

# CD54AC00F3A, CD54ACT00F3A

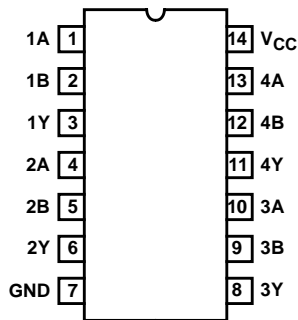
July 1998

## Quad 2-Input NAND Gate

### Features

- This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.
- Exceeds 2kV ESD Protection MIL-STD-883, Method 3015
- Meets JEDEC Standard No. 20
- SCR - Latch-Up-Resistant CMOS Process and Circuit Design
- Speed of Bipolar FAST/A/S with Significantly Reduced Power Consumption
- Functionally and Pin-Compatible with Industry 54 Bipolar Types in the FAST, AS and S Series
- Balanced Propagation Delays
- Military Operating Temperature Range
  - Ceramic (CERDIP) 54 Series: ..... -55 to 125°C
- ±24mA Output Drive Current, Drives 75Ω Lines without Need for Terminations
- Fan Out (Over Temperature)
  - ACL Loads ..... 2400
  - FAST Loads..... 15
  - AS Loads..... 48
- Balanced Noise Immunity at 30% of Supply for AC Types
- Supply Voltage Range
  - AC Types ..... 1.5V to 5.5V
  - ACT Types ..... 4.5V to 5.5V

### Pinout



### Description

The CD54AC00F3A and CD54ACT00F3A are quad 2-input NAND gates that utilize the Harris Advanced CMOS Logic technology.

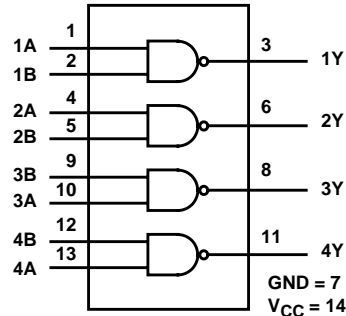
### Ordering Information

| PART NUMBER  | TEMP. RANGE (°C) | PACKAGE      | PKG. NO. |
|--------------|------------------|--------------|----------|
| CD54AC00F3A  | -55 to 125       | 14 Ld CERDIP | F14.3    |
| CD54ACT00F3A | -55 to 125       | 14 Ld CERDIP | F14.3    |

NOTE:

1. Wafer and die for this part number is available which meets all electrical specifications. Please contact your local sales office or Harris customer service for ordering information.

### Functional Diagram



TRUTH TABLE

| INPUTS |   | OUTPUTS |
|--------|---|---------|
| A      | B | Y       |
| L      | L | H       |
| H      | L | H       |
| L      | H | H       |
| H      | H | L       |

## CD54AC00F3A, CD54ACT00F3A

### Absolute Maximum Ratings

|   |             |
|---|-------------|
| DC Supply Voltage, $V_{CC}$ .....                                   | -0.5V to 6V |
| DC Input Diode Current, $I_{IK}$                                    |             |
| For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$ .....                    | $\pm 20mA$  |
| DC Output Diode Current, $I_{OK}$                                   |             |
| For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$ .....                    | $\pm 50mA$  |
| DC Output Source or Sink Current per Output Pin, $I_O$              |             |
| For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$ .....                    | $\pm 50mA$  |
| DC $V_{CC}$ or Ground Current, $I_{CC}$ or $I_{GND}$ (Note 2) ..... | $\pm 100mA$ |

### Thermal Information

|  |                                    |                                 |
|--|------------------------------------|---------------------------------|
| Thermal Resistance (Typical, Note 4)                         | $\theta_{JA}$ ( $^{\circ}C/W$ )    | $\theta_{JC}$ ( $^{\circ}C/W$ ) |
| CERDIP Package .....   | 80                                 | 24                              |
| Maximum Junction Temperature (Hermetic Package or Die) . . . | 175 $^{\circ}C$                    |                                 |
| Maximum Storage Temperature Range .....                      | -65 $^{\circ}C$ to 150 $^{\circ}C$ |                                 |
| Maximum Lead Temperature (Soldering 10s) .....               | 300 $^{\circ}C$                    |                                 |

### Operating Conditions

|   |                                    |
|---|------------------------------------|
| Temperature Range, $T_A$ .....                  | -55 $^{\circ}C$ to 125 $^{\circ}C$ |
| Supply Voltage Range, $V_{CC}$ (Note 3)         |                                    |
| AC Types .....                                  | 1.5V to 5.5V                       |
| ACT Types .....                                 | 4.5V to 5.5V                       |
| DC Input or Output Voltage, $V_I$ , $V_O$ ..... | 0V to $V_{CC}$                     |
| Input Rise and Fall Slew Rate, $dt/dv$          |                                    |
| AC Types  |                                    |
| 1.5V to 3V .....                                | 50ns (Max)                         |
| 3.6V to 5.5V .....                              | 20ns (Max)                         |
| 4.5V to 5.5V .....                              | 10ns (Max)                         |

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

#### NOTES:

2. For up to 4 outputs per device, add  $\pm 25mA$  for each additional output.
3. Unless otherwise specified, all voltages are referenced to ground.
4.  $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

### DC Electrical Specifications

| PARAMETER                 | SYMBOL   | TEST CONDITIONS      |                    | $V_{CC}$ (V) | 25 $^{\circ}C$   |                  | -55 $^{\circ}C$ TO 125 $^{\circ}C$ |                  | UNITS |   |
|---------------------------|----------|----------------------|--------------------|--------------|------------------|------------------|------------------------------------|------------------|-------|---|
|                           |          | $V_I$ (V)            | $I_O$ (mA)         |              | MIN              | MAX              | MIN                                | MAX              |       |   |
| <b>AC TYPES</b>           |          |                      |                    |              |                  |                  |                                    |                  |       |   |
| High Level Input Voltage  | $V_{IH}$ | -                    | -                  | 1.5          | 1.2              | -                | 1.2                                | -                | V     |   |
|                           |          |                      |                    | 3            | 2.1              | -                | 2.1                                | -                | V     |   |
|                           |          |                      |                    | 4.5          | 3.15<br>(Note 5) | -                | 3.15<br>(Note 5)                   | -                | V     |   |
|                           |          |                      |                    | 5.5          | 3.85             | -                | 3.85                               | -                | V     |   |
| Low Level Input Voltage   | $V_{IL}$ | -                    | -                  | 1.5          | -                | 0.3              | -                                  | 0.3              | V     |   |
|                           |          |                      |                    | 3            | -                | 0.9              | -                                  | 0.9              | V     |   |
|                           |          |                      |                    | 4.5          | -                | 1.35<br>(Note 5) | -                                  | 1.35<br>(Note 5) | V     |   |
|                           |          |                      |                    | 5.5          | -                | 1.65             | -                                  | 1.65             | V     |   |
| High Level Output Voltage | $V_{OH}$ | $V_{IH}$ or $V_{IL}$ | -0.05              | -0.05        | 1.5              | 1.4              | -                                  | 1.4              | -     | V |
|                           |          |                      | -0.05              | -0.05        | 3                | 2.9              | -                                  | 2.9              | -     | V |
|                           |          |                      | -0.05              | -0.05        | 4.5              | 4.4              | -                                  | 4.4              | -     | V |
|                           |          |                      | -4                 | -4           | 3                | 2.58             | -                                  | 2.4              | -     | V |
|                           |          |                      | -24                | -24          | 4.5              | 3.94<br>(Note 5) | -                                  | 3.7<br>(Note 5)  | -     | V |
|                           |          |                      | -50<br>(Note 6, 7) | -50          | 5.5              | -                | -                                  | 3.85             | -     | V |

**CD54AC00F3A, CD54ACT00F3A**

**DC Electrical Specifications (Continued)**

| PARAMETER   | SYMBOL           | TEST CONDITIONS                    |                     | V <sub>CC</sub> (V) | 25°C             |                  | -55°C TO 125°C  |                 | UNITS |
|---|------------------|------------------------------------|---------------------|---------------------|------------------|------------------|-----------------|-----------------|-------|
|   |                  | V <sub>I</sub> (V)                 | I <sub>O</sub> (mA) |                     | MIN              | MAX              | MIN             | MAX             |       |
| Low Level Output Voltage  | V <sub>OL</sub>  | V <sub>IH</sub> or V <sub>IL</sub> | 0.05                | 1.5                 | -                | 0.1              | -               | 0.1             | V     |
|   |                  |                                    | 0.05                | 3                   | -                | 0.1              | -               | 0.1             | V     |
|   |                  |                                    | 0.05                | 4.5                 | -                | 0.1              | -               | 0.1             | V     |
|   |                  |                                    | 12                  | 3                   | -                | 0.36             | -               | 0.5             | V     |
|   |                  |                                    | 24                  | 4.5                 | -                | 0.36<br>(Note 5) | -               | 0.5<br>(Note 5) | V     |
|   |                  |                                    | 50<br>(Note 6, 7)   | 5.5                 | -                | -                | -               | 1.65            | V     |
| Input Leakage Current   | I <sub>I</sub>   | V <sub>CC</sub> or GND             | -                   | 5.5                 | -                | ±0.1<br>(Note 5) | -               | ±1<br>(Note 5)  | µA    |
| Quiescent Device Current  | I <sub>CC</sub>  |                                    | 0                   | 5.5                 | -                | 4<br>(Note 5)    | -               | 80<br>(Note 5)  | µA    |
| <b>ACT TYPES</b>  |                  |                                    |                     |                     |                  |                  |                 |                 |       |
| High Level Input Voltage  | V <sub>IH</sub>  | -                                  | -                   | 4.5 to 5.5          | 2<br>(Note 5)    | -                | 2<br>(Note 5)   | -               | V     |
| Low Level Input Voltage   | V <sub>IL</sub>  | -                                  | -                   | 4.5 to 5.5          | -                | 0.8<br>(Note 5)  | -               | 0.8<br>(Note 5) | V     |
| High Level Output Voltage   | V <sub>OH</sub>  | V <sub>IH</sub> or V <sub>IL</sub> | -0.05               | 4.5                 | 4.4              | -                | 4.4             | -               | V     |
|   |                  |                                    | -24                 | 4.5                 | 3.94<br>(Note 5) | -                | 3.7<br>(Note 5) | -               | V     |
|   |                  |                                    | -50<br>(Note 6, 7)  | 5.5                 | -                | -                | 3.85            | -               | V     |
| Low Level Output Voltage  | V <sub>OL</sub>  | V <sub>IH</sub> or V <sub>IL</sub> | 0.05                | 4.5                 | -                | 0.1              | -               | 0.1             | V     |
|   |                  |                                    | 24                  | 4.5                 | -                | 0.36<br>(Note 5) | -               | 0.5<br>(Note 5) | V     |
|   |                  |                                    | 50<br>(Note 6, 7)   | 5.5                 | -                | -                | -               | 1.65            | V     |
| Input Leakage Current   | I <sub>I</sub>   | V <sub>CC</sub> or GND             | -                   | 5.5                 | -                | ±0.1<br>(Note 5) | -               | ±1<br>(Note 5)  | µA    |
| Quiescent Device Current  | I <sub>CC</sub>  | V <sub>CC</sub> or GND             | 0                   | 5.5                 | -                | 4<br>(Note 5)    | -               | 80<br>(Note 5)  | µA    |
| Additional Supply Current per Input Pin TTL Inputs High 1 Unit Load | ΔI <sub>CC</sub> | V <sub>CC</sub> -2.1               | -                   | 4.5 to 5.5          | -                | 2.4              | -               | 3               | mA    |

**NOTES:**

5. Tested at 100%.
6. 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.
7. Test verifies a minimum transmission-line-drive capability of 75Ω for 54AC/ACT Series.

**ACT Input Load Table**

| INPUT | UNIT LOAD |
|-------|-----------|
| All   | 0.15      |

NOTE: Unit load is ΔI<sub>CC</sub> limit specified in DC Electrical Specifications Table, e.g., 2.4mA max at 25°C.

## CD54AC00F3A, CD54ACT00F3A

### Switching Specifications Input $t_r$ , $t_f = 3\text{ns}$ , $C_L = 50\text{pF}$ (Worst Case)

| PARAMETER                          | SYMBOL                | $V_{CC}$ (V) | -55°C TO 125°C |     |               | UNITS |
|------------------------------------|-----------------------|--------------|----------------|-----|---------------|-------|
|                                    |                       |              | MIN            | TYP | MAX           |       |
| <b>AC TYPES</b>                    |                       |              |                |     |               |       |
| Propagation Delay, Input to Output | $t_{PLH}$ , $t_{PHL}$ | 1.5          | -              | -   | 91            | ns    |
|                                    |                       | 3.3 (Note 9) | 3.1            | -   | 10.2          | ns    |
|                                    |                       | 5 (Note 10)  | 2.2            | -   | 7.3 (Note 8)  | ns    |
| Input Capacitance                  | $C_I$                 | -            | -              | -   | 10            | pF    |
| Power Dissipation Capacitance      | $C_{PD}$ (Note 11)    | -            | -              | 45  | -             | pF    |
| <b>ACT TYPES</b>                   |                       |              |                |     |               |       |
| Propagation Delay, Input to Output | $t_{PLH}$             | 5 (Note 10)  | 3.2            | -   | 10.8 (Note 8) | ns    |
|                                    | $t_{PHL}$             |              |                |     |               | 4     |
| Input Capacitance                  | $C_I$                 | -            | -              | -   | 10            | pF    |
| Power Dissipation Capacitance      | $C_{PD}$ (Note 11)    | -            | -              | 45  | -             | pF    |

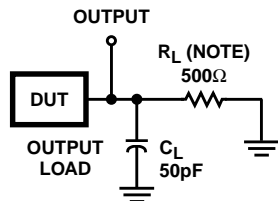
**NOTES:**

8. Limits tested at 100%.
9. 3.3V Min at 3.6V, Max at 3V.
10. 5V Min at 5.5V, Max at 4.5V
11.  $C_{PD}$  is used to determine the dynamic power consumption per gate.  
 AC:  $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$   
 ACT:  $P_D = V_{CC}^2 f_i (C_{PD} + C_L) + V_{CC} \Delta I_{CC}$  where  $f_i$  = input frequency,  $C_L$  = output load capacitance,  $V_{CC}$  = supply voltage.

### Burn-In Test Circuit Connections (Use DC II for F3A Burn-In and AC for Life Test)

| DC           | DC BURN-IN I |                              |                   | DC BURN-IN II |                           |                            |
|--------------|--------------|------------------------------|-------------------|---------------|---------------------------|----------------------------|
|              | OPEN         | GROUND                       | $V_{CC}$ (6V)     | OPEN          | GROUND                    | $V_{CC}$ (6V)              |
| CD54AC/ACT00 | 3, 6, 8, 11  | 1, 2, 4, 5, 7, 9, 10, 12, 13 | 14                | 3, 6, 8, 11   | 7                         | 1, 2, 4, 5, 9, 10, 12 - 14 |
| AC           | OPEN         | GROUND                       | $1/2 V_{CC}$ (3V) | $V_{CC}$ (6V) | OSCILLATOR                |                            |
|              |              |                              |                   |               | 50kHz                     | 25kHz                      |
| CD54AC/ACT00 | -            | 7                            | 3, 6, 8, 11       | 14            | 1, 2, 4, 5, 9, 10, 12, 13 | -                          |

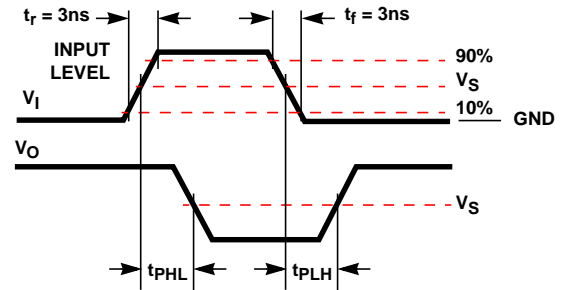
NOTE: Each pin except  $V_{CC}$  and Gnd will have a resistor of  $2\text{k}\Omega$ - $47\text{k}\Omega$ .



NOTE: For AC Series Only: When  $V_{CC} = 1.5\text{V}$ ,  $R_L = 1\text{k}\Omega$ .

|                                 | CD54AC       | CD54ACT      |
|---------------------------------|--------------|--------------|
| Input Level                     | $V_{CC}$     | 3V           |
| Input Switching Voltage, $V_S$  | $0.5 V_{CC}$ | 1.5V         |
| Output Switching Voltage, $V_S$ | $0.5 V_{CC}$ | $0.5 V_{CC}$ |

**FIGURE 1. PROPAGATION DELAY TIMES**



**FIGURE 2. WAVEFORMS**