

## 54AC00 • 54ACT00 Quad 2-Input NAND Gate

### General Description

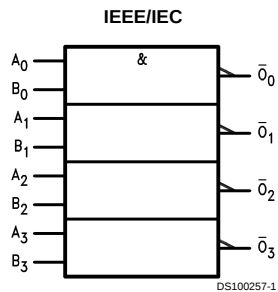
The 'AC/'ACT00 contains four 2-input NAND gates.

### Features

- $I_{CC}$  reduced by 50%

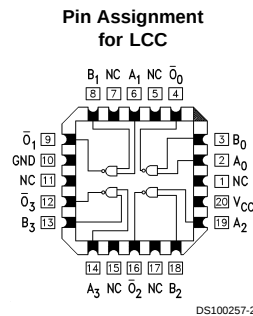
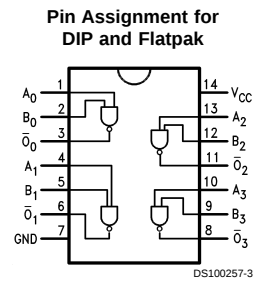
- Outputs source/sink 24 mA
- 'ACT00 has TTL-compatible inputs
- Standard Microcircuit Drawing (SMD)
  - 'AC00: 5962-87549
  - 'ACT00: 5962-87699

### Logic Symbol



| Pin Names   | Description |
|-------------|-------------|
| $A_n, B_n$  | Inputs      |
| $\bar{O}_n$ | Outputs     |

### Connection Diagrams



## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|                                                                        |                          |
|------------------------------------------------------------------------|--------------------------|
| Supply Voltage ( $V_{CC}$ )                                            | -0.5V to +7.0V           |
| DC Input Diode Current ( $I_{IK}$ )                                    |                          |
| $V_I = -0.5V$                                                          | -20 mA                   |
| $V_I = V_{CC} + 0.5V$                                                  | +20 mA                   |
| DC Input Voltage ( $V_I$ )                                             | -0.5V to $V_{CC} + 0.5V$ |
| DC Output Diode Current ( $I_{OK}$ )                                   |                          |
| $V_O = -0.5V$                                                          | -20 mA                   |
| $V_O = V_{CC} + 0.5V$                                                  | +20 mA                   |
| DC Output Voltage ( $V_O$ )                                            | -0.5V to $V_{CC} + 0.5V$ |
| DC Output Source or Sink Current ( $I_O$ )                             | ±50 mA                   |
| DC $V_{CC}$ or Ground Current per Output Pin ( $I_{CC}$ or $I_{GND}$ ) | ±50 mA                   |
| Storage Temperature ( $T_{STG}$ )                                      | -65°C to +150°C          |
| Junction Temperature ( $T_J$ )                                         |                          |
| CDIP                                                                   | 175°C                    |

## Recommended Operating Conditions

|                                                 |                 |
|-------------------------------------------------|-----------------|
| Supply Voltage ( $V_{CC}$ )                     |                 |
| 'AC                                             | 2.0V to 6.0V    |
| 'ACT                                            | 4.5V to 5.5V    |
| Input Voltage ( $V_I$ )                         | 0V to $V_{CC}$  |
| Output Voltage ( $V_O$ )                        | 0V to $V_{CC}$  |
| Operating Temperature ( $T_A$ )                 |                 |
| 54AC/ACT                                        | -55°C to +125°C |
| Minimum Input Edge Rate ( $\Delta V/\Delta t$ ) |                 |
| 'AC Devices                                     |                 |
| $V_{IN}$ from 30% to 70% of $V_{CC}$            |                 |
| $V_{CC}$ @ 3.3V, 4.5V, 5.5V                     | 125 mV/ns       |
| Minimum Input Edge Rate ( $\Delta V/\Delta t$ ) |                 |
| 'ACT Devices                                    |                 |
| $V_{IN}$ from 0.8V to 2.0V                      |                 |
| $V_{CC}$ @ 4.5V, 5.5V                           | 125 mV/ns       |

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT® circuits outside databook specifications.

## DC Characteristics for 'AC Family Devices

| Symbol    | Parameter                               | $V_{CC}$<br>(V) | 54AC                       | Units | Conditions                                                                                                           |
|-----------|-----------------------------------------|-----------------|----------------------------|-------|----------------------------------------------------------------------------------------------------------------------|
|           |                                         |                 | $T_A =$<br>-55°C to +125°C |       |                                                                                                                      |
|           |                                         |                 | Guaranteed Limits          |       |                                                                                                                      |
| $V_{IH}$  | Minimum High Level Input Voltage        | 3.0             | 2.1                        | V     | $V_{OUT} = 0.1V$<br>or $V_{CC} - 0.1V$                                                                               |
|           |                                         | 4.5             | 3.15                       |       |                                                                                                                      |
|           |                                         | 5.5             | 3.85                       |       |                                                                                                                      |
| $V_{IL}$  | Maximum Low Level Input Voltage         | 3.0             | 0.9                        | V     | $V_{OUT} = 0.1V$<br>or $V_{CC} - 0.1V$                                                                               |
|           |                                         | 4.5             | 1.35                       |       |                                                                                                                      |
|           |                                         | 5.5             | 1.65                       |       |                                                                                                                      |
| $V_{OH}$  | Minimum High Level Output Voltage       | 3.0             | 2.9                        | V     | $I_{OUT} = -50 \mu A$                                                                                                |
|           |                                         | 4.5             | 4.4                        |       |                                                                                                                      |
|           |                                         | 5.5             | 5.4                        |       |                                                                                                                      |
|           | (Note 2)                                | 3.0             | 2.4                        | V     | $V_{IN} = V_{IL}$ or $V_{IH}$<br>$I_{OH} = -12 \text{ mA}$<br>$I_{OH} = -24 \text{ mA}$<br>$I_{OH} = -24 \text{ mA}$ |
|           |                                         | 4.5             | 3.7                        |       |                                                                                                                      |
|           |                                         | 5.5             | 4.7                        |       |                                                                                                                      |
|           |                                         |                 |                            |       |                                                                                                                      |
| $V_{OL}$  | Maximum Low Level Output Voltage        | 3.0             | 0.1                        | V     | $I_{OUT} = 50 \mu A$                                                                                                 |
|           |                                         | 4.5             | 0.1                        |       |                                                                                                                      |
|           |                                         | 5.5             | 0.1                        |       |                                                                                                                      |
|           | (Note 2)                                | 3.0             | 0.5                        | V     | $V_{IN} = V_{IL}$ or $V_{IH}$<br>$I_{OL} = 12 \text{ mA}$<br>$I_{OL} = 24 \text{ mA}$<br>$I_{OL} = 24 \text{ mA}$    |
|           |                                         | 4.5             | 0.5                        |       |                                                                                                                      |
|           |                                         | 5.5             | 0.5                        |       |                                                                                                                      |
|           |                                         |                 |                            |       |                                                                                                                      |
| $I_{IN}$  | Maximum Input Leakage Current           | 5.5             | ±1.0                       | μA    | $V_I = V_{CC}, \text{ GND}$                                                                                          |
| $I_{OLD}$ | Minimum Dynamic Output Current (Note 4) | 5.5             | 50                         | mA    | $V_{OLD} = 1.65V \text{ Max}$                                                                                        |
| $I_{OHD}$ |                                         | 5.5             | -50                        | mA    | $V_{OHD} = 3.85V \text{ Min}$                                                                                        |
| $I_{CC}$  | Maximum Quiescent                       | 5.5             | 40.0                       | μA    | $V_{IN} = V_{CC}$                                                                                                    |

## DC Characteristics for 'AC Family Devices (Continued)

| Symbol | Parameter      | V <sub>CC</sub><br>(V) | 54AC                                | Units | Conditions |
|--------|----------------|------------------------|-------------------------------------|-------|------------|
|        |                |                        | T <sub>A</sub> =<br>-55°C to +125°C |       |            |
|        |                |                        | Guaranteed Limits                   |       |            |
|        | Supply Current |                        |                                     |       | or GND     |

**Note 2:** All outputs loaded; thresholds on input associated with output under test.

**Note 3:** I<sub>IN</sub> and I<sub>CC</sub> @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V<sub>CC</sub>.

I<sub>CC</sub> for 54AC @ 25°C is identical to 74AC @ 25°C.

**Note 4:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 5:** I<sub>IN</sub> and I<sub>CC</sub> @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V<sub>CC</sub>.

I<sub>CC</sub> for 54AC @ 25°C is identical to 74AC @ 25°C.

## DC Characteristics for 'ACT Family Devices

| Symbol           | Parameter                               | V <sub>CC</sub><br>(V) | 54ACT                               | Units | Conditions                                                                                                               |
|------------------|-----------------------------------------|------------------------|-------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------|
|                  |                                         |                        | T <sub>A</sub> =<br>-55°C to +125°C |       |                                                                                                                          |
|                  |                                         |                        | Guaranteed Limits                   |       |                                                                                                                          |
| V <sub>IH</sub>  | Minimum High Level Input Voltage        | 4.5                    | 2.0                                 | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> - 0.1V                                                                     |
|                  |                                         | 5.5                    | 2.0                                 |       |                                                                                                                          |
| V <sub>IL</sub>  | Maximum Low Level Input Voltage         | 4.5                    | 0.8                                 | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> - 0.1V                                                                     |
|                  |                                         | 5.5                    | 0.8                                 |       |                                                                                                                          |
| V <sub>OH</sub>  | Minimum High Level Output Voltage       | 4.5                    | 4.4                                 | V     | I <sub>OUT</sub> = -50 µA                                                                                                |
|                  |                                         | 5.5                    | 5.4                                 |       |                                                                                                                          |
|                  |                                         | 4.5                    | 3.70                                | V     | (Note 6)<br>V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OH</sub> = -24 mA<br>I <sub>OH</sub> = -24 mA |
|                  |                                         | 5.5                    | 4.70                                |       |                                                                                                                          |
| V <sub>OL</sub>  | Maximum Low Level Output Voltage        | 4.5                    | 0.1                                 | V     | I <sub>OUT</sub> = 50 µA                                                                                                 |
|                  |                                         | 5.5                    | 0.1                                 |       |                                                                                                                          |
|                  |                                         | 4.5                    | 0.50                                | V     | (Note 6)<br>V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OL</sub> = 24 mA<br>I <sub>OL</sub> = 24 mA   |
|                  |                                         | 5.5                    | 0.50                                |       |                                                                                                                          |
| I <sub>IN</sub>  | Maximum Input Leakage Current           | 5.5                    | ±1.0                                | µA    | V <sub>I</sub> = V <sub>CC</sub> , GND                                                                                   |
| I <sub>CCT</sub> | Maximum I <sub>CC</sub> /Input          | 5.5                    | 1.6                                 | mA    | V <sub>I</sub> = V <sub>CC</sub> - 2.1V                                                                                  |
| I <sub>OLD</sub> | Minimum Dynamic Output Current (Note 7) | 5.5                    | 50                                  | mA    | V <sub>OLD</sub> = 1.65V Max                                                                                             |
| I <sub>OHD</sub> |                                         | 5.5                    | -50                                 | mA    | V <sub>OHD</sub> = 3.85V Min                                                                                             |
| I <sub>CC</sub>  | Maximum Quiescent Supply Current        | 5.5                    | 40.0                                | µA    | V <sub>IN</sub> = V <sub>CC</sub><br>or GND                                                                              |

**Note 6:** All outputs loaded; thresholds on input associated with output under test.

**Note 7:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 8:** I<sub>CC</sub> for 54ACT @ 25°C is identical to 74ACT @ 25°C.

## AC Electrical Characteristics

| Symbol           | Parameter         | V <sub>CC</sub><br>(V)<br>(Note 9) | 54AC                                                          |      | Units | Fig.<br>No. |
|------------------|-------------------|------------------------------------|---------------------------------------------------------------|------|-------|-------------|
|                  |                   |                                    | T <sub>A</sub> = -55°C<br>to +125°C<br>C <sub>L</sub> = 50 pF |      |       |             |
|                  |                   |                                    | Min                                                           | Max  |       |             |
| t <sub>PLH</sub> | Propagation Delay | 3.3                                | 1.0                                                           | 11.0 | ns    |             |
|                  |                   | 5.0                                | 1.5                                                           | 8.5  |       |             |
| t <sub>PHL</sub> | Propagation Delay | 3.3                                | 1.0                                                           | 9.0  | ns    |             |
|                  |                   | 5.0                                | 1.5                                                           | 7.0  |       |             |

**Note 9:** Voltage Range 3.3 is 3.3V ±0.3V  
Voltage Range 5.0 is 5.0V ±0.5V

## AC Electrical Characteristics

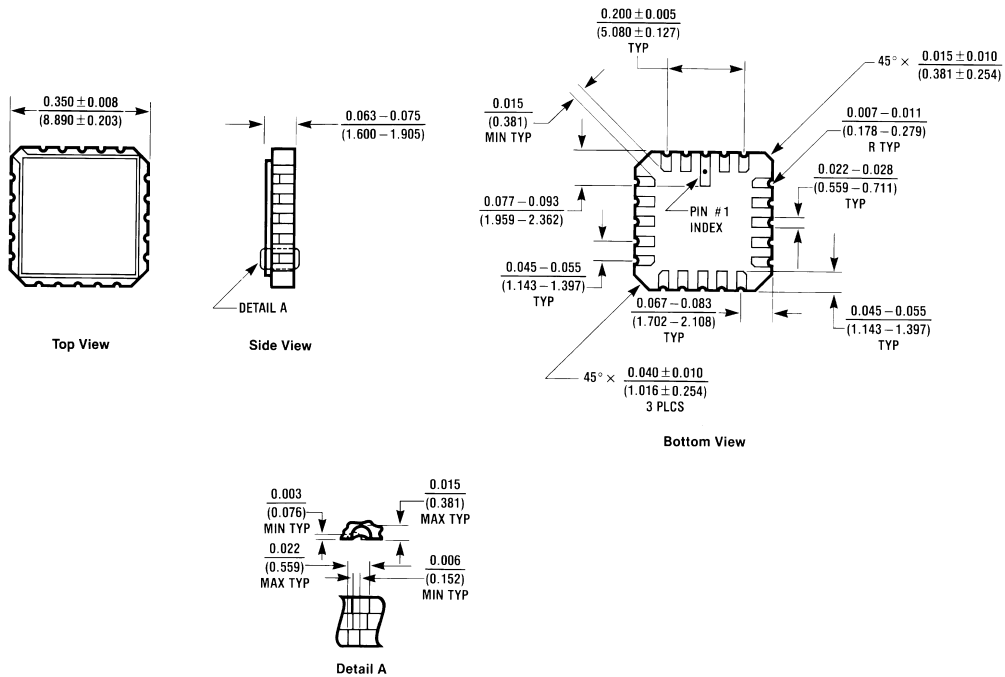
| Symbol           | Parameter         | V <sub>CC</sub><br>(V)<br>(Note 10) | 54ACT                                                         |     | Units | Fig.<br>No. |
|------------------|-------------------|-------------------------------------|---------------------------------------------------------------|-----|-------|-------------|
|                  |                   |                                     | T <sub>A</sub> = -55°C<br>to +125°C<br>C <sub>L</sub> = 50 pF |     |       |             |
|                  |                   |                                     | Min                                                           | Max |       |             |
| t <sub>PLH</sub> | Propagation Delay | 5.0                                 | 1.5                                                           | 9.5 | ns    |             |
| t <sub>PHL</sub> | Propagation Delay | 5.0                                 | 1.5                                                           | 8.0 | ns    |             |

**Note 10:** Voltage Range 5.0 is 5.0V ±0.5V

## Capacitance

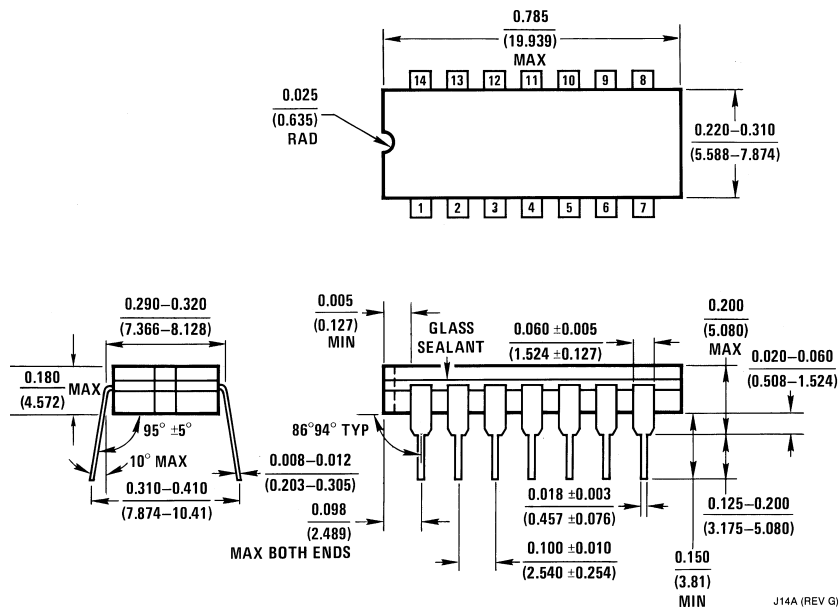
| Symbol          | Parameter                        | Typ  | Units | Conditions             |
|-----------------|----------------------------------|------|-------|------------------------|
| C <sub>IN</sub> | Input Capacitance                | 4.5  | pF    | V <sub>CC</sub> = Open |
| C <sub>PD</sub> | Power Dissipation<br>Capacitance | 30.0 | pF    | V <sub>CC</sub> = 5.0V |

## Physical Dimensions inches (millimeters) unless otherwise noted



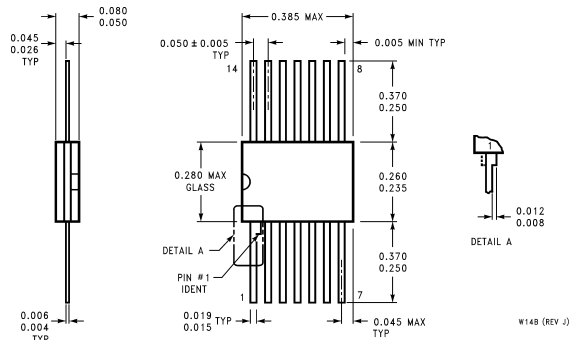
E20A (REV D)

**20 Terminal Ceramic Leadless Chip Carrier (L)**  
**NS Package Number E20A**



J14A (REV G)

**14 Lead Ceramic Dual-In-Line Package (D)**  
**NS Package Number J14A**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

**14 Lead Ceramic Flatpak (F)**  
**NS Package Number W14B**

**LIFE SUPPORT POLICY**

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



**National Semiconductor Corporation**  
Americas  
Tel: 1-800-272-9959  
Fax: 1-800-737-7018  
Email: support@nsc.com

www.national.com

**National Semiconductor Europe**

Fax: +49 (0) 1 80-530 85 86  
Email: europe.support@nsc.com  
Deutsch Tel: +49 (0) 1 80-530 85 85  
English Tel: +49 (0) 1 80-532 78 32  
Français Tel: +49 (0) 1 80-532 93 58  
Italiano Tel: +49 (0) 1 80-534 16 80

**National Semiconductor Asia Pacific Customer Response Group**

Tel: 65-2544466  
Fax: 65-2504466  
Email: sea.support@nsc.com

**National Semiconductor Japan Ltd.**

Tel: 81-3-5639-7560  
Fax: 81-3-5639-7507