

MOS INTEGRATED CIRCUIT

μ PD42S16800L, 4216800L, 42S17800L, 4217800L

3.3 V OPERATION 16 M-BIT DYNAMIC RAM

2 M-WORD BY 8-BIT, FAST PAGE MODE

DESCRIPTION

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

These differ in refresh cycle and the μ 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).

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FEATURES

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

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Part number	Refresh cycle	Refresh	Power consumption at standby (MAX.)
μ 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)
μ PD42S17800L	2 048 cycles/128 ms		
μ 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)
μ 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.)
μ PD42S16800L-A60, 4216800L-A60	288 mW	60 ns	110 ns	40 ns
μ PD42S17800L-A60, 4217800L-A60	360 mW			
μ PD42S16800L-A70, 4216800L-A70	252 mW	70 ns	130 ns	45 ns
μ PD42S17800L-A70, 4217800L-A70	324 mW			
μ PD42S16800L-A80, 4216800L-A80	216 mW	80 ns	150 ns	50 ns
μ PD42S17800L-A80, 4217800L-A80	288 mW			

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

★ ORDERING INFORMATION

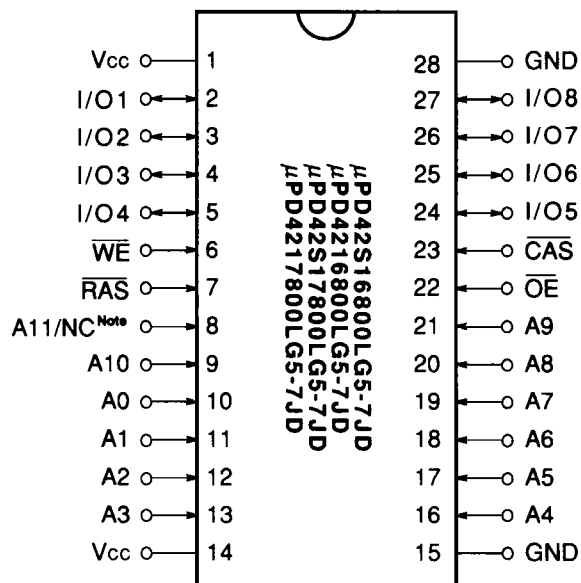
Part number	Access time (MAX.)	Package	Refresh
μPD42S16800LG5-A60	60 ns	28-pin plastic TSOP (II) (400 mil) Normal pinout	$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ self refresh $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh $\overline{\text{RAS}}$ only refresh Hidden refresh
μPD42S17800LG5-A60			
μPD42S16800LG5-A70	70 ns		
μPD42S17800LG5-A70			
μPD42S16800LG5-A80	80 ns		
μPD42S17800LG5-A80			
μPD42S16800LG5M-A60	60 ns	28-pin plastic TSOP (II) (400 mil) Reverse pinout	
μPD42S17800LG5M-A60			
μPD42S16800LG5M-A70	70 ns		
μPD42S17800LG5M-A70			
μPD42S16800LG5M-A80	80 ns		
μPD42S17800LG5M-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 (II) (400 mil) Normal pinout	$\overline{\text{CAS}}$ 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			
μPD4216800LG5M-A60	60 ns	28-pin plastic TSOP (II) (400 mil) Reverse pinout	
μPD4217800LG5M-A60			
μPD4216800LG5M-A70	70 ns		
μPD4217800LG5M-A70			
μPD4216800LG5M-A80	80 ns		
μPD4217800LG5M-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

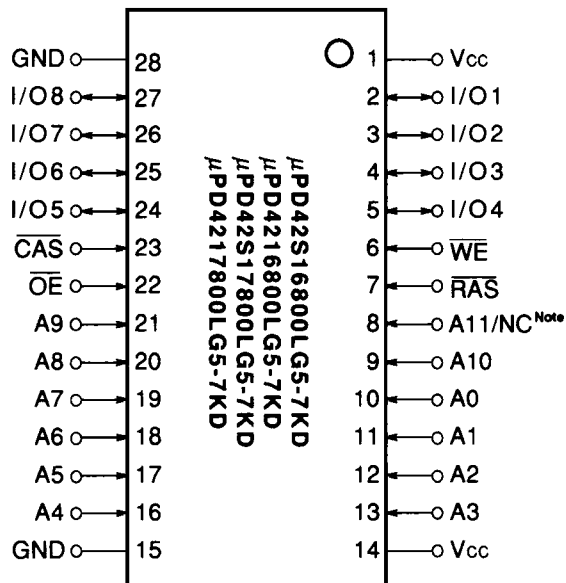
Please refer to "Quality grade on NEC Semiconductor Devices" (Document number I EI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

PIN CONFIGURATIONS (Marking Side)

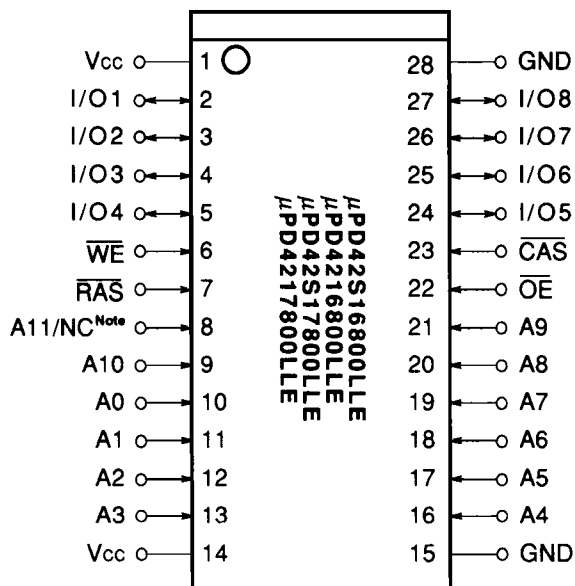
28-pin Plastic TSOP (II)



Reverse bent



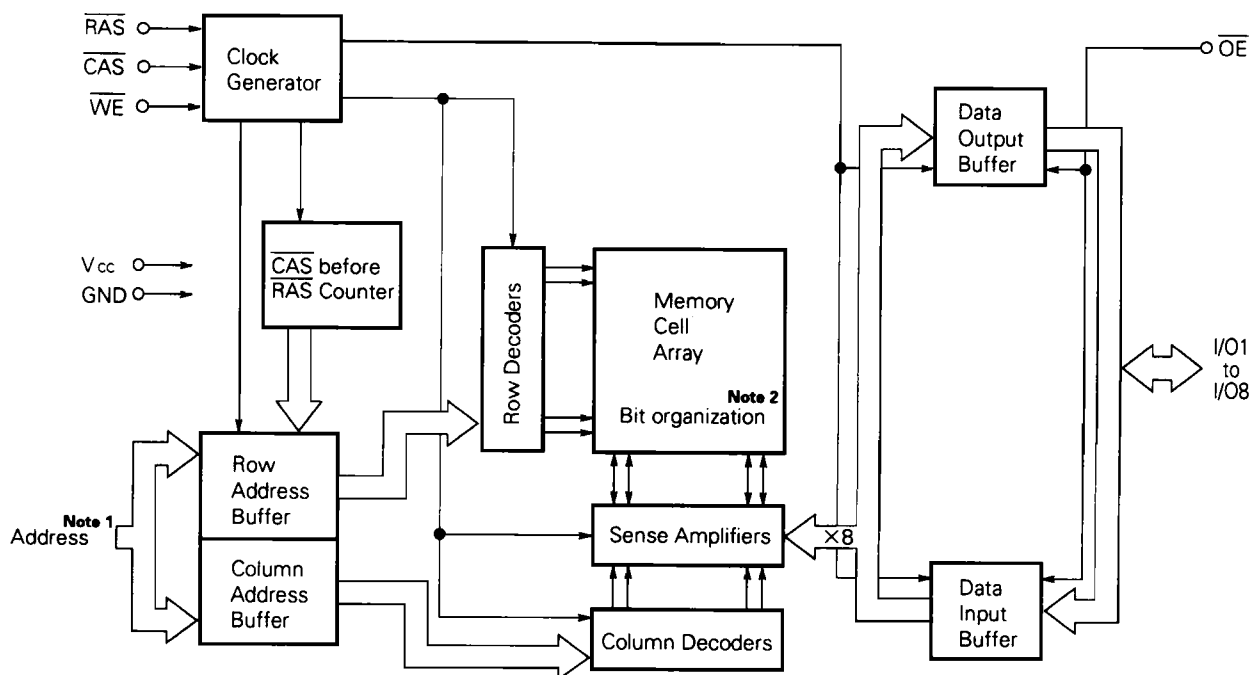
28-pin Plastic SOJ



- A0 to A11 : Address inputs
- I/O1 to I/O8 : Data Inputs/Outputs
- RAS : Row address strobe
- CAS : Column address strobe
- WE : Write enable
- 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
μ PD42S16800L, 4216800L	A0 to A11	A0 to A8
μ PD42S17800L, 4217800L	A0 to A10	A0 to A9

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

μ 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^{Note1} 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 ^{Note1} (Address input)		Address bus. Input total 21-bit of address signal, upper 12/11 ^{Note2} -bit and lower 9/10 ^{Note3} -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

2. 12...μPD42S16800L, 4216800L

3. 9...μPD42S16800L, 4216800L

A10...μPD42S17800L, 4217800L

11...μPD42S17800L, 4217800L

10...μPD42S17800L, 4217800L

ELECTRICAL SPECIFICATIONS Notes1, 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_{opt}		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 ($T_a = +25\text{ }^{\circ}\text{C}$, $f = 1\text{ MHz}$)

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

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[μPD42S17800L, 4217800L]

Parameter		Symbol	Test condition	MIN.	MAX.	Unit	Notes
Operating current		I _{CC1}	$\overline{\text{RAS}}, \overline{\text{CAS}}$ Cycling	$t_{\text{RAC}} = 60 \text{ ns}$	100	mA	3,4
			$t_{\text{RC}} = t_{\text{RC(MIN.)}}$	$t_{\text{RAC}} = 70 \text{ ns}$	90		
			$I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 80 \text{ ns}$	80		
Standby current	μPD42S17800L	I _{CC2}	$V_{\text{IH(MIN.)}} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	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		$V_{\text{IH(MIN.)}} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	2		
			$V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	0.5		
$\overline{\text{RAS}}$ only refresh current		I _{CC3}	$\overline{\text{RAS}}$ Cycling	$t_{\text{RAC}} = 60 \text{ ns}$	100	mA	3,4
			$V_{\text{IH(MIN.)}} \leq \overline{\text{CAS}}$	$t_{\text{RAC}} = 70 \text{ ns}$	90		
			$t_{\text{RC}} = t_{\text{RC(MIN.)}}$	$t_{\text{RAC}} = 80 \text{ ns}$	80		
Operating current (Fast page mode)		I _{CC4}	$\overline{\text{CAS}}$ Cycling	$t_{\text{RAC}} = 60 \text{ ns}$	70	mA	3,4
			$\overline{\text{RAS}} \leq V_{\text{IL(MAX.)}}$	$t_{\text{RAC}} = 70 \text{ ns}$	60		
			$t_{\text{PC}} = t_{\text{PC(MIN.)}}$	$t_{\text{RAC}} = 80 \text{ ns}$	50		
$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh current		I _{CC5}	$\overline{\text{RAS}}$ Cycling,	$t_{\text{RAC}} = 60 \text{ ns}$	100	mA	3,4
			$t_{\text{RC}} = t_{\text{RC(MIN.)}}$	$t_{\text{RAC}} = 70 \text{ ns}$	90		
			$I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 80 \text{ ns}$	80		
$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ long refresh current (2 048 cycles/128 ms, only for μPD42S17800L)		I _{CC6}	Standby : $V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}$ $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh : 2 048 cycles/128 ms $\overline{\text{RAS}}, \overline{\text{CAS}} : 0 \text{ V} \leq V_{\text{IL}} \leq 0.2 \text{ V}$ $V_{\text{CC}} - 0.2 \text{ V} \leq V_{\text{IH}} \leq V_{\text{IH(MAX.)}}$ $\overline{\text{WE}}, \overline{\text{OE}} : V_{\text{IH}}$ 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 _{CC7}	$I_o = 0 \text{ mA}$ $\overline{\text{RAS}}, \overline{\text{CAS}} : 0 \text{ V} \leq V_{\text{IL}} \leq 0.2 \text{ V}$ $V_{\text{CC}} - 0.2 \text{ V} \leq V_{\text{IH}} \leq V_{\text{IH(MAX.)}}$		150	μA	
Input leakage current		I _{I(L)}	$V_i = 0 \text{ to } 3.6 \text{ V}$ all other pins not under test = 0 V	-5	+5	μA	
Output leakage current		I _{O(L)}	Outputs are disabled (Hi-Z) $V_o = 0 \text{ to } 3.6 \text{ V}$	-5	+5	μA	
High level output voltage		V _{OH}	$I_o = -2.0 \text{ mA}$	2.4		V	
Low level output voltage		V _{OL}	$I_o = +2.0 \text{ mA}$		0.4	V	

AC CHARACTERISTICS

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

(1/2)

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

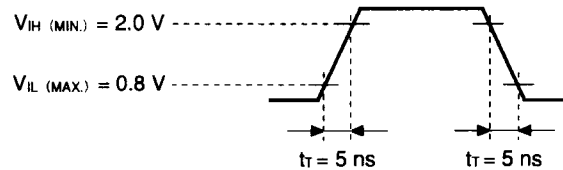
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Parameter	Symbol	t _{RAC} = 60 ns		t _{RAC} = 70 ns		t _{RAC} = 80 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Column Address Setup Time	t _{ASC}	0		0		0		ns	
Column Address Hold Time	t _{CAH}	15		15		15		ns	
Column Address Lead Time Referenced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

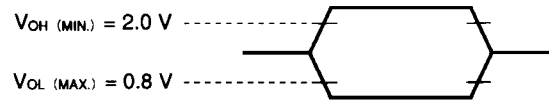
Notes

1. All voltages are referenced to GND.
2. After power-up, wait more than 100 μ 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. Icc1 , Icc3 , Icc4 , Icc5 , and Icc6 depend on trc and tpc . 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 $\text{tr} = 5 \text{ ns}$.
6. AC Characteristics test condition

(1) Input timing specification



(2) Output timing specification

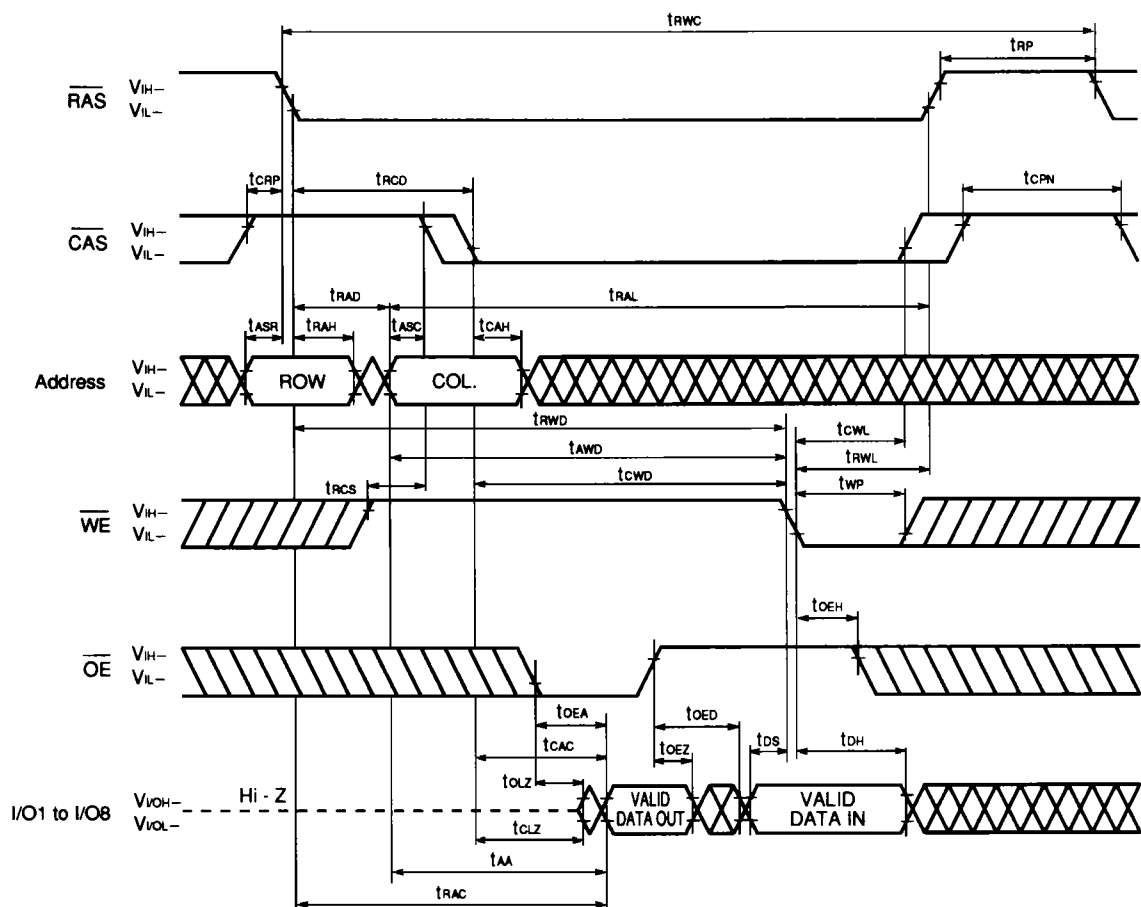
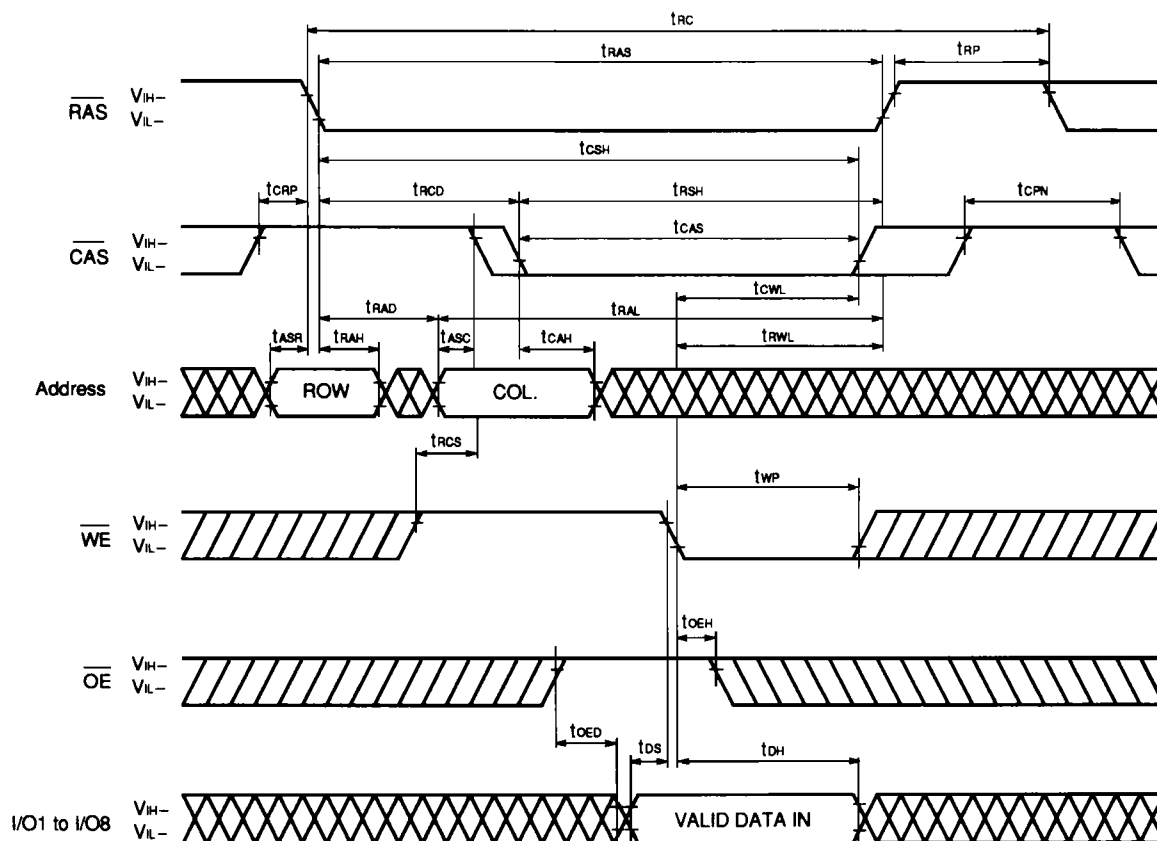


7. The minimum specifications are used only to indicate cycle time at which proper operation over the full temperature range ($T_a = 0$ to 70°C) is assured.
8. In random read cycle, the access time is changed by the conditions of trAD and trCD as follows.

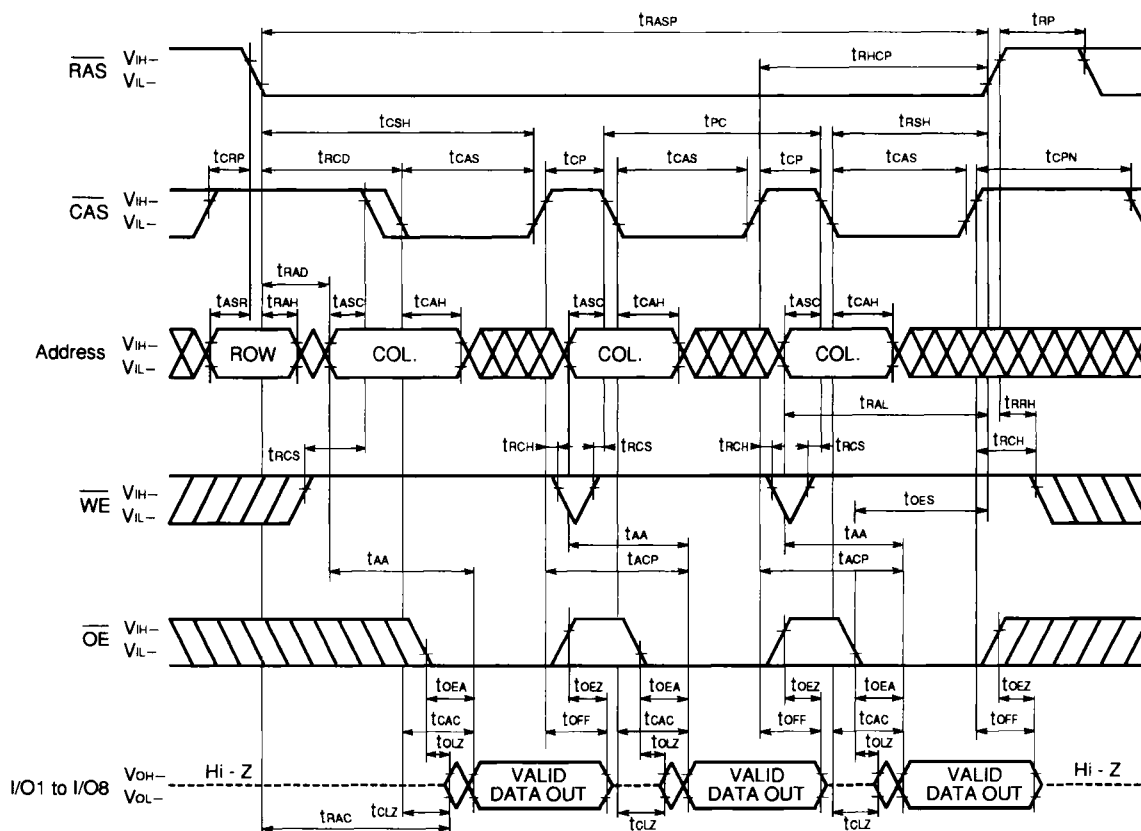
CONDITION	ACCESS TIME
$\text{trAD} \leq \text{trAD (MAX.)}$ and $\text{trCD} \leq \text{trCD (MAX.)}$	trAC (MAX.)
$\text{trAD (MAX.)} < \text{trAD}$ and $\text{trCD} \leq \text{trCD (MAX.)}$	tAA (MAX.)
$\text{trCD (MAX.)} < \text{trCD}$	tCAC (MAX.)

trAD (MAX.) and trCD (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. toFF (MAX.) and toEZ (MAX.) define the time at which the output achieves the open circuit condition and are not referenced to VOH or VOL .
11. tCRP (MIN.) requirement should be applicable for $\overline{\text{RAS}}$ / $\overline{\text{CAS}}$ cycles preceded by any cycles.
12. Either trCH (MIN.) or trRH (MIN.) must be satisfied for a read cycle.
13. tWP (MIN.) is applicable for late write cycle or read modify write cycle. In early write cycles, twCH (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 $\text{twCS} \geq \text{twCS (MIN.)}$, the cycle is an early write cycle and the data out will remain Hi-Z through the entire cycle. If $\text{trWD} \geq \text{trWD (MIN.)}$, $\text{tcWD} \geq \text{tcWD (MIN.)}$, $\text{tAWD} \geq \text{tAWD (MIN.)}$, $\text{tcpWD} \geq \text{tcpWD (MIN.)}$, 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 condition of the data out is indeterminate.
16. This specification is applicable only for μ PD42S16800L and μ PD42S17800L.

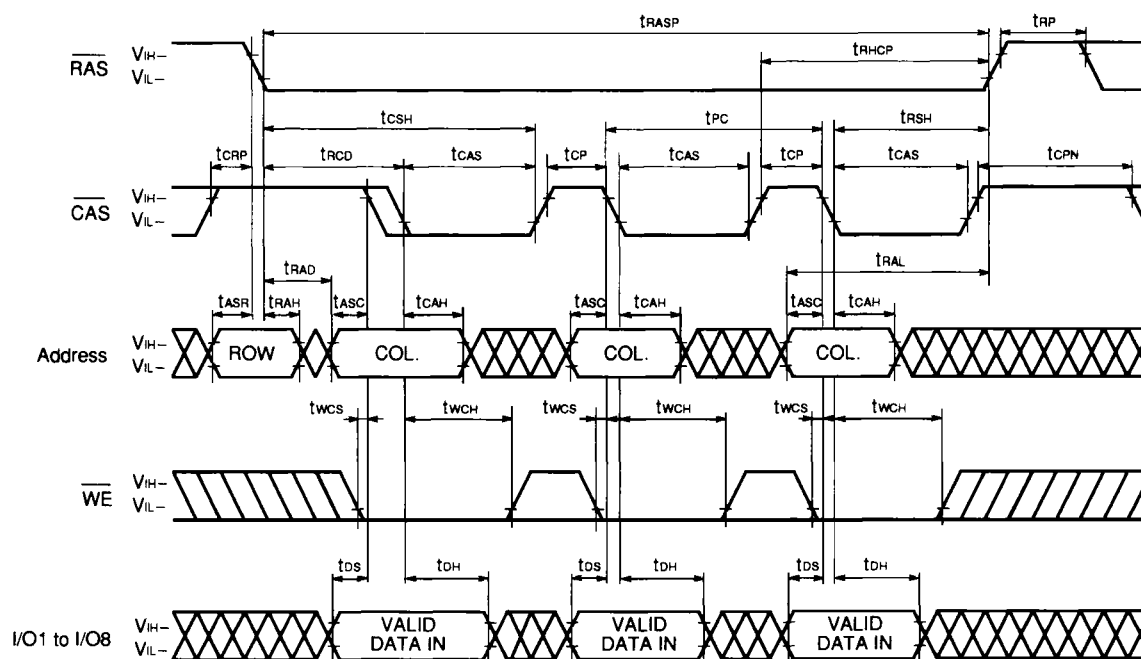


FAST PAGE MODE READ CYCLE



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.

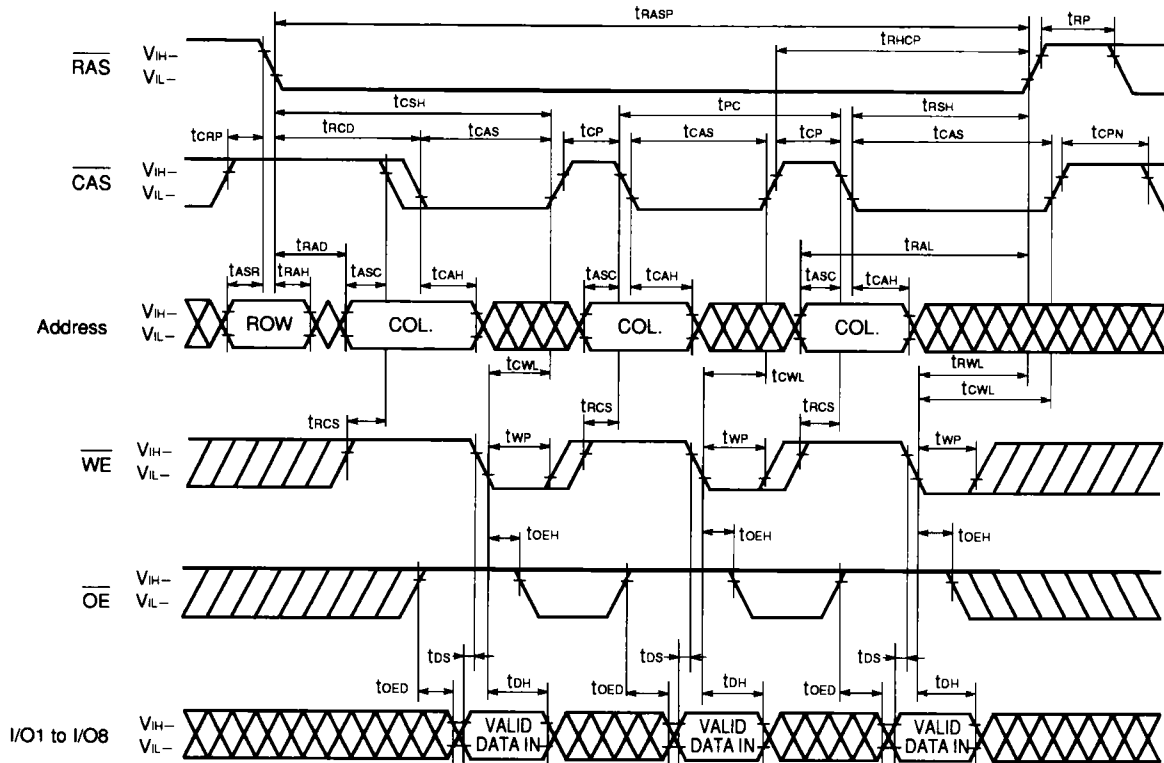
FAST PAGE MODE EARLY WRITE CYCLE



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

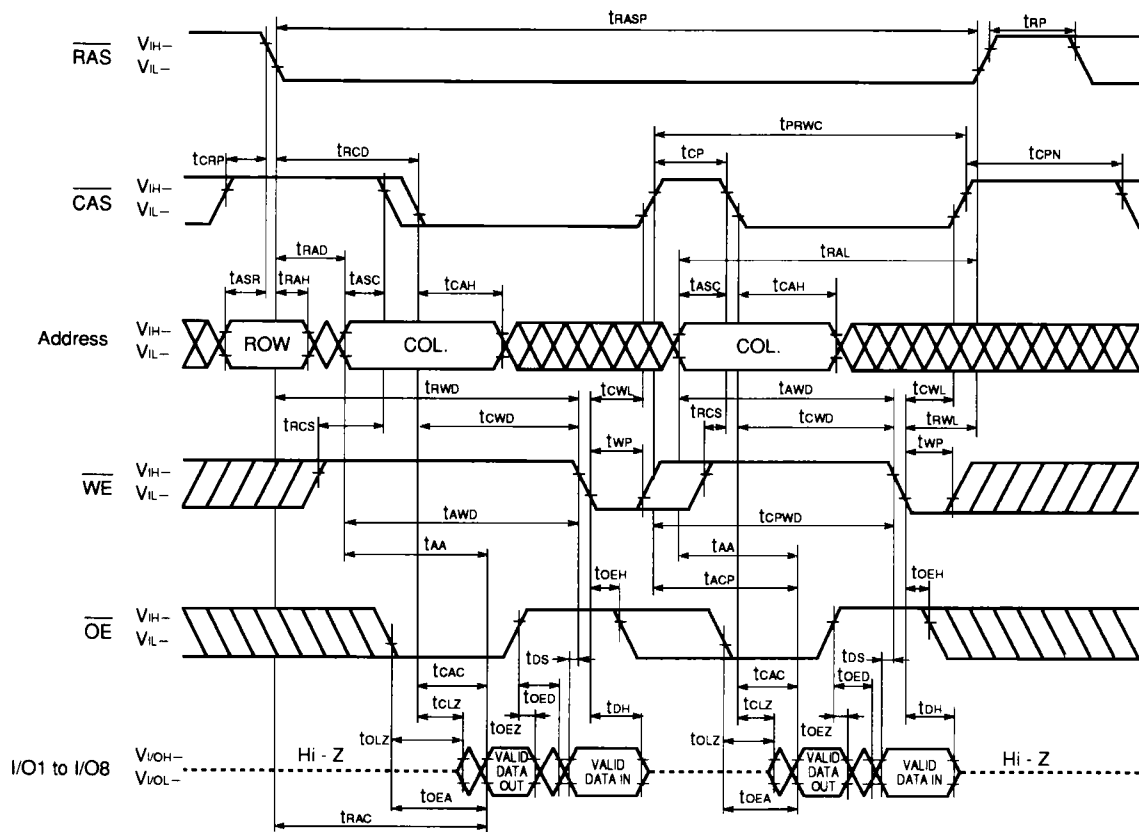
In the fast page mode, read, write and read modify write cycles are available for each of the consecutive CAS cycles within the same RAS cycle.

FAST PAGE MODE LATE WRITE CYCLE



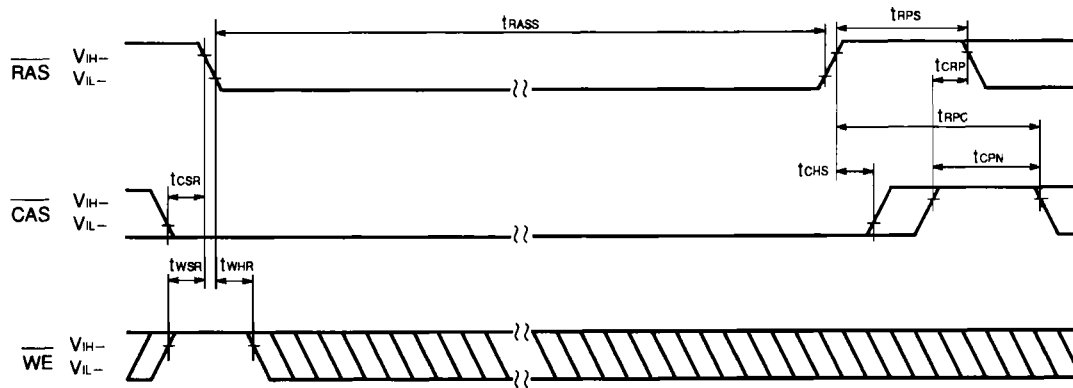
Remark In the fast page mode, read, write and read modify write cycles are available for each of the consecutive CAS cycles within the same RAS cycle.

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 μ PD42S16800L, 42S17800L)



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

How to use $\overline{CAS}$ before $\overline{RAS}$ self refresh mode

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

★ **• When using distributed $\overline{CAS}$ before $\overline{RAS}$ refresh**

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

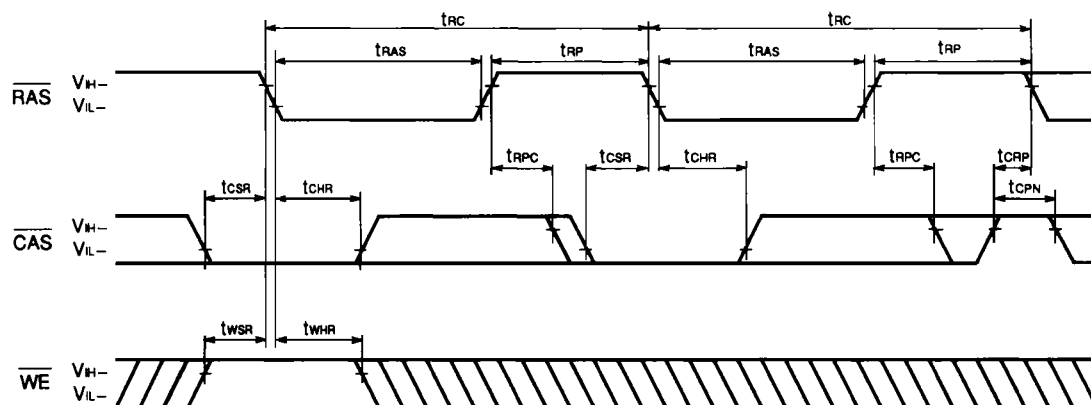
• When using burst $\overline{CAS}$ before $\overline{RAS}$ refresh

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

• When using $\overline{RAS}$ only refresh

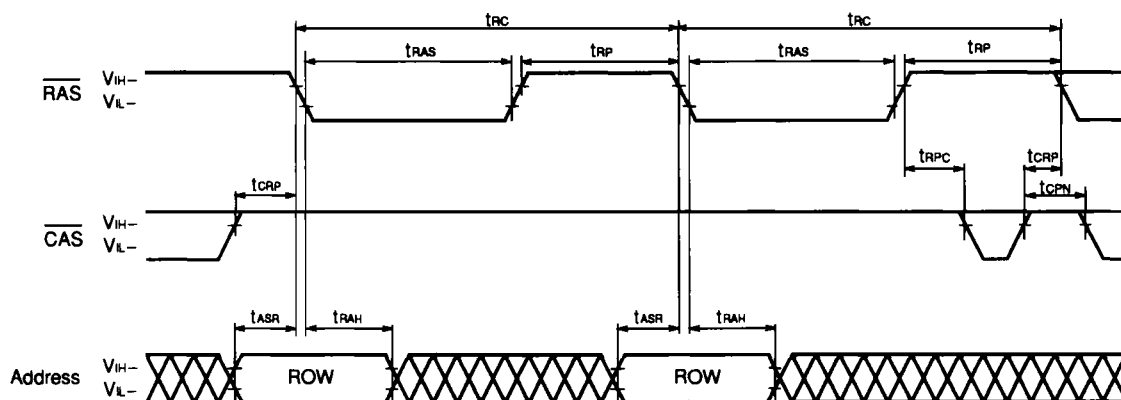
Refresh against all refresh addresses during 64 ms (μ PD42S16800L) or during 32 ms (μ PD42S17800L) before set into the $\overline{CAS}$ before $\overline{RAS}$ self refresh mode and after reset.

CAS BEFORE RAS REFRESH CYCLE



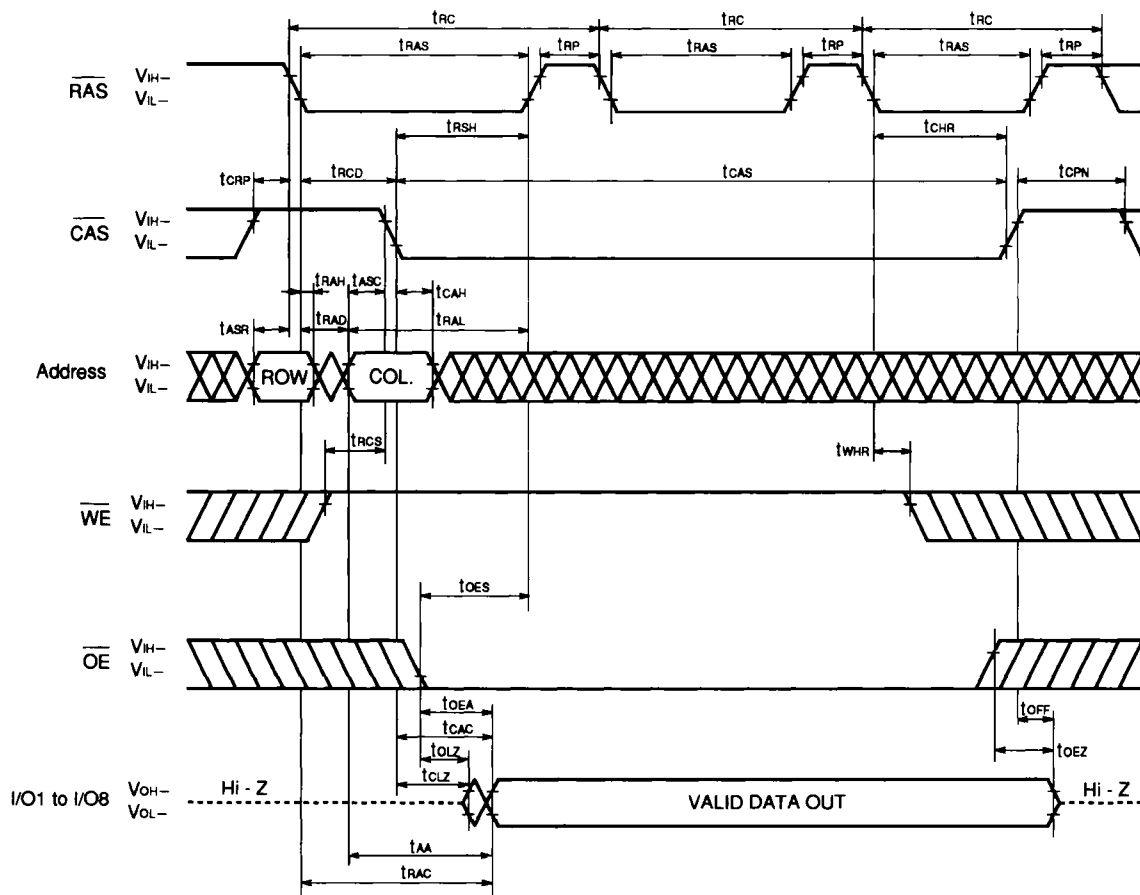
Remark Address, $\overline{OE}$ = Don't care I/O1 to I/O8 = Hi - Z

RAS ONLY REFRESH CYCLE

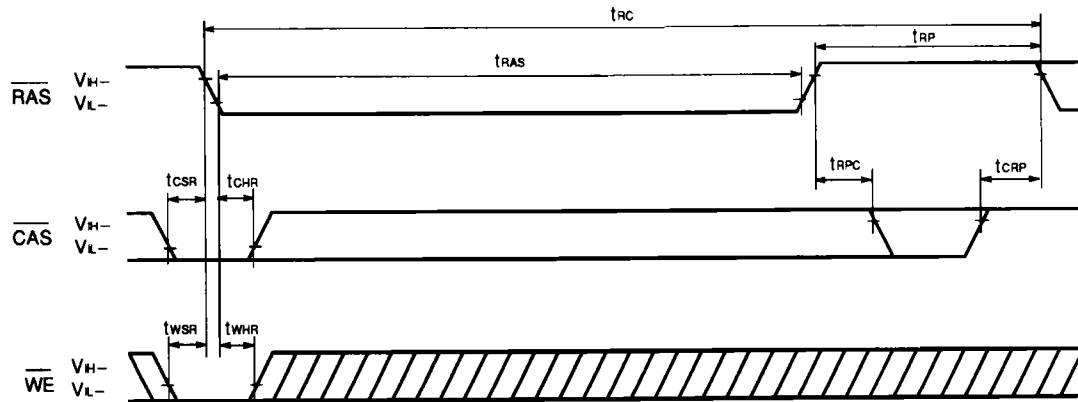


Remark $\overline{WE}$, $\overline{OE}$ = Don't care I/O1 to I/O8 = Hi - Z

HIDDEN REFRESH CYCLE



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



Remark Address, $\overline{\text{OE}}$ = 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 $\overline{\text{CAS}}$ input A0.

1. How to enter TEST MODE

Through TEST MODE SET CYCLE ($\overline{\text{WE}}$ and $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ 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

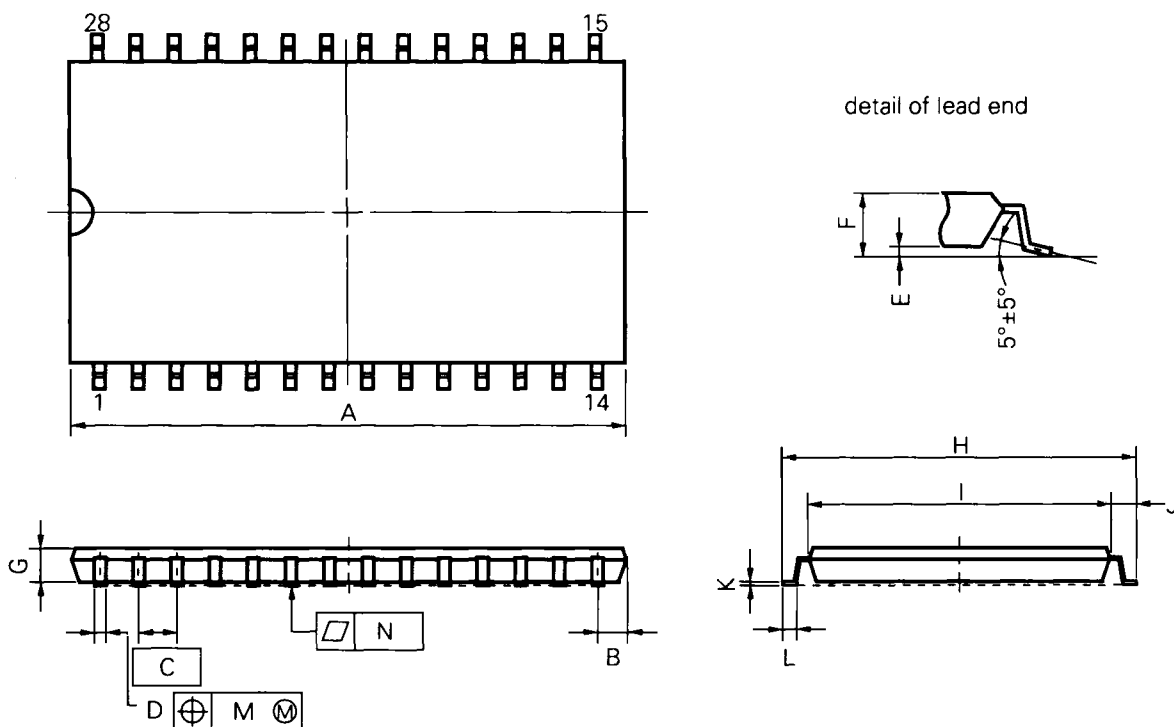
Use normal read cycle or $\overline{\text{WE}}$ and $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh cycle.

4. How to exit from TEST MODE

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

PACKAGE DRAWINGS

28 PIN PLASTIC TSOP(II) (400 mil)



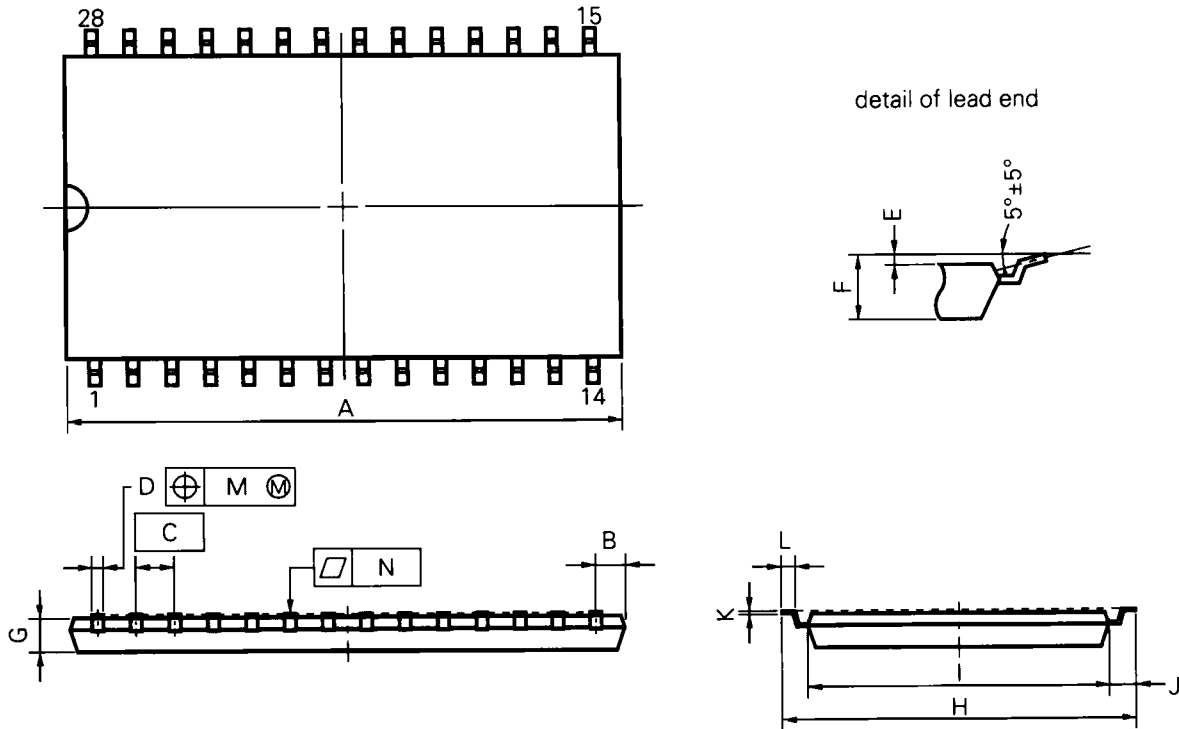
NOTE

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

S28G5-50-7JD2-1

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 ^{+0.004} _{-0.005}
E	0.05±0.05	0.002±0.002
F	1.1 MAX.	0.044 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 ^{+0.009} _{-0.008}
K	0.125 ^{+0.10} _{-0.05}	0.005 ^{+0.004} _{-0.002}
L	0.5±0.1	0.020 ^{+0.004} _{-0.005}
M	0.21	0.009
N	0.10	0.004

28 PIN PLASTIC TSOP(II) (400 mil)



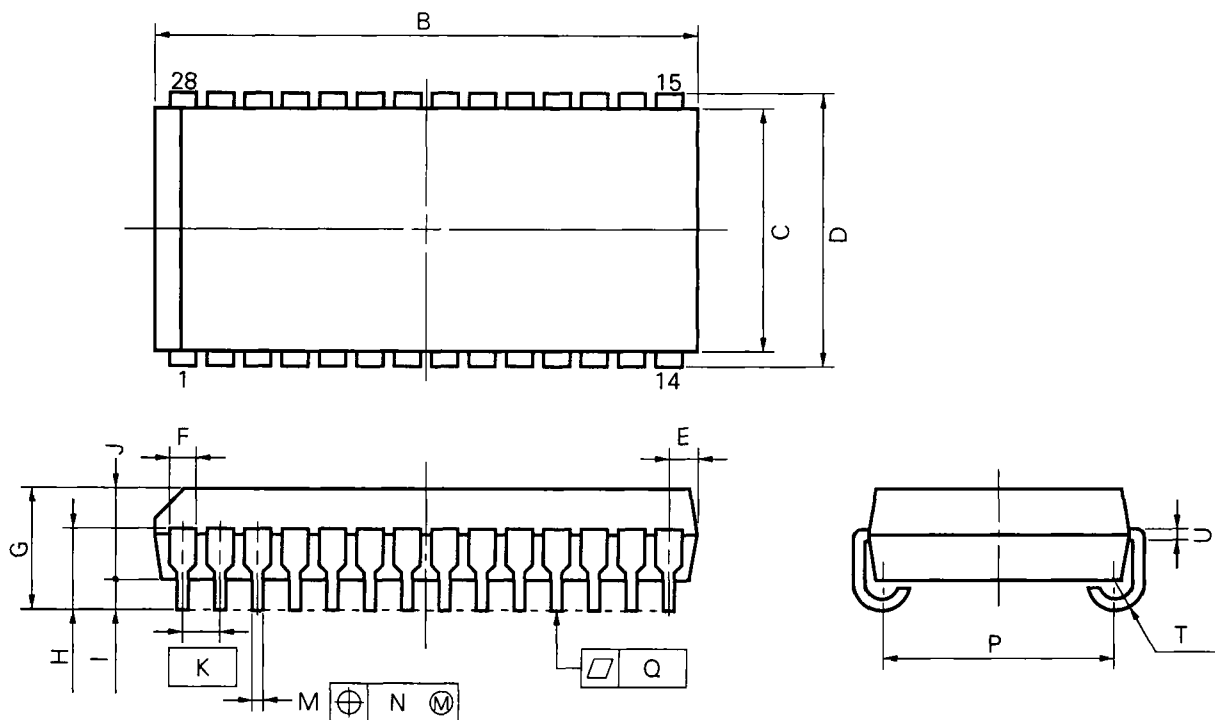
NOTE

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

S28G5-50-7KD2-1

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 ^{+0.004} _{-0.005}
E	0.05±0.05	0.002±0.002
F	1.1 MAX.	0.044 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 ^{+0.009} _{-0.008}
K	0.125 ^{+0.10} _{-0.05}	0.005 ^{+0.004} _{-0.002}
L	0.5±0.1	0.020 ^{+0.004} _{-0.005}
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 ^{+0.2} _{-0.35}	0.735 ^{+0.008} _{-0.013}
C	10.16	0.400
D	11.18±0.2	0.440 ^{+0.008} _{-0.007}
E	1.08±0.15	0.043 ^{+0.006} _{-0.007}
F	0.74	0.029
G	3.5±0.2	0.138 ^{+0.008} _{-0.007}
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 ^{+0.004} _{-0.005}
N	0.12	0.005
P	9.40±0.20	0.370 ^{+0.008} _{-0.007}
Q	0.10	0.004
T	R 0.85	R 0.033
U	0.20 ^{+0.10} _{-0.05}	0.008 ^{+0.004} _{-0.002}

RECOMMENDED SOLDERING CONDITIONS

Please consult with our sales offices for soldering conditions of the μPD42S16800L, 4216800L, 42S17800L, 4217800L.

TYPE OF SURFACE MOUNT DEVICE

μPD42S16800LG5, 4216800LG5, 42S17800LG5, 4217800LG5 : 28-pin Plastic TSOP (II) (400 mil)

μPD42S16800LLE, 4216800LLE, 42S17800LLE, 4217800LLE : 28-pin Plastic SOJ (400 mil)

[MEMO]

NOTES FOR CMOS DEVICES

① PRECAUTION AGAINST ESD FOR SEMICONDUCTORS

Note: Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

② HANDLING OF UNUSED INPUT PINS FOR CMOS

Note: No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS device behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

③ STATUS BEFORE INITIALIZATION OF MOS DEVICES

Note: Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.

[MEMO]

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Application examples recommended by NEC Corporation.

Standard: Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tools, Industrial robots, Audio and Visual equipment, Other consumer products, etc.

Special: Automotive and Transportation equipment, Traffic control systems, Antidisaster systems, Anticrime systems, etc.