Quad 2-Input NAND Gate

MC74VHCT00A

The MC74VHCT00A is an advanced high speed CMOS 2-input NAND gate fabricated with silicon gate CMOS technology. It achieves high speed operation while maintaining CMOS low power dissipation.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output.

The device input is compatible with TTL-type input thresholds and the output has a full 5 V CMOS level output swing. The input protection circuitry on this device allows overvoltage tolerance on the input, allowing the device to be used as a logic-level translator from 3.0 V CMOS logic to 5.0 V CMOS Logic or from 1.8 V CMOS logic to 3.0 V CMOS Logic while operating at the high-voltage power supply.

The MC74VHCT00A input structure provides protection when voltages up to 7 V are applied, regardless of the supply voltage. This allows the MC74VHCT00A to be used to interface 5 V circuits to 3 V circuits. The output structures also provide protection when $V_{\rm CC}=0$ V. These input and output structures help prevent device destruction caused by supply voltage – input/output voltage mismatch, battery backup, hot insertion, etc.

- High Speed: $t_{PD} = 5.0 \text{ ns (Typ)}$ at $V_{CC} = 5 \text{ V}$
- Low Power Dissipation: $I_{CC} = 2 \mu A$ (Max) at $T_A = 25^{\circ}C$
- TTL-Compatible Inputs: $V_{IL} = 0.8 \text{ V}$; $V_{IH} = 2.0 \text{ V}$
- Power Down Protection Provided on Inputs and Outputs
- Balanced Propagation Delays
- Designed for 3.0 V to 5.5 V Operating Range
- Low Noise: $V_{OLP} = 0.8 \text{ V (Max)}$
- Pin and Function Compatible with Other Standard Logic Families
- Chip Complexity: 48 FETs or 12 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

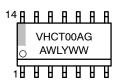


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MARKING DIAGRAMS







TSSOP-14 DT SUFFIX CASE 948G



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)

ORDERING INFORMATION

See detailed ordering and shipping information in the dimensions section on page 6 of this data sheet.

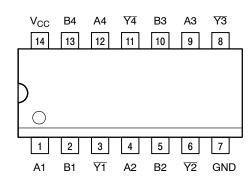


Figure 1. Pin Assignment (Top View)

PIN ASSIGNMENT				
1	IN A1			
2	IN B1			
3	OUT YT			
4	IN A2			
5	IN B2			
6	OUT Y2			
7	GND			
8	OUT \overline{73}			
9	IN A3			
10	IN B3			
11	OUT Y 4			
12	IN A4			
13	IN B4			
14	V _{CC}			

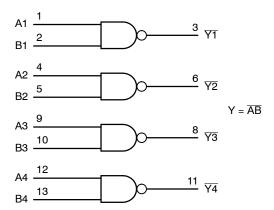


Figure 2. Logic Diagram

FUNCTION TABLE

uts	Output
В	Y
L	Н
Н	Н
L	Н
Н	L
	B L

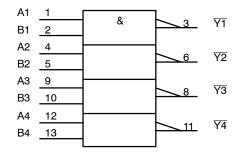


Figure 3. IEC LOGIC DIAGRAM

MAXIMUM RATINGS

Symbol	Ch	aracteristics	Value	Unit
V _{CC}	DC Supply Voltage		-0.5 to +7.0	V
V _{IN}	DC Input Voltage		-0.5 to +7.0	V
V _{OUT}	DC Output Voltage	V _{CC} = 0 High or Low State	-0.5 to 7.0 -0.5 to V _{CC} + 0.5	V
I _{IK}	Input Diode Current		-20	mA
I _{OK}	Output Diode Current	V_{OUT} < GND; V_{OUT} > V_{CC}	+20	mA
I _{OUT}	DC Output Current, per Pin		+25	mA
I _{CC}	DC Supply Current, V _{CC} and	GND	+50	mA
P _D	Power Dissipation in Still Air,	SOIC Package (Note 1) TSSOP Package (Note 1)	500 450	mW
TL	Lead temperature, 1 mm fron	n case for 10 s	260	°C
T _{stg}	Storage temperature		-65 to +150	°C
V _{ESD}	ESD Withstand Voltage	Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4)	> 2000 > 200 > 3000	V
I _{Latch-Up}	Latch-Up Performance (Note 5)	Above V _{CC} and Below GND at 125°C	±300	mA

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} 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.

- 1. Derating SOIC Package: –7 mW/°C from 65° to 125°C TSSOP Package: –6.1 mW/°C from 65° to 125°C
- 2. Tested to EIA/JESD22-A114-A
- 3. Tested to EIA/JESD22-A115-A
- 3. Tested to EIA/JESD22-ATT
- 4. Tested to JESD22-C101-A
- 5. Tested to EIA/JESD78

RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics		Min	Max	Unit
V _{CC}	DC Supply Voltage		3.0	5.5	V
V _{IN}	DC Input Voltage		0.0	5.5	V
V _{OUT}	DC Output Voltage	VCC = 0 High or Low State	0.0 0.0	5.5 V _{CC}	V
T _A	Operating Temperature Range		-55	+125	°C
t _r , t _f	Input Rise and Fall Time	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	0 0	100 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.

The θ_{JA} of the package is equal to 1/Derating. Higher junction temperatures may affect the expected lifetime of the device per the table and figure below.

DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

Junction Temperature °C	Time, Hours	Time, Years
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

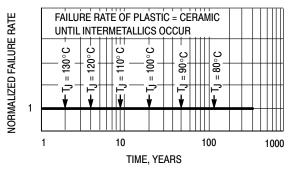


Figure 4. Failure Rate vs. Time Junction Temperature

DC ELECTRICAL CHARACTERISTICS

			V _{CC}	1	A = 25°C		T _A ≤	85°C	T _A ≤ 1	125°C	
Symbol	Parameter	Test Conditions	(V)	Min	Тур	Max	Min	Max	Min	Max	Unit
V _{IH}	Minimum High-Level Input Voltage		3.0 4.5 5.5	1.4 2.0 2.0			1.4 2.0 2.0		1.4 2.0 2.0		V
V _{IL}	Maximum Low-Level Input Voltage		3.0 4.5 5.5			0.53 0.8 0.8		0.53 0.8 0.8		0.53 0.8 0.8	٧
V _{OH}	Minimum High-Level Output Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -50 \mu\text{A}$	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}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -4 \text{ mA}$ $I_{OH} = -8 \text{ mA}$	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66		٧
V _{OL}	Maximum Low-Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $I_{OL} = 50 \mu A$	3.0 4.5		0.0 0.0	0.1 0.1		0.1 0.1		0.1 0.1	٧
	$V_{IN} = V_{IH}$ or V_{IL}	$V_{IN} = V_{IH}$ 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	٧
I _{IN}	Maximum Input Leakage Current	V _{IN} = 5.5 V or GND	0 to 5.5			±0.1		±1.0		±1.0	μА
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND	5.5			2.0		20		40	μА
I _{CCT}	Quiescent Supply Current	Input: V _{IN} = 3.4 V	5.5			1.35		1.50		1.65	mA
I _{OPD}	Output Leakage Current	V _{OUT} = 5.5 V	0.0			0.5		5.0		10	μА

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 C_{load} = 50 pF, Input t_r = t_f = 3.0 ns

				1	Γ _A = 25°	C	T _A ≤	85°C	T _A ≤ 1	125°C	
Symbol	Parameter	Test Condi	tions	Min	Тур	Max	Min	Max	Min	Max	Unit
t _{PLH} , t _{PHL}	Maximum Propogation Delay,	$V_{CC} = 3.3 \pm 0.3 \text{ V}$	$C_L = 15 \text{ pF}$ $C_L = 50 \text{ pF}$		4.1 5.5	10.0 13.5		11.0 15.0		13.0 17.5	ns
	Input A or B to Y	$V_{CC} = 5.0 \pm 0.5 \text{ V}$	$C_L = 15 \text{ pF}$ $C_L = 50 \text{ pF}$		3.1 6.9 3.6 7.9		8.0 9.0		9.5 10.5		
C _{IN}	Maximum Input Capacitance				5.5	10		10		10	pF

		Typical @ 25°C, V _{CC} = 5.0 V	
C _{PD}	Power Dissipation Capacitance (Note 6)	17	pF

^{6.} 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}. 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}.

$\textbf{NOISE CHARACTERISTICS} \; (Input \; t_r = t_f = 3.0 \text{ns}, \; C_L = 50 \text{pF}, \; V_{CC} = 5.0 \text{V}, \; \text{Measured in SO Package})$

		T _A = 25°C		
Symbol	Characteristic	Тур	Max	Unit
V _{OLP}	Quiet Output Maximum Dynamic V _{OL}	0.4	0.8	V
V _{OLV}	Quiet Output Minimum Dynamic V _{OL}	- 0.4	- 0.8	V
V_{IHD}	Minimum High Level Dynamic Input Voltage		2.0	V
V _{ILD}	Maximum Low Level Dynamic Input Voltage		0.8	V

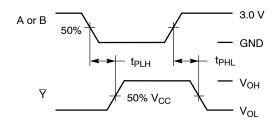
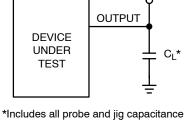


Figure 5. Switching Waveforms



TEST POINT

Figure 6. Test Circuit

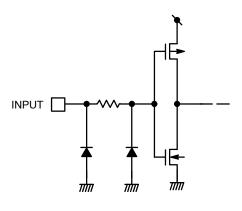


Figure 7. Input Equivalent Circuit

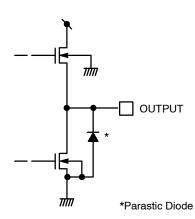


Figure 8. Output Equivalent Circuit

ORDERING INFORMATION

Device	Package	Shipping [†]
MC74VHCT00ADR2G	SOIC-14 (Pb-Free)	2500 / Tape & Reel
MC74VHCT00ADTR2G	TSSOP-14	2000 / Tana & Baal
NLV74VHCT00ADTR2G*	(Pb-Free)	2000 / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.
*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP

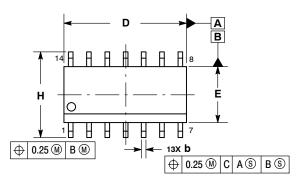
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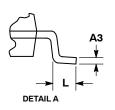


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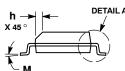
SOIC-14 NB CASE 751A-03 ISSUE L

DATE 03 FEB 2016





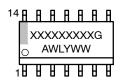




- NOTES:
 1. DIMENSIONING AND TOLERANCING PER
 - ASME Y14.5M, 1994.
 CONTROLLING DIMENSION: MILLIMETERS.
 - DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT
- MAXIMUM MATERIAL CONDITION.
 DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
- 5.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

	MILLIN	IETERS	INC	HES
DIM	MIN	MAX	MIN	MAX
Α	1.35	1.75	0.054	0.068
A1	0.10	0.25	0.004	0.010
АЗ	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
Е	3.80	4.00	0.150	0.157
œ	1.27 BSC		0.050	BSC
Н	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
М	0 °	7°	0 °	7 °

GENERIC MARKING DIAGRAM*

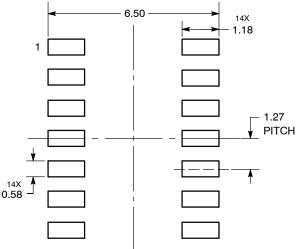


XXXXX = Specific Device Code Α = Assembly Location

WL = Wafer Lot Υ = 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.

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

C SEATING PLANE

STYLES ON PAGE 2

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

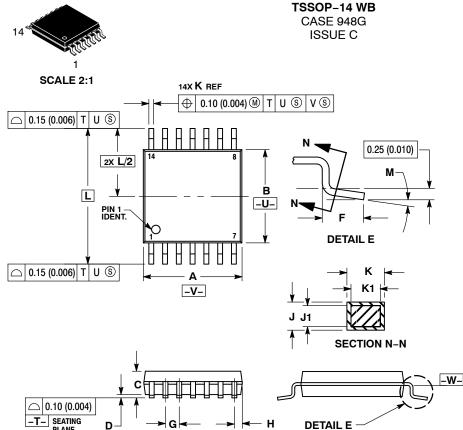
SOIC-14 CASE 751A-03 ISSUE L

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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DATE 17 FEB 2016

- 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.
 DIMENSION B DOES NOT INCLUDE
- INTERLEAD FLASH OR PROTRUSION.
 INTERLEAD FLASH OR PROTRUSION SHALL
- 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 DEFERENCE ONLY.
- REFERENCE ONLY.
 DIMENSION A AND B ARE TO BE
- DETERMINED AT DATUM PLANE -W-.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α	4.90	5.10	0.193	0.200
В	4.30	4.50	0.169	0.177
С		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	
Н	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	
М	0°	8 °	0 °	8 °

GENERIC MARKING DIAGRAM*



= Assembly Location

= Wafer Lot ٧ = 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.

◀	7.06
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	0.65
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0.36 14X 1.26	DIMENSIONS: MILLIMETERS

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NLV74HC02ADR2G 74HC32S14-13 74LS133 74LVC1G32Z-7 M38510/30402BDA 74LVC1G86Z-7 74LVC2G08RA3-7
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