



## U74HC20

CMOS IC

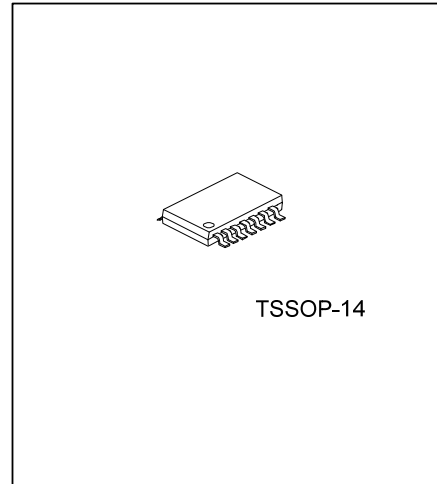
### DUAL 4-INPUT NAND GATES

#### DESCRIPTION

The **U74HC20** contains two independent 4-input NAND gates. They perform the Boolean function  $Y = \overline{A \cdot B \cdot C \cdot D}$  or  $Y = \overline{A} + \overline{B} + \overline{C} + \overline{D}$  in positive logic.

#### FEATURES

- \* Operation voltage range: 2~6V
- \* Low Quiescent Current:  $I_{CC} = 2\mu A$  (Max)
- \* High speed:  $t_{PD} = 11ns$  (Typ)
- \* Low input current: 100nA Max

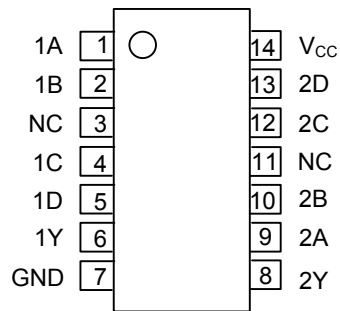


#### ORDERING INFORMATION

| Ordering Number |                | Package  | Packing   |
|-----------------|----------------|----------|-----------|
| Lead Free       | Halogen Free   |          |           |
| U74HC20L-P14-T  | U74HC20G-P14-T | TSSOP-14 | Tube      |
| U74HC20L-P14-R  | U74HC20G-P14-R | TSSOP-14 | Tape Reel |

|  |  |
|--|--|
| <p>U74HC20L-P14-T</p> <p>(1) Packing Type<br/>(2) Package Type<br/>(3) Lead Free</p> | <p>(1) R: Tape Reel, T: Tube<br/>(2) P14: TSSOP-14<br/>(3) G: Halogen Free, L: Lead Free</p> |
|--|--|

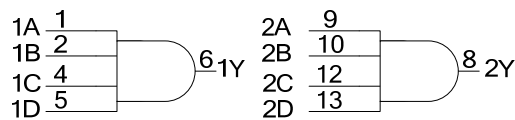
■ PIN CONFIGURATION



■ FUNCTION TABLE (each gate)

| INPUT(A) | INPUT(B) | INPUT(C) | INPUT(D) | OUTPUT(Y) |
|----------|----------|----------|----------|-----------|
| H        | H        | H        | H        | L         |
| L        | X        | X        | X        | H         |
| X        | L        | X        | X        | H         |
| X        | X        | L        | X        | H         |
| X        | X        | X        | L        | H         |

■ LOGIC DIAGRAM



■ ABSOLUTE MAXIMUM RATING (unless otherwise specified)

| PARAMETER               | SYMBOL    | RATINGS    | UNIT        |
|-------------------------|-----------|------------|-------------|
| Supply Voltage          | $V_{CC}$  | -0.5~7     | V           |
| Input Clamp Current     | $I_{IK}$  | -20        | mA          |
| Output Clamp Current    | $I_{OK}$  | $\pm 20$   | mA          |
| Output Current          | $I_{OUT}$ | $\pm 25$   | mA          |
| $V_{CC}$ or GND Current | $I_{CC}$  | $\pm 50$   | mA          |
| Storage Temperature     | $T_{STG}$ | -65 ~ +150 | $^{\circ}C$ |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.  
 Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ RECOMMENDED OPERATING CONDITIONS

| PARAMETER                          | SYMBOL     | CONDITIONS    | MIN | TYP | MAX      | UNIT        |
|------------------------------------|------------|---------------|-----|-----|----------|-------------|
| Supply Voltage                     | $V_{CC}$   |               | 2   |     | 6        | V           |
| Input Voltage                      | $V_{IN}$   |               | 0   |     | $V_{CC}$ | V           |
| Output Voltage                     | $V_{OUT}$  |               | 0   |     | $V_{CC}$ | V           |
| Input Transition Rise or Fall Rate | $t_R, t_F$ | $V_{CC}=2V$   |     |     | 1000     | ns          |
|                                    |            | $V_{CC}=4.5V$ |     |     | 500      |             |
|                                    |            | $V_{CC}=6V$   |     |     | 400      |             |
| Operating Temperature              | $T_A$      |               | -40 |     | 85       | $^{\circ}C$ |

■ STATIC CHARACTERISTICS ( $T_A = 25^{\circ}C$ )

| PARAMETER                 | SYMBOL        | TEST CONDITIONS                                      | MIN  | TYP       | MAX       | UNIT    |
|---------------------------|---------------|--|------|-----------|-----------|---------|
| High-Level Input Voltage  | $V_{IH}$      | $V_{CC} = 2V$  | 1.5  |           |           | V       |
|                           |               | $V_{CC} = 4.5V$                                      | 3.15 |           |           |         |
|                           |               | $V_{CC} = 6V$  | 4.2  |           |           |         |
| Low-Level Input Voltage   | $V_{IL}$      | $V_{CC} = 2V$  |      |           | 0.5       | V       |
|                           |               | $V_{CC} = 4.5V$                                      |      |           | 1.35      |         |
|                           |               | $V_{CC} = 6V$  |      |           | 1.8       |         |
| High-Level Output Voltage | $V_{OH}$      | $V_{CC} = 2V, I_{OH} = 20\mu A$                      | 1.9  | 1.998     |           | V       |
|                           |               | $V_{CC} = 4.5V, I_{OH} = 20\mu A$                    | 4.4  | 4.999     |           |         |
|                           |               | $V_{CC} = 6V, I_{OH} = 20\mu A$                      | 5.9  | 5.999     |           |         |
|                           |               | $V_{CC} = 4.5V, I_{OH} = 4mA$                        | 3.98 | 4.3       |           |         |
|                           |               | $V_{CC} = 6V, I_{OH} = 5.2mA$                        | 5.48 | 5.8       |           |         |
| Low-Level Output Voltage  | $V_{OL}$      | $V_{CC} = 2V, I_{OL} = 20\mu A$                      |      | 0.002     | 0.1       | V       |
|                           |               | $V_{CC} = 4.5V, I_{OL} = 20\mu A$                    |      | 0.001     | 0.1       |         |
|                           |               | $V_{CC} = 6V, I_{OL} = 20\mu A$                      |      | 0.001     | 0.1       |         |
|                           |               | $V_{CC} = 4.5V, I_{OL} = 4mA$                        |      | 0.17      | 0.26      |         |
|                           |               | $V_{CC} = 6V, I_{OL} = 5.2mA$                        |      | 0.15      | 0.26      |         |
| Input Leakage Current     | $I_{I(LEAK)}$ | $V_{CC} = 6V, V_{IN} = V_{CC}$ or GND                |      | $\pm 0.1$ | $\pm 100$ | nA      |
| Quiescent Supply Current  | $I_Q$         | $V_{CC} = 6V, V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0$ |      |           | 2         | $\mu A$ |
| Input Capacitance         | $C_{IN}$      | $V_{CC} = 2V \sim 6V$                                |      | 3         | 10        | pF      |

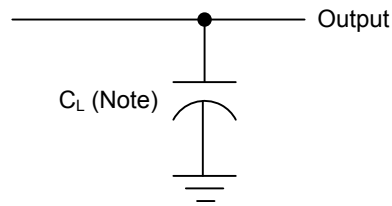
■ DYNAMIC CHARACTERISTICS ( $T_A=25^\circ\text{C}$ , Input:  $t_R=t_F=6\text{ns}$ , unless otherwise specified )

| PARAMETER   | SYMBOL             | TEST CONDITIONS                       | MIN | TYP | MAX | UNIT |
|---|--------------------|---------------------------------------|-----|-----|-----|------|
| Propagation delay from Input(A, B, C or D) to Output(Y) | $t_{PLH}, t_{PHL}$ | $V_{CC}=2\text{V}, C_L=50\text{pF}$   |     | 45  | 110 | ns   |
|   |                    | $V_{CC}=4.5\text{V}, C_L=50\text{pF}$ |     | 14  | 22  |      |
|   |                    | $V_{CC}=6\text{V}, C_L=50\text{pF}$   |     | 11  | 19  |      |
| Output Transition Time                                  | $t_T$              | $V_{CC}=2\text{V}, C_L=50\text{pF}$   |     | 27  | 75  | ns   |
|   |                    | $V_{CC}=4.5\text{V}, C_L=50\text{pF}$ |     | 9   | 15  |      |
|   |                    | $V_{CC}=6\text{V}, C_L=50\text{pF}$   |     | 7   | 13  |      |

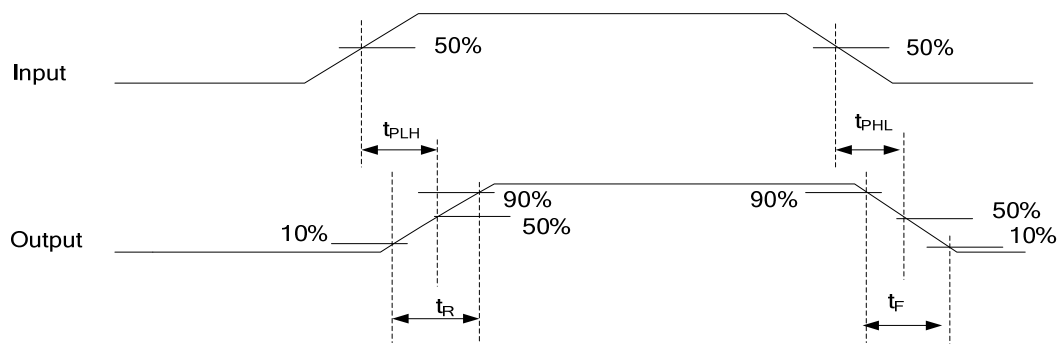
■ OPERATING CHARACTERISTICS ( $T_A=25^\circ\text{C}$ , unless otherwise specified)

| PARAMETER                     | SYMBOL   | TEST CONDITION | MIN | TYP | MAX | UNIT |
|-------------------------------|----------|----------------|-----|-----|-----|------|
| Power Dissipation Capacitance | $C_{PD}$ | No load        |     | 25  |     | pF   |

## TEST CIRCUIT AND WAVEFORMS



Note : C<sub>L</sub> includes probe and jig capacitance.



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