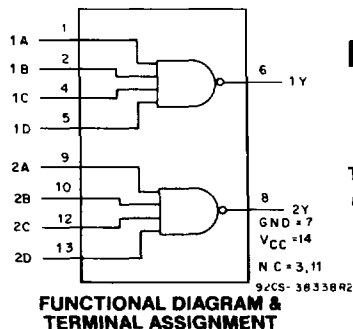


CD54/74AC20 CD54/74ACT20



Dual 4-Input NAND Gate

Type Features:

- Typical propagation delay (AC20):
6 ns @ $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{ C}$, $C_L = 50\text{ pF}$

The RCA CD54/74AC20 and CD54/74ACT20 dual 4-input NAND gates use the RCA ADVANCED CMOS technology. The CD74AC20 and CD74ACT20 are supplied in 14-lead dual-in-line plastic packages (E suffix) and in 14-lead dual-in-line small-outline plastic packages (M suffix). Both package types are operable over the following temperature ranges: Commercial (0 to 70°C); Industrial (-40 to +85°C); and Extended Industrial/Military (-55 to +25°C).

The CD54AC20 and CD54ACT20, available in chip form (H suffix), are operable over the -55 to +125°C temperature range.

Family Features:

- Exceeds 2-kV ESD Protection - MIL-STD-883, Method 3015
- SCR-Latchup-resistant CMOS process and circuit design
- Speed of bipolar FAST[®]/AS/S with significantly reduced power consumption
- Balanced propagation delays
- AC types feature 1.5-V to 5.5-V operation and balanced noise immunity at 30% of the supply.
- ± 24-mA output drive current
 - Fanout to 15 FAST[®] ICs
 - Drives 50-ohm transmission lines

[®]FAST is a Registered Trademark of Fairchild Semiconductor Corp

TRUTH TABLE

| INPUTS | | | | OUTPUTS |
|--------|----|----|----|---------|
| nA | nB | nC | nD | nY |
| 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

CD54/74AC20 CD54/74ACT20

MAXIMUM RATINGS, Absolute-Maximum Values:

| | | |
|--|-------|---|
| DC SUPPLY-VOLTAGE (V_{CC}) | | -0.5 to 6 V |
| DC INPUT DIODE CURRENT, I_{IK} (for $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V) | | ± 20 mA |
| DC OUTPUT DIODE CURRENT, I_{OK} (for $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V) | | ± 50 mA |
| DC OUTPUT SOURCE OR SINK CURRENT per Output Pin, I_O (for $V_O > -0.5$ V or $V_O < V_{CC} + 0.5$ V) | | ± 50 mA |
| DC V_{CC} or GROUND CURRENT (I_{CC} or I_{GND}) | | ± 100 mA* |
| POWER DISSIPATION PER PACKAGE (P_D): | | |
| For $T_A = -55$ to $+100^\circ\text{C}$ (PACKAGE TYPE E) | | 500 mW |
| For $T_A = +100$ to $+125^\circ\text{C}$ (PACKAGE TYPE E) | | Derate Linearly at 8 mW/ $^\circ\text{C}$ to 300 mW |
| For $T_A = -55$ to $+70^\circ\text{C}$ (PACKAGE TYPE M) | | 400 mW |
| For $T_A = +70$ to $+125^\circ\text{C}$ (PACKAGE TYPE M) | | Derate Linearly at 6 mW/ $^\circ\text{C}$ to 70 mW |
| OPERATING-TEMPERATURE RANGE (T_A) | | -55 to $+125^\circ\text{C}$ |
| STORAGE TEMPERATURE (T_{stg}) | | -65 to $+150^\circ\text{C}$ |
| LEAD TEMPERATURE (DURING SOLDERING): | | |
| At distance $1/16 \pm 1/32$ in. (1.59 ± 0.79 mm) from case for 10 s maximum | | $+265^\circ\text{C}$ |
| Unit inserted into PC board min. thickness $1/16$ in. (1.59 mm) with solder contacting lead tips only | | $+300^\circ\text{C}$ |

*For up to 4 outputs per device; add ± 25 mA for each additional output.

RECOMMENDED OPERATING CONDITIONS:

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

| CHARACTERISTICS | LIMITS | | UNITS |
|---|--------|----------|------------------|
| | MIN. | MAX. | |
| Supply-Voltage Range, V_{CC} *: (For $T_A =$ Full Package-Temperature Range) | | | |
| AC Types | 1.5 | 5.5 | V |
| ACT Types | 4.5 | 5.5 | V |
| DC Input or Output Voltage, V_I , V_O | 0 | V_{CC} | V |
| Operating Temperature, T_A | -55 | +125 | $^\circ\text{C}$ |
| Input Rise and Fall Slew Rate, dt/dv | | | |
| at 1.5 V to 3 V (AC Types) | 0 | 50 | ns/V |
| at 3.6 V to 5.5 V (AC Types) | 0 | 20 | ns/V |
| at 4.5 V to 5.5 V (ACT Types) | 0 | 10 | ns/V |

*Unless otherwise specified, all voltages are referenced to ground.

CD54/74AC20

CD54/74ACT20

STATIC ELECTRICAL CHARACTERISTICS: AC Series

| CHARACTERISTICS | TEST CONDITIONS | | V _{CC} (V) | AMBIENT TEMPERATURE (T _A) - °C | | | | | | UNITS |
|--|--|------------------------|------------------------|--|------|------------|------|-------------|------|-------|
| | V _i (V) | I _o (mA) | | +25 | | -40 to +85 | | -55 to +125 | | |
| | | | | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | |
| High-Level Input Voltage V _{IH} | | | 1.5 | 1.2 | — | 1.2 | — | 1.2 | — | V |
| | | | 3 | 2.1 | — | 2.1 | — | 2.1 | — | |
| | | | 5.5 | 3.85 | — | 3.85 | — | 3.85 | — | |
| Low-Level Input Voltage V _{IL} | | | 1.5 | — | 0.3 | — | 0.3 | — | 0.3 | V |
| | | | 3 | — | 0.9 | — | 0.9 | — | 0.9 | |
| | | | 5.5 | — | 1.65 | — | 1.65 | — | 1.65 | |
| High-Level Output Voltage V _{OH} | V _{IH} or V _{IL} | -0.05 | 1.5 | 1.4 | — | 1.4 | — | 1.4 | — | V |
| | | -0.05 | 3 | 2.9 | — | 2.9 | — | 2.9 | — | |
| | | -0.05 | 4.5 | 4.4 | — | 4.4 | — | 4.4 | — | |
| | #, * | -4 | 3 | 2.58 | — | 2.48 | — | 2.4 | — | |
| | | -24 | 4.5 | 3.94 | — | 3.8 | — | 3.7 | — | |
| | | -75 | 5.5 | — | — | 3.85 | — | — | — | |
| | | -50 | 5.5 | — | — | — | — | 3.85 | — | |
| Low-Level Output Voltage V _{OL} | V _{IH} or V _{IL} | 0.05 | 1.5 | — | 0.1 | — | 0.1 | — | 0.1 | V |
| | | 0.05 | 3 | — | 0.1 | — | 0.1 | — | 0.1 | |
| | | 0.05 | 4.5 | — | 0.1 | — | 0.1 | — | 0.1 | |
| | #, * | 12 | 3 | — | 0.36 | — | 0.44 | — | 0.5 | |
| | | 24 | 4.5 | — | 0.36 | — | 0.44 | — | 0.5 | |
| | | 75 | 5.5 | — | — | — | 1.65 | — | — | |
| | | 50 | 5.5 | — | — | — | — | — | 1.65 | |
| Input Leakage Current I _I | V _{CC} or GND | | 5.5 | — | ±0.1 | — | ±1 | — | ±1 | μA |
| Quiescent Supply Current, SSI I _{CC} | V _{CC} or GND | 0 | 5.5 | — | 4 | — | 40 | — | 80 | μA |

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C. 75 ohms at +125°C.

STATIC ELECTRICAL CHARACTERISTICS: ACT Series

| CHARACTERISTICS | TEST CONDITIONS | | V_{CC} (V) | AMBIENT TEMPERATURE (T_A) - °C | | | | | | UNITS | |
|---|-----------------|------------------------------|-----------------|------------------------------------|------|------------|------|-------------|------|-------|----|
| | | | | +25 | | -40 to +85 | | -55 to +125 | | | |
| | | | | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | | |
| High-Level Input Voltage | V_{IH} | | 4.5 to 5.5 | 2 | — | 2 | — | 2 | — | V | |
| Low-Level Input Voltage | V_{IL} | | 4.5 to 5.5 | — | 0.8 | — | 0.8 | — | 0.8 | V | |
| High-Level Output Voltage | V_{OH} | V_{IH} or V_{IL} #, * | -0.05 | 4.5 | 4.4 | — | 4.4 | — | 4.4 | — | V |
| | | | -24 | 4.5 | 3.94 | — | 3.8 | — | 3.7 | — | |
| | | | -75 | 5.5 | — | — | 3.85 | — | — | — | |
| | | | -50 | 5.5 | — | — | — | — | 3.85 | — | |
| Low-Level Output Voltage | V_{OL} | V_{IH} or V_{IL} #, * | 0.05 | 4.5 | — | 0.1 | — | 0.1 | — | 0.1 | V |
| | | | 24 | 4.5 | — | 0.36 | — | 0.44 | — | 0.5 | |
| | | | 75 | 5.5 | — | — | — | 1.65 | — | — | |
| | | | 50 | 5.5 | — | — | — | — | — | 1.65 | |
| Input Leakage Current | I_i | V_{CC} or GND | 5.5 | — | ±0.1 | — | ±1 | — | ±1 | μA | |
| Quiescent Supply Current, SSI | I_{CC} | V_{CC} or GND | 0 | 5.5 | — | 4 | — | 40 | — | 80 | μA |
| Additional Quiescent Supply Current per Input Pin TTL Inputs High 1 Unit Load | ΔI_{CC} | $V_{CC}-2.1$ | 4.5 to 5.5 | — | 2.4 | — | 2.8 | — | 3 | mA | |

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

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ACT INPUT LOADING TABLE

| INPUT | UNIT LOAD* |
|-------|------------|
| ALL | 0.27 |

*Unit load is ΔI_{CC} limit specified in Static Characteristics Chart, e.g., 2.4 mA max. @ 25°C.

CD54/74AC20

CD54/74ACT20

SWITCHING CHARACTERISTICS: AC Series; $t_r, t_f = 3 \text{ ns}$, $C_L = 50 \text{ pF}$

| CHARACTERISTICS | SYMBOL | V_{CC} (V) | AMBIENT TEMPERATURE (T_A) - °C | | | | UNITS |
|--------------------------------------|------------------------|-------------------|------------------------------------|---------------------|-----------------|---------------------|-------|
| | | | -40 to +85 | | -55 to +125 | | |
| | | | MIN. | MAX. | MIN. | MAX. | |
| Propagation Delay Input to Output | t_{PLH} t_{PHL} | 1.5 3.3* 5† | — 4.4 3.1 | 139 15.5 11.1 | — 4.3 3.1 | 153 17.1 12.2 | ns |
| Power Dissipation Capacitance | $C_{PD}\S$ | — | 48 Typ. | | 48 Typ. | | pF |
| Input Capacitance | C_i | — | — | 10 | — | 10 | pF |

SWITCHING CHARACTERISTICS: ACT Series; $t_r, t_f = 3 \text{ ns}$, $C_L = 50 \text{ pF}$

| CHARACTERISTICS | SYMBOL | V_{CC} (V) | AMBIENT TEMPERATURE (T_A) - °C | | | | UNITS |
|--------------------------------------|------------------------|-----------------|------------------------------------|------|-------------|------|-------|
| | | | -40 to +85 | | -55 to +125 | | |
| | | | MIN. | MAX. | MIN. | MAX. | |
| Propagation Delay Input to Output | t_{PLH} t_{PHL} | 5† | 3.5 | 12.3 | 3.4 | 13.5 | ns |
| Power Dissipation Capacitance | $C_{PD}\S$ | — | 48 Typ. | | 48 Typ. | | pF |
| Input Capacitance | C_i | — | — | 10 | — | 10 | pF |

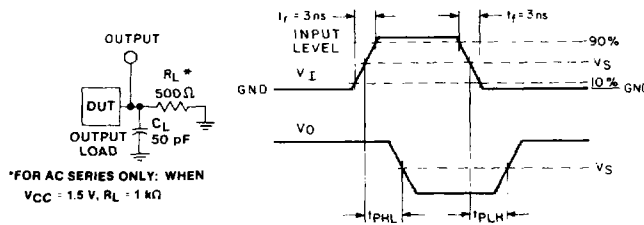
*3.3 V: min. is @ 3.6 V
max. is @ 3 V

†5 V: min. is @ 5.5 V
max. is @ 4.5 V

§ C_{PD} is used to determine the dynamic power consumption, per gate.

For AC series: $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$

For ACT series: $P_D = V_{CC}^2 f_i (C_{PD} + C_L) + V_{CC} \Delta I_{CC}$ where f_i = input frequency
 C_L = output load capacitance
 V_{CC} = supply voltage.



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| | CD54/74AC | CD54/74ACT |
|---------------------------------|--------------|--------------|
| Input Level | V_{CC} | 3 V |
| Input Switching Voltage, V_s | 0.5 V_{CC} | 1.5 V |
| Output Switching Voltage, V_s | 0.5 V_{CC} | 0.5 V_{CC} |

Fig. 1 - Propagation delay times and test circuit.