

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

#### DESCRIPTION

The  $\mu$ PD42S16800, 4216800, 42S17800, 4217800 are 2 097 152 words by 8 bits dynamic CMOS RAMs. These differ in refresh cycle and the  $\mu$ PD42S16800, 42S17800 can execute  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  self refresh. These are packed in 28-pin plastic TSOP(II) and 28-pin plastic SOJ.

#### FEATURES

- 2 097 152 words by 8 bits organization
- Single +5.0 V $\pm$ 10 % power supply
- Fast page mode
- The  $\mu$ PD42S16800, 42S17800 can execute  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  self refresh

Part number	Refresh cycle	Refresh	Power consumption at standby (MAX.)
$\mu$ PD42S16800	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	1.4 mW (CMOS level input)
$\mu$ PD42S17800	2 048 cycles/128 ms		
$\mu$ PD4216800	4 096 cycles/64 ms	$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh, $\overline{\text{RAS}}$ only refresh, Hidden refresh	5.5 mW (CMOS level input)
$\mu$ PD4217800	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.)
$\mu$ PD42S16800-50, 4216800-50	550 mW	50 ns	90 ns	35 ns
$\mu$ PD42S17800-50, 4217800-50	660 mW			
$\mu$ PD42S16800-60, 4216800-60	495 mW	60 ns	110 ns	40 ns
$\mu$ PD42S17800-60, 4217800-60	605 mW			
$\mu$ PD42S16800-70, 4216800-70	440 mW	70 ns	130 ns	45 ns
$\mu$ PD42S17800-70, 4217800-70	550 mW			
$\mu$ PD42S16800-80, 4216800-80	385 mW	80 ns	150 ns	50 ns
$\mu$ PD42S17800-80, 4217800-80	495 mW			

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

**ORDERING INFORMATION**

Part number	Access time (MAX.)	Package	Refresh
μPD42S16800G5-50	50 ns	28-pin Plastic TSOP(II) (400 mil)	CAS before RAS self refresh CAS before RAS refresh RAS only refresh Hidden refresh
μPD42S17800G5-50			
μPD42S16800G5-60	60 ns		
μPD42S17800G5-60			
μPD42S16800G5-70	70 ns		
μPD42S17800G5-70			
μPD42S16800G5-80	80 ns		
μPD42S17800G5-80			
μPD42S16800LE-50	50 ns	28-pin Plastic SOJ (400 mil)	CAS before RAS self refresh CAS before RAS refresh RAS only refresh Hidden refresh
μPD42S17800LE-50			
μPD42S16800LE-60	60 ns		
μPD42S17800LE-60			
μPD42S16800LE-70	70 ns		
μPD42S17800LE-70			
μPD42S16800LE-80	80 ns		
μPD42S17800LE-80			
μPD4216800G5-50	50 ns	28-pin Plastic TSOP(II) (400 mil)	CAS before RAS refresh RAS only refresh Hidden refresh
μPD4217800G5-50			
μPD4216800G5-60	60 ns		
μPD4217800G5-60			
μPD4216800G5-70	70 ns		
μPD4217800G5-70			
μPD4216800G5-80	80 ns		
μPD4217800G5-80			
μPD4216800LE-50	50 ns	28-pin Plastic SOJ (400 mil)	CAS before RAS refresh RAS only refresh Hidden refresh
μPD4217800LE-50			
μPD4216800LE-60	60 ns		
μPD4217800LE-60			
μPD4216800LE-70	70 ns		
μPD4217800LE-70			
μPD4216800LE-80	80 ns		
μPD4217800LE-80			

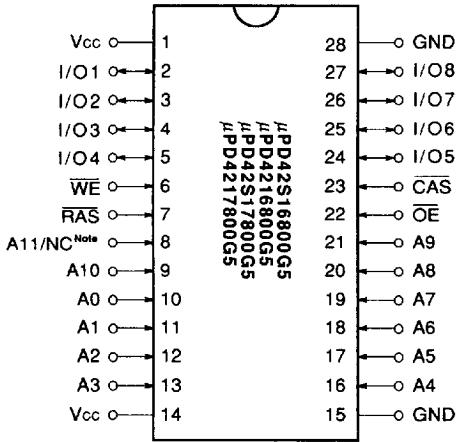
**QUALITY GRADE**

STANDARD

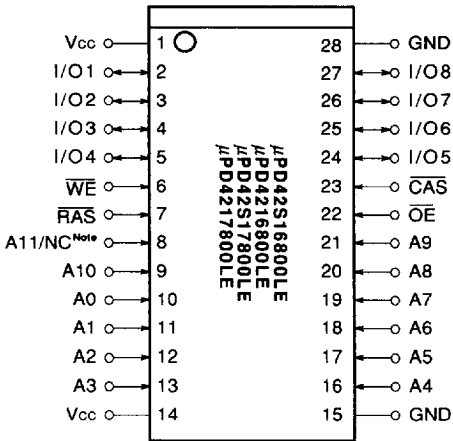
Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

PIN CONFIGURATIONS (Marking side)

28-pin Plastic TSOP (III)



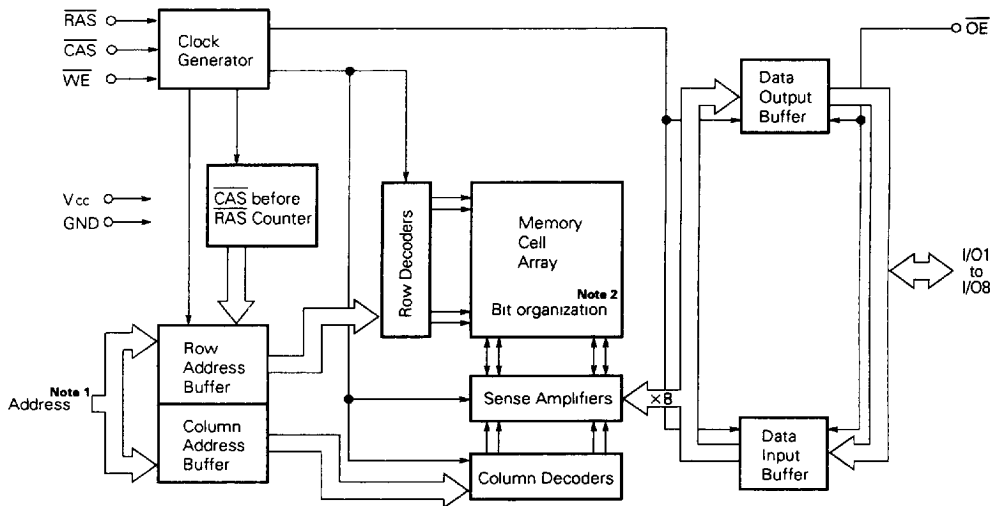
28-pin Plastic SOJ



- 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 ...μPD42S16800, 4216800  
 NC ...μPD42S17800, 4217800 (No connection)

BLOCK DIAGRAM



Notes 1.

Part number	Row address	Column address
μPD42S16800, 4216800	A0 to A11	A0 to A8
μPD42S17800, 4217800	A0 to A10	A0 to A9

2. μPD42S16800, 4216800...4 096×512×8

μPD42S17800, 4217800...2 048×1 024×8

**INPUT/OUTPUT PIN FUNCTIONS**

The μPD42S16800, 4216800, 42S17800, 4217800 have input pins  $\overline{RAS}$ ,  $\overline{CAS}$ ,  $\overline{WE}$ ,  $\overline{OE}$ , A0 to A11/A10<sup>Note1</sup> and input/output pins I/O1 to I/O8.

Pin name	Input/Output	Function
$\overline{RAS}$ (Row address strobe)	Input	$\overline{RAS}$ 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. • $\overline{CAS}$ before $\overline{RAS}$ refresh.
$\overline{CAS}$ (Column address strobe)		$\overline{CAS}$ 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 $\overline{RAS}$ . Then, switch the address bus to column address and activate $\overline{CAS}$ . Each address is taken into the device when $\overline{RAS}$ and $\overline{CAS}$ 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 $\overline{RAS}$ and $\overline{CAS}$ .
$\overline{WE}$ (Write enable)		Write control signal. Write operation is executed by activating $\overline{RAS}$ , $\overline{CAS}$ and $\overline{WE}$ .
$\overline{OE}$ (Output enable)		Read control signal. Read operation can be executed by activating $\overline{RAS}$ , $\overline{CAS}$ and $\overline{OE}$ . If $\overline{WE}$ is activated during read operation, $\overline{OE}$ 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 ... μPD42S16800, 4216800    A10 ... μPD42S17800, 4217800  
 2. 12 ... μPD42S16800, 4216800    11 ... μPD42S17800, 4217800  
 3. 9 ... μPD42S16800, 4216800    10 ... μPD42S17800, 4217800

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**ELECTRICAL SPECIFICATIONS** Notes1, 2

**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 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	$V_{CC}$		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
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
	$C_{I2}$	$\overline{\text{RAS}}$ , $\overline{\text{CAS}}$ , $\overline{\text{WE}}$ , 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)

[μPD42S16800, 4216800]

Parameter		Symbol	Test condition	MIN.	MAX.	Unit	Notes
Operating current		I <sub>CC1</sub>	$\overline{\text{RAS}}, \overline{\text{CAS}}$ Cycling $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 50 \text{ ns}$	100	mA	3,4
				$t_{\text{RAC}} = 60 \text{ ns}$	90		
				$t_{\text{RAC}} = 70 \text{ ns}$	80		
				$t_{\text{RAC}} = 80 \text{ ns}$	70		
Standby current	μPD42S16800	I <sub>CC2</sub>	$V_{\text{IH}(\text{MIN})} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	2	mA	
	μPD4216800		$V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	0.25		
			$V_{\text{IH}(\text{MIN})} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	2		
			$V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	1		
$\overline{\text{RAS}}$ only refresh current		I <sub>CC3</sub>	$\overline{\text{RAS}}$ Cycling $V_{\text{IH}(\text{MIN})} \leq \overline{\text{CAS}}$ $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 50 \text{ ns}$	100	mA	3,4
				$t_{\text{RAC}} = 60 \text{ ns}$	90		
				$t_{\text{RAC}} = 70 \text{ ns}$	80		
				$t_{\text{RAC}} = 80 \text{ ns}$	70		
Operating current (Fast page mode)		I <sub>CC4</sub>	$\overline{\text{CAS}}$ Cycling $\overline{\text{RAS}} \leq V_{\text{IL}(\text{MAX})}$ $t_{\text{PC}} = t_{\text{PC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 50 \text{ ns}$	80	mA	3,4
				$t_{\text{RAC}} = 60 \text{ ns}$	70		
				$t_{\text{RAC}} = 70 \text{ ns}$	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, $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 50 \text{ ns}$	100	mA	3,4
				$t_{\text{RAC}} = 60 \text{ ns}$	90		
				$t_{\text{RAC}} = 70 \text{ ns}$	80		
				$t_{\text{RAC}} = 80 \text{ ns}$	70		
$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ long refresh current (4 096 cycles/128 ms, only for μPD42S16800)		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	$t_{\text{RAS}} \leq 300 \text{ ns}$	450	μA	3,4
				$t_{\text{RAS}} \leq 1 \text{ μs}$	600		
Self refresh current (CAS before RAS self refresh, only for μPD42S16800)		I <sub>CC7</sub>	$I_o = 0 \text{ mA}$ $\overline{\text{RAS}}, \overline{\text{CAS}} : 0 \text{ V} \leq V_{\text{IL}} \leq 0.2 \text{ V}$ $V_{\text{CC}} - 0.2 \text{ V} \leq V_{\text{IH}} \leq V_{\text{IH}(\text{MAX})}$		250	μA	
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>	Outputs are disabled (Hi-Z) $V_o = 0 \text{ to } 5.5 \text{ V}$	-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	

[μPD42S17800, 4217800]

Parameter		Symbol	Test condition	MIN.	MAX.	Unit	Notes
Operating current	I <sub>CC1</sub>	$\overline{\text{RAS}}, \overline{\text{CAS}}$ Cycling $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 50 \text{ ns}$		120	mA	3,4
			$t_{\text{RAC}} = 60 \text{ ns}$		110		
			$t_{\text{RAC}} = 70 \text{ ns}$		100		
			$t_{\text{RAC}} = 80 \text{ ns}$		90		
Standby current	μPD42S17800	I <sub>CC2</sub>	$V_{\text{IH}(\text{MIN})} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	2	mA	
			$V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	0.25		
	μPD4217800		$V_{\text{IH}(\text{MIN})} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	2		
			$V_{\text{CC}} - 0.2 \text{ V} \leq \overline{\text{RAS}}, \overline{\text{CAS}}$	$I_o = 0 \text{ mA}$	1		
$\overline{\text{RAS}}$ only refresh current	I <sub>CC3</sub>	$\overline{\text{RAS}}$ Cycling $V_{\text{IH}(\text{MIN})} \leq \overline{\text{CAS}}$ $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 50 \text{ ns}$		120	mA	3,4
			$t_{\text{RAC}} = 60 \text{ ns}$		110		
			$t_{\text{RAC}} = 70 \text{ ns}$		100		
			$t_{\text{RAC}} = 80 \text{ ns}$		90		
Operating current (Fast page mode)	I <sub>CC4</sub>	$\overline{\text{CAS}}$ Cycling $\overline{\text{RAS}} \leq V_{\text{IL}(\text{MAX})}$ $t_{\text{PC}} = t_{\text{PC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 50 \text{ ns}$		80	mA	3,4
			$t_{\text{RAC}} = 60 \text{ ns}$		70		
			$t_{\text{RAC}} = 70 \text{ ns}$		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, $t_{\text{RC}} = t_{\text{RC}(\text{MIN})}$ $I_o = 0 \text{ mA}$	$t_{\text{RAC}} = 50 \text{ ns}$		120	mA	3,4
			$t_{\text{RAC}} = 60 \text{ ns}$		110		
			$t_{\text{RAC}} = 70 \text{ ns}$		100		
			$t_{\text{RAC}} = 80 \text{ ns}$		90		
$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ long refresh current (2 048 cycles/128 ms, only for μPD42S17800)	I <sub>CC6</sub>	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 $\overline{\text{RAS}}, \overline{\text{CAS}}: 0 \text{ V} \leq V_{\text{IL}} \leq 0.2 \text{ V}$ $V_{\text{CC}} - 0.2 \text{ V} \leq V_{\text{IH}} \leq V_{\text{IH}(\text{MAX})}$ $\overline{\text{WE}}, \overline{\text{OE}}: V_{\text{IH}}$ Address input: Don't care Output: Open	$t_{\text{RAS}} \leq 300 \text{ ns}$		400	μA	3,4
			$t_{\text{RAS}} \leq 1 \text{ μs}$		500		
Self refresh current ( $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ self refresh, only for μPD42S17800)	I <sub>CC7</sub>	$I_o = 0 \text{ mA}$ $\overline{\text{RAS}}, \overline{\text{CAS}}: 0 \text{ V} \leq V_{\text{IL}} \leq 0.2 \text{ V}$ $V_{\text{CC}} - 0.2 \text{ V} \leq V_{\text{IH}} \leq V_{\text{IH}(\text{MAX})}$			250	μA	
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>	Outputs are disabled (Hi-Z) $V_o = 0 \text{ to } 5.5 \text{ V}$		-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	



AC CHARACTERISTICS

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

(1/2)

Parameter	Symbol	t <sub>RAC</sub> = 50 ns		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.	MIN.	MAX.		
Random Read or Write Cycle Time	t <sub>RC</sub>	90		110		130		150		ns	7
Read Modify Write Cycle Time	t <sub>RWC</sub>	140		160		180		200		ns	7
Fast Page Mode Cycle Time (Read or Write)	t <sub>PC</sub>	35		40		45		50		ns	7
Read Modify Write Cycle Time (Fast Page Mode)	t <sub>PRWC</sub>	80		85		90		100		ns	7
Access Time from RAS	t <sub>RAC</sub>		50		60		70		80	ns	8, 9
Access Time from CAS (Falling Edge)	t <sub>CAC</sub>		13		15		18		20	ns	8, 9
Access Time from Column Address	t <sub>AA</sub>		25		30		35		40	ns	8, 9
Access Time from CAS Precharge	t <sub>ACP</sub>		30		35		40		45	ns	9
Access Time from OE	t <sub>OEA</sub>		13		15		18		20	ns	9
RAS to Column Address Delay Time	t <sub>RAD</sub>	13	25	15	30	15	35	17	40	ns	8
CAS-Data Setup Time	t <sub>CLZ</sub>	0		0		0		0		ns	9
OE-Data Setup Time	t <sub>OLZ</sub>	0		0		0		0		ns	9
Output Buffer Turn-off Delay (CAS)	t <sub>OFF</sub>	0	10	0	13	0	15	0	15	ns	10
OE-Data Delay Time	t <sub>OED</sub>	10		13		15		15		ns	
Output Buffer Turn-off Delay (OE)	t <sub>OEZ</sub>	0	10	0	13	0	15	0	15	ns	10
OE Command Hold Time	t <sub>OEH</sub>	0		0		0		0		ns	
OE to RAS Inactive Setup Time	t <sub>OES</sub>	0		0		0		0		ns	
Transition Time (Rise and Fall)	t <sub>T</sub>	3	50	3	50	3	50	3	50	ns	
RAS Precharge Time	t <sub>RP</sub>	30		40		50		60		ns	
RAS Pulse Width (Random Read, Write Cycle)	t <sub>RAS</sub>	50	10 000	60	10 000	70	10 000	80	10 000	ns	
RAS Pulse Width (Fast Page Mode)	t <sub>RASP</sub>	50	125 000	60	125 000	70	125 000	80	125 000	ns	
RAS Hold Time	t <sub>RSH</sub>	13		15		18		20		ns	
CAS Pulse Width	t <sub>CAS</sub>	13	10 000	15	10 000	18	10 000	20	10 000	ns	
CAS Hold Time	t <sub>CSH</sub>	50		60		70		80		ns	
RAS to CAS Delay Time	t <sub>RCD</sub>	18	32	20	45	20	50	25	60	ns	8
CAS to RAS Precharge Time	t <sub>CRP</sub>	5		5		5		5		ns	11
CAS Precharge Time	t <sub>CPN</sub>	8		10		10		10		ns	
CAS Precharge Time (Fast Page Mode)	t <sub>CP</sub>	8		10		10		10		ns	
RAS Precharge CAS Hold Time	t <sub>RPC</sub>	5		5		5		5		ns	
RAS Hold Time from CAS Precharge	t <sub>RHCP</sub>	30		35		40		45		ns	
Row Address Setup Time	t <sub>ASR</sub>	0		0		0		0		ns	
Row Address Hold Time	t <sub>RAH</sub>	8		10		10		12		ns	

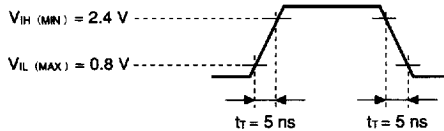
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Parameter	Symbol	t <sub>RAC</sub> = 50 ns		t <sub>RAC</sub> = 60 ns		t <sub>RAC</sub> = 70 ns		t <sub>RAC</sub> = 80 ns		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Column Address Setup Time	t <sub>ASC</sub>	0		0		0		0		ns	
Column Address Hold Time	t <sub>CAH</sub>	13		15		15		15		ns	
Column Address Lead Time Referenced to $\overline{\text{RAS}}$	t <sub>RAL</sub>	25		30		35		40		ns	
Read Command Setup Time	t <sub>RCS</sub>	0		0		0		0		ns	
Read Command Hold Time Referenced to $\overline{\text{RAS}}$	t <sub>RRH</sub>	0		0		0		0		ns	12
Read Command Hold Time Referenced to $\overline{\text{CAS}}$	t <sub>RCH</sub>	0		0		0		0		ns	12
Write Command Hold Time Referenced to $\overline{\text{CAS}}$	t <sub>WCH</sub>	8		10		10		15		ns	13
Write Command Pulse Width	t <sub>W<sub>P</sub></sub>	8		10		10		15		ns	13
Data-in Setup Time	t <sub>DS</sub>	0		0		0		0		ns	14
Data-in Hold Time	t <sub>DH</sub>	10		10		15		15		ns	14
$\overline{\text{WE}}$ Command Setup Time	t <sub>WCS</sub>	0		0		0		0		ns	15
$\overline{\text{CAS}}$ to $\overline{\text{WE}}$ Delay Time	t <sub>CWD</sub>	33		38		43		45		ns	15
$\overline{\text{RAS}}$ to $\overline{\text{WE}}$ Delay Time	t <sub>RWD</sub>	70		83		95		105		ns	15
$\overline{\text{CAS}}$ Precharge Delay Time Referenced to $\overline{\text{WE}}$ (Fast Page Mode)	t <sub>CPWD</sub>	50		58		65		70		ns	15
Column Address Delay Time Referenced to $\overline{\text{WE}}$	t <sub>AWD</sub>	45		53		60		65		ns	15
Write Command Lead Time Referenced to $\overline{\text{RAS}}$	t <sub>RWL</sub>	18		20		20		20		ns	
Write Command Lead Time Referenced to $\overline{\text{CAS}}$	t <sub>CWL</sub>	13		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		5		ns	
$\overline{\text{CAS}}$ Hold Time for $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh	t <sub>CHR</sub>	10		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		100		μs	16
$\overline{\text{RAS}}$ Precharge Time ( $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Self Refresh Cycle)	t <sub>RPS</sub>	90		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		-50		ns	16
$\overline{\text{WE}}$ Setup Time	t <sub>WSR</sub>	10		10		10		10		ns	
$\overline{\text{WE}}$ Hold Time	t <sub>WHR</sub>	15		15		15		15		ns	
Refresh Time	μPD42S16800, 42S17800		128		128		128		128	ms	16
	μPD4216800	t <sub>REF</sub>	64		64		64		64		
	μPD4217800		32		32		32		32		

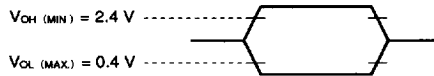
Notes

1. All voltages are referenced to GND.
2. After power-up, wait more than 100 μs 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  $t_{rc}$  and  $t_{pc}$ . Specified values are obtained with outputs open.
4. Address can be changed once or less while  $\overline{\text{RAS}} = V_{IL}$  and  $\overline{\text{CAS}} = V_{IH}$ .
5. AC measurements assume  $t_T = 5$  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  $t_{RAD}$  and  $t_{RCD}$  as follows.

CONDITION	ACCESS TIME
$t_{RAD} \leq t_{RAD} (MAX.)$ and $t_{RCD} \leq t_{RCD} (MAX.)$	$t_{RAC} (MAX.)$
$t_{RAD} (MAX.) < t_{RAD}$ and $t_{RCD} \leq t_{RCD} (MAX.)$	$t_{AA} (MAX.)$
$t_{RCD} (MAX.) < t_{RCD}$	$t_{CAC} (MAX.)$

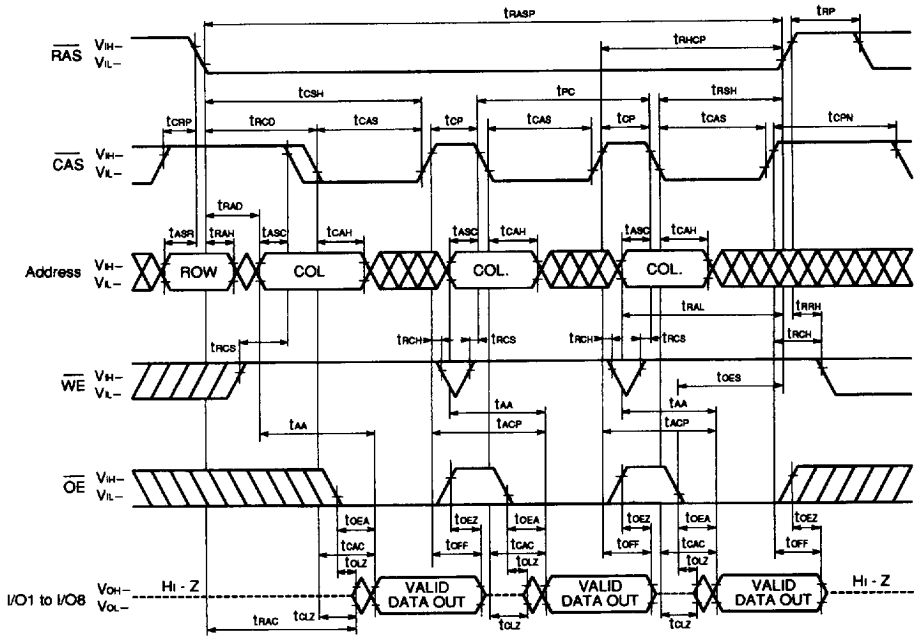
$t_{RAD} (MAX.)$  and  $t_{RCD} (MAX.)$  indicate the points which the access time changes and are not the limits of operation.

9. Loading conditions are 2 TTL and 100 pF.
10.  $t_{OFF} (MAX.)$  and  $t_{OEZ} (MAX.)$  define the time at which the output achieves the open circuit condition and are not referenced to  $V_{OH}$  or  $V_{OL}$ .
11.  $t_{CRP} (MIN.)$  requirement should be applicable for  $\overline{\text{RAS}} / \overline{\text{CAS}}$  cycles preceded by any cycles.
12. Either  $t_{RCH} (MIN.)$  or  $t_{RRH} (MIN.)$  must be satisfied for a read cycle.
13.  $t_{WP} (MIN.)$  is applicable for late write cycle or read modify write cycle. In early write cycles,  $t_{WCH} (MIN.)$  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  $t_{WCS} \geq t_{WCS} (MIN.)$ , the cycle is an early write cycle and the data out will remain Hi-Z through the entire cycle. If  $t_{RDW} \geq t_{RDW} (MIN.)$ ,  $t_{CWD} \geq t_{CWD} (MIN.)$ ,  $t_{AWD} \geq t_{AWD} (MIN.)$ ,  $t_{CPWD} \geq t_{CPWD} (MIN.)$ , 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 condition is met, the condition of the data out is indeterminate.
16. This specification is applicable only for μPD42S16800 and μPD42S17800.



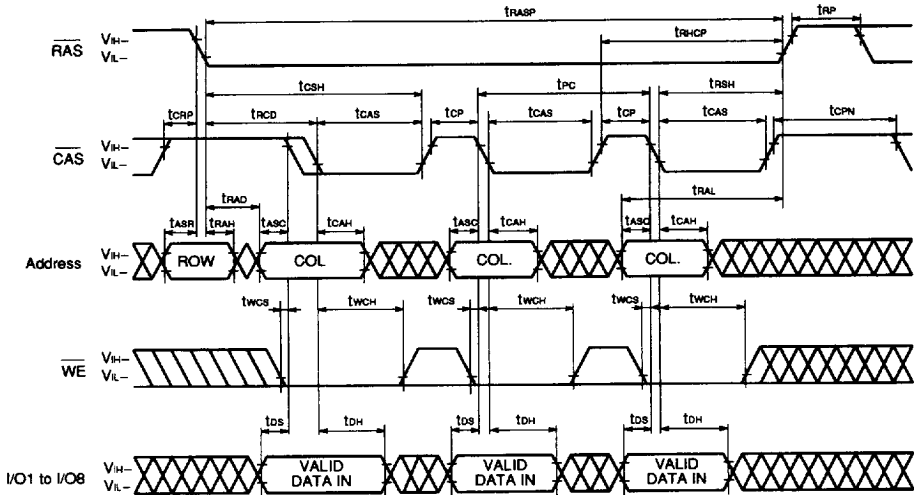


**FAST PAGE MODE READ CYCLE**



**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.

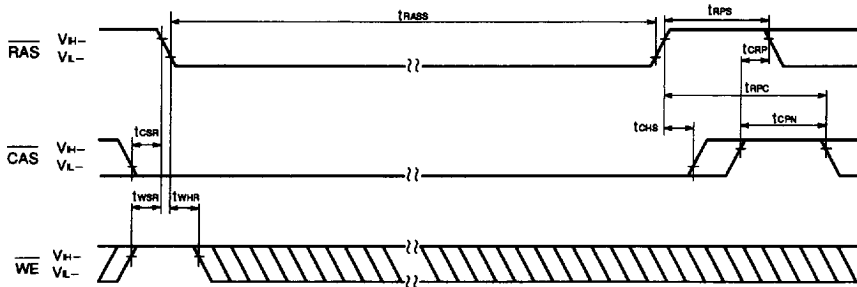
**FAST PAGE MODE EARLY WRITE CYCLE**



**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.



**CAS BEFORE RAS SELF REFRESH CYCLE (Only for the  $\mu$ PD42S16800, 42S17800)**



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 ( $\mu$ PD42S16800) or 2 048 times ( $\mu$ PD42S17800) during 128 ms before set into the CAS before RAS self refresh mode and after reset.

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

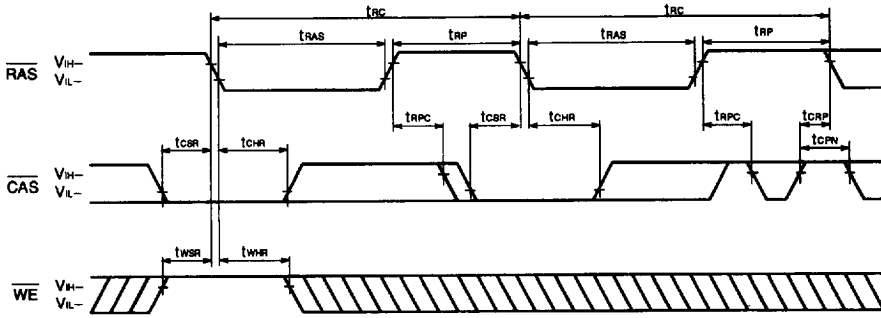
Refresh 4 096 times during 64 ms ( $\mu$ PD42S16800) or 2 048 times during 32 ms ( $\mu$ PD42S17800) before set into the CAS before RAS self refresh mode and after reset).

• **When using RAS only refresh**

Refresh against all refresh addresses during 64 ms ( $\mu$ PD42S16800) or during 32ms ( $\mu$ PD42S17800) before set into the CAS before RAS self refresh mode and after reset.

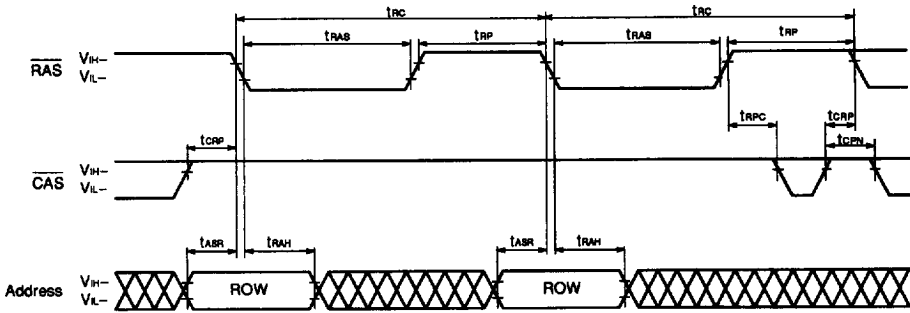


**CAS BEFORE RAS REFRESH CYCLE**



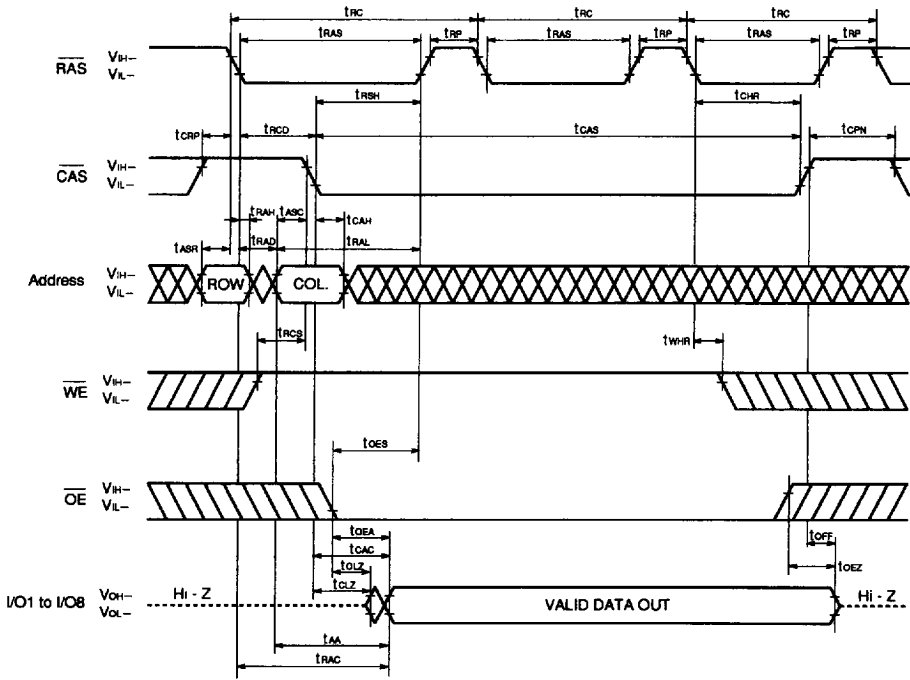
Remark Address,  $\overline{OE}$  = Don't care I/O1 to I/O8 = Hi - Z

**RAS ONLY REFRESH CYCLE**

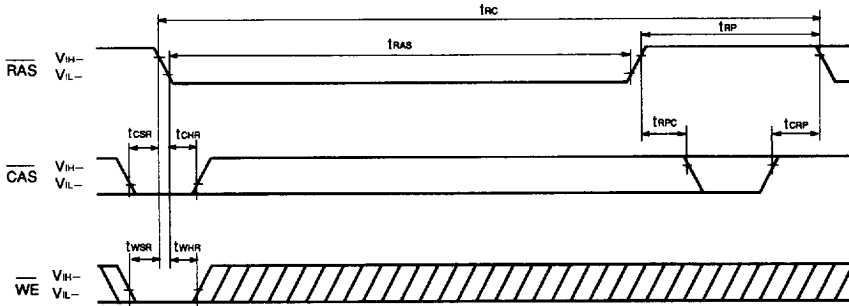


Remark  $\overline{WE}$ ,  $\overline{OE}$  = Don't care I/O1 to I/O8 = Hi - Z

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**

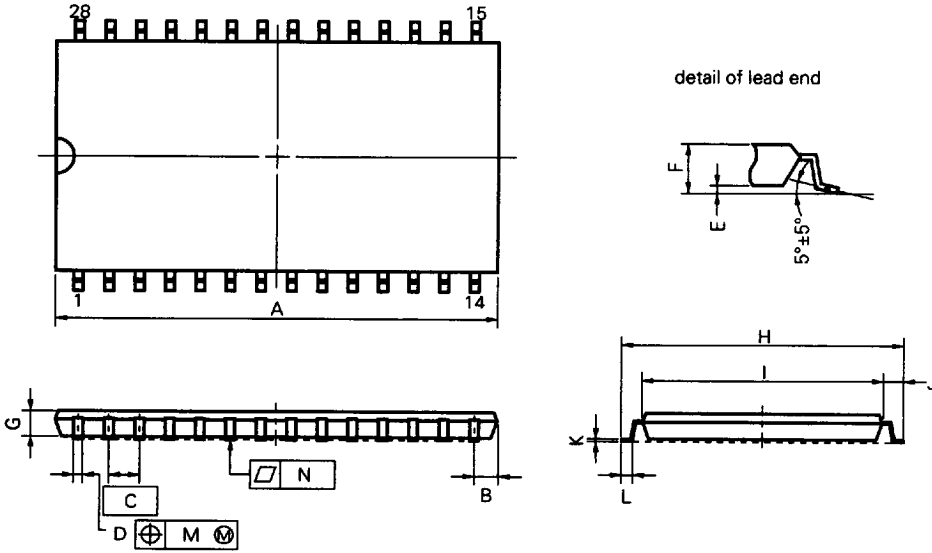
Use normal read cycle or  $\overline{WE}$  and  $\overline{CAS}$  before  $\overline{RAS}$  refresh cycle.

**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)



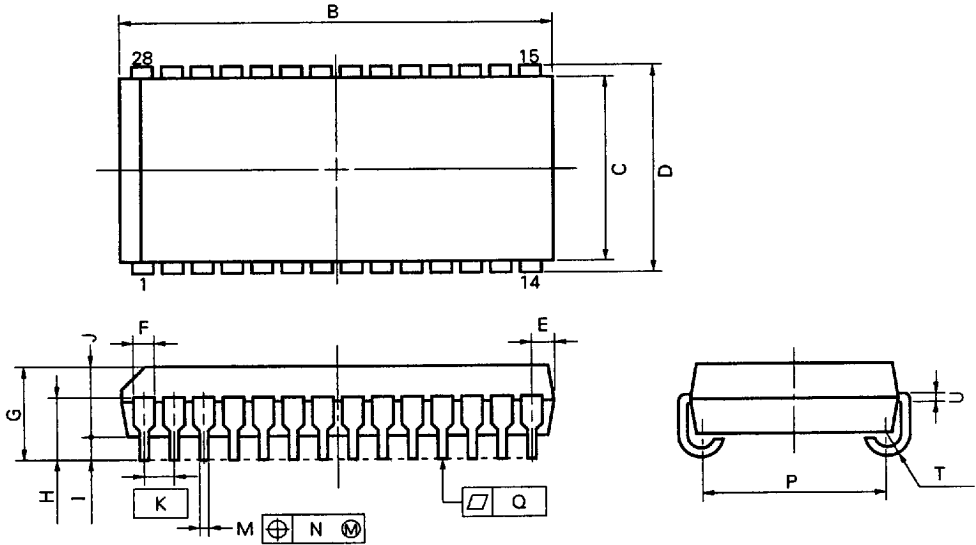
NOTE

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 <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 μPD42S16800, 4216800, 42S17800, 4217800.

**TYPE OF SURFACE MOUNT DEVICE**

μPD42S16800G5, 4216800G5, 42S17800G5, 4217800G5 : 28-pin Plastic TSOP(II) (400 mil)

μPD42S16800LE, 4216800LE, 42S17800LE, 4217800LE : 28-pin Plastic SOJ (400 mil)