

TC74HC20AP, TC74HC20AF, TC74HC20AFN

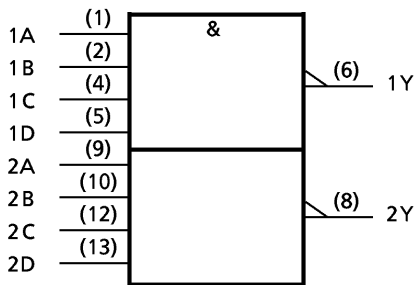
DUAL 4 – INPUT NAND GATE

The TC74HC20A is a high speed CMOS 4-INPUT NAND GATE fabricated with silicon gate C<sup>2</sup>MOS technology. It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. The internal circuit is composed of 3 stages including buffer output, which provide high noise immunity and stable output. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

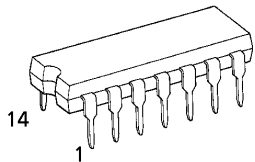
FEATURES :

- High Speed..... $t_{pd} = 8ns (typ.)$  at  $V_{CC} = 5V$
- Low Power Dissipation..... $I_{CC} = 1\mu A (Max.)$  at  $T_a = 25^{\circ}C$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC} (Min.)$
- Output Drive Capability..... 10 LSTTL Loads
- Symmetrical Output Impedance...  $|I_{OH}| = I_{OL} = 4mA (Min.)$
- Balanced Propagation Delays.....  $t_{PLH} \approx t_{PHL}$
- Wide Operating Voltage Range....  $V_{CC} (opr.) = 2V \sim 6V$
- Pin and Function Compatible with 74LS20

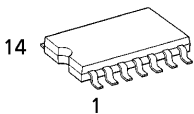
IEC LOGIC SYMBOL



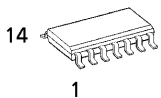
(Note) The JEDEC SOP (FN) is not available in Japan.



P (DIP14-P-300-2.54)  
Weight : 0.96g (Typ.)

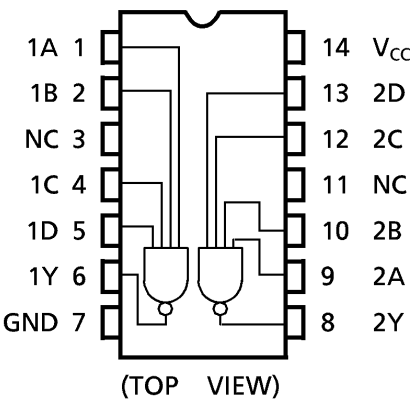


F (SOP14-P-300-1.27)  
Weight : 0.18g (Typ.)



FN (SOL14-P-150-1.27)  
Weight : 0.12g (Typ.)

PIN ASSIGNMENT



TRUTH TABLE

| A | B | C | D | Y |
|---|---|---|---|---|
| L | X | X | X | H |
| X | L | X | X | H |
| X | X | L | X | H |
| X | X | X | L | H |
| H | H | H | H | L |

X : Don't Care

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                    | SYMBOL    | VALUE                    | UNIT |
|------------------------------|-----------|--------------------------|------|
| Supply Voltage Range         | $V_{CC}$  | $-0.5 \sim 7$            | V    |
| DC Input Voltage             | $V_{IN}$  | $-0.5 \sim V_{CC} + 0.5$ | V    |
| DC Output Voltage            | $V_{OUT}$ | $-0.5 \sim V_{CC} + 0.5$ | V    |
| Input Diode Current          | $I_{IK}$  | $\pm 20$                 | mA   |
| Output Diode Current         | $I_{OK}$  | $\pm 20$                 | mA   |
| DC Output Current            | $I_{OUT}$ | $\pm 25$                 | mA   |
| DC $V_{CC}$ / Ground Current | $I_{CC}$  | $\pm 50$                 | mA   |
| Power Dissipation            | $P_D$     | 500 (DIP)* / 180 (SOP)   | mW   |
| Storage Temperature          | $T_{stg}$ | $-65 \sim 150$           | °C   |

\*500mW in the range of  $T_a = -40^\circ\text{C} \sim 65^\circ\text{C}$ . From  $T_a = 65^\circ\text{C}$  to  $85^\circ\text{C}$  a derating factor of  $-10\text{mW}/^\circ\text{C}$  shall be applied until 300mW.

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL     | VALUE                                                                                                              | UNIT |
|--------------------------|------------|--------------------------------------------------------------------------------------------------------------------|------|
| Supply Voltage           | $V_{CC}$   | $2 \sim 6$                                                                                                         | V    |
| Input Voltage            | $V_{IN}$   | $0 \sim V_{CC}$                                                                                                    | V    |
| Output Voltage           | $V_{OUT}$  | $0 \sim V_{CC}$                                                                                                    | V    |
| Operating Temperature    | $T_{opr}$  | $-40 \sim 85$                                                                                                      | °C   |
| Input Rise and Fall Time | $t_r, t_f$ | $0 \sim 1000 (V_{CC} = 2.0\text{V})$<br>$0 \sim 500 (V_{CC} = 4.5\text{V})$<br>$0 \sim 400 (V_{CC} = 6.0\text{V})$ | ns   |

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                   | SYMBOL   | TEST CONDITION                                                    | $V_{CC}$<br>(V)   | $T_a = 25^\circ\text{C}$ |                   |                      | $T_a = -40 \sim 85^\circ\text{C}$ |                      | UNIT          |
|-----------------------------|----------|-------------------------------------------------------------------|-------------------|--------------------------|-------------------|----------------------|-----------------------------------|----------------------|---------------|
|                             |          |                                                                   |                   | MIN.                     | TYP.              | MAX.                 | MIN.                              | MAX.                 |               |
| High - Level Input Voltage  | $V_{IH}$ |                                                                   | 2.0<br>4.5<br>6.0 | 1.50<br>3.15<br>4.20     | —<br>—<br>—       | —<br>—<br>—          | 1.50<br>3.15<br>4.20              | —<br>—<br>—          | V             |
| Low - Level Input Voltage   | $V_{IL}$ |                                                                   | 2.0<br>4.5<br>6.0 | —<br>—<br>—              | —<br>—<br>—       | 0.50<br>1.35<br>1.80 | —<br>—<br>—                       | 0.50<br>1.35<br>1.80 | V             |
| High - Level Output Voltage | $V_{OH}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$<br>$I_{OH} = -20\mu\text{A}$ | 2.0<br>4.5<br>6.0 | 1.9<br>4.4<br>5.9        | 2.0<br>4.5<br>6.0 | —<br>—<br>—          | 1.9<br>4.4<br>5.9                 | —<br>—<br>—          | V             |
|                             |          |                                                                   | 4.5<br>6.0        | 4.18<br>5.68             | 4.31<br>5.80      | —<br>—               | 4.13<br>5.63                      | —<br>—               |               |
|                             |          |                                                                   |                   |                          |                   |                      |                                   |                      |               |
| Low - Level Output Voltage  | $V_{OL}$ | $V_{IN} = V_{IH}$<br>$I_{OL} = 20\mu\text{A}$                     | 2.0<br>4.5<br>6.0 | —<br>—<br>—              | 0.0<br>0.0<br>0.0 | 0.1<br>0.1<br>0.1    | —<br>—<br>—                       | 0.1<br>0.1<br>0.1    | V             |
|                             |          |                                                                   | 4.5<br>6.0        | —<br>—                   | 0.17<br>0.18      | 0.26<br>0.26         | —<br>—                            | 0.33<br>0.33         |               |
|                             |          |                                                                   |                   |                          |                   |                      |                                   |                      |               |
| Input Leakage Current       | $I_{IN}$ | $V_{IN} = V_{CC} \text{ or GND}$                                  | 6.0               | —                        | —                 | $\pm 0.1$            | —                                 | $\pm 1.0$            | $\mu\text{A}$ |
| Quiescent Supply Current    | $I_{CC}$ | $V_{IN} = V_{CC} \text{ or GND}$                                  | 6.0               | —                        | —                 | 1.0                  | —                                 | 10.0                 | $\mu\text{A}$ |

**AC ELECTRICAL CHARACTERISTICS (  $C_L = 15\text{pF}$ ,  $V_{CC} = 5\text{V}$ ,  $T_a = 25^\circ\text{C}$ , Input  $t_r = t_f = 6\text{ns}$  )**

| PARAMETER              | SYMBOL                 | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|------------------------|------------------------|----------------|------|------|------|------|
| Output Transition Time | $t_{TLH}$<br>$t_{THL}$ |                | —    | 5    | 8    | ns   |
| Propagation Delay Time | $t_{PLH}$<br>$t_{PHL}$ |                | —    | 8    | 15   |      |

**AC ELECTRICAL CHARACTERISTICS (  $C_L = 50\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$  )**

| PARAMETER                     | SYMBOL              | TEST CONDITION | Ta = 25°C           |      |      |      | Ta = -40~85°C |      | UNIT |
|-------------------------------|---------------------|----------------|---------------------|------|------|------|---------------|------|------|
|                               |                     |                | V <sub>CC</sub> (V) | MIN. | TYP. | MAX. | MIN.          | MAX. |      |
| Output Transition Time        | t <sub>TLH</sub>    |                | 2.0                 | —    | 30   | 75   | —             | 95   | ns   |
|                               | t <sub>THL</sub>    |                | 4.5                 | —    | 8    | 15   | —             | 19   |      |
|                               |                     |                | 6.0                 | —    | 7    | 13   | —             | 16   |      |
| Propagation Delay Time        | t <sub>pLH</sub>    |                | 2.0                 | —    | 33   | 90   | —             | 115  |      |
|                               | t <sub>pHL</sub>    |                | 4.5                 | —    | 11   | 18   | —             | 23   |      |
|                               |                     |                | 6.0                 | —    | 9    | 15   | —             | 20   |      |
| Input Capacitance             | C <sub>IN</sub>     |                |                     | —    | 5    | 10   | —             | 10   | pF   |
| Power Dissipation Capacitance | C <sub>PD</sub> (1) |                |                     | —    | 29   | —    | —             | —    |      |

Note (1)  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2 \text{ ( per Gate )}$$

## DIP 14PIN PACKAGE DIMENSIONS (DIP14-P-300-2.54)

Unit in mm



Weight : 0.96g (Typ.)

## SOP 14PIN (200mil BODY) PACKAGE DIMENSIONS (SOP14-P-300-1.27)

Unit in mm

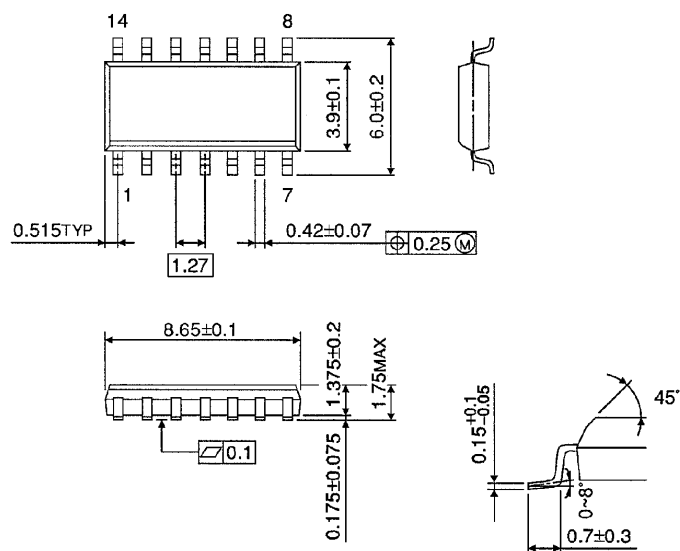


Weight : 0.18g (Typ.)

**SOP 14PIN (150mil BODY) PACKAGE DIMENSIONS (SOL14-P-150 -1.27)**

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

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000707EBA

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