

Quad 2-Input AND Gate

MC74VHCT08A

The MC74VHCT08A is an advanced high speed CMOS 2-input AND gate fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

The VHCT inputs are compatible with TTL levels. This device can be used as a level converter for interfacing 3.3 V to 5.0 V, because it has full 5.0 V CMOS level output swings.

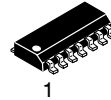
The VHCT08A input structures provide protection when voltages between 0 V and 5.5 V are applied, regardless of the supply voltage. The output structures also provide protection when $V_{CC} = 0$ V. These input and output structures help prevent device destruction caused by supply voltage – input/output voltage mismatch, battery backup, hot insertion, etc.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

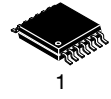
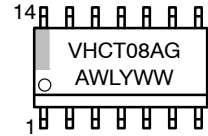
Features

- High Speed: $t_{PD} = 4.3$ ns (Typ) at $V_{CC} = 5$ V
- Low Power Dissipation: $I_{CC} = 2$ μ A (Max) at $T_A = 25^\circ$ C
- TTL-Compatible Inputs: $V_{IL} = 0.8$ V; $V_{IH} = 2.0$ V
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2 V to 5.5 V Operating Range
- Low Noise: $V_{OLP} = 0.8$ V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: Human Body Model; > 2000 V, Machine Model; > 200 V
- Chip Complexity: 24 FETs or 6 Equivalent Gates
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

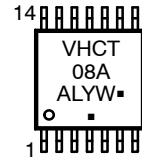
MARKING DIAGRAMS



SOIC-14
D SUFFIX
CASE 751A



TSSOP-14
DT SUFFIX
CASE 948G



A = Assembly Location
WL, L = Wafer Lot
Y, YY = Year
WW, W = Work Week
G or ■ = Pb-Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

MC74VHCT08A

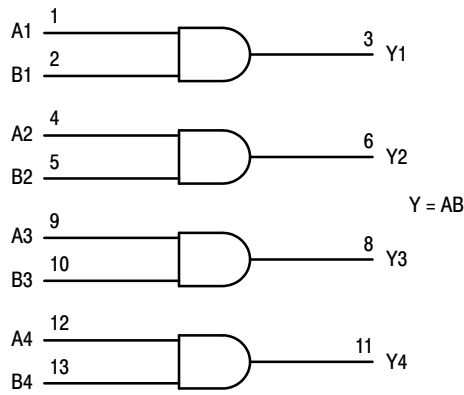


Figure 1. Logic Diagram

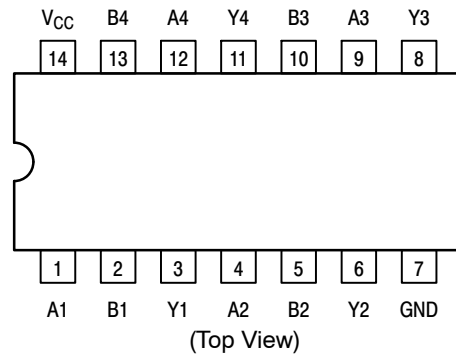


Figure 2. Pinout: 14-Lead Packages

FUNCTION TABLE

| Inputs | | Output |
|--------|---|--------|
| A | B | Y |
| L | L | L |
| L | H | L |
| H | L | L |
| H | H | H |

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--|-----------|------------------------|------|
| DC Supply Voltage | V_{CC} | -0.5 to +7.0 | V |
| DC Input Voltage | V_{in} | -0.5 to +7.0 | V |
| DC Output Voltage | V_{out} | -0.5 to $V_{CC} + 0.5$ | V |
| Input Diode Current | I_{IK} | -20 | mA |
| Output Diode Current | I_{OK} | ± 20 | mA |
| DC Output Current, per Pin | I_{out} | ± 25 | mA |
| DC Supply Current, V_{CC} and GND Pins | I_{CC} | ± 50 | mA |
| Power Dissipation in Still Air, SOIC Packages† TSSOP Package† | P_D | 500 450 | mW |
| Storage Temperature | T_{stg} | -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 those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

†Derating – SOIC Packages: - 7 mW/°C from 65° to 125°C
TSSOP Package: - 6.1 mW/°C from 65° to 125°C

RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Min | Max | Unit |
|---|------------|-----|----------|------|
| DC Supply Voltage | V_{CC} | 2.0 | 5.5 | V |
| DC Input Voltage | V_{in} | 0 | 5.5 | V |
| DC Output Voltage | V_{out} | 0 | V_{CC} | V |
| Operating Temperature | T_A | -40 | + 125 | °C |
| Input Rise and Fall Time $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$ | t_r, t_f | 0 | 20 | ns/V |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

MC74VHCT08A

DC ELECTRICAL CHARACTERISTICS

| Parameter | Test Conditions | Symbol | V _{CC} (V) | T _A = 25°C | | | T _A ≤ 85°C | | T _A ≤ 125°C | | Unit |
|---|--|--------------------|------------------------|-----------------------|------------|--------------------|-----------------------|--------------------|------------------------|--------------------|------|
| | | | | Min | Typ | Max | Min | Max | Min | Max | |
| Minimum High-Level Input Voltage | | V _{IH} | 3.0 4.5 5.5 | 1.2 2.0 2.0 | | | 1.2 2.0 2.0 | | 1.2 2.0 2.0 | | V |
| Maximum Low-Level Input Voltage | | V _{IL} | 3.0 4.5 5.5 | | | 0.53 0.8 0.8 | | 0.53 0.8 0.8 | | 0.53 0.8 0.8 | V |
| Minimum High-Level Output Voltage V _{IN} = V _{IH} or V _{IL} | V _{IN} = V _{IH} or V _{IL} I _{OH} = -50 μA | V _{OH} | 3.0 4.5 | 2.9 4.4 | 3.0 4.5 | | 2.9 4.4 | | 2.9 4.4 | | V |
| | V _{IN} = V _{IH} or V _{IL} I _{OH} = -4 mA I _{OH} = -8 mA | | 3.0 4.5 | 2.58 3.94 | | | 2.48 3.80 | | 2.34 3.66 | | |
| Maximum Low-Level Output Voltage V _{IN} = V _{IH} or V _{IL} | V _{IN} = V _{IH} or V _{IL} I _{OL} = 50 μA | V _{OL} | 3.0 4.5 | | 0.0 0.0 | 0.1 0.1 | | 0.1 0.1 | | 0.1 0.1 | V |
| | V _{IN} = V _{IH} or V _{IL} I _{OL} = 4 mA I _{OL} = 8 mA | | 3.0 4.5 | | | 0.36 0.36 | | 0.44 0.44 | | 0.52 0.52 | |
| Maximum Input Leakage Current | V _{IN} = 5.5 V or GND | I _{IN} | 0 to 5.5 | | | ±0.1 | | ±1.0 | | ±1.0 | μA |
| Maximum Quiescent Supply Current | V _{IN} = V _{CC} or GND | I _{CC} | 5.5 | | | 2.0 | | 20 | | 40 | μA |
| Quiescent Supply Current | Input: V _{IN} = 3.4 V | I _{CC(T)} | 5.5 | | | 1.35 | | 1.50 | | 1.65 | mA |
| Output Leakage Current | V _{OUT} = 5.5 V | I _{OPD} | 0.0 | | | 0.5 | | 5.0 | | 10 | μA |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

AC ELECTRICAL CHARACTERISTICS (Input t_r = t_f = 3.0ns)

| Characteristic | Test Conditions | Symbol | T _A = 25°C | | | T _A ≤ 85°C | | T _A ≤ 125°C | | Unit |
|---|---|--|--|------------|-------------|-----------------------|--------------|------------------------|--------------|------|
| | | | Min | Typ | Max | Min | Max | Max | Max | |
| Maximum Propagation Delay, Input A or B to Y | V _{CC} = 3.0 ± 0.3V C _L = 15 pF C _L = 50 pF | t _{PLH} , t _{PHL} | | 6.2 8.7 | 8.8 12.3 | | 10.5 14.0 | | 14.0 17.5 | ns |
| | V _{CC} = 5.0 ± 0.5V C _L = 15 pF C _L = 50 pF | | | 4.3 5.8 | 5.9 7.9 | | 7.0 9.0 | | 9.0 11.0 | |
| Maximum Input Capacitance | | C _{in} | | 4 | 10 | | 10 | | 10 | pF |
| Power Dissipation Capacitance (Note 1) | | C _{PD} | Typical @ 25°C, V _{CC} = 5.0V | | | | | | | |
| | | | 20 | | | | | | | pF |

- C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC}/4 (per gate). C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC} • 7

NOISE CHARACTERISTICS (Input t_r = t_f = 3.0 ns, C_L = 50pF, V_{CC} = 5.0 V)

| Characteristic | Symbol | T _A = 25°C | | Unit |
|--|------------------|-----------------------|------|------|
| | | Typ | Max | |
| Quiet Output Maximum Dynamic V _{OL} | V _{OLP} | 0.3 | 0.8 | V |
| Quiet Output Minimum Dynamic V _{OL} | V _{OLV} | -0.3 | -0.8 | V |
| Minimum High Level Dynamic Input Voltage | V _{IHD} | | 3.5 | V |
| Maximum Low Level Dynamic Input Voltage | V _{ILD} | | 1.5 | V |

MC74VHCT08A

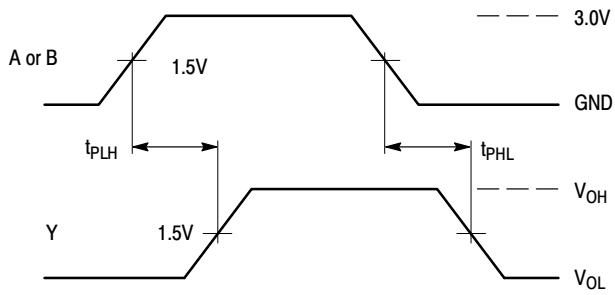
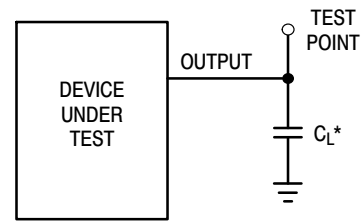


Figure 3. Switching Waveforms



*Includes all probe and jig capacitance

Figure 4. Test Circuit

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|--------------------|-----------------------|--------------------------|
| MC74VHCT08ADR2G | SOIC-14 (Pb-Free) | 2500 Units / Tape & Reel |
| MC74VHCT08ADTR2G | TSSOP-14 (Pb-Free) | 2500 Units / Tape & Reel |
| NLV74VHCT08ADTR2G* | TSSOP-14 (Pb-Free) | 2500 Units / Tape & Reel |

[†]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.

*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-14 NB
CASE 751A-03
ISSUE L

DATE 03 FEB 2016



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
 4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
 5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | 0.054 | 0.068 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| A3 | 0.19 | 0.25 | 0.008 | 0.010 |
| b | 0.35 | 0.49 | 0.014 | 0.019 |
| D | 8.55 | 8.75 | 0.337 | 0.344 |
| E | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| H | 5.80 | 6.20 | 0.228 | 0.244 |
| h | 0.25 | 0.50 | 0.010 | 0.019 |
| L | 0.40 | 1.25 | 0.016 | 0.049 |
| M | 0° | 7° | 0° | 7° |

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.

GENERIC MARKING DIAGRAM*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLES ON PAGE 2

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SOIC-14
CASE 751A-03
ISSUE L

DATE 03 FEB 2016

STYLE 1:
 PIN 1. COMMON CATHODE
 2. ANODE/CATHODE
 3. ANODE/CATHODE
 4. NO CONNECTION
 5. ANODE/CATHODE
 6. NO CONNECTION
 7. ANODE/CATHODE
 8. ANODE/CATHODE
 9. ANODE/CATHODE
 10. NO CONNECTION
 11. ANODE/CATHODE
 12. ANODE/CATHODE
 13. NO CONNECTION
 14. COMMON ANODE

STYLE 2:
 CANCELLED

STYLE 3:
 PIN 1. NO CONNECTION
 2. ANODE
 3. ANODE
 4. NO CONNECTION
 5. ANODE
 6. NO CONNECTION
 7. ANODE
 8. ANODE
 9. ANODE
 10. NO CONNECTION
 11. ANODE
 12. ANODE
 13. NO CONNECTION
 14. COMMON CATHODE

STYLE 4:
 PIN 1. NO CONNECTION
 2. CATHODE
 3. CATHODE
 4. NO CONNECTION
 5. CATHODE
 6. NO CONNECTION
 7. CATHODE
 8. CATHODE
 9. CATHODE
 10. NO CONNECTION
 11. CATHODE
 12. CATHODE
 13. NO CONNECTION
 14. COMMON ANODE

STYLE 5:
 PIN 1. COMMON CATHODE
 2. ANODE/CATHODE
 3. ANODE/CATHODE
 4. ANODE/CATHODE
 5. ANODE/CATHODE
 6. NO CONNECTION
 7. COMMON ANODE
 8. COMMON CATHODE
 9. ANODE/CATHODE
 10. ANODE/CATHODE
 11. ANODE/CATHODE
 12. ANODE/CATHODE
 13. NO CONNECTION
 14. COMMON ANODE

STYLE 6:
 PIN 1. CATHODE
 2. CATHODE
 3. CATHODE
 4. CATHODE
 5. CATHODE
 6. CATHODE
 7. CATHODE
 8. ANODE
 9. ANODE
 10. ANODE
 11. ANODE
 12. ANODE
 13. ANODE
 14. ANODE

STYLE 7:
 PIN 1. ANODE/CATHODE
 2. COMMON ANODE
 3. COMMON CATHODE
 4. ANODE/CATHODE
 5. ANODE/CATHODE
 6. ANODE/CATHODE
 7. ANODE/CATHODE
 8. ANODE/CATHODE
 9. ANODE/CATHODE
 10. ANODE/CATHODE
 11. COMMON CATHODE
 12. COMMON ANODE
 13. ANODE/CATHODE
 14. ANODE/CATHODE

STYLE 8:
 PIN 1. COMMON CATHODE
 2. ANODE/CATHODE
 3. ANODE/CATHODE
 4. NO CONNECTION
 5. ANODE/CATHODE
 6. ANODE/CATHODE
 7. COMMON ANODE
 8. COMMON ANODE
 9. ANODE/CATHODE
 10. ANODE/CATHODE
 11. NO CONNECTION
 12. ANODE/CATHODE
 13. ANODE/CATHODE
 14. COMMON CATHODE

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MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



TSSOP-14 WB
CASE 948G
ISSUE C

DATE 17 FEB 2016

SCALE 2:1



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- 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.
- DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
- 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.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- 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° | 0° | 8° |

GENERIC MARKING DIAGRAM*



- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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