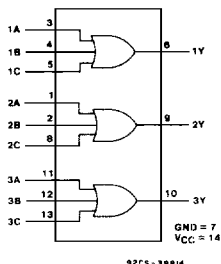


# CD54/74HC4075 CD54/74HCT4075

## High-Speed CMOS Logic



FUNCTIONAL DIAGRAM

### Triple 3-Input OR Gate

**Type Features:**

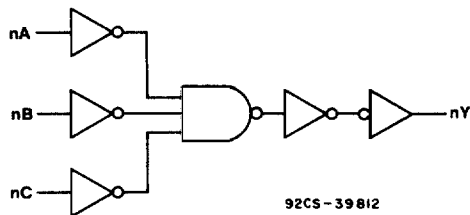
- Buffered inputs
- Typical CD54/74HC4075 Propagation Delay = 8ns  
@  $V_{CC} = 5V$ ,  $C_L = 15pF$ ,  $T_A = 25^\circ C$

The RCA-CD54/74HC4075 and CD54/74HCT4075 logic gates utilize silicon-gate CMOS technology to achieve operating speeds similar to LSTTL gates with the low power consumption of standard CMOS integrated circuits. All devices have the ability to drive 10 LSTTL loads. The CD54/74HCT logic family is functionally as well as pin compatible with the standard 54LS/74LS logic family.

The CD54HC4075 and CD54HCT4075 are supplied in 14-lead hermetic dual-in-line ceramic packages (F suffix). The CD74HC4075 and CD74HCT4075 are supplied in 14-lead dual-in-line plastic packages (E suffix) and in 14-lead dual-in-line surface-mount plastic packages (M suffix). Both types are also available in chip form (H suffix).

**Family Features:**

- Fanout (over temperature range):  
Standard Outputs - 10 LSTTL loads  
Bus driver outputs - 15 LSTTL loads
- Wide Operating temperature range:  
CD74HC/HCT:  $-40$  to  $+85^\circ C$
- Balanced propagation delay and transition times
- Significant power reduction compared to LSTTL logic ICs
- Alternate source is Philips/Signetics
- CD54HC/CD74HC Types:  
2 to 6 V Operation  
High noise immunity:  $N_{IL} = 30\%$ ,  $N_{IH} = 30\%$  of  $V_{CC}$ :  
@  $V_{CC} = 5V$
- CD54HCT/CD74HCT Types:  
4.5 to 5.5 V Operation  
Direct LSTTL input logic compatibility  
 $V_{IL} = 0.8V$  max.,  $V_{IH} = 2V$  Min.  
CMOS input compatibility  
 $I_i \leq 1 \mu A$  @  $V_{OL}$ ,  $V_{OH}$



LOGIC DIAGRAM

**TRUTH TABLE**

| nA | nB | nC | nY |
|----|----|----|----|
| L  | L  | L  | L  |
| H  | X  | X  | H  |
| X  | H  | X  | H  |
| X  | X  | H  | H  |

L = Low voltage Level  
H = High voltage Level  
X = Don't Care

# CD54/74HC4075 CD54/74HCT4075

**MAXIMUM RATINGS, Absolute-Maximum Values:**

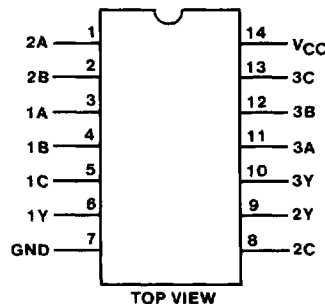
|  |   |
|--|---|
| DC SUPPLY-VOLTAGE, ( $V_{CC}$ ):   |   |
| (Voltages referenced to ground)  | -0.5 to + 7 V                                 |
| DC INPUT DIODE CURRENT, $I_{IK}$ (FOR $V_i < -0.5$ V OR $V_i > V_{CC} + 0.5$ V)  | $\pm 20$ mA                                   |
| DC OUTPUT DIODE CURRENT, $I_{OK}$ (FOR $V_o < -0.5$ V OR $V_o > V_{CC} + 0.5$ V) | $\pm 20$ mA                                   |
| DC DRAIN CURRENT, PER OUTPUT ( $I_o$ ) (FOR $-0.5$ V $< V_o < V_{CC} + 0.5$ V)   | $\pm 25$ mA                                   |
| DC $V_{CC}$ OR GROUND CURRENT ( $I_{CC}$ )                                       | $\pm 50$ mA                                   |
| POWER DISSIPATION PER PACKAGE ( $P_D$ ):   |   |
| For $T_A = -40$ to $+60^\circ$ C (PACKAGE TYPE E)                                | 500 mW  |
| For $T_A = +60$ to $+85^\circ$ C (PACKAGE TYPE E)                                | Derate Linearly at 8 mW/ $^\circ$ C to 300 mW |
| For $T_A = -55$ to $+100^\circ$ C (PACKAGE TYPE F, H)                            | 500 mW  |
| For $T_A = +100$ to $+125^\circ$ C (PACKAGE TYPE F, H)                           | Derate Linearly at 8 mW/ $^\circ$ C to 300 mW |
| For $T_A = -40$ to $+70^\circ$ C (PACKAGE TYPE M)                                | 400 mW  |
| For $T_A = +70$ to $+125^\circ$ C (PACKAGE TYPE M)                               | Derate Linearly at 6 mW/ $^\circ$ C to 70 mW  |
| OPERATING-TEMPERATURE RANGE ( $T_A$ ):   |   |
| PACKAGE TYPE F, H  | -55 to $+125^\circ$ C                         |
| PACKAGE TYPE E, M  | -40 to $+85^\circ$ C                          |
| STORAGE TEMPERATURE ( $T_{STG}$ )  | -65 to $+150^\circ$ C                         |
| LEAD TEMPERATURE (DURING SOLDERING):   |   |
| At distance 1/16 $\pm$ 1/32 in. (1.59 $\pm$ 0.79 mm) from case for 10 s max.     | $+265^\circ$ C                                |
| Unit inserted into a PC Board (min. thickness 1/16 in., 1.59 mm)                 |   |
| with solder contacting lead tips only  | $+300^\circ$ C                                |

**RECOMMENDED OPERATING CONDITIONS:**

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

| CHARACTERISTIC  | LIMITS |          | UNITS      |
|---|--------|----------|------------|
|   | MIN.   | MAX.     |            |
| Supply-Voltage Range (For $T_A =$ Full Package-Temperature Range) $V_{CC}$ .* |        |          |            |
| CD54/74HC Types   | 2      | 6        | V          |
| CD54/74HCT Types  | 4.5    | 5.5      | V          |
| DC Input or Output Voltage $V_i, V_o$   | 0      | $V_{CC}$ | V          |
| Operating Temperature $T_A$ :   |        |          |            |
| CD74 Types  | -40    | +85      | $^\circ$ C |
| CD54 Types  | -55    | +125     | $^\circ$ C |
| Input Rise and Fall Times $t_r, t_f$  |        |          |            |
| at 2 V  | 0      | 1000     | ns         |
| at 4.5 V  | 0      | 500      |            |
| at 6 V  | 0      | 400      |            |

\*Unless otherwise specified, all voltages are referenced to Ground.



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TERMINAL ASSIGNMENT

# CD54/74HC4075

# CD54/74HCT4075

## STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC  | CD74HC4075/CD54HC4075                    |                      |                      |                 |      |      |               |      |                |      | CD74HCT4075/CD54HCT4075                                |                      |                   |     |      |               |      |                |     |     | UNITS |
|---|--|----------------------|----------------------|-----------------|------|------|---------------|------|----------------|------|--|----------------------|-------------------|-----|------|---------------|------|----------------|-----|-----|-------|
|   | TEST CONDITIONS                          |                      |                      | 74HC/54HC TYPES |      |      | 74HC TYPE     |      | 54HC TYPE      |      | TEST CONDITIONS  |                      | 74HCT/54HCT TYPES |     |      | 74HCT TYPE    |      | 54HCT TYPE     |     |     |       |
|   | V <sub>I</sub><br>V                      | I <sub>O</sub><br>mA | V <sub>CC</sub><br>V | +25°C           |      |      | -40/<br>+85°C |      | -55/<br>+125°C |      | V <sub>I</sub><br>V                                    | V <sub>CC</sub><br>V | +25°C             |     |      | -40/<br>+85°C |      | -55/<br>+125°C |     |     |       |
|   |  |                      |                      | Min             | Typ  | Max  | Min           | Max  | Min            | Max  |  |                      | Min               | Typ | Max  | Min           | Max  | Min            | Max |     |       |
| High-Level<br>Input Voltage V <sub>IH</sub>   |  |                      | 2                    | 1.5             | —    | —    | 1.5           | —    | 1.5            | —    | —  | 4.5                  |                   |     |      |               |      |                |     | V   |       |
|   |  |                      | 4.5                  | 3.15            | —    | —    | 3.15          | —    | 3.15           | —    | to   | 2                    | —                 | —   | 2    | —             | 2    | —              |     |     |       |
|   |  |                      | 6                    | 4.2             | —    | —    | 4.2           | —    | 4.2            | —    | 5.5  |                      |                   |     |      |               |      |                |     |     |       |
| Low-Level<br>Input Voltage V <sub>IL</sub>  |  |                      | 2                    | —               | —    | 0.5  | —             | 0.5  | —              | 0.5  | —  | 4.5                  |                   |     |      |               |      |                |     | V   |       |
|   |  |                      | 4.5                  | —               | —    | 1.35 | —             | 1.35 | —              | 1.35 | to   | —                    | —                 | 0.8 | —    | 0.8           | —    | 0.8            | —   |     |       |
|   |  |                      | 6                    | —               | —    | 1.8  | —             | 1.8  | —              | 1.8  | 5.5  |                      |                   |     |      |               |      |                |     |     |       |
| High-Level<br>Output Voltage V <sub>OH</sub>  | V <sub>IL</sub><br>or<br>V <sub>IH</sub> | -0.02                | 2                    | 1.9             | —    | —    | 1.9           | —    | 1.9            | —    | V <sub>IL</sub><br>or<br>V <sub>IH</sub>               | 4.5                  | 4.4               | —   | —    | 4.4           | —    | 4.4            | —   | V   |       |
| CMOS Loads  |  |                      | 4.5                  | 4.4             | —    | —    | 4.4           | —    | 4.4            | —    |  |                      |                   |     |      |               |      |                |     |     |       |
|   |  |                      | 6                    | 5.9             | —    | —    | 5.9           | —    | 5.9            | —    |  |                      |                   |     |      |               |      |                |     |     |       |
| TTL Loads   | V <sub>IL</sub><br>or<br>V <sub>IH</sub> |                      |                      |                 |      |      |               |      |                |      | V <sub>IL</sub><br>or<br>V <sub>IH</sub>               | 4.5                  | 3.98              | —   | —    | 3.84          | —    | 3.7            | —   | V   |       |
|   |  |                      | -4                   | 4.5             | 3.98 | —    | —             | 3.84 | —              | 3.7  | —  |                      |                   |     |      |               |      |                |     |     |       |
|   |  |                      | -5.2                 | 6               | 5.48 | —    | —             | 5.34 | —              | 5.2  | —  |                      |                   |     |      |               |      |                |     |     |       |
| Low-Level<br>Output Voltage V <sub>OL</sub>   | V <sub>IL</sub><br>or<br>V <sub>IH</sub> | 0.02                 | 2                    | —               | —    | 0.1  | —             | 0.1  | —              | 0.1  | V <sub>IL</sub><br>or<br>V <sub>IH</sub>               | 4.5                  | —                 | —   | 0.1  | —             | 0.1  | —              | 0.1 | V   |       |
| CMOS Loads  |  |                      | 4.5                  | —               | —    | 0.1  | —             | 0.1  | —              | 0.1  |  |                      |                   |     |      |               |      |                |     |     |       |
|   |  |                      | 6                    | —               | —    | 0.1  | —             | 0.1  | —              | 0.1  |  |                      |                   |     |      |               |      |                |     |     |       |
| TTL Loads   | V <sub>IL</sub><br>or<br>V <sub>IH</sub> |                      |                      |                 |      |      |               |      |                |      | V <sub>IL</sub><br>or<br>V <sub>IH</sub>               | 4.5                  | —                 | —   | 0.26 | —             | 0.33 | —              | 0.4 | V   |       |
|   |  |                      | 4                    | 4.5             | —    | —    | 0.26          | —    | 0.33           | —    | 0.4  |                      |                   |     |      |               |      |                |     |     |       |
|   |  |                      | 5.2                  | 6               | —    | —    | 0.26          | —    | 0.33           | —    | 0.4  |                      |                   |     |      |               |      |                |     |     |       |
| Input Leakage<br>Current I <sub>I</sub>   | V <sub>CC</sub><br>or<br>Gnd             |                      | 6                    | —               | —    | ±0.1 | —             | ±1   | —              | ±1   | Any<br>Voltage<br>Between<br>V <sub>CC</sub><br>& Grid | 5.5                  | —                 | —   | ±0.1 | —             | ±1   | —              | ±1  | μA  |       |
| Quiescent<br>Device<br>Current I <sub>CC</sub>  | V <sub>CC</sub><br>or<br>Gnd             | 0                    | 6                    | —               | —    | 2    | —             | 20   | —              | 40   | V <sub>CC</sub><br>or<br>Gnd                           | 5.5                  | —                 | —   | 2    | —             | 20   | —              | 40  | μA  |       |
| Additional<br>Quiescent<br>Device Current<br>per input pin:<br>1 unit load ΔI <sub>CC</sub> * |  |                      |                      |                 |      |      |               |      |                |      | V <sub>CC</sub> -2.1                                   | 4.5                  | to                | —   | 100  | 360           | —    | 450            | —   | 490 | μA    |
|   |  |                      |                      |                 |      |      |               |      |                |      |  | 5.5                  |                   |     |      |               |      |                |     |     |       |

\*For dual-supply systems theoretical worst case (V<sub>I</sub> = 2.4 V, V<sub>CC</sub> = 5.5 V) specification is 1.8 mA.

### HCT INPUT LOADING TABLE

| INPUT | UNIT LOADS* |
|-------|-------------|
| All   | 1.6         |

\*Unit Load is ΔI<sub>CC</sub> limit specified in Static Characteristic Chart, e.g., 360 μA max. @25° C.

# CD54/74HC4075 CD54/74HCT4075

**SWITCHING CHARACTERISTICS (V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C, Input t<sub>r</sub> = 6 ns)**

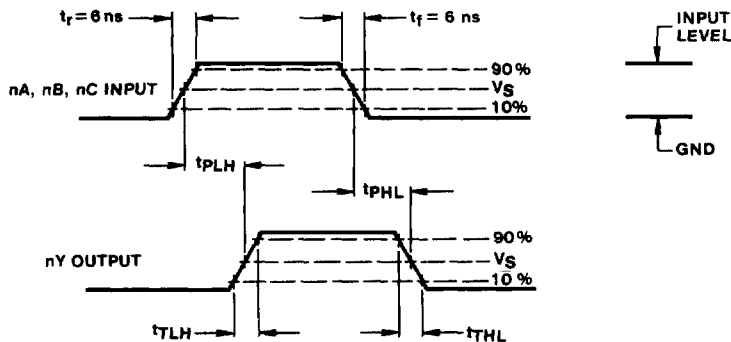
| CHARACTERISTIC                                     | CL (pF)                             | TYPICAL |       | UNITS |
|--|-------------------------------------|---------|-------|-------|
|  |                                     | HC      | HCT   |       |
| Propagation Delay, Data Input to Output Y (Fig. 1) | t <sub>PLH</sub> , t <sub>PHL</sub> | 15      | 8 9   | ns    |
| Power Dissipation Capacitance*                     | C <sub>PD</sub>                     | —       | 26 28 | pF    |

\*C<sub>PD</sub> is used to determine the dynamic power consumption, per gate.

$P_D = V_{CC}^2 f_i (C_{PD} + C_L)$  where:  $f_i$  = input frequency  
 $C_L$  = load capacitance  
 $V_{CC}$  = supply voltage

**SWITCHING CHARACTERISTICS (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = 6 ns)**

| CHARACTERISTIC                              | V <sub>CC</sub>  | 25°C |      |      |      | -40°C to +85°C |      |       |      | -55°C to +125°C |      |       |      | UNITS |    |
|---|------------------|------|------|------|------|----------------|------|-------|------|-----------------|------|-------|------|-------|----|
|   |                  | HC   |      | HCT  |      | 74HC           |      | 74HCT |      | 54HC            |      | 54HCT |      |       |    |
|   |                  | Min. | Max. | Min. | Max. | Min.           | Max. | Min.  | Max. | Min.            | Max. | Min.  | Max. |       |    |
| Propagation Delay, Input to Output (Fig. 1) | t <sub>PLH</sub> | 4.5  | —    | 100  | —    | —              | —    | 125   | —    | —               | —    | 150   | —    | —     | ns |
|   | t <sub>PHL</sub> | 2    | —    | 20   | —    | 24             | —    | 25    | —    | 30              | —    | 30    | —    | 36    |    |
|   |                  | 6    | —    | 17   | —    | —              | —    | 21    | —    | —               | —    | 26    | —    | —     |    |
| Transition Times (Fig. 1)                   | t <sub>TLH</sub> | 2    | —    | 75   | —    | —              | —    | 95    | —    | —               | —    | 110   | —    | —     | ns |
|   | t <sub>THL</sub> | 4.5  | —    | 15   | —    | 15             | —    | 19    | —    | 19              | —    | 22    | —    | 22    |    |
|   |                  | 6    | —    | 13   | —    | —              | —    | 16    | —    | —               | —    | 19    | —    | —     |    |
| Input Capacitance                           | C <sub>i</sub>   |      | —    | 10   | —    | 10             | —    | 10    | —    | 10              | —    | 10    | —    | 10    | pF |



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|                                   | 54/74HC             | 54/74HCT |
|-----------------------------------|---------------------|----------|
| Input Level                       | V <sub>CC</sub>     | 3V       |
| Switching Voltage, V <sub>s</sub> | 50% V <sub>CC</sub> | 1.3 V    |

Fig. 1 - Transition times and propagation delay times.