

# 74AC20

## Dual 4-Input NAND Gate

### Features

- $I_{CC}$  reduced by 50%
- Outputs source/sink 24mA

### General Description

The AC20 contains four, 4-input NAND gates.

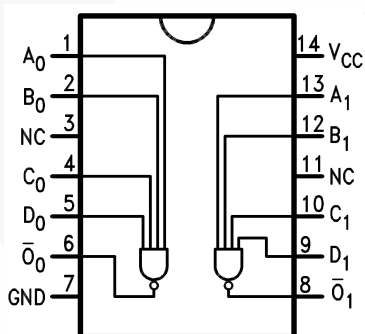
### Ordering Information

| Order Number | Package Number | Package Description                                                          |
|--------------|----------------|------------------------------------------------------------------------------|
| 74AC20SC     | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| 74AC20SJ     | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                |
| 74AC20MTC    | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  |
| 74AC20PC     | N14A           | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide       |

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

 All packages are lead free per JEDEC: J-STD-020B standard.

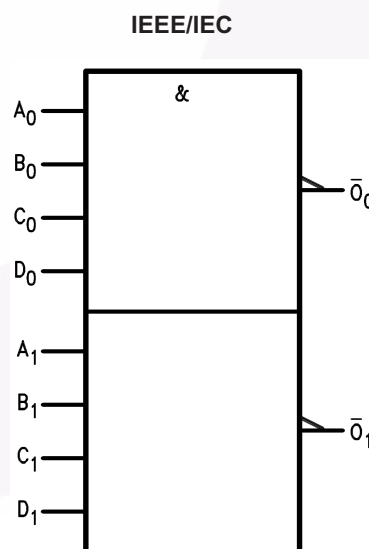
### Connection Diagram



### Pin Description

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

### Logic Symbol



## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol                | Parameter                                    | Rating                   |
|-----------------------|----------------------------------------------|--------------------------|
| $V_{CC}$              | Supply Voltage                               | −0.5V to +7.0V           |
| $I_{IK}$              | DC Input Diode Current<br>$V_I = -0.5V$      | −20mA                    |
|                       | $V_I = V_{CC} + 0.5$                         | +20mA                    |
| $V_I$                 | DC Input Voltage                             | −0.5V to $V_{CC} + 0.5V$ |
| $I_{OK}$              | DC Output Diode Current<br>$V_O = -0.5V$     | −20mA                    |
|                       | $V_O = V_{CC} + 0.5V$                        | +20mA                    |
| $V_O$                 | DC Output Voltage                            | −0.5V to $V_{CC} + 0.5V$ |
| $I_O$                 | DC Output Source or Sink Current             | ±50mA                    |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current per Output Pin | ±50mA                    |
| $T_{STG}$             | Storage Temperature                          | −65°C to +150°C          |
| $T_J$                 | Junction Temperature                         | 140°C                    |

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

| Symbol                | Parameter                                                                                      | Rating         |
|-----------------------|------------------------------------------------------------------------------------------------|----------------|
| $V_{CC}$              | Supply Voltage                                                                                 | 2.0V to 6.0V   |
| $V_I$                 | Input Voltage                                                                                  | 0V to $V_{CC}$ |
| $V_O$                 | Output Voltage                                                                                 | 0V to $V_{CC}$ |
| $T_A$                 | Operating Temperature                                                                          | −40°C to +85°C |
| $\Delta V / \Delta t$ | Minimum Input Edge Rate:<br>$V_{IN}$ from 30% to 70% of $V_{CC}$ ; $V_{CC}$ @ 3.3V, 4.5V, 5.5V | 125mV/ns       |

## DC Electrical Characteristics

| Symbol                         | Parameter                                     | V <sub>CC</sub><br>(V) | Conditions                                                                     | T <sub>A</sub> = +25°C                                                         |                                                                                               | T <sub>A</sub> = −40°C to +85°C |      | Units |
|--------------------------------|-----------------------------------------------|------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------|------|-------|
|                                |                                               |                        |                                                                                | Typ.                                                                           | Guaranteed Limits                                                                             |                                 |      |       |
| V <sub>IH</sub>                | Minimum HIGH Level Input Voltage              | 3.0                    | V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> − 0.1V                              | 1.5                                                                            | 2.1                                                                                           | 2.1                             |      | V     |
|                                |                                               | 4.5                    |                                                                                | 2.25                                                                           | 3.15                                                                                          | 3.15                            |      |       |
|                                |                                               | 5.5                    |                                                                                | 2.75                                                                           | 3.85                                                                                          | 3.85                            |      |       |
| V <sub>IL</sub>                | Maximum LOW Level Input Voltage               | 3.0                    | V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> − 0.1V                              | 1.5                                                                            | 0.9                                                                                           | 0.9                             |      | V     |
|                                |                                               | 4.5                    |                                                                                | 2.25                                                                           | 1.35                                                                                          | 1.35                            |      |       |
|                                |                                               | 5.5                    |                                                                                | 2.75                                                                           | 1.65                                                                                          | 1.65                            |      |       |
| V <sub>OH</sub>                | Minimum HIGH Level Output Voltage             | 3.0                    | I <sub>OUT</sub> = −50μA                                                       | 2.99                                                                           | 2.9                                                                                           | 2.9                             |      | V     |
|                                |                                               | 4.5                    |                                                                                | 4.49                                                                           | 4.4                                                                                           | 4.4                             |      |       |
|                                |                                               | 5.5                    |                                                                                | 5.49                                                                           | 5.4                                                                                           | 5.4                             |      |       |
|                                |                                               | 3.0                    | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = −12mA |                                                                                | 2.56                                                                                          | 2.46                            |      |       |
|                                |                                               | 4.5                    |                                                                                | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = −24mA |                                                                                               | 3.86                            | 3.76 |       |
|                                |                                               | 5.5                    |                                                                                |                                                                                | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = −24mA <sup>(1)</sup> |                                 | 4.86 |       |
| V <sub>OL</sub>                | Maximum LOW Level Output Voltage              | 3.0                    | I <sub>OUT</sub> = 50μA                                                        | 0.002                                                                          |                                                                                               | 0.1                             | 0.1  |       |
|                                |                                               | 4.5                    |                                                                                | 0.001                                                                          | 0.1                                                                                           | 0.1                             |      |       |
|                                |                                               | 5.5                    |                                                                                | 0.001                                                                          | 0.1                                                                                           | 0.1                             |      |       |
|                                |                                               | 3.0                    | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 12mA  |                                                                                | 0.36                                                                                          | 0.44                            |      |       |
|                                |                                               | 4.5                    |                                                                                | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA  |                                                                                               | 0.36                            | 0.44 |       |
|                                |                                               | 5.5                    |                                                                                |                                                                                | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA <sup>(1)</sup>  |                                 | 0.36 | 0.44  |
| I <sub>IN</sub> <sup>(3)</sup> | Maximum Input Leakage Current                 | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> , GND                                         |                                                                                |                                                                                               | ±0.1                            | ±1.0 |       |
| I <sub>OLD</sub>               | Minimum Dynamic Output Current <sup>(2)</sup> | 5.5                    | V <sub>OLD</sub> = 1.65V Max.                                                  |                                                                                |                                                                                               | 75                              |      | mA    |
| I <sub>OHD</sub>               |                                               | 5.5                    | V <sub>OHD</sub> = 3.85V Min.                                                  |                                                                                |                                                                                               | −75                             |      | mA    |
| I <sub>CC</sub> <sup>(3)</sup> | Maximum Quiescent Supply Current              | 5.5                    | V <sub>IN</sub> = V <sub>CC</sub> or GND                                       |                                                                                | 2.0                                                                                           | 20.0                            |      | μA    |

## Notes:

1. All outputs loaded; thresholds on input associated with output under test.
2. Maximum test duration 2.0ms, one output loaded at a time.
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>.

**AC Electrical Characteristics**

| Symbol    | Parameter         | $V_{CC}$ (V) <sup>(4)</sup> | $T_A = +25^{\circ}\text{C}$ ,<br>$C_L = 50\text{pF}$ |      |      | $T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$ ,<br>$C_L = 50\text{pF}$ |      | Units |
|-----------|-------------------|-----------------------------|------------------------------------------------------|------|------|------------------------------------------------------------------------------|------|-------|
|           |                   |                             | Min.                                                 | Typ. | Max. | Min.                                                                         | Max. |       |
| $t_{PLH}$ | Propagation Delay | 3.3                         | 2.0                                                  | 6.0  | 8.5  | 1.5                                                                          | 10.0 | ns    |
|           |                   | 5.0                         | 1.5                                                  | 5.0  | 7.0  | 1.0                                                                          | 8.0  |       |
| $t_{PHL}$ | Propagation Delay | 3.3                         | 1.5                                                  | 5.0  | 7.0  | 1.0                                                                          | 9.0  | ns    |
|           |                   | 5.0                         | 1.5                                                  | 4.0  | 6.0  | 1.0                                                                          | 7.0  |       |

**Note:**

4. Voltage range 3.3 is  $3.3\text{V} \pm 0.3\text{V}$ . Voltage range 5.0 is  $5.0\text{V} \pm 0.5\text{V}$ .

**Capacitance**

| Symbol   | Parameter                     | Conditions             | Typ. | Units |
|----------|-------------------------------|------------------------|------|-------|
| $C_{IN}$ | Input Capacitance             | $V_{CC} = \text{OPEN}$ | 4.5  | pF    |
| $C_{PD}$ | Power Dissipation Capacitance | $V_{CC} = 5.0\text{V}$ | 40.0 | pF    |

## Physical Dimensions

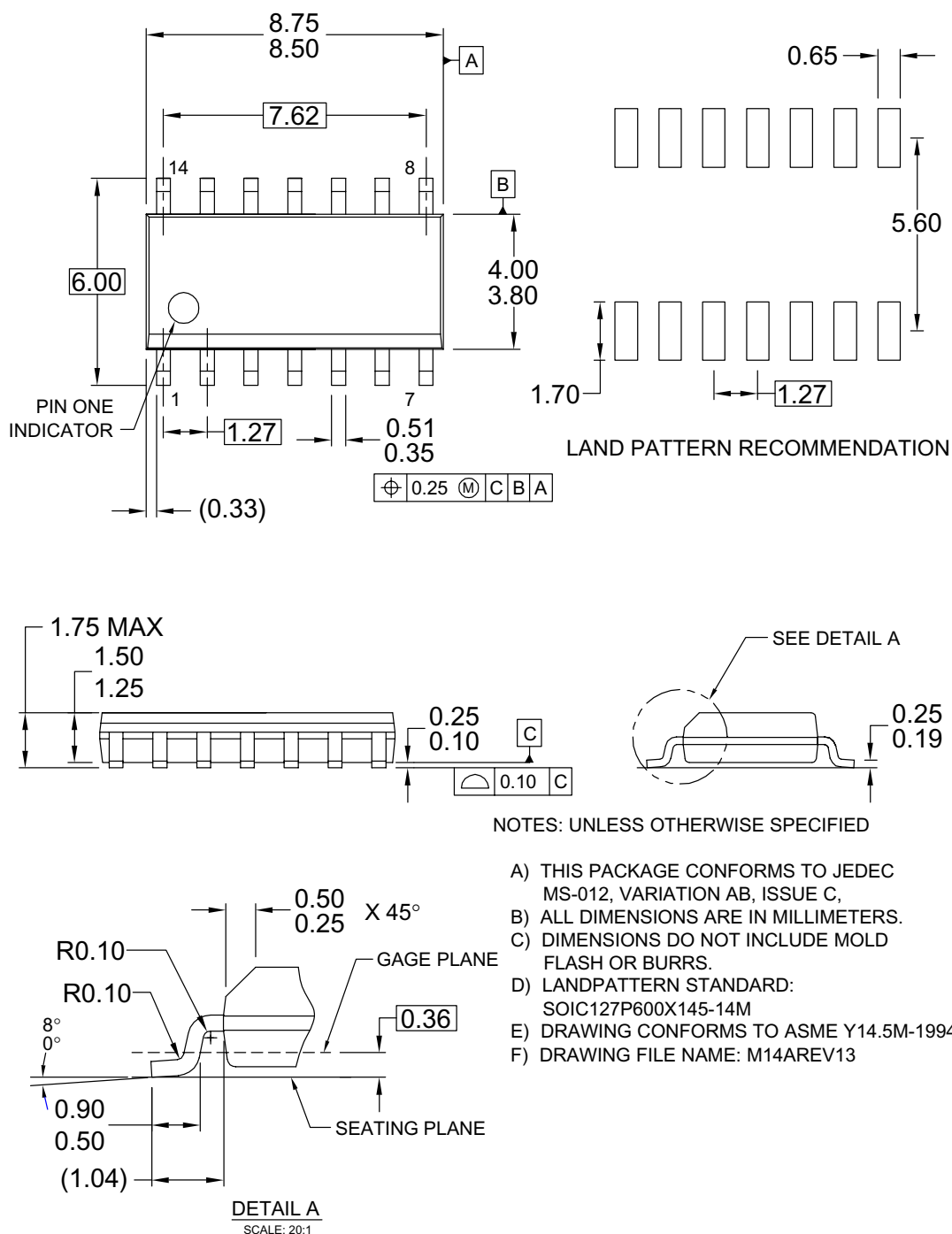


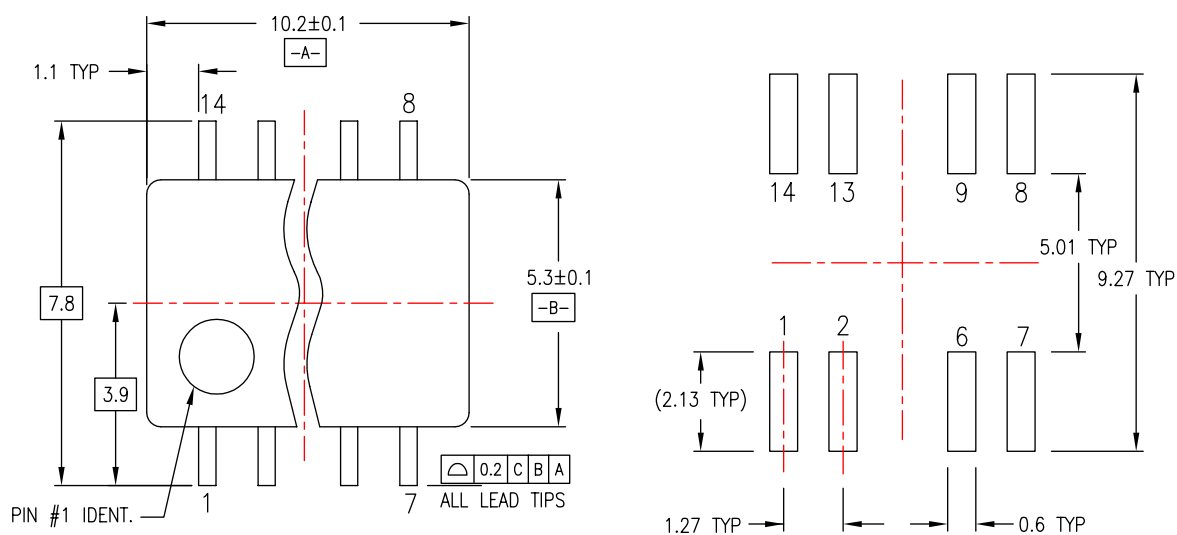
Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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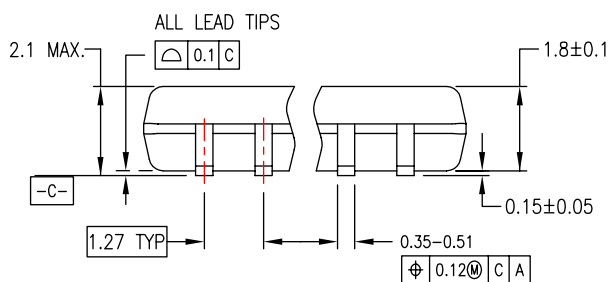
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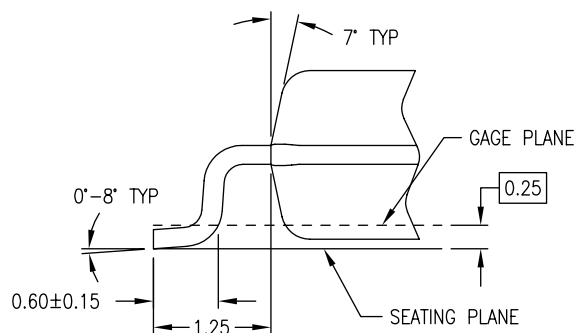
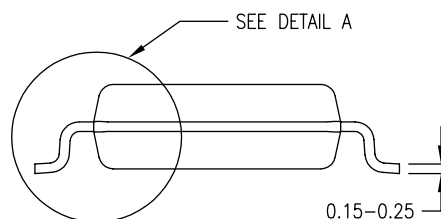
### Physical Dimensions (Continued)



## LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



DETAIL A

NOTES:

- NOTES:
- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
  - B. DIMENSIONS ARE IN MILLIMETERS.
  - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DREVC

**Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**

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**Physical Dimensions** (Continued)**NOTES: UNLESS OTHERWISE SPECIFIED**

THIS PACKAGE CONFORMS TO

A) JEDEC MS-001 VARIATION BA

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS ARE EXCLUSIVE OF BURRS,  
MOLD FLASH, AND TIE BAR EXTRUSIONS.D) DIMENSIONS AND TOLERANCES PER  
ASME Y14.5-1994

E) DRAWING FILE NAME: MKT-N14AREV7

**Figure 4. 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide**

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|                                                                                   |                                              | SuperSOT <sup>™</sup> -6               | VCX <sup>™</sup>                 |
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