

TC74HCT02AP, TC74HCT02AF, TC74HCT02AFN

QUAD 2-INPUT NOR GATE

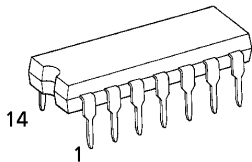
(Note) The JEDEC SOP (FN) is not available in Japan.

The TC74HCT02A is a high speed CMOS 2-INPUT NOR 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. This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

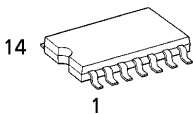
The internal circuit is composed of 3 stages, including buffer output, which provide high noise immunity and stable output. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES :

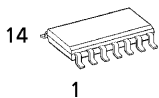
- High Speed..... $t_{pd} = 9\text{ns}(\text{typ.})$  at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 1\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs ...  $V_{IH} = 2\text{V}(\text{Min.})$   
 $V_{IL} = 0.8\text{V}(\text{Max.})$
- Wide Interfacing ability.....LSTTL, NMOS, CMOS
- Output Drive Capability.....10 LSTTL Loads
- Symmetrical Output Impedance...  $|I_{OH}| = I_{OL} = 4\text{mA}(\text{Min.})$
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Pin and Function Compatible with 74LS02



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

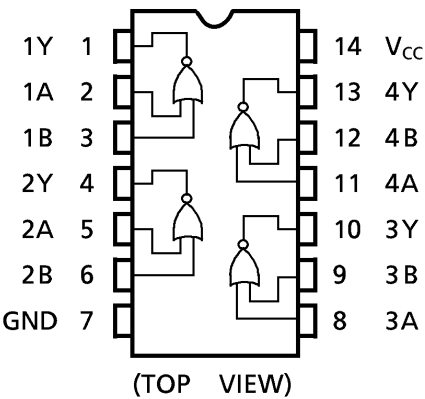


F (SOP14-P-300-1.27)  
Weight : 0.18g (Typ.)

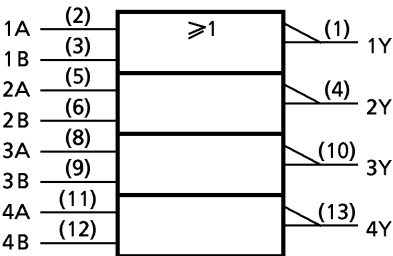


FN (SOL14-P-150-1.27)  
Weight : 0.12g (Typ.)

PIN ASSIGNMENT



IEC LOGIC SYMBOL



TRUTH TABLE

| A | B | Y |
|---|---|---|
| L | L | H |
| L | H | L |
| H | L | L |
| H | H | L |

## 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           | $V_{CC}$   | $4.5 \sim 5.5$  | 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 | $t_r, t_f$ | $0 \sim 500$    | 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  | $V_{IH}$ |                                                                                           | $4.5 \begin{smallmatrix} \text{ } \\ \text{ } \end{smallmatrix} 5.5$ | 2.0                      | —    | —         | 2.0                               | —         | V             |
| Low - Level Input Voltage   | $V_{IL}$ |                                                                                           | $4.5 \begin{smallmatrix} \text{ } \\ \text{ } \end{smallmatrix} 5.5$ | —                        | —    | 0.8       | —                                 | 0.8       | V             |
| High - Level Output Voltage | $V_{OH}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$                                                      | $I_{OH} = -20 \mu\text{A}$                                           | 4.5                      | 4.4  | 4.5       | —                                 | 4.4       | V             |
|                             |          |                                                                                           | $I_{OH} = -4 \text{ mA}$                                             | 4.5                      | 4.18 | 4.31      | —                                 | 4.13      |               |
| Low - Level Output Voltage  | $V_{OL}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$                                                      | $I_{OL} = 20 \mu\text{A}$                                            | 4.5                      | —    | 0.0       | 0.1                               | —         | V             |
|                             |          |                                                                                           | $I_{OL} = 4 \text{ mA}$                                              | 4.5                      | —    | 0.17      | 0.26                              | —         |               |
| Input Leakage Current       | $I_{IN}$ | $V_{IN} = V_{CC} \text{ or GND}$                                                          | 5.5                                                                  | —                        | —    | $\pm 0.1$ | —                                 | $\pm 1.0$ | $\mu\text{A}$ |
| Quiescent Supply Current    | $I_{CC}$ | $V_{IN} = V_{CC} \text{ or GND}$                                                          | 5.5                                                                  | —                        | —    | 1.0       | —                                 | 10.0      | mA            |
|                             | $I_C$    | PER INPUT: $V_{IN} = 0.5\text{V or } 2.4\text{V}$<br>OTHER INPUT: $V_{CC} \text{ or GND}$ | 5.5                                                                  | —                        | —    | 2.0       | —                                 | 2.9       |               |

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>$t_{THL}$ |                | —    | 6    | 12   | ns   |
| Propagation Delay Time | $t_{PLH}$<br>$t_{PHL}$ |                | —    | 9    | 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>    |                | 4.5                 | —    | 8    | 15   | —              | 19   | ns   |
|                               | t <sub>THL</sub>    |                | 5.5                 | —    | 7    | 13   | —              | 16   |      |
| Propagation Delay Time        | t <sub>pLH</sub>    |                | 4.5                 | —    | 12   | 18   | —              | 23   |      |
|                               | t <sub>pHL</sub>    |                | 5.5                 | —    | 11   | 16   | —              | 20   |      |
| Input Capacitance             | C <sub>IN</sub>     |                |                     | —    | 5    | 10   | —              | 10   | pF   |
| Power Dissipation Capacitance | C <sub>PD</sub> (1) |                |                     | —    | 18   | —    | —              | —    |      |

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 :

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 4 \text{ (per Gate)}$$

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

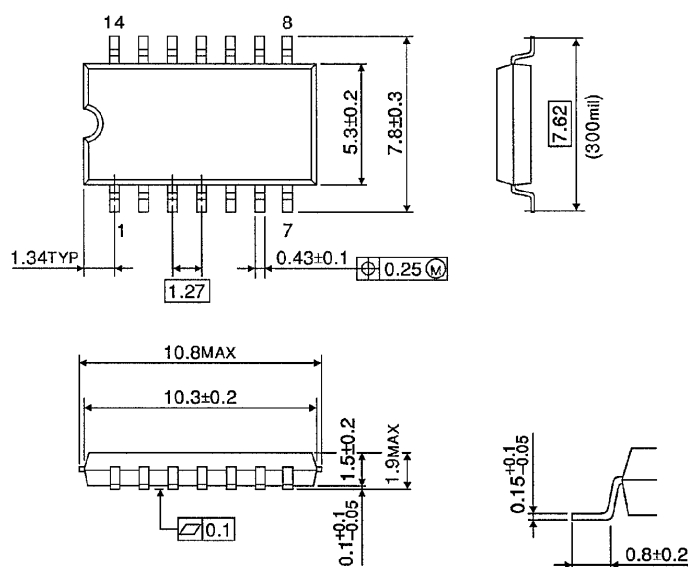
Unit in mm



Weight : 0.96g (Typ.)

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

Unit in mm

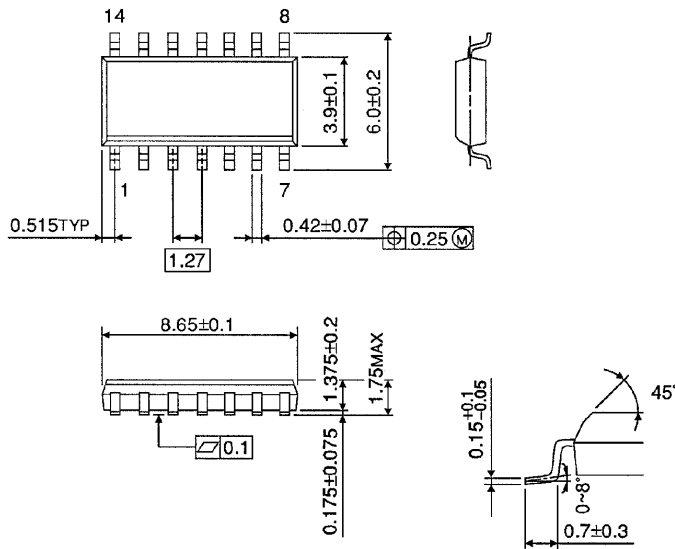


Weight : 0.18g (Typ.)

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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