

### 256K-BIT CMOS STATIC RAM

### 32K-WORD BY 8-BIT

#### Description

The  $\mu$ PD43257B is a high speed, low power, and 262,144 bits (32,768 words by 8 bits) CMOS static RAM. Battery backup is available. And the  $\mu$ PD43257B has two chip enable pins (/CE1, CE2) to extend the capacity. The  $\mu$ PD43257B is packed in 28-pin plastic DIP and 28-pin plastic SOP.

#### Features

- 32,768 words by 8 bits organization
- Fast access time: 70, 85 ns (MAX.)
- Low  $V_{CC}$  data retention: 2.0 V (MIN.)
- Two Chip Enable inputs: /CE1, CE2

| Part number         | Access time<br>ns (MAX.) | Operating supply<br>voltage<br>V | Operating ambient<br>temperature<br>°C | Supply current            |                              |   |
|---------------------|--------------------------|----------------------------------|--|---------------------------|------------------------------|---|
|                     |                          |                                  |  | At operating<br>mA (MAX.) | At standby<br>$\mu$ A (MAX.) | At data retention<br>$\mu$ A (MAX.) <sup>Note</sup> |
| $\mu$ PD43257B-xxL  | 70, 85                   | 4.5 to 5.5                       | 0 to 70                                | 45                        | 50                           | 3   |
| $\mu$ PD43257B-xxLL |                          |                                  |  | 45                        | 15                           | 2   |

**Note**  $T_A \leq 40$  °C,  $V_{CC} = 3.0$  V

#### Version X

This Data sheet can be applied to the version X. This version is identified with its lot number. Letter X in the fifth character position in a lot number signifies version X.



The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version. Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

Ordering Information

| Part number      | Package                                | Access time<br>ns (MAX.) | Supply current μA (MAX.) |                                   | Remark     |
|------------------|--|--------------------------|--------------------------|-----------------------------------|------------|
|                  |  |                          | At standby               | At data retention <sup>Note</sup> |            |
| μPD43257BCZ-70L  | 28-PIN PLASTIC DIP<br>(15.24 mm (600)) | 70                       | 50                       | 3                                 | L version  |
| μPD43257BCZ-85L  |  | 85                       |                          |                                   |            |
| μPD43257BCZ-70LL |  | 70                       | 15                       | 2                                 | LL version |
| μPD43257BCZ-85LL |  | 85                       |                          |                                   |            |
| μPD43257BGU-70L  | 28-PIN PLASTIC SOP<br>(11.43 mm (450)) | 70                       | 50                       | 3                                 | L version  |
| μPD43257BGU-85L  |  | 85                       |                          |                                   |            |
| μPD43257BGU-70LL |  | 70                       | 15                       | 2                                 | LL version |
| μPD43257BGU-85LL |  | 85                       |                          |                                   |            |

**Note** T<sub>A</sub> ≤ 40 °C, V<sub>CC</sub> = 3.0 V

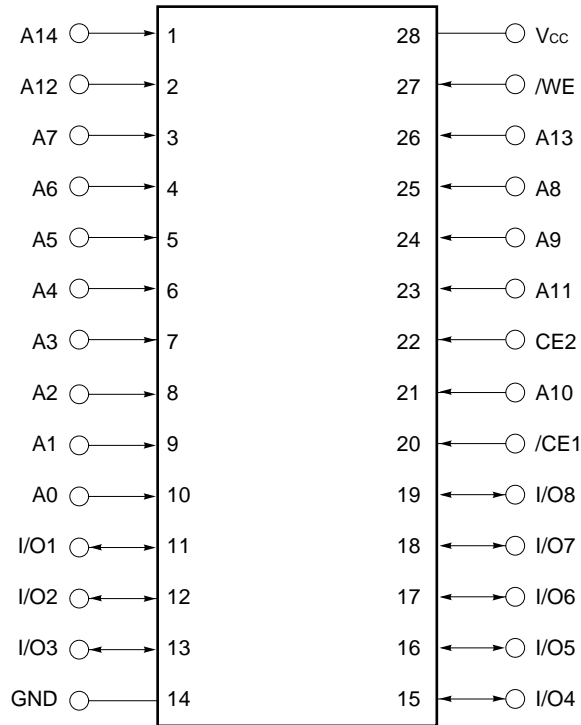
**Pin Configurations (Marking Side)**

/xxx indicates active low signal.

**28-PIN PLASTIC DIP (15.24 mm (600))**

[ μPD43257BCZ-xxL ]

[ μPD43257BCZ-xxLL ]



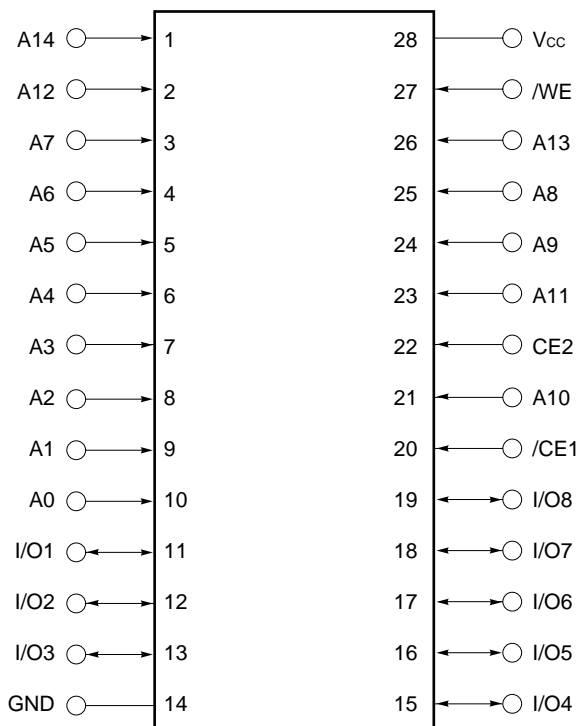
- A0 - A14 : Address inputs
- I/O1 - I/O8 : Data inputs / outputs
- /CE1 : Chip Enable 1
- CE2 : Chip Enable 2
- /WE : Write Enable
- Vcc : Power supply
- GND : Ground

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

28-PIN PLASTIC SOP (11.43 mm (450))

[ μPD43257BGU-xxL ]

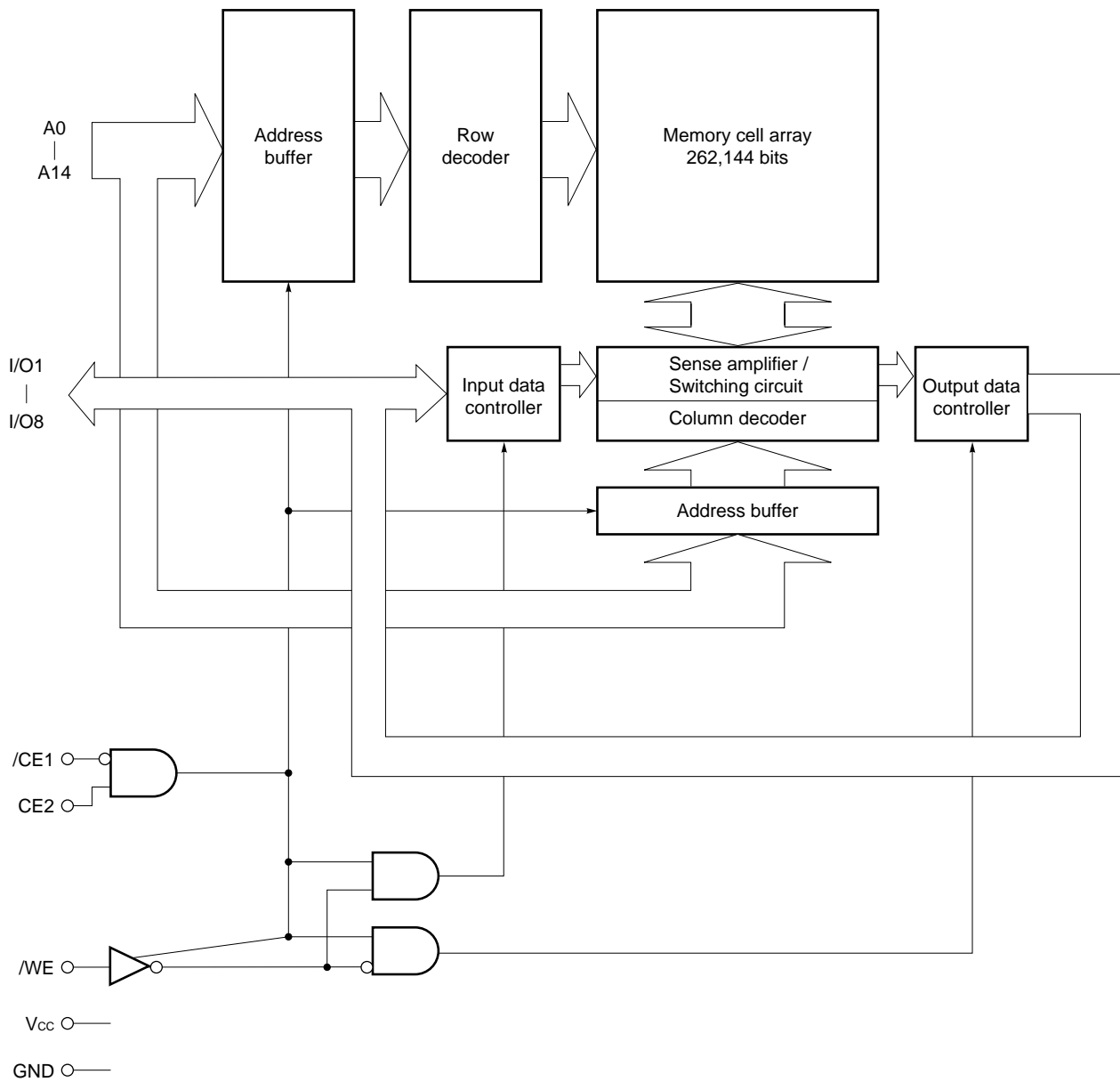
[ μPD43257BGU-xxLL ]



- A0 - A14 : Address inputs
- I/O1 - I/O8 : Data inputs / outputs
- /CE1 : Chip Enable 1
- CE2 : Chip Enable 2
- /WE : Write Enable
- Vcc : Power supply
- GND : Ground

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

Block Diagram



Truth Table

| /CE1 | CE2 | /WE | Mode         | I/O              | Supply current   |
|------|-----|-----|--------------|------------------|------------------|
| H    | x   | x   | Not selected | High impedance   | I <sub>SB</sub>  |
| x    | L   | x   |              |                  |                  |
| L    | H   | H   | Read         | D <sub>OUT</sub> | I <sub>CCA</sub> |
| L    | H   | L   | Write        | D <sub>IN</sub>  |                  |

Remark x : V<sub>IH</sub> or V<sub>IL</sub>

**Electrical Specifications**

**Absolute Maximum Ratings**

| Parameter                     | Symbol           | Condition | Rating  | Unit |
|-------------------------------|------------------|-----------|---|------|
| Supply voltage                | V <sub>CC</sub>  |           | -0.5 <sup>Note</sup> to +7.0                  | V    |
| Input / Output voltage        | V <sub>T</sub>   |           | -0.5 <sup>Note</sup> to V <sub>CC</sub> + 0.5 | V    |
| Operating ambient temperature | T <sub>A</sub>   |           | 0 to 70                                       | °C   |
| Storage temperature           | T <sub>stg</sub> |           | -55 to +125                                   | °C   |

**Note** -3.0 V (MIN.) (Pulse width : 50 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> |           | 4.5                  | 5.0  | 5.5                  | V    |
| High level input voltage      | V <sub>IH</sub> |           | 2.2                  |      | V <sub>CC</sub> +0.5 | 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** -3.0 V (MIN.) (Pulse width: 50 ns)

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

| Parameter                  | Symbol           | Test conditions        | MIN. | TYP. | MAX. | Unit |
|----------------------------|------------------|------------------------|------|------|------|------|
| Input capacitance          | C <sub>IN</sub>  | V <sub>IN</sub> = 0 V  |      |      | 5    | pF   |
| Input / Output capacitance | C <sub>I/O</sub> | V <sub>I/O</sub> = 0 V |      |      | 8    | 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.

DC Characteristics (Recommended Operating Conditions Unless Otherwise Noted)

| Parameter                 | Symbol            | Test condition   | μPD43257B-xxL        |      |      | μPD43257B-xxLL       |      |      | Unit |    |
|---------------------------|-------------------|--|----------------------|------|------|----------------------|------|------|------|----|
|                           |                   |  | MIN.                 | TYP. | MAX. | MIN.                 | TYP. | MAX. |      |    |
| Input leakage current     | I <sub>LI</sub>   | V <sub>IN</sub> = 0 V to V <sub>CC</sub>   | -1.0                 |      | +1.0 | -1.0                 |      | +1.0 | μA   |    |
| I/O leakage current       | I <sub>LO</sub>   | V <sub>I/O</sub> = 0 V to V <sub>CC</sub> , /CE1 = V <sub>IH</sub> or CE2 = V <sub>IL</sub> or /WE = V <sub>IL</sub>                                       | -1.0                 |      | +1.0 | -1.0                 |      | +1.0 | μA   |    |
| Operating supply current  | I <sub>CCA1</sub> | /CE1 = V <sub>IL</sub> , CE2 = V <sub>IH</sub> ,<br>Minimum cycle time, I <sub>I/O</sub> = 0 mA  | μPD43257B-70         |      |      |                      | 45   |      | 45   | mA |
|                           |                   |  | μPD43257B-85         |      |      |                      | 45   |      | 45   |    |
|                           | I <sub>CCA2</sub> | /CE1 = V <sub>IL</sub> , CE2 = V <sub>IH</sub> , I <sub>I/O</sub> = 0 mA   |                      |      | 10   |                      |      | 10   |      |    |
|                           | I <sub>CCA3</sub> | /CE1 ≤ 0.2 V, CE2 ≥ V <sub>CC</sub> - 0.2 V, Cycle = 1 MHz,<br>I <sub>I/O</sub> = 0 mA, V <sub>IL</sub> ≤ 0.2 V, V <sub>IH</sub> ≥ V <sub>CC</sub> - 0.2 V |                      |      | 10   |                      |      | 10   |      |    |
| Standby supply current    | I <sub>SB</sub>   | /CE1 = V <sub>IH</sub> or CE2 = V <sub>IL</sub> ,  |                      |      | 3    |                      |      | 3    | mA   |    |
|                           | I <sub>SB1</sub>  | /CE1 ≥ V <sub>CC</sub> - 0.2 V, CE2 ≥ V <sub>CC</sub> - 0.2 V  |                      | 1.0  | 50   |                      | 0.5  | 15   |      | μA |
|                           | I <sub>SB2</sub>  | CE2 ≤ 0.2 V  |                      | 1.0  | 50   |                      | 0.5  | 15   |      |    |
| High level output voltage | V <sub>OH1</sub>  | I <sub>OH</sub> = -1.0 mA  | 2.4                  |      |      | 2.4                  |      |      | V    |    |
|                           | V <sub>OH2</sub>  | I <sub>OH</sub> = -0.1 mA  | V <sub>CC</sub> -0.5 |      |      | V <sub>CC</sub> -0.5 |      |      |      |    |
| Low level output voltage  | V <sub>OL</sub>   | I <sub>OL</sub> = 2.1 mA   |                      |      | 0.4  |                      |      | 0.4  | V    |    |

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

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

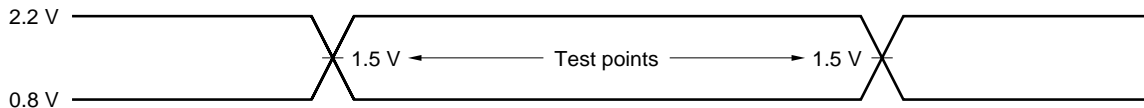
2. These DC characteristics are in common regardless of package types and access time.

AC Characteristics (Recommended Operating Conditions Unless Otherwise Noted)

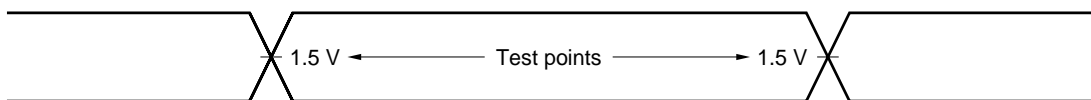
AC Test Conditions

[ μPD43257B-70L, μPD43257B-85L, μPD43257B-70LL, μPD43257B-85LL ]

Input Waveform (Rise and Fall Time ≤ 5 ns)



Output Waveform



Output Load

AC characteristics with notes should be measured with the output load shown in **Figure 1** and **Figure 2**.

Figure 1

(tAA, tCO1, tCO2, tOH)

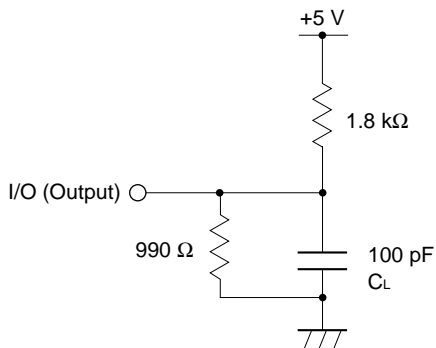
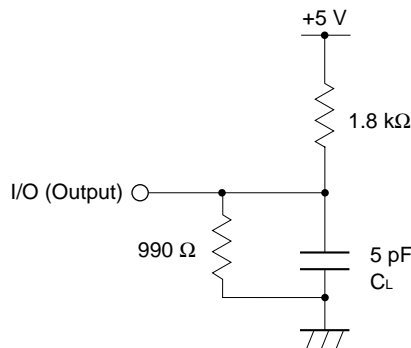


Figure 2

(tLZ1, tLZ2, tHZ1, tHZ2, tWHZ, tOW)



**Remark** CL includes capacitance of the probe and jig, and stray capacitance.



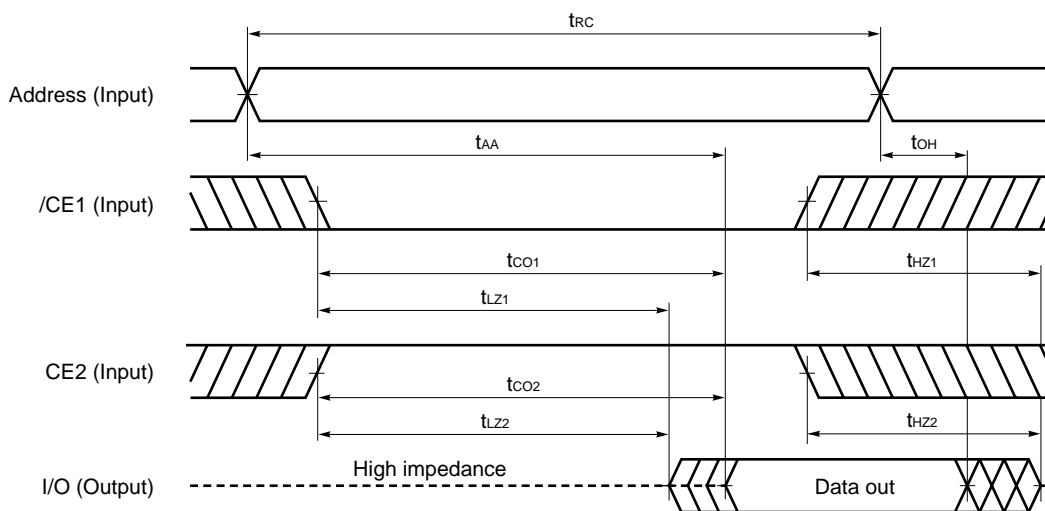
Read Cycle

| Parameter                        | Symbol    | μPD43257B-70 |      | μPD43257B-85 |      | Unit | Condition |
|----------------------------------|-----------|--------------|------|--------------|------|------|-----------|
|                                  |           | MIN.         | MAX. | MIN.         | MAX. |      |           |
| Read cycle time                  | $t_{RC}$  | 70           |      | 85           |      | ns   |           |
| Address access time              | $t_{AA}$  |              | 70   |              | 85   | ns   | Note 1    |
| /CE1 access time                 | $t_{CO1}$ |              | 70   |              | 85   | ns   |           |
| CE2 access time                  | $t_{CO2}$ |              | 70   |              | 85   | ns   |           |
| Output hold from address change  | $t_{OH}$  | 10           |      | 10           |      | ns   |           |
| /CE1 to output in low impedance  | $t_{LZ1}$ | 10           |      | 10           |      | ns   | Note 2    |
| CE2 to output in low impedance   | $t_{LZ2}$ | 10           |      | 10           |      | ns   |           |
| /CE1 to output in high impedance | $t_{HZ1}$ |              | 30   |              | 30   | ns   |           |
| CE2 to output in high impedance  | $t_{HZ2}$ |              | 30   |              | 30   | ns   |           |

- Notes**
1. See the output load shown in **Figure 1**.
  2. See the output load shown in **Figure 2**.

**Remark** These AC characteristics are in common regardless of package types and L, LL versions.

Read Cycle Timing Chart



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

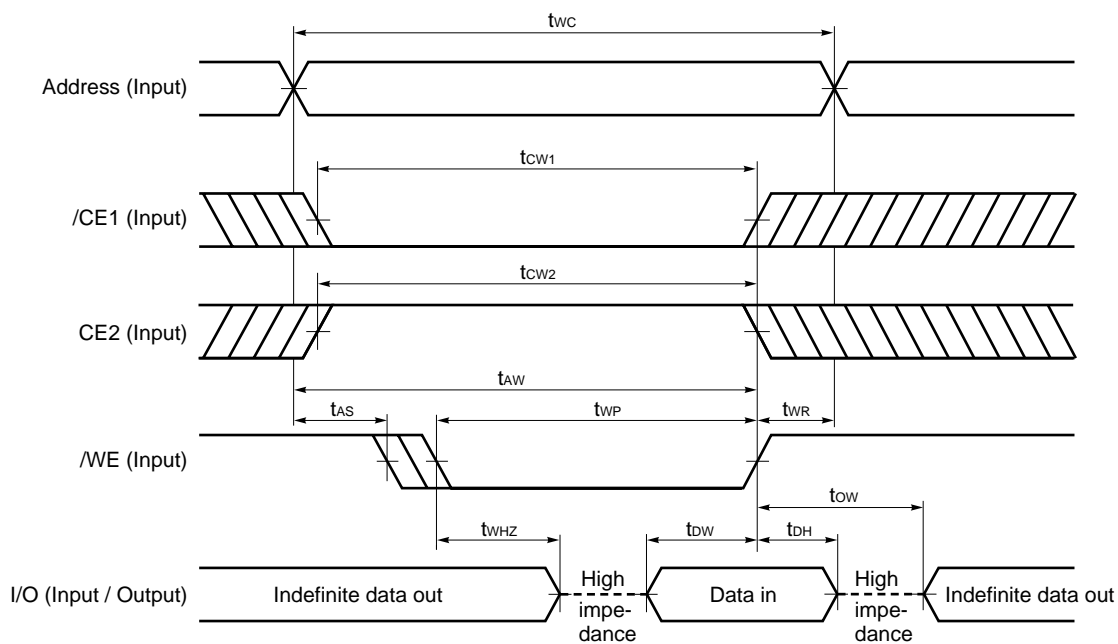
**Write Cycle**

| Parameter                       | Symbol           | μPD43257B-70 |      | μPD43257B-85 |      | Unit | Condition   |
|---------------------------------|------------------|--------------|------|--------------|------|------|-------------|
|                                 |                  | MIN.         | MAX. | MIN.         | MAX. |      |             |
| Write cycle time                | t <sub>wc</sub>  | 70           |      | 85           |      | ns   |             |
| /CE1 to end of write            | t <sub>cw1</sub> | 50           |      | 70           |      | ns   |             |
| CE2 to end of write             | t <sub>cw2</sub> | 50           |      | 70           |      | ns   |             |
| Address valid to end of write   | t <sub>aw</sub>  | 50           |      | 70           |      | ns   |             |
| Address setup time              | t <sub>as</sub>  | 0            |      | 0            |      | ns   |             |
| Write pulse width               | t <sub>wp</sub>  | 55           |      | 65           |      | ns   |             |
| Write recovery time             | t <sub>wr</sub>  | 0            |      | 0            |      | ns   |             |
| Data valid to end of write      | t <sub>dw</sub>  | 30           |      | 35           |      | ns   |             |
| Data hold time                  | t <sub>dh</sub>  | 0            |      | 0            |      | ns   |             |
| /WE to output in high impedance | t <sub>whz</sub> |              | 30   |              | 30   | ns   | <b>Note</b> |
| Output active from end of write | t <sub>ow</sub>  | 10           |      | 10           |      | ns   |             |

**Note** See the output load shown in **Figure 2**.

**Remark** These AC characteristics are in common regardless of package types and L, LL versions.

Write Cycle Timing Chart 1 (/WE Controlled)

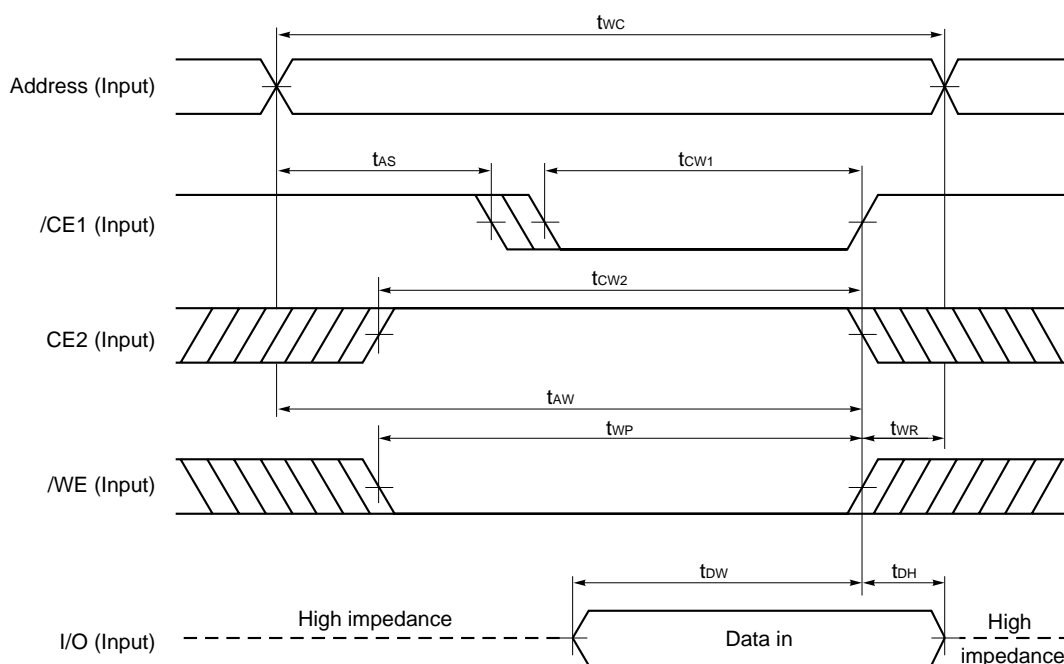


**Cautions** 1. During address transition, at least one of pins /CE1, CE2, /WE should be inactivated.

★ 2. When I/O pins are in the output state, therefore the input signals must not be applied to the output.

**Remarks** 1. Write operation is done during the overlap time of a low level /CE1, /WE and a high level CE2.  
 2. If /CE1 changes to low level at the same time or after the change of /WE to low level, or if CE2 changes to high level at the same time or after the change of /WE to low level, the I/O pins will remain high impedance state.  
 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 (/CE1 Controlled)

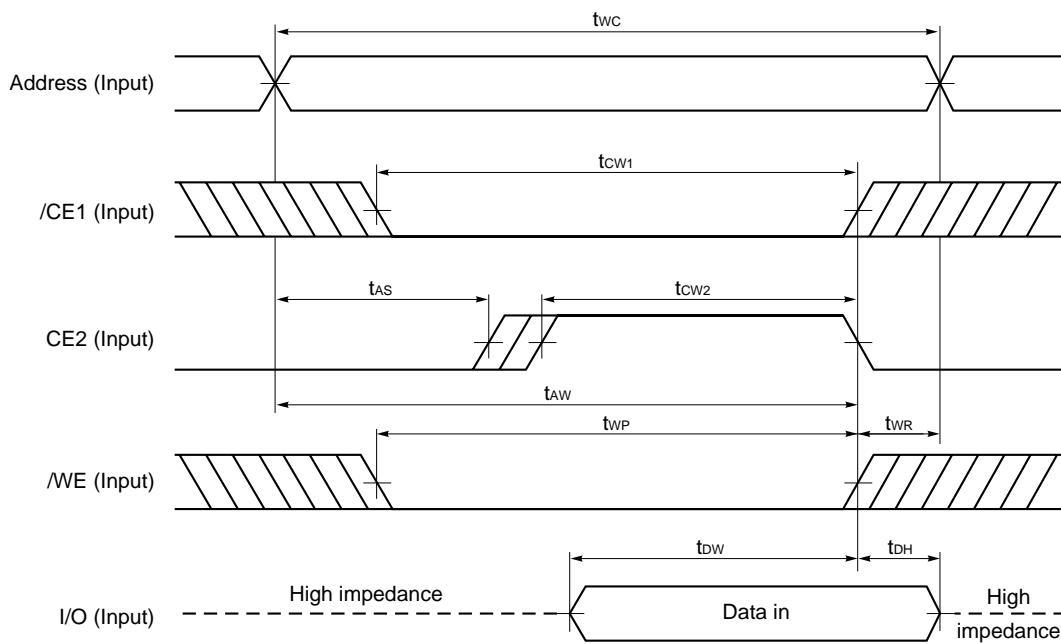


**Cautions** 1. During address transition, at least one of pins /CE1, CE2, /WE should be inactivated.

- ★ 2. When I/O pins are in the output state, therefore the input signals must not be applied to the output.

**Remark** Write operation is done during the overlap time of a low level /CE1, /WE and a high level CE2.

Write Cycle Timing Chart 3 (CE2 Controlled)



**Cautions** 1. During address transition, at least one of pins /CE1, CE2, /WE should be inactivated.

- ★ 2. When I/O pins are in the output state, therefore the input signals must not be applied to the output.

**Remark** Write operation is done during the overlap time of a low level /CE1, /WE and a high level CE2.

Low V<sub>CC</sub> Data Retention Characteristics (T<sub>A</sub> = 0 to 70 °C)

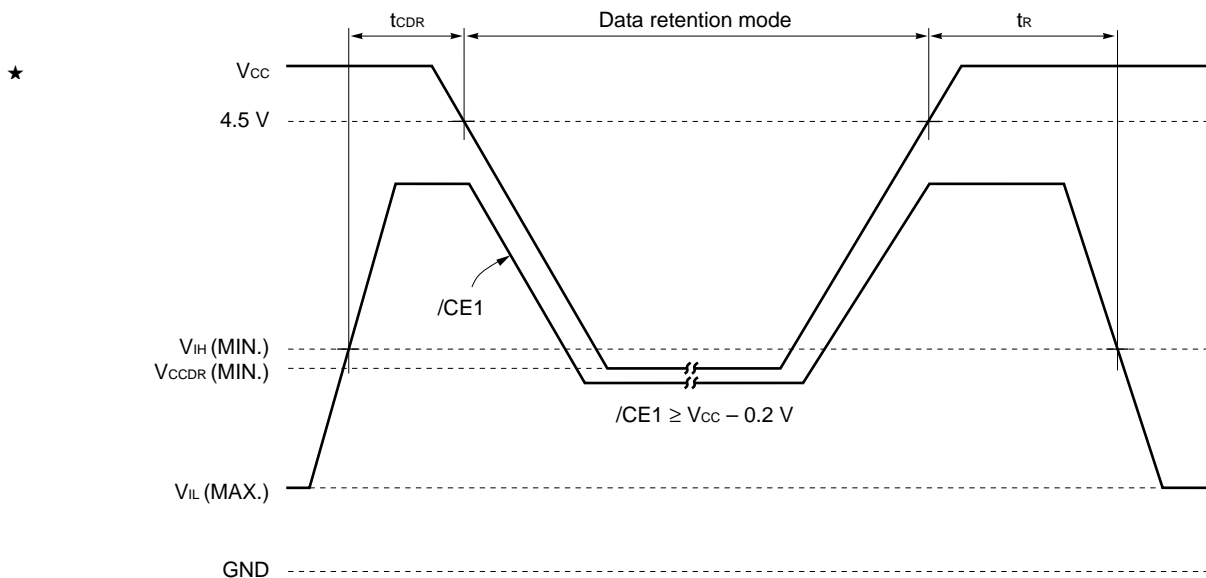
| Parameter                               | Symbol             | Test Condition  | μPD43257B-xxL |      |                     | μPD43257B-xxLL |      |                    | Unit |
|---|--------------------|---|---------------|------|---------------------|----------------|------|--------------------|------|
|   |                    |   | MIN.          | TYP. | MAX.                | MIN.           | TYP. | MAX.               |      |
| Data retention supply voltage           | V <sub>CCDR1</sub> | /CE1 ≥ V <sub>CC</sub> – 0.2 V,<br>CE2 ≥ V <sub>CC</sub> – 0.2 V                          | 2.0           |      | 5.5                 | 2.0            |      | 5.5                | V    |
|   | V <sub>CCDR2</sub> | CE2 ≤ 0.2 V   | 2.0           |      | 5.5                 | 2.0            |      | 5.5                |      |
| Data retention supply current           | I <sub>CCDR1</sub> | V <sub>CC</sub> = 3.0 V, /CE1 ≥ V <sub>CC</sub> – 0.2 V,<br>CE2 ≥ V <sub>CC</sub> – 0.2 V |               | 0.5  | 20 <sup>Note1</sup> |                | 0.5  | 7 <sup>Note2</sup> | μA   |
|   | I <sub>CCDR2</sub> | V <sub>CC</sub> = 3.0 V, CE2 ≤ 0.2 V  |               | 0.5  | 20 <sup>Note1</sup> |                | 0.5  | 7 <sup>Note2</sup> |      |
| Chip deselection to data retention mode | t <sub>CDR</sub>   |   | 0             |      |                     | 0              |      |                    | ns   |
| Operation recovery time                 | t <sub>R</sub>     |   | 5             |      |                     | 5              |      |                    | ms   |

Notes 1. 3 μA (T<sub>A</sub> ≤ 40 °C)

2. 2 μA (T<sub>A</sub> ≤ 40 °C), 1 μA (T<sub>A</sub> ≤ 25 °C)

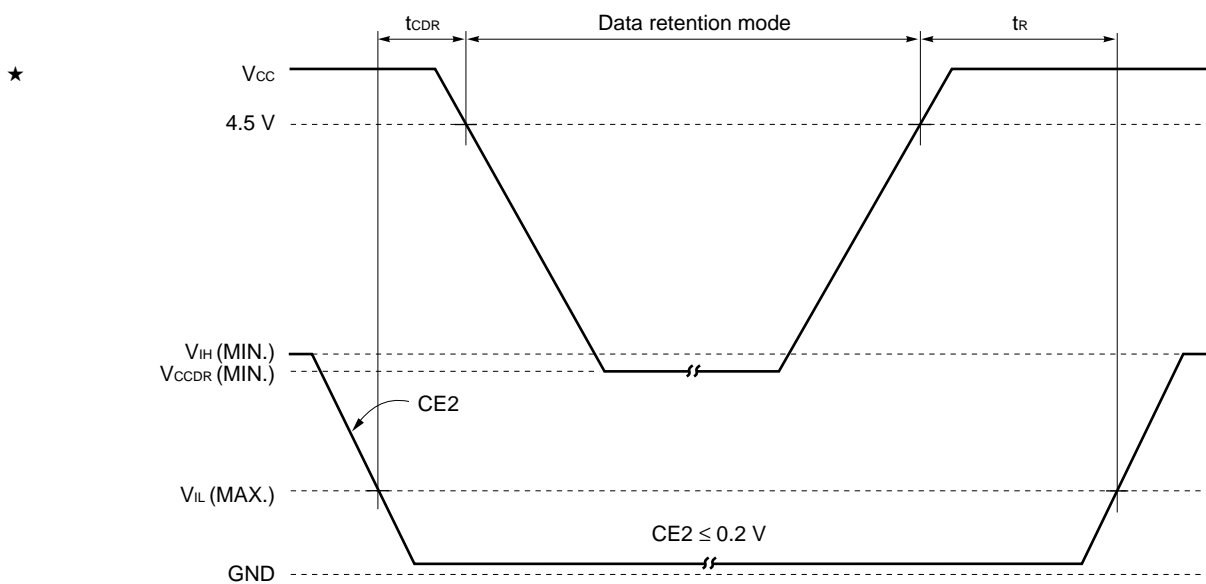
Data Retention Timing Chart

(1) /CE1 Controlled



**Remark** On the data retention mode by controlling  $\overline{CE1}$ , the input level of CE2 must be  $CE2 \geq V_{CC} - 0.2 \text{ V}$  or  $CE2 \leq 0.2 \text{ V}$ . The other pins (Address, I/O,  $\overline{WE}$ ) can be in high impedance state.

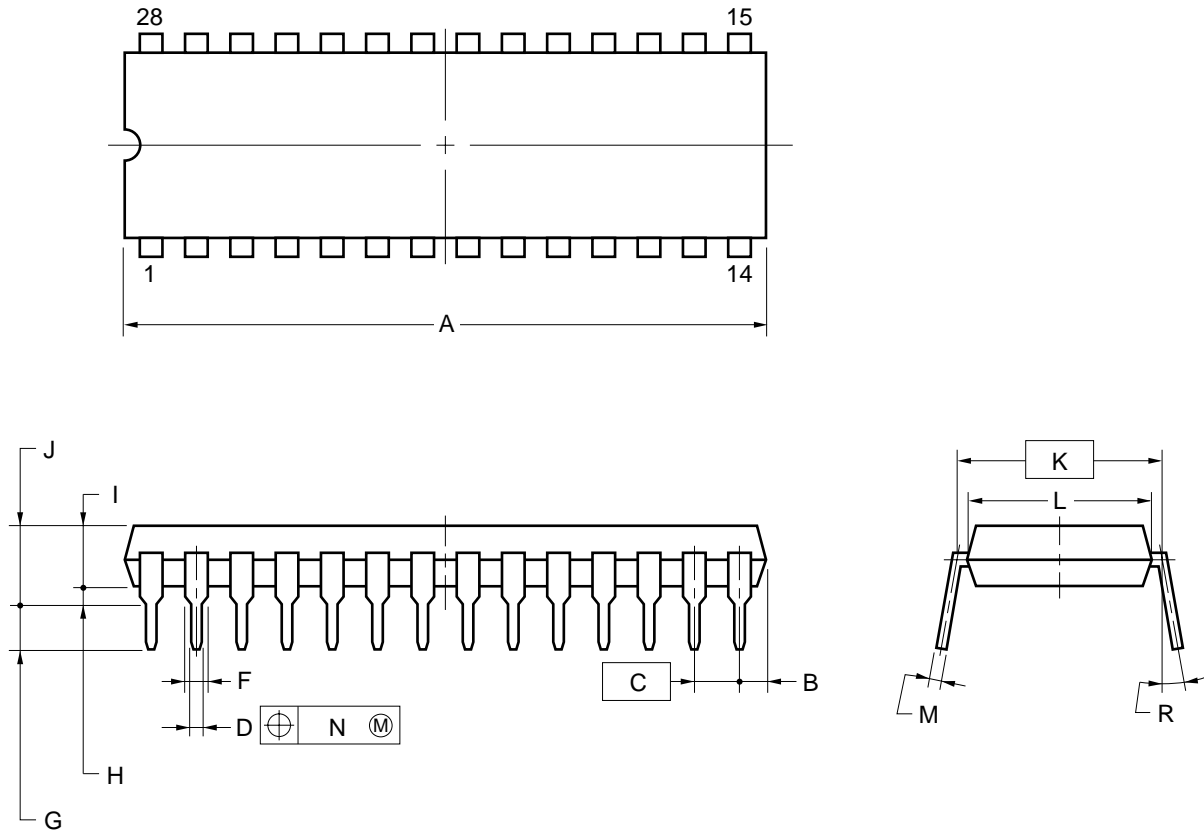
(2) CE2 Controlled



**Remark** On the data retention mode by controlling CE2, the other pins ( $\overline{CE1}$ , Address, I/O,  $\overline{WE}$ ) can be in high impedance state.

★ Package Drawings

28-PIN PLASTIC DIP (15.24 mm (600))



NOTES

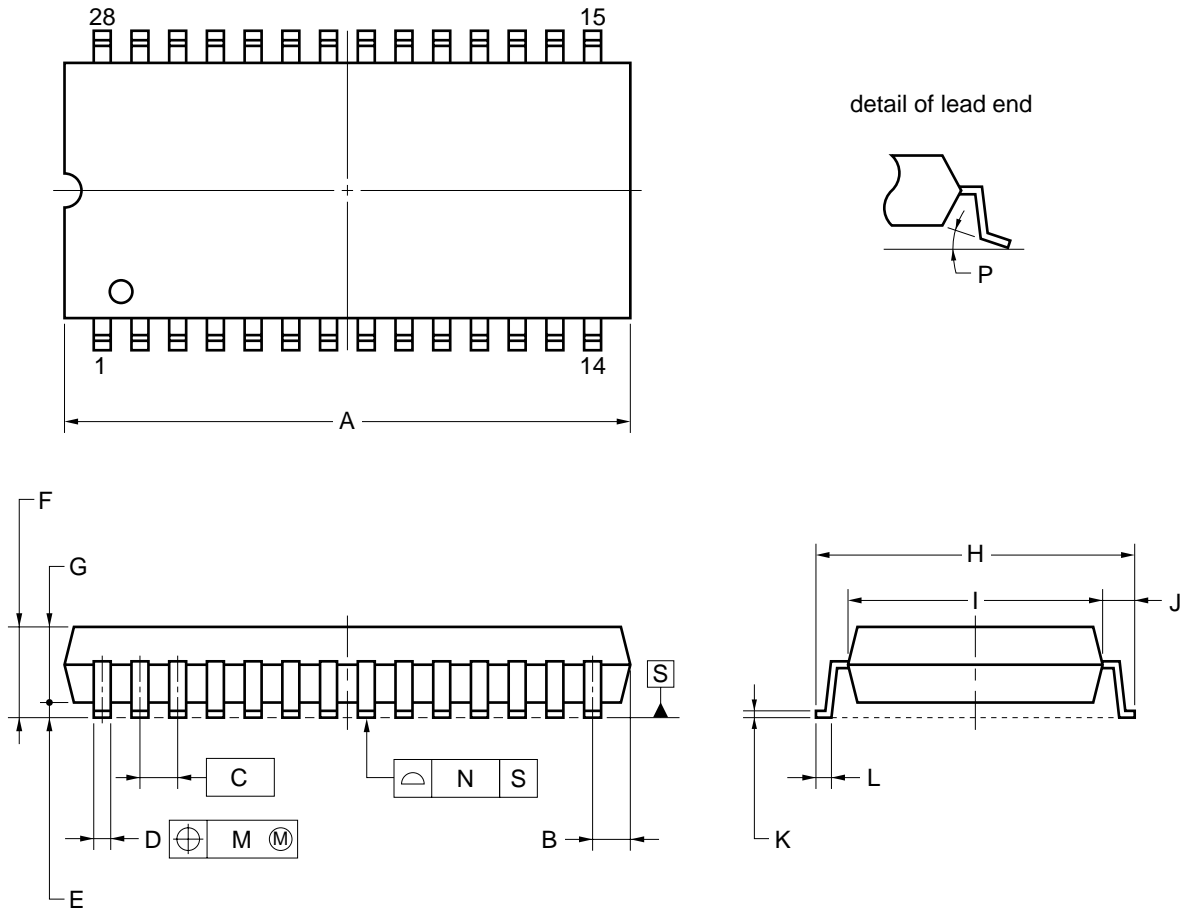
1. Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.
2. Item "K" to center of leads when formed parallel.

| ITEM | MILLIMETERS                            |
|------|--|
| A    | 38.10 MAX.                             |
| B    | 2.54 MAX.                              |
| C    | 2.54 (T.P.)                            |
| D    | 0.50±0.10                              |
| F    | 1.2 MIN.                               |
| G    | 3.6±0.3                                |
| H    | 0.51 MIN.                              |
| I    | 4.31 MAX.                              |
| J    | 5.72 MAX.                              |
| K    | 15.24 (T.P.)                           |
| L    | 13.2                                   |
| M    | 0.25 <sup>+0.10</sup> <sub>-0.05</sub> |
| N    | 0.25                                   |
| R    | 0~15°                                  |

P28C-100-600A1-2



28-PIN PLASTIC SOP (11.43 mm (450))



**NOTE**

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

| ITEM | MILLIMETERS                            |
|------|--|
| A    | 18.0 <sup>+0.6</sup> <sub>-0.05</sub>  |
| B    | 1.27 MAX.                              |
| C    | 1.27 (T.P.)                            |
| D    | 0.42 <sup>+0.08</sup> <sub>-0.07</sub> |
| E    | 0.2±0.1                                |
| F    | 2.95 MAX.                              |
| G    | 2.55±0.1                               |
| H    | 11.8±0.3                               |
| I    | 8.4±0.1                                |
| J    | 1.7±0.2                                |
| K    | 0.22±0.05                              |
| L    | 0.7±0.2                                |
| M    | 0.12                                   |
| N    | 0.10                                   |
| P    | 3° <sup>+7°</sup> <sub>-3°</sub>       |

P28GU-50-450A-4

**Recommended Soldering Conditions**

The following conditions must be met when soldering μPD43257B. For more details, refer to our document “SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL” (C10535E).

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

**Types of Surface Mount Device**

μPD43257BGU-xxL : 28-PIN PLASTIC SOP (11.43 mm (450))

μPD43257BGU-xxLL : 28-PIN PLASTIC SOP (11.43 mm (450))

Please consult with our sales offices.

**Types of Through Hole Mount Device**

μPD43257BCZ-xxL : 28-PIN PLASTIC DIP (15.24 mm (600))

μPD43257BCZ-xxLL : 28-PIN PLASTIC DIP (15.24 mm (600))

| Soldering process              | Soldering conditions  |
|--------------------------------|---|
| Wave soldering (only to leads) | Solder temperature : 260 °C or below,<br>Flow time : 10 seconds or below            |
| Partial heating method         | Terminal temperature : 300 °C or below,<br>Time : 3 seconds or below (Per one lead) |

**Caution** Do not jet molten solder on the surface of package.

**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 devices 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.

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