

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

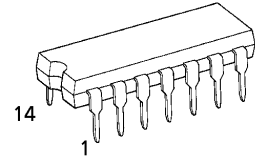
# TC74HC4072AP, TC74HC4072AF

## DUAL 4-INPUT OR GATE

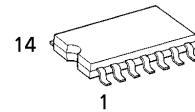
The TC74HC4072A is a high speed CMOS 4-INPUT OR GATE fabricated with silicon gate C<sup>2</sup>MOS technology. It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. The internal circuit is composed of 4 stages including buffered outputs, which 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  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC} (\text{Min.})$
- Output Drive Capability ..... 10 LSTTL Loads
- Symmetrical Output Impedance...  $|I_{OH}| = I_{OL} = 4\text{mA}(\text{Min.})$
- Balanced Propagation Delays.....  $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range...  $V_{CC} (\text{opr.}) = 2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 4072B

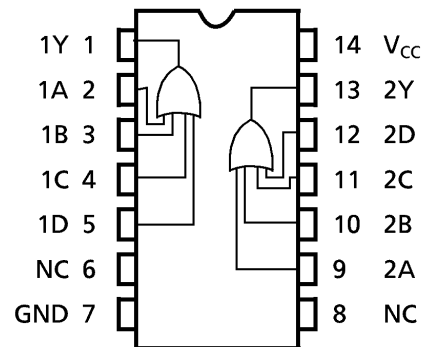


P (DIP14-P-300-2.54)  
Weight : 0.96g (Typ.)



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

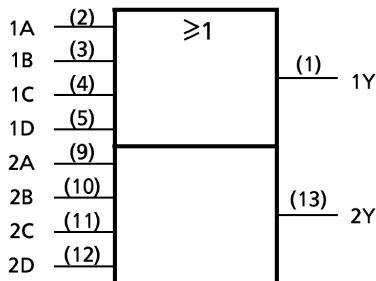
### PIN ASSIGNMENT



(TOP VIEW)

NC : No Connection

### IEC LOGIC SYMBOL



### TRUTH TABLE

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

X : Don't Care

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**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                    | SYMBOL    | VALUE                  | UNIT |
|------------------------------|-----------|------------------------|------|
| Supply Voltage Range         | $V_{CC}$  | -0.5~7                 | V    |
| DC Input Voltage             | $V_{IN}$  | -0.5~ $V_{CC} + 0.5$   | V    |
| DC Output Voltage            | $V_{OUT}$ | -0.5~ $V_{CC} + 0.5$   | V    |
| Input Diode Current          | $I_{IK}$  | ± 20                   | mA   |
| Output Diode Current         | $I_{OK}$  | ± 20                   | mA   |
| DC Output Current            | $I_{OUT}$ | ± 25                   | mA   |
| DC $V_{CC}$ / Ground Current | $I_{CC}$  | ± 50                   | mA   |
| Power Dissipation            | $P_D$     | 500 (DIP)* / 180 (SOP) | mW   |
| Storage Temperature          | $T_{stg}$ | -65~150                | °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           | $V_{CC}$   | 2~6  | V    |
| Input Voltage            | $V_{IN}$   | 0~ $V_{CC}$  | V    |
| Output Voltage           | $V_{OUT}$  | 0~ $V_{CC}$  | V    |
| Operating Temperature    | $T_{opr}$  | -40~85   | °C   |
| Input Rise and Fall Time | $t_r, t_f$ | 0~ 1000 ( $V_{CC} = 2.0\text{V}$ )<br>0~ 500 ( $V_{CC} = 4.5\text{V}$ )<br>0~ 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  | 1.50                       | —    | —     | 1.50                                | —     | V             |   |
|                             |          |  | 4.5  | 3.15                       | —    | —     | 3.15                                | —     |               |   |
|                             |          |  | 6.0  | 4.20                       | —    | —     | 4.20                                | —     |               |   |
| Low - Level Input Voltage   | $V_{IL}$ |  | 2.0  | —                          | —    | 0.50  | —                                   | 0.50  | V             |   |
|                             |          |  | 4.5  | —                          | —    | 1.35  | —                                   | 1.35  |               |   |
|                             |          |  | 6.0  | —                          | —    | 1.80  | —                                   | 1.80  |               |   |
| High - Level Output Voltage | $V_{OH}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$     | $I_{OH} = -20\mu\text{A}$                              | 2.0                        | 1.9  | 2.0   | —                                   | 1.9   | —             | V |
|                             |          |  |  | 4.5                        | 4.4  | 4.5   | —                                   | 4.4   | —             |   |
|                             |          |  | $I_{OH} = -4 \text{ mA}$<br>$I_{OH} = -5.2 \text{ mA}$ | 4.5                        | 4.18 | 4.31  | —                                   | 4.13  | —             |   |
|                             |          |  |  | 6.0                        | 5.68 | 5.80  | —                                   | 5.63  | —             |   |
| Low - Level Output Voltage  | $V_{OL}$ | $V_{IN} = V_{IL}$                        | $I_{OL} = 20\mu\text{A}$                               | 2.0                        | —    | 0.0   | 0.1                                 | —     | 0.1           | V |
|                             |          |  |  | 4.5                        | —    | 0.0   | 0.1                                 | —     | 0.1           |   |
|                             |          |  | $I_{OL} = 4 \text{ mA}$<br>$I_{OL} = 5.2 \text{ mA}$   | 4.5                        | —    | 0.17  | 0.26                                | —     | 0.33          |   |
|                             |          |  |  | 6.0                        | —    | 0.18  | 0.26                                | —     | 0.33          |   |
| Input Leakage Current       | $I_{IN}$ | $V_{IN} = V_{CC} \text{ or } \text{GND}$ | 6.0  | —                          | —    | ± 0.1 | —                                   | ± 1.0 | $\mu\text{A}$ |   |
| Quiescent Supply Current    | $I_{CC}$ | $V_{IN} = V_{CC} \text{ or } \text{GND}$ | 6.0  | —                          | —    | 1.0   | —                                   | 10.0  |               |   |

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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 | $t_{TLH}$ |                | —    | 4    | 8    | ns   |
|                        | $t_{THL}$ |                |      |      |      |      |
| Propagation Delay Time | $t_{pLH}$ |                | —    | 9    | 16   |      |
|                        | $t_{pHL}$ |                |      |      |      |      |

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

| PARAMETER                     | SYMBOL       | TEST CONDITION | $T_a = 25^\circ\text{C}$ |      |      | $T_a = -40\sim 85^\circ\text{C}$ |      | UNIT |      |
|-------------------------------|--------------|----------------|--------------------------|------|------|----------------------------------|------|------|------|
|                               |              |                | $V_{CC}$ (V)             | MIN. | TYP. | MAX.                             | MIN. |      | MAX. |
| Output Transition Time        | $t_{TLH}$    |                | 2.0                      | —    | 30   | 75                               | —    | 95   | ns   |
|                               |              |                | 4.5                      | —    | 8    | 15                               | —    | 19   |      |
|                               |              |                | 6.0                      | —    | 7    | 13                               | —    | 16   |      |
| Propagation Delay Time        | $t_{pLH}$    |                | 2.0                      | —    | 36   | 100                              | —    | 125  | ns   |
|                               |              |                | 4.5                      | —    | 12   | 20                               | —    | 25   |      |
|                               |              |                | 6.0                      | —    | 10   | 17                               | —    | 21   |      |
| Input Capacitance             | $C_{IN}$     |                | —                        | 5    | 10   | —                                | 10   | pF   |      |
| Power Dissipation Capacitance | $C_{PD}$ (1) |                | —                        | 22   | —    | —                                | —    |      |      |

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 OUTLINE DRAWING (DIP14-P-300-2.54)**

Unit in mm



**SOP 14PIN (200mil BODY) OUTLINE DRAWING (SOP14-P-300-1.27)**

Unit in mm

