

# MC74HCT20A

## Dual 4-Input NAND Gate with LSTTL-Compatible Inputs

### High-Performance Silicon-Gate CMOS

The MC74HCT20A is identical in pinout to the LS20. The device inputs are compatible with standard CMOS LSTTL outputs.

#### Features

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 4.5 V to 5.5 V
- Low Input Current: 1  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- These are Pb-Free Devices

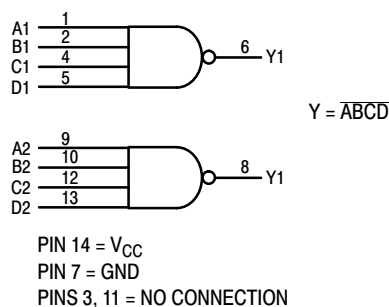


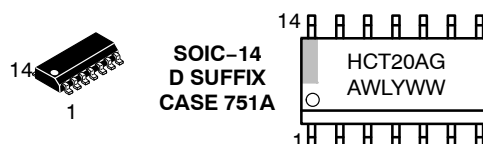
Figure 1. Logic Diagram



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<http://onsemi.com>

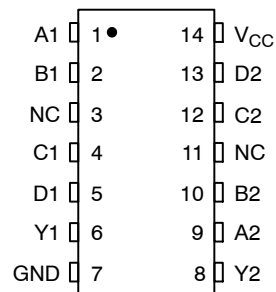
#### MARKING DIAGRAMS



A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week  
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

#### PIN ASSIGNMENT



#### FUNCTION TABLE

| Inputs |   |   |   | Output |
|--------|---|---|---|--------|
| A      | B | C | D | Y      |
| 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      |

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

# MC74HCT20A

## MAXIMUM RATINGS

| Symbol    | Parameter                                                       | Value                  | Unit |
|-----------|-----------------------------------------------------------------|------------------------|------|
| $V_{CC}$  | DC Supply Voltage (Referenced to GND)                           | -0.5 to +7.0           | V    |
| $V_{in}$  | DC Input Voltage (Referenced to GND)                            | -0.5 to $V_{CC} + 0.5$ | V    |
| $V_{out}$ | DC Output Voltage (Referenced to GND)                           | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_{in}$  | DC Input Current, per Pin                                       | $\pm 20$               | mA   |
| $I_{out}$ | DC Output Current, per Pin                                      | $\pm 25$               | mA   |
| $I_{CC}$  | DC Supply Current, $V_{CC}$ and GND Pins                        | $\pm 50$               | mA   |
| $P_D$     | Power Dissipation in Still Air<br>SOIC Package<br>TSSOP Package | 500<br>450             | mW   |
| $T_{stg}$ | Storage Temperature                                             | -65 to +150            | °C   |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ . Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

## RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter                                            | Min | Max      | Unit |
|-------------------|------------------------------------------------------|-----|----------|------|
| $V_{CC}$          | DC Supply Voltage (Referenced to GND)                | 4.5 | 5.5      | V    |
| $V_{in}, V_{out}$ | DC Input Voltage, Output Voltage (Referenced to GND) | 0   | $V_{CC}$ | V    |
| $T_A$             | Operating Temperature Range, All Package Types       | -55 | +125     | °C   |
| $t_r, t_f$        | Input Rise/Fall Time (Figure 1)                      | 0   | 500      | ns   |

## DC CHARACTERISTICS (Voltages Referenced to GND)

| Symbol           | Parameter                                      | Condition                                                                                                                 | V <sub>CC</sub><br>V | Guaranteed Limit |             |            | Unit |
|------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|-------------|------------|------|
|                  |                                                |                                                                                                                           |                      | −55 to 25°C      | ≤85°C       | ≤125°C     |      |
| V <sub>IH</sub>  | Minimum High-Level Input Voltage               | V <sub>out</sub> = 0.1V<br> I <sub>out</sub>   ≤ 20μA                                                                     | 4.5<br>5.5           | 2.0<br>2.0       | 2.0<br>2.0  | 2.0<br>2.0 | V    |
| V <sub>IL</sub>  | Maximum Low-Level Input Voltage                | V <sub>out</sub> = V <sub>CC</sub> − 0.1V<br> I <sub>out</sub>   ≤ 20μA                                                   | 4.5<br>5.5           | 0.8<br>0.8       | 0.8<br>0.8  | 0.8<br>0.8 | V    |
| V <sub>OH</sub>  | Minimum High-Level Output Voltage              | V <sub>in</sub> = V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20μA                                                           | 4.5<br>5.5           | 4.4<br>5.4       | 4.4<br>5.4  | 4.4<br>5.4 | V    |
|                  |                                                | V <sub>in</sub> = V <sub>IL</sub>  I <sub>out</sub>   ≤ 4.0mA                                                             | 4.5                  | 3.98             | 3.84        | 3.70       |      |
| V <sub>OL</sub>  | Maximum Low-Level Output Voltage               | V <sub>in</sub> = V <sub>IH</sub><br> I <sub>out</sub>   ≤ 20μA                                                           | 4.5<br>5.5           | 0.1<br>0.1       | 0.1<br>0.1  | 0.1<br>0.1 | V    |
|                  |                                                | V <sub>in</sub> = V <sub>IH</sub>  I <sub>out</sub>   ≤ 4.0mA                                                             | 4.5                  | 0.26             | 0.33        | 0.40       |      |
| I <sub>in</sub>  | Maximum Input Leakage Current                  | V <sub>in</sub> = V <sub>CC</sub> or GND                                                                                  | 5.5                  | ±0.1             | ±1.0        | ±1.0       | μA   |
| I <sub>CC</sub>  | Maximum Quiescent Supply Current (per Package) | V <sub>in</sub> = V <sub>CC</sub> or GND<br>I <sub>out</sub> = 0μA                                                        | 5.5                  | 1                | 10          | 40         | μA   |
| ΔI <sub>CC</sub> | Additional Quiescent Supply Current            | V <sub>in</sub> = 2.4V, Any One Input<br>V <sub>in</sub> = V <sub>CC</sub> or GND, Other Inputs<br>I <sub>out</sub> = 0μA | 5.5                  | ≥ −55°C          | 25 to 125°C |            | mA   |
|                  |                                                |                                                                                                                           |                      | 2.9              | 2.4         |            |      |

- Information on typical parametric values can be found in Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).
- Total Supply Current =  $I_{CC} + \Sigma \Delta I_{CC}$ .

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## AC ELECTRICAL CHARACTERISTICS ( $C_L = 50$ pF, Input $t_r = t_f = 6$ ns, $V_{CC} = 5.0$ V)

| Symbol                   | Parameter                                                                    | Guaranteed Limit |        |         | Unit |
|--------------------------|------------------------------------------------------------------------------|------------------|--------|---------|------|
|                          |                                                                              | - 55 to 25°C     | ≤ 85°C | ≤ 125°C |      |
| $t_{PLH}$ ,<br>$t_{PHL}$ | Maximum Propagation Delay, Input A, B, or C to Output Y<br>(Figures 2 and 3) | 28               | 35     | 42      | ns   |
| $t_{TLH}$ ,<br>$t_{THL}$ | Maximum Output Transition Time, Any Output<br>(Figures 2 and 3)              | 15               | 19     | 22      | ns   |
| $C_{in}$                 | Maximum Input Capacitance                                                    | 10               | 10     | 10      | pF   |

| C <sub>PD</sub> | Power Dissipation Capacitance (Per Gate) | Typical @ 25°C, V <sub>CC</sub> = 5.0 V | pF |
|-----------------|------------------------------------------|-----------------------------------------|----|
|                 |                                          | 26                                      |    |

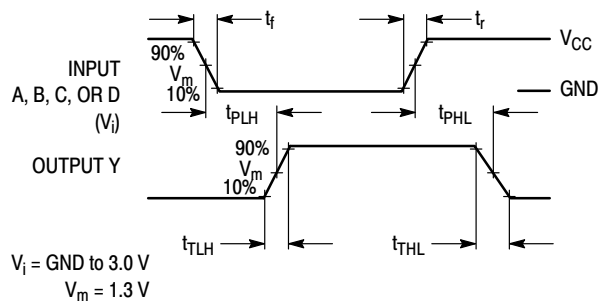


Figure 2. Switching Waveforms

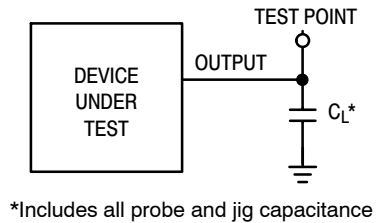


Figure 3. Test Circuit

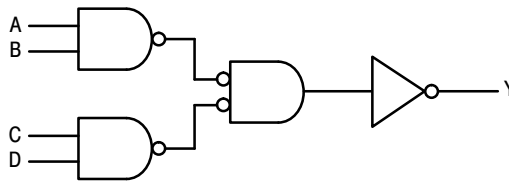


Figure 4. Expanded Logic Diagram  
(1/2 of the Device)

## ORDERING INFORMATION

| Device          | Package              | Shipping†        |
|-----------------|----------------------|------------------|
| MC74HCT20ADG    | SOIC-14<br>(Pb-Free) | 55 Units/Rail    |
| MC74HCT20ADR2G  | SOIC-14<br>(Pb-Free) | 2500/Tape & Reel |
| MC74HCT20ADTR2G | TSSOP-14*            |                  |

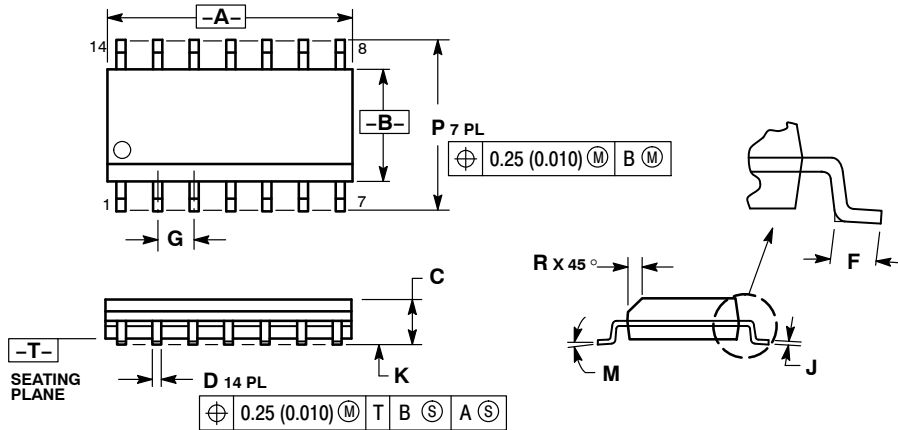
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*This package is inherently Pb-Free.

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## PACKAGE DIMENSIONS

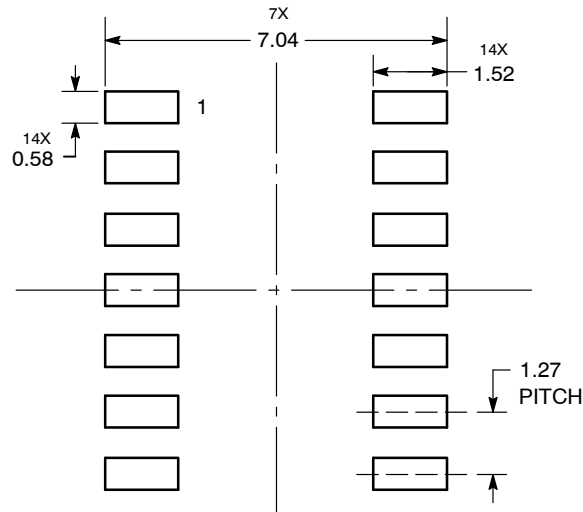
SOIC-14  
CASE 751A-03  
ISSUE J



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 8.55        | 8.75 | 0.337     | 0.344 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.054     | 0.068 |
| D   | 0.35        | 0.49 | 0.014     | 0.019 |
| F   | 0.40        | 1.25 | 0.016     | 0.049 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| J   | 0.19        | 0.25 | 0.008     | 0.009 |
| K   | 0.10        | 0.25 | 0.004     | 0.009 |
| M   | 0°          | 7°   | 0°        | 7°    |
| P   | 5.80        | 6.20 | 0.228     | 0.244 |
| R   | 0.25        | 0.50 | 0.010     | 0.019 |

### SOLDERING FOOTPRINT\*



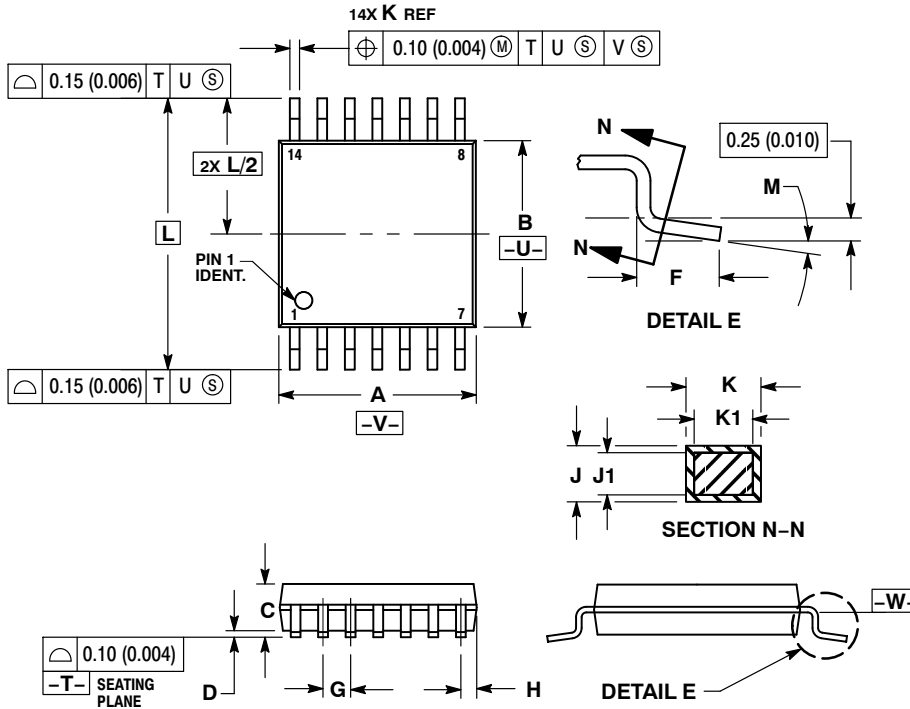
DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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## PACKAGE DIMENSIONS

**TSSOP-14**  
CASE 948G-01  
ISSUE B

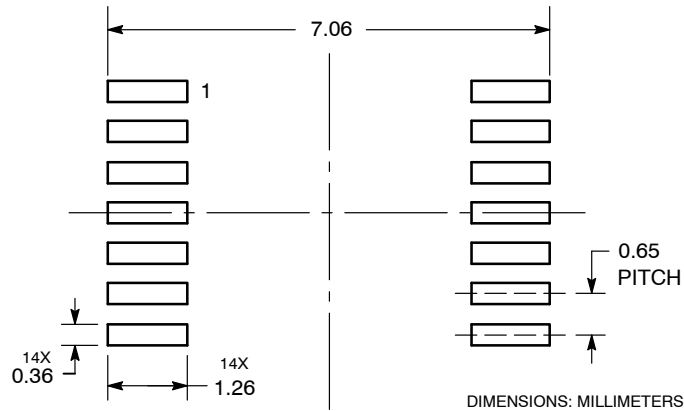


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| F   | 0.50        | 0.75 | 0.020     | 0.030 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| H   | 0.50        | 0.60 | 0.020     | 0.024 |
| J   | 0.09        | 0.20 | 0.004     | 0.008 |
| J1  | 0.09        | 0.16 | 0.004     | 0.006 |
| K   | 0.19        | 0.30 | 0.007     | 0.012 |
| K1  | 0.19        | 0.25 | 0.007     | 0.010 |
| L   | 6.40 BSC    |      | 0.252 BSC |       |
| M   | 0°          |      | 8°        |       |

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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