refresh 4 096 times during 64 ms ( $\mu$ PD42S16800L) or 2 048 times during 32 ms ( $\mu$ PD42S17800L) before set into the CAS before RAS self refresh mode and after reset.

• **When using RAS only refresh**

Refresh against all refresh addresses during 64 ms ( $\mu$ PD42S16800L) or during 32 ms ( $\mu$ PD42S17800L) before set into the CAS before RAS self refresh mode and after reset.

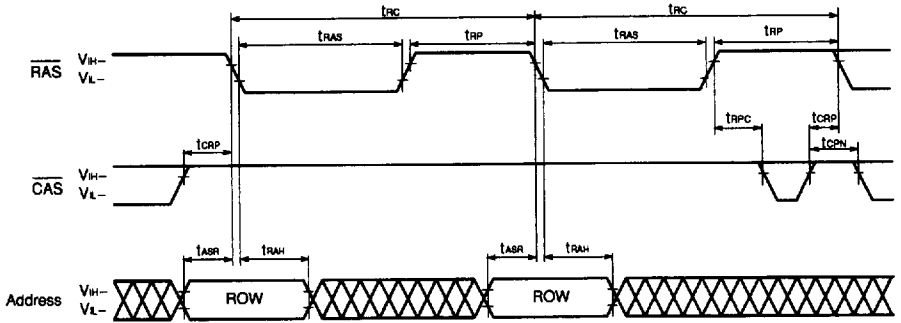


**CAS BEFORE RAS REFRESH CYCLE**



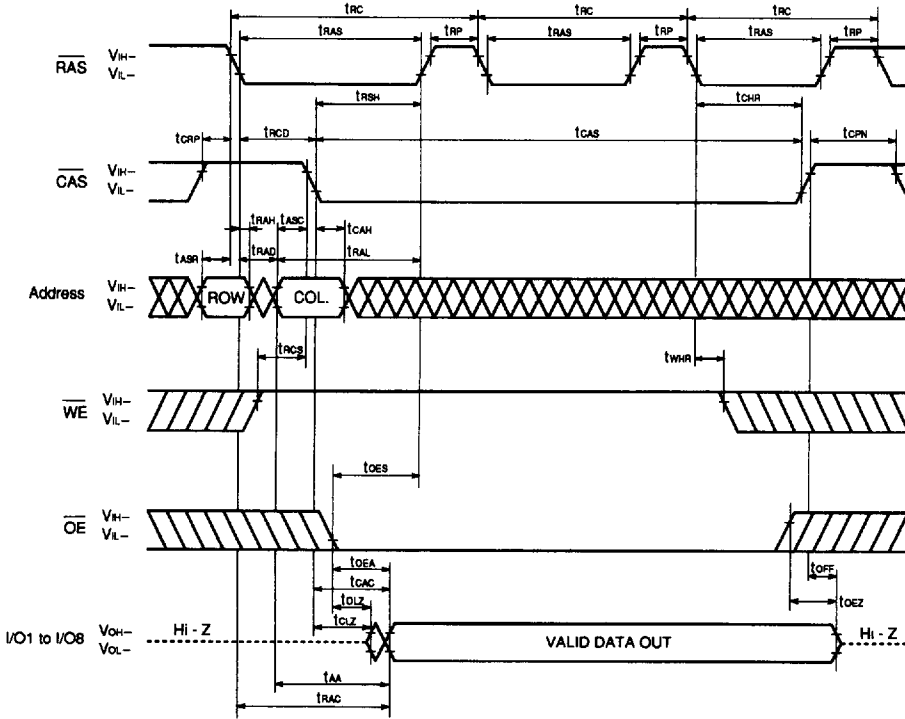
Remark Address,  $\overline{OE}$  = Don't care I/O1 to I/O8 = Hi - Z

**RAS ONLY REFRESH CYCLE**

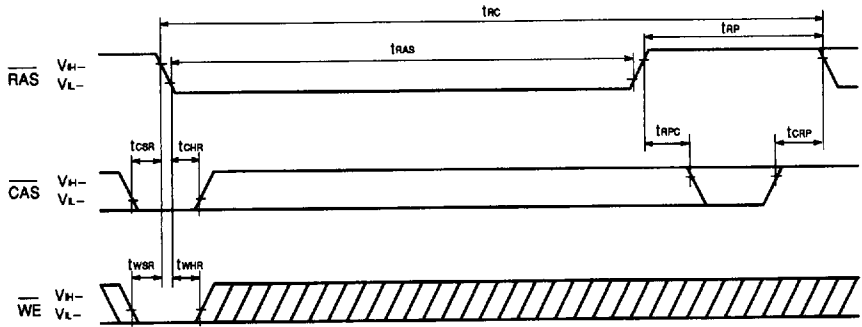


Remark  $\overline{WE}$ ,  $\overline{OE}$  = Don't care I/O1 to I/O8 = Hi - Z

HIDDEN REFRESH CYCLE



**TEST MODE SET CYCLE ( $\overline{WE}$  AND  $\overline{CAS}$  BEFORE  $\overline{RAS}$  REFRESH CYCLE)**



**Remark** Address,  $\overline{OE}$  = Don't care I/O1 to I/O8 = Hi - Z

**TEST MODE**

TEST MODE is fast test function. On using this mode, test time is reduced to 1/2. In this TEST MODE, internal organization is 1 M words by 16 bits apparently. Don't care about the input levels of the  $\overline{CAS}$  input A0.

**1. How to enter TEST MODE**

Through TEST MODE SET CYCLE ( $\overline{WE}$  and  $\overline{CAS}$  before  $\overline{RAS}$  refresh cycle), the device enters TEST MODE.

**2. Write / Read in TEST MODE**

Write data of "1" or "0" through I/O1 to I/O8 by controlling address except for above-mentioned address. Each input data through each I/O write 2 bits at once. And read through I/O1 to I/O8 to check written data. In case of writing each 2 bits rightly, each I/O data is "1". But wrong, the data is "0".

**3. Refresh in TEST MODE**

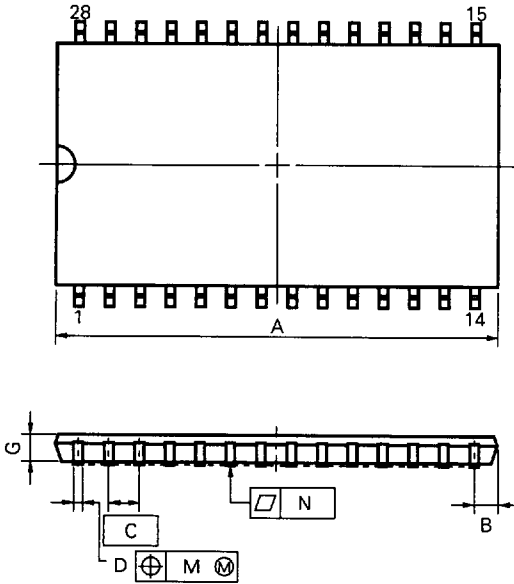
Use normal read cycle or  $\overline{WE}$  and  $\overline{CAS}$  before  $\overline{RAS}$  refresh cycle.

**4. How to exit from TEST MODE**

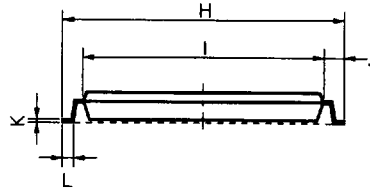
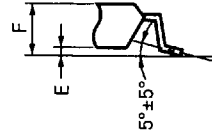
Through  $\overline{RAS}$  only refresh cycle or  $\overline{CAS}$  before  $\overline{RAS}$  refresh cycle, the device exits from TEST MODE.

PACKAGE DRAWINGS

28 PIN PLASTIC TSOP(III) (400 mil)



detail of lead end



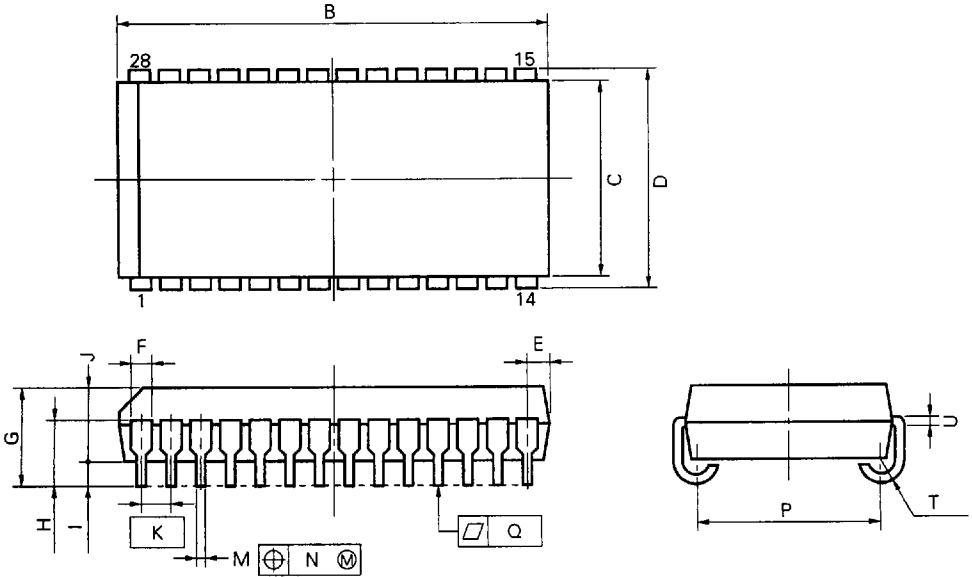
S28G5-50-7JD2-1

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	18.81 MAX.	0.741 MAX.
B	1.15 MAX.	0.046 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.40±0.10	0.016 <sup>+0.004</sup> <sub>-0.005</sub>
E	0.1 ± 0.05	0.004 ± 0.002
F	1.2 MAX.	0.047 MAX.
G	0.97	0.038
H	11.76±0.2	0.463±0.008
I	10.16±0.1	0.400±0.004
J	0.8±0.2	0.031 <sup>+0.009</sup> <sub>-0.008</sub>
K	0.125 <sup>+0.10</sup> <sub>-0.05</sub>	0.005 <sup>+0.004</sup> <sub>-0.002</sub>
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

28 PIN PLASTIC SOJ (400 mil)



**NOTE**

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

P28LE-400A1

ITEM	MILLIMETERS	INCHES
B	18.67 <sup>+0.2</sup> / <sub>-0.35</sub>	0.735 <sup>+0.008</sup> / <sub>-0.013</sub>
C	10.16	0.400
D	11.18±0.2	0.440 <sup>+0.008</sup> / <sub>-0.007</sub>
E	1.08±0.15	0.043 <sup>+0.006</sup> / <sub>-0.007</sub>
F	0.74	0.029
G	3.5±0.2	0.138 <sup>+0.008</sup> / <sub>-0.007</sub>
H	2.545±0.2	0.100±0.008
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	9.40±0.20	0.370 <sup>+0.008</sup> / <sub>-0.007</sub>
Q	0.10	0.004
T	R 0.85	R 0.033
U	0.20 <sup>+0.10</sup> / <sub>-0.05</sub>	0.008 <sup>+0.004</sup> / <sub>-0.002</sub>

**RECOMMENDED SOLDERING CONDITIONS**

Please consult with our sales offices for soldering conditions of the  $\mu$ PD42S16800L, 4216800L, 42S17800L, 4217800L.

**TYPE OF SURFACE MOUNT DEVICE**

$\mu$ PD42S16800LG5, 4216800LG5, 42S17800LG5, 4217800LG5 : 28-pin Plastic TSOP (II) (400 mil)

$\mu$ PD42S16800LLE, 4216800LLE, 42S17800LLE, 4217800LLE : 28-pin Plastic SOJ (400 mil)