

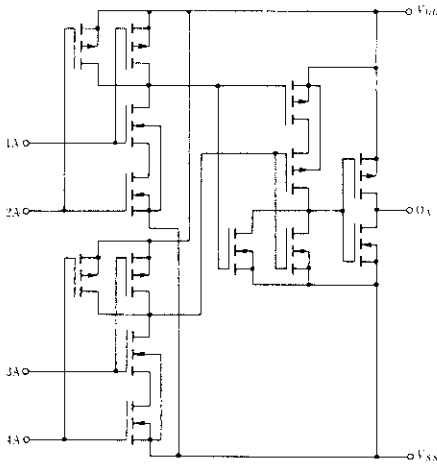
# HD14012B

## Dual 4-input NAND Gate

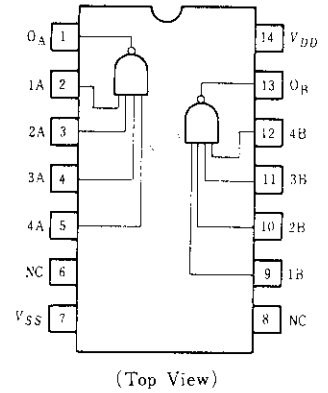
### FEATURES

- Quiescent Current = 0.5nA typ/pkg @5V
- Noise Immunity = 45% of  $V_{DD}$  typ
- Capable of Driving One Low-power Schottky TTL Load Over the Rated Temperature Range
- Pin-for Pin Replacements for CD4012B and MC14012B Series

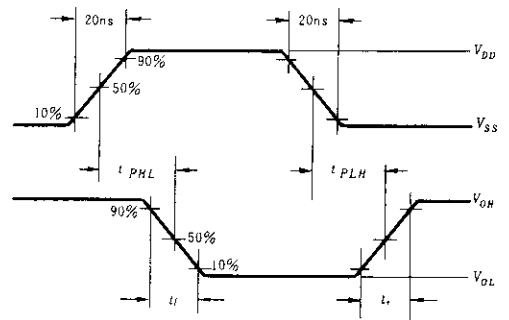
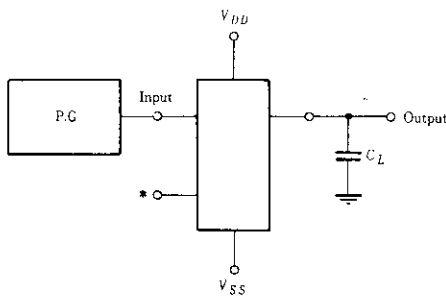
### CIRCUIT SCHEMATIC (1/2)



### PIN ARRANGEMENT



### SWITCHING TIME TEST CIRCUIT



\* All unused inputs of AND, NAND gates must be connected to  $V_{DD}$ .

■ ELECTRICAL CHARACTERISTICS

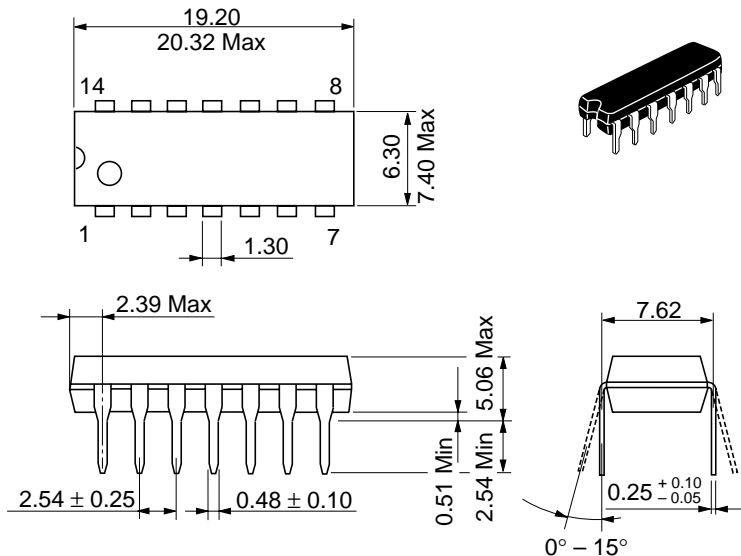
| Characteristic        | Symbol          | $V_{DD}(V)$ | Test Conditions   | -40°C |           | 25°C  |               |           | 85°C  |           | Unit    |
|-----------------------|-----------------|-------------|---|-------|-----------|-------|---------------|-----------|-------|-----------|---------|
|                       |                 |             |   | min   | max       | min   | typ           | max       | min   | max       |         |
| Output Voltage        | $V_{OL}$        | 5.0         | $V_{in} = V_{DD}$   | -     | 0.05      | -     | 0             | 0.05      | -     | 0.05      | V       |
|                       |                 | 10          |   | -     | 0.05      | -     | 0             | 0.05      | -     | 0.05      |         |
|                       |                 | 15          |   | -     | 0.05      | -     | 0             | 0.05      | -     | 0.05      |         |
|                       | $V_{OH}$        | 5.0         | $V_{in} = 0$  | 4.95  | -         | 4.95  | 5.0           | -         | 4.95  | -         | V       |
|                       |                 | 10          |   | 9.95  | -         | 9.95  | 10            | -         | 9.95  | -         |         |
|                       |                 | 15          |   | 14.95 | -         | 14.95 | 15            | -         | 14.95 | -         |         |
| Input Voltage         | $V_{IL}$        | 5.0         | $V_{out} = 4.5V$  | -     | 1.5       | -     | 2.25          | 1.5       | -     | 1.5       | V       |
|                       |                 | 10          | $V_{out} = 9.0V$  | -     | 3.0       | -     | 4.50          | 3.0       | -     | 3.0       |         |
|                       |                 | 15          | $V_{out} = 13.5V$   | -     | 4.0       | -     | 6.75          | 4.0       | -     | 4.0       |         |
|                       | $V_{IH}$        | 5.0         | $V_{out} = 0.5V$  | 3.5   | -         | 3.5   | 2.75          | -         | 3.5   | -         | V       |
|                       |                 | 10          | $V_{out} = 1.0V$  | 7.0   | -         | 7.0   | 5.50          | -         | 7.0   | -         |         |
|                       |                 | 15          | $V_{out} = 1.5V$  | 11.0  | -         | 11.0  | 8.25          | -         | 11.0  | -         |         |
| Output Drive Current  | $I_{OH}$        | 5.0         | $V_{OH} = 2.5V$   | -2.5  | -         | -2.1  | -4.2          | -         | -1.7  | -         | mA      |
|                       |                 | 5.0         | $V_{OH} = 4.6V$   | -0.52 | -         | -0.44 | -0.88         | -         | -0.36 | -         |         |
|                       |                 | 10          | $V_{OH} = 9.5V$   | -1.3  | -         | -1.1  | -2.25         | -         | -0.9  | -         |         |
|                       | $I_{OL}$        | 15          | $V_{OH} = 13.5V$  | -3.6  | -         | -3.0  | -8.8          | -         | -2.4  | -         |         |
|                       |                 | 5.0         | $V_{OL} = 0.4V$   | 0.52  | -         | 0.44  | 0.88          | -         | 0.36  | -         | mA      |
|                       |                 | 10          | $V_{OL} = 0.5V$   | 1.3   | -         | 1.1   | 2.25          | -         | 0.9   | -         |         |
| 15                    | $V_{OL} = 1.5V$ | 3.6         | -   | 3.0   | 8.8       | -     | 2.4           | -         |       |           |         |
| Input Current         | $I_{in}$        | 15          |   | -     | $\pm 0.3$ | -     | $\pm 0.00001$ | $\pm 0.3$ | -     | $\pm 1.0$ | $\mu A$ |
| Input Capacitance     | $C_{in}$        | -           | $V_{in} = 0$  | -     | -         | -     | 5.0           | 7.5       | -     | -         | pF      |
| Quiescent Current     | $I_{DD}$        | 5.0         | Zero Signal,<br>per Package                               | -     | 1.0       | -     | 0.0005        | 1.0       | -     | 7.5       | $\mu A$ |
|                       |                 | 10          |   | -     | 2.0       | -     | 0.0010        | 2.0       | -     | 15.0      |         |
|                       |                 | 15          |   | -     | 4.0       | -     | 0.0015        | 4.0       | -     | 30.0      |         |
| Total Supply Current* | $I_T$           | 5.0         | Dynamic + $I_{DD}$ , $C_L = 50pF$<br>per Gate, $f = 1kHz$ | -     | -         | -     | 0.3           | -         | -     | -         | $\mu A$ |
|                       |                 | 10          |   | -     | -         | -     | 0.6           | -         | -     | -         |         |
|                       |                 | 15          |   | -     | -         | -     | 0.9           | -         | -     | -         |         |

\* To calculate total supply current at frequency other than 1kHz.

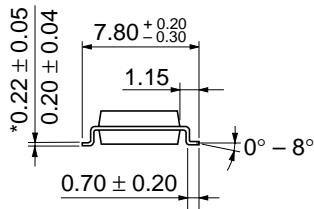
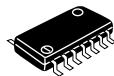
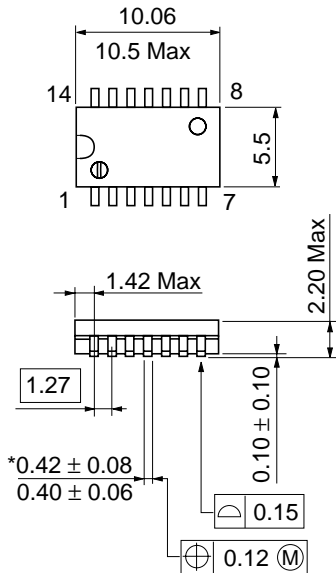
$\mu V_{DD} = 5.0V$   $I_T = 0.3\mu A/kHz \cdot f + I_{DD}/2$     $\mu V_{DD} = 10V$   $I_T = 0.6\mu A/kHz \cdot f + I_{DD}/2$     $\mu V_{DD} = 15V$   $I_T = 0.9\mu A/kHz \cdot f + I_{DD}/2$

■ SWITCHING CHARACTERISTICS ( $C_L = 50pF, T_a = 25^\circ C$ )

| Characteristic         | Symbol    | $V_{DD}(V)$ | min | typ | max | Unit |
|------------------------|-----------|-------------|-----|-----|-----|------|
| Output Rise Time       | $t_r$     | 5.0         | -   | 100 | 200 | ns   |
|                        |           | 10          | -   | 50  | 100 |      |
|                        |           | 15          | -   | 40  | 80  |      |
| Output Fall Time       | $t_f$     | 5.0         | -   | 100 | 200 | ns   |
|                        |           | 10          | -   | 50  | 100 |      |
|                        |           | 15          | -   | 40  | 80  |      |
| Propagation Delay Time | $t_{PLH}$ | 5.0         | -   | 160 | 320 | ns   |
|                        |           | 10          | -   | 65  | 130 |      |
|                        |           | 15          | -   | 50  | 100 |      |
|                        | $t_{PHL}$ | 5.0         | -   | 160 | 320 | ns   |
|                        |           | 10          | -   | 65  | 130 |      |
|                        |           | 15          | -   | 50  | 100 |      |

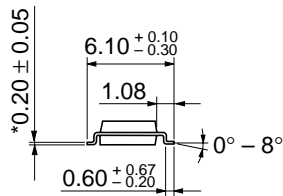
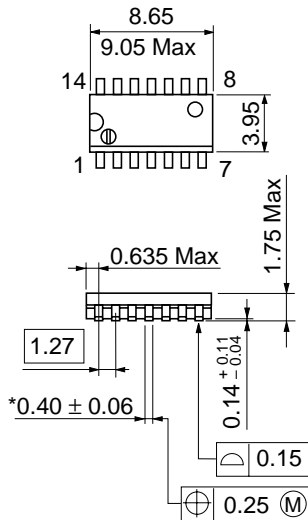


|                          |          |
|--------------------------|----------|
| Hitachi Code             | DP-14    |
| JEDEC                    | Conforms |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.97 g   |



|                          |          |
|--------------------------|----------|
| Hitachi Code             | FP-14DA  |
| JEDEC                    | —        |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.23 g   |

\*Dimension including the plating thickness  
Base material dimension



|                          |          |
|--------------------------|----------|
| Hitachi Code             | FP-14DN  |
| JEDEC                    | Conforms |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.13 g   |

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