

**4M-BIT CMOS FAST SRAM  
256K-WORD BY 16-BIT****Description**

The  $\mu$ PD434016AL is a high speed, low power, 4,194,304 bits (262,144 words by 16 bits) CMOS static RAM.

Operating supply voltage is  $3.3\text{ V} \pm 0.3\text{ V}$ .

The  $\mu$ PD434016AL is packaged in 44-pin plastic SOJ and 44-pin plastic TSOP (II).

**Features**

- 262,144 words by 16 bits organization
- Fast access time : 15, 17, 20 ns (MAX.)
- Byte data control : /LB (I/O1 to I/O8), /UB (I/O9 to I/O16)
- Output Enable input for easy application
- Single +3.3 V power supply

**Ordering Information**

Part number	Package	Access time ns (MAX.)	Supply current mA (MAX.)	
			At operating	At standby
$\mu$ PD434016ALLE-A15	44-pin plastic SOJ (10.16 mm (400))	15	190	5
$\mu$ PD434016ALLE-A17		17	180	
$\mu$ PD434016ALLE-A20		20	170	
$\mu$ PD434016ALG5-A15-7JF	44-pin plastic TSOP (II) (10.16 mm (400)) (Normal bent)	15	190	
$\mu$ PD434016ALG5-A17-7JF		17	180	
$\mu$ PD434016ALG5-A20-7JF		20	170	

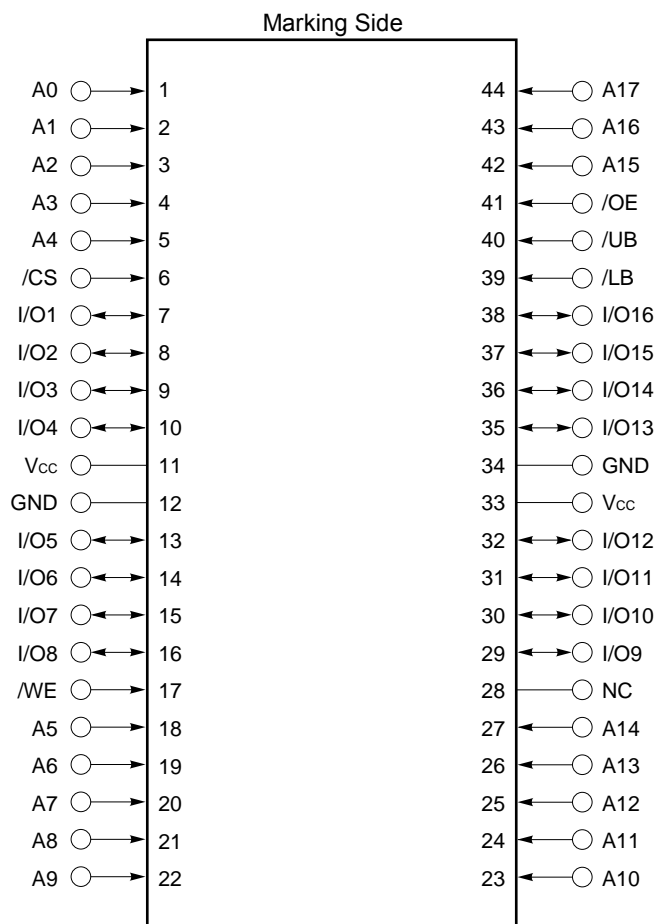
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Pin Configuration

/xxx indicates active low signal.

44-pin plastic SOJ (10.16 mm (400))  
[ μPD434016ALLE ]

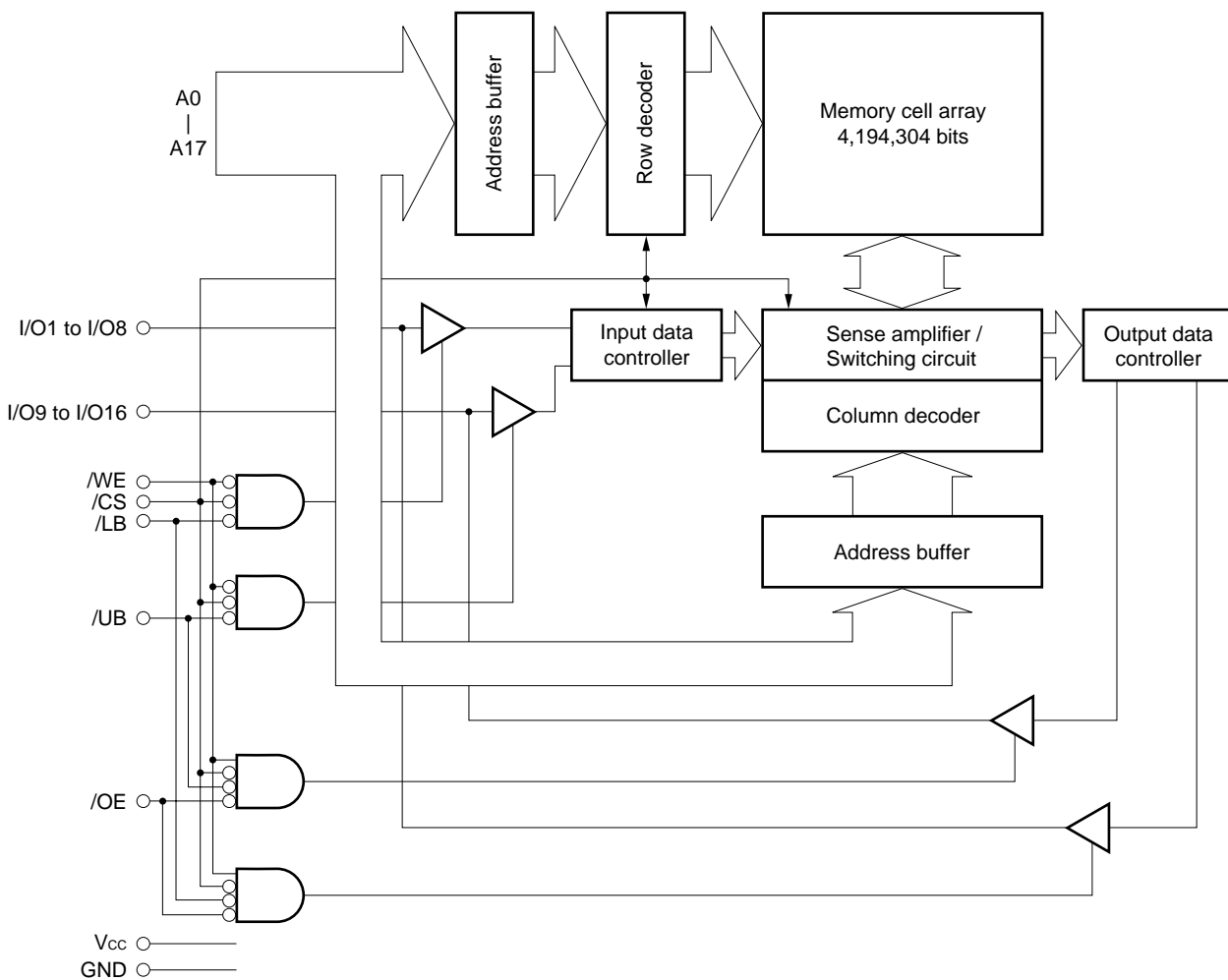
44-pin plastic TSOP (II) (10.16 mm (400)) (Normal bent)  
[ μPD434016ALG5-7JF ]



- A0 to A17 : Address Inputs
- I/O1 to I/O16 : Data Inputs / Outputs
- /CS : Chip Select
- /WE : Write Enable
- /OE : Output Enable
- /LB, /UB : Byte data select
- Vcc : Power supply
- GND : Ground
- NC : No connection

**Remark** Refer to **Package Drawings** for the 1-pin index mark.

Block Diagram



Truth Table

/CS	/OE	/WE	/LB	/UB	Mode	I/O		Supply current
						I/O1 to I/O8	I/O9 to I/O16	
H	×	×	×	×	Not selected	High-Z	High-Z	I <sub>SB</sub>
L	L	H	L	L	Read	D <sub>OUT</sub>	D <sub>OUT</sub>	I <sub>CC</sub>
			L	H		D <sub>OUT</sub>	High-Z	
			H	L		High-Z	D <sub>OUT</sub>	
L	×	L	L	L	Write	D <sub>IN</sub>	D <sub>IN</sub>	
			L	H		D <sub>IN</sub>	High-Z	
			H	L		High-Z	D <sub>IN</sub>	
L	H	H	×	×	Output disable	High-Z	High-Z	
			L	×		×	High-Z	High-Z

Remark × : Don't care

**Electrical Specifications**

**Absolute Maximum Ratings**

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	V <sub>CC</sub>		-0.5 <sup>Note</sup> to +4.6	V
Input / Output voltage	V <sub>T</sub>		-0.5 <sup>Note</sup> to +4.6	V
Operating ambient temperature	T <sub>A</sub>		0 to 70	°C
Storage temperature	T <sub>stg</sub>		-55 to +125	°C

**Note** -2.0 V (MIN.) (pulse width : 2 ns)

**Caution** Exposing the device to stress above those listed in Absolute Maximum Rating 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 <sub>CC</sub>		3.0	3.3	3.6	V
High level input voltage	V <sub>IH</sub>		2.2		V <sub>CC</sub> +0.3	V
Low level input voltage	V <sub>IL</sub>		-0.3 <sup>Note</sup>		+0.8	V
Operating ambient temperature	T <sub>A</sub>		0		70	°C

**Note** -2.0 V (MIN.) (pulse width : 2 ns)

**DC Characteristics (Recommended Operating Conditions Unless Otherwise Noted)**

Parameter	Symbol	Test condition	MIN.	TYP.	MAX.	Unit
Input leakage current	I <sub>LI</sub>	V <sub>IN</sub> = 0 V to V <sub>CC</sub>	-2		+2	μA
Output leakage current	I <sub>LO</sub>	V <sub>I/O</sub> = 0 V to V <sub>CC</sub> , /CS = V <sub>IH</sub> or /OE = V <sub>IH</sub> or /WE = V <sub>IL</sub> or /LB = V <sub>IH</sub> or /UB = V <sub>IH</sub>	-2		+2	μA
Operating supply current	I <sub>CC</sub>	/CS = V <sub>IL</sub> , I <sub>I/O</sub> = 0 mA, Minimum cycle time	Cycle time : 15 ns		190	mA
			Cycle time : 17 ns		180	
			Cycle time : 20 ns		170	
Standby supply current	I <sub>SB</sub>	/CS = V <sub>IH</sub> , V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>			50	mA
	I <sub>SB1</sub>	/CS ≥ V <sub>CC</sub> - 0.2 V, V <sub>IN</sub> ≤ 0.2 V or V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2 V			5	
High level output voltage	V <sub>OH</sub>	I <sub>OH</sub> = -4.0 mA	2.4			V
Low level output voltage	V <sub>OL</sub>	I <sub>OL</sub> = +8.0 mA			0.4	V

**Remarks 1.** V<sub>IN</sub> : Input voltage

V<sub>I/O</sub> : Input / Output voltage

**2.** These DC characteristics are in common regardless of package types.

**Capacitance (T<sub>A</sub> = 25 °C, f = 1 MHz)**

Parameter	Symbol	Test condition	MIN.	TYP.	MAX.	Unit
Input capacitance	C <sub>IN</sub>	V <sub>IN</sub> = 0 V			6	pF
Input / Output capacitance	C <sub>I/O</sub>	V <sub>I/O</sub> = 0 V			10	pF

**Remarks 1.** V<sub>IN</sub> : Input voltage

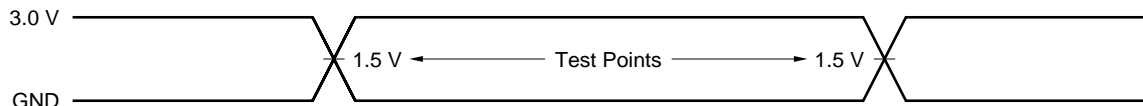
V<sub>I/O</sub> : Input / Output voltage

**2.** These parameters are periodically sampled and not 100% tested.

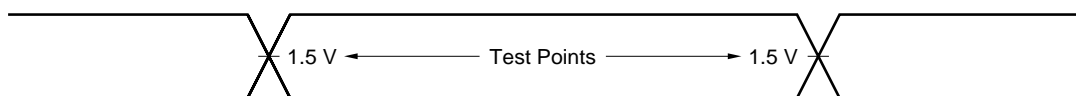
AC Characteristics (Recommended Operating Conditions Unless Otherwise Noted)

AC Test Conditions

Input Waveform (Rise and Fall Time ≤ 3 ns)



Output Waveform

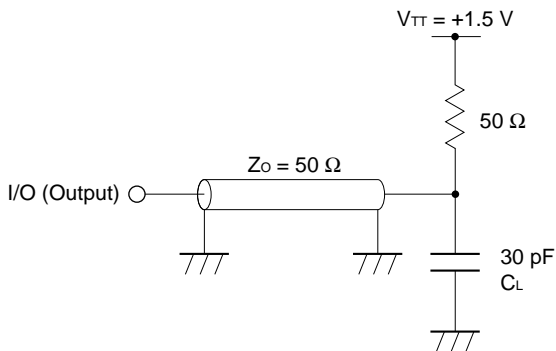


Output Load

AC characteristics directed with the note should be measured with the output load shown in **Figure 1** or **Figure 2**.

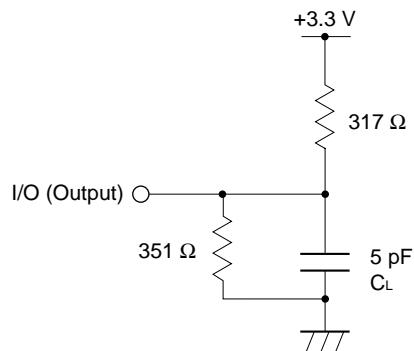
**Figure 1**

(for  $t_{AA}$ ,  $t_{ACS}$ ,  $t_{OE}$ ,  $t_{ABD}$ ,  $t_{OH}$ )



**Figure 2**

(for  $t_{CLZ}$ ,  $t_{OLZ}$ ,  $t_{BLZ}$ ,  $t_{CHZ}$ ,  $t_{OHZ}$ ,  $t_{BHZ}$ ,  $t_{WHZ}$ ,  $t_{OW}$ )



**Remark** C<sub>L</sub> includes capacitances of the probe and jig, and stray capacitances.

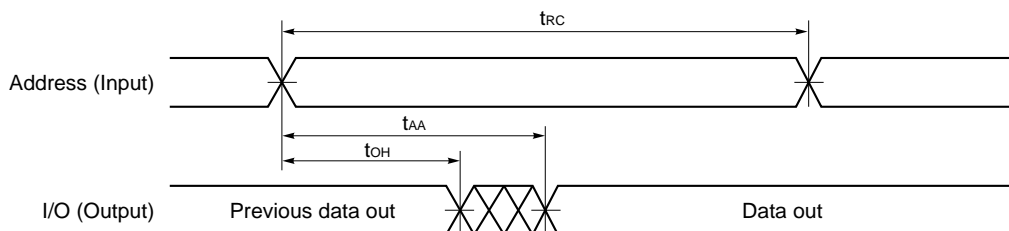
**Read Cycle**

Parameter	Symbol	-A15		-A17		-A20		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Read cycle time	t <sub>RC</sub>	15		17		20		ns	
Address access time	t <sub>AA</sub>		15		17		20	ns	1
/CS access time	t <sub>ACS</sub>		15		17		20	ns	
/OE access time	t <sub>OE</sub>		7		8		10	ns	
/LB, /UB access time	t <sub>ABD</sub>		7		8		10	ns	
Output hold from address change	t <sub>OH</sub>	3		3		3		ns	
/CS to output in low impedance	t <sub>CLZ</sub>	3		3		3		ns	2, 3
/OE to output in low impedance	t <sub>OLZ</sub>	0		0		0		ns	
/LB, /UB to output in low impedance	t <sub>BLZ</sub>	0		0		0		ns	
/CS to output in high impedance	t <sub>CHZ</sub>		7		8		8	ns	
/OE to output hold in high impedance	t <sub>OHZ</sub>		7		8		8	ns	
/LB, /UB to output hold in high impedance	t <sub>BHZ</sub>		7		8		8	ns	

- Notes**
1. See the output load shown in **Figure 1**.
  2. Transition is measured at ± 200 mV from steady-state voltage with the output load shown in **Figure 2**.
  3. These parameters are periodically sampled and not 100% tested.

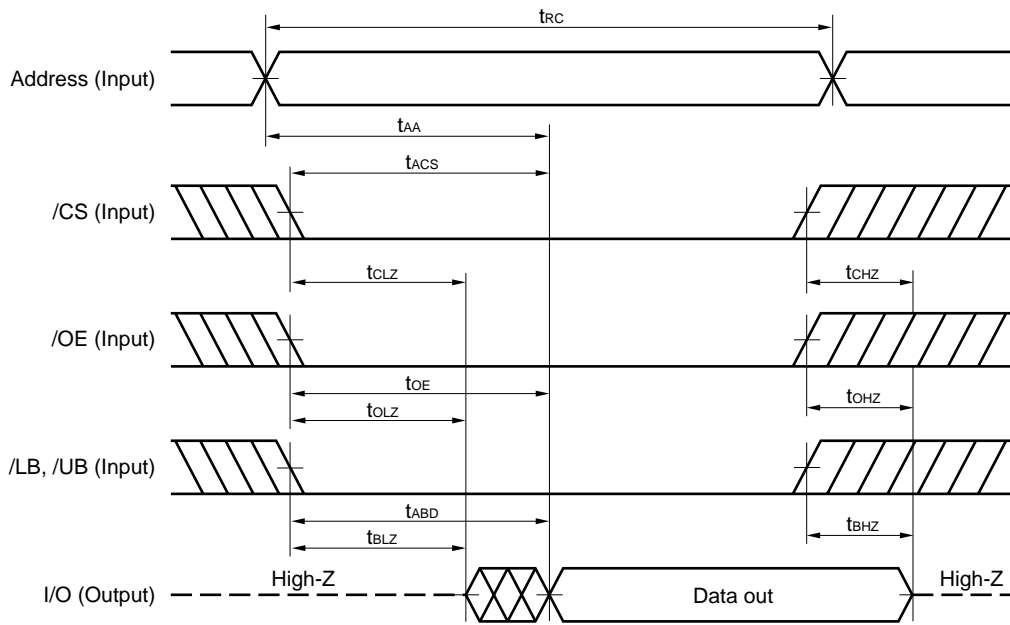
**Remark** These AC characteristics are in common regardless of package types.

**Read Cycle Timing Chart 1 (Address Access)**



- Remarks**
1. In read cycle, /WE should be fixed to high level.
  2. /CS = /OE = /LB (or /UB) = V<sub>IL</sub>

Read Cycle Timing Chart 2 (/CS Access)



**Caution** Address valid prior to or coincident with /CS low level input.

**Remark** In read cycle, /WE should be fixed to high level.



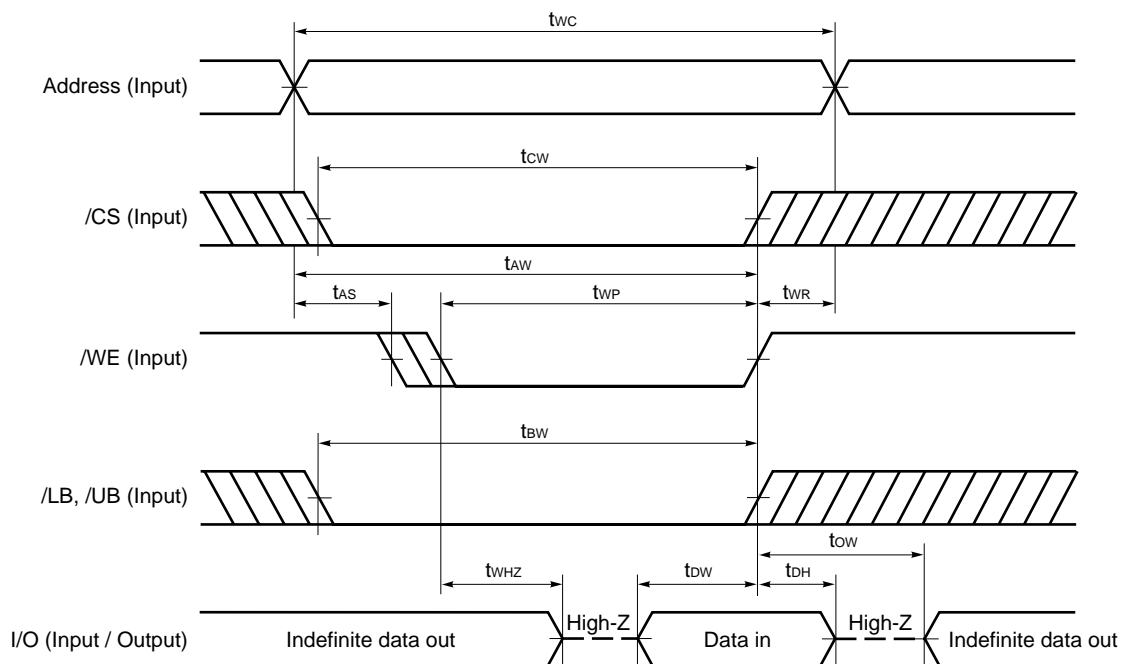
Write Cycle

Parameter	Symbol	-A15		-A17		-A20		Unit	Notes
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Write cycle time	$t_{wc}$	15		17		20		ns	
/CS to end of write	$t_{cw}$	10		11		12		ns	
Address valid to end of write	$t_{aw}$	10		11		12		ns	
Write pulse width	$t_{wp}$	10		11		12		ns	
/LB, /UB to end of write	$t_{bw}$	10		11		12		ns	
Data valid to end of write	$t_{dw}$	7		8		9		ns	
Data hold time	$t_{dh}$	0		0		0		ns	
Address setup time	$t_{as}$	0		0		0		ns	
Write recovery time	$t_{wr}$	1		1		1		ns	
/WE to output in high impedance	$t_{whz}$		7		8		8	ns	1, 2
Output active from end of write	$t_{ow}$	3		3		3		ns	

- Notes**
1. Transition is measured at ± 200 mV from steady-state voltage with the output load shown in **Figure 2**.
  2. These parameters are periodically sampled and not 100% tested.

**Remark** These AC characteristics are in common regardless of package types.

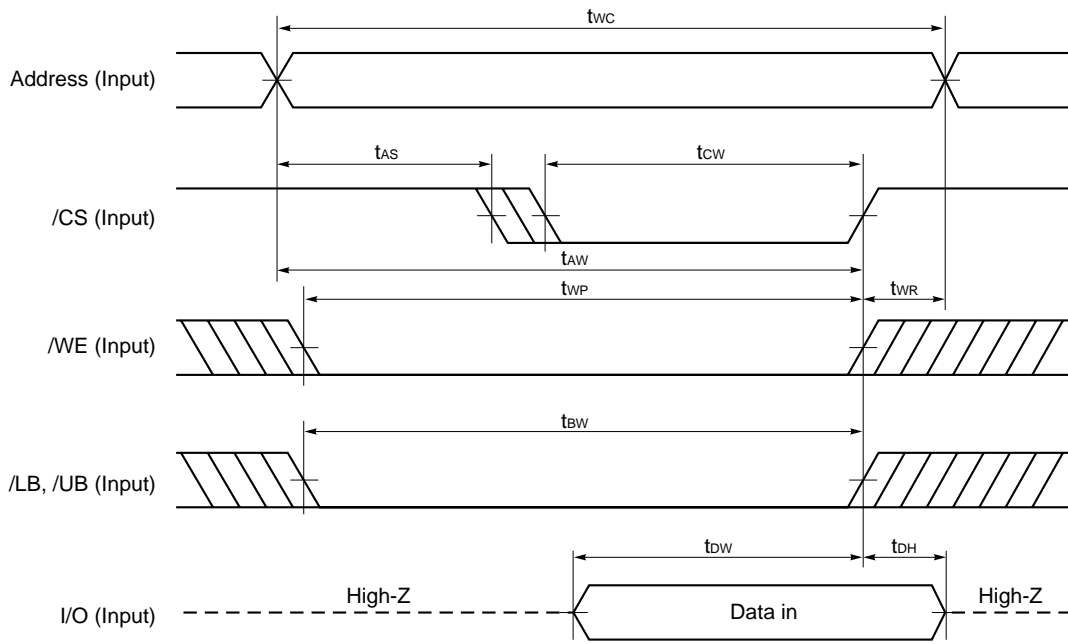
Write Cycle Timing Chart 1 (/WE Controlled)



**Caution** /CS or /WE should be fixed to high level during address transition.

- Remarks**
1. Write operation is done during the overlap time of a low level /CS, a low level /WE and a low level /LB (or low level /UB).
  2. During  $t_{whz}$ , I/O pins are in the output state, therefore the input signals must not be applied to the output.
  3. When /WE is at low level, the I/O pins are always high impedance. When /WE is at high level, read operation is executed. Therefore /OE should be at high level to make the I/O pins high impedance.

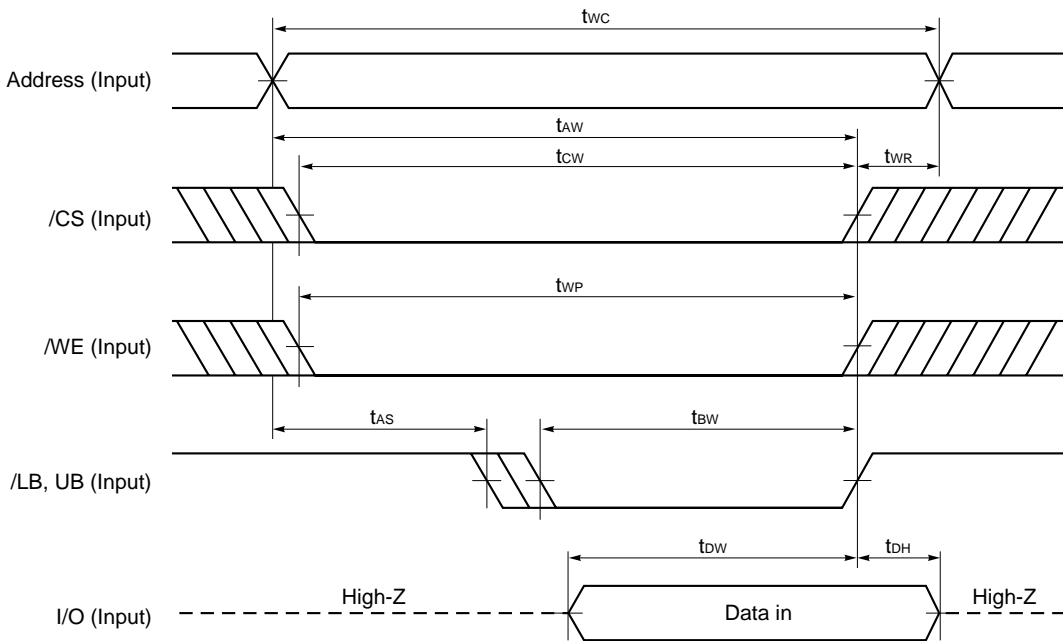
Write Cycle Timing Chart 2 (/CS Controlled)



**Caution** /CS or /WE should be fixed to high level during address transition.

**Remark** Write operation is done during the overlap time of a low level /CS, a low level /WE and a low level /LB (or low level /UB).

Write Cycle Timing Chart 3 (/LB, /UB Controlled)

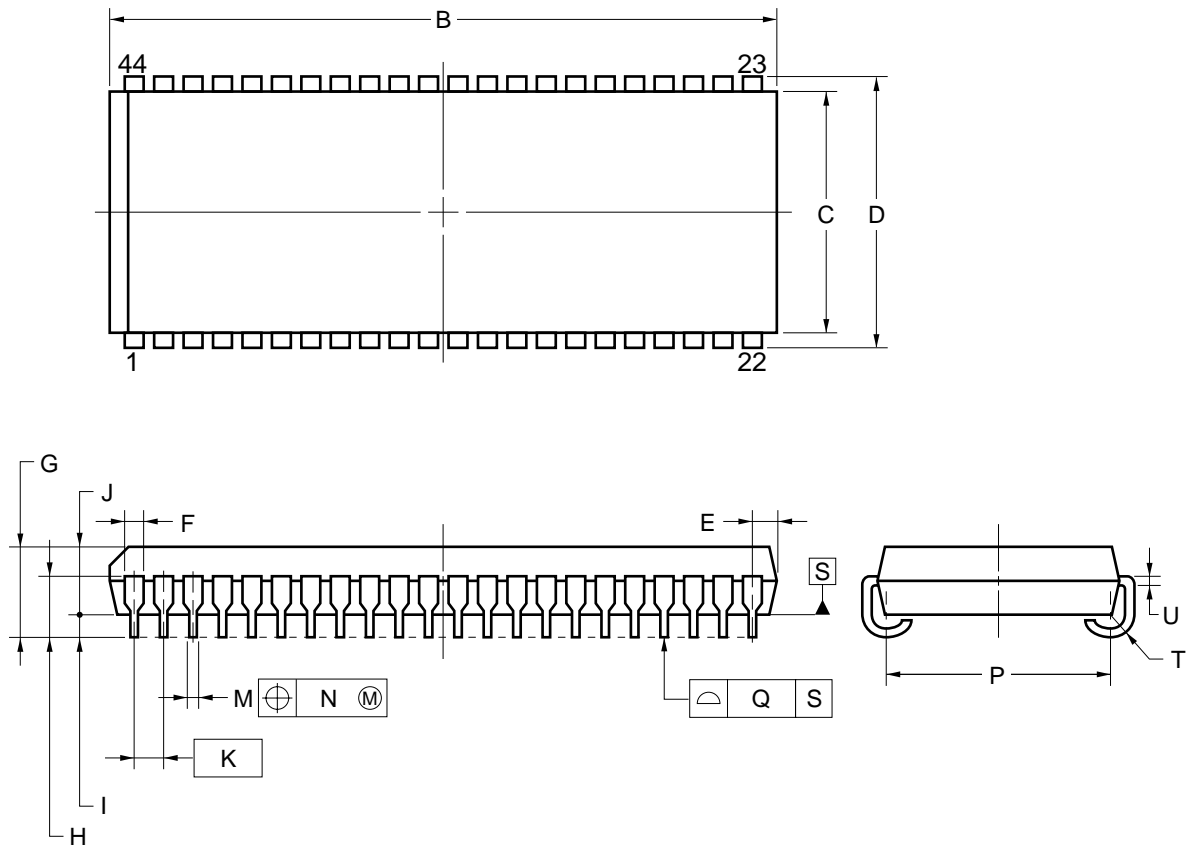


**Caution** /CS or /WE should be fixed to high level during address transition.

**Remark** Write operation is done during the overlap time of a low level /CS, a low level /WE and a low level /LB (or low level /UB).

Package Drawings

44-PIN PLASTIC SOJ (10.16mm (400))

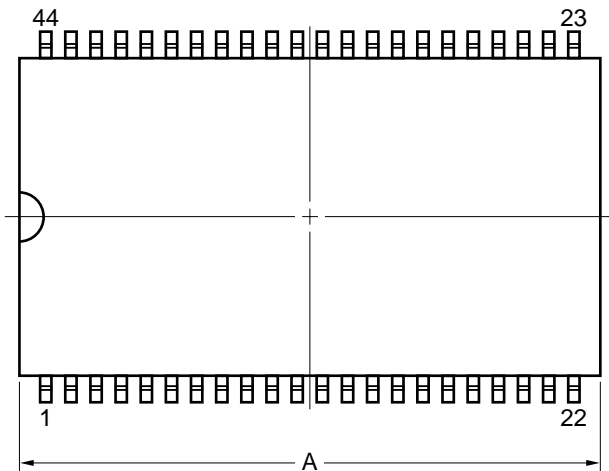


**NOTE**

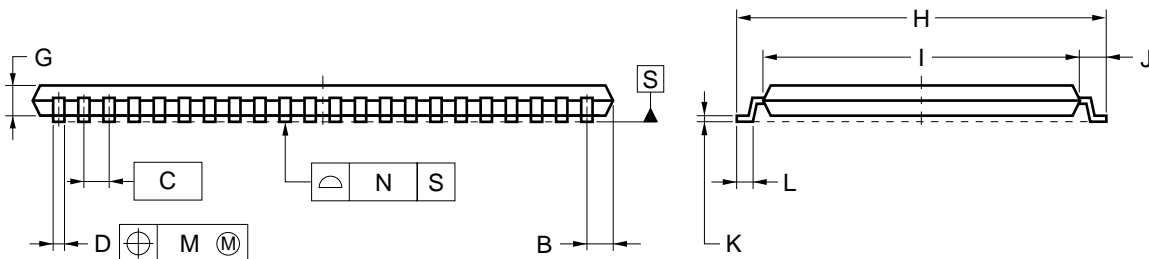
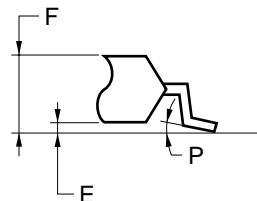
Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
B	28.73 <sup>+0.20</sup> <sub>-0.35</sub>
C	10.16
D	11.18±0.20
E	1.03±0.15
F	0.74
G	3.5±0.2
H	2.3±0.2
I	0.8 MIN.
J	2.6
K	1.27 (T.P.)
M	0.40±0.10
N	0.12
P	9.4±0.20
Q	0.10
T	R 0.85
U	0.20 <sup>+0.10</sup> <sub>-0.05</sub>
<b>P44LE-400A-1</b>	

44-PIN PLASTIC TSOP (II) (10.16 mm (400))



detail of lead end



NOTE

Each lead centerline is located within 0.13 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	18.63 MAX.
B	0.93 MAX.
C	0.8 (T.P.)
D	0.32 <sup>+0.08</sup> <sub>-0.07</sub>
E	0.1±0.05
F	1.2 MAX.
G	0.97
H	11.76±0.2
I	10.16±0.1
J	0.8±0.2
K	0.145 <sup>+0.025</sup> <sub>-0.015</sub>
L	0.5±0.1
M	0.13
N	0.10
P	3° <sup>+7°</sup> <sub>-3°</sub>

S44G5-80-7JF5-1

**Recommended Soldering Conditions**

Please consult with our sales offices for soldering conditions of the  $\mu$ PD434016AL.

**Types of Surface Mount Device**

$\mu$ PD434016ALLE : 44-pin plastic SOJ (10.16 mm (400))

$\mu$ PD434016ALG5-7JF : 44-pin plastic TSOP (II) (10.16 mm (400)) (Normal bent)

[ 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 THE APPLIED WAVEFORM OF INPUT PINS AND THE UNUSED INPUT PINS FOR CMOS**

Note:

Input levels of CMOS devices must be fixed. CMOS devices behave differently than Bipolar or NMOS devices. If the input of a CMOS device stays in an area that is between  $V_{IL}$  (MAX.) and  $V_{IH}$  (MIN.) due to the effects of noise or some other irregularity, malfunction may result. Therefore, not only the input waveform is fixed, but also the waveform changes, it is important to use the CMOS device under AC test conditions. For unused input pins in particular, CMOS devices should not be operated in a state where nothing is connected, so input levels of CMOS devices must be fixed to high or low by using 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.

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