

Quad 2-Input NAND Gate

MC74VHC00

The MC74VHC00 is an advanced high speed CMOS 2-input NAND 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 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 V, allowing the interface of 5 V systems to 3 V systems.

Features

- High Speed: $t_{PD} = 3.7 \text{ ns}$ (Typ) at $V_{CC} = 5 \text{ V}$
- Low Power Dissipation: $I_{CC} = 2 \mu\text{A}$ (Max) at $T_A = 25^\circ\text{C}$
- High Noise Immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2 V to 5.5 V Operating Range
- Low Noise: $V_{OLP} = 0.8 \text{ V}$ (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: HBM > 2000 V; Machine Model > 200 V
- Chip Complexity: 32 FETs or 8 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

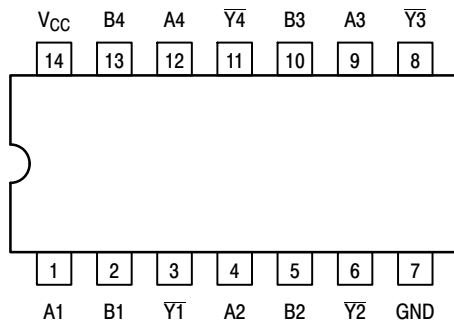


Figure 1. Pinout: 14-Lead Packages
(Top View)

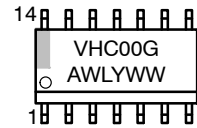
FUNCTION TABLE

Inputs		Output
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

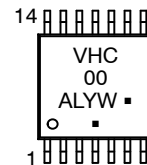
MARKING DIAGRAMS



SO-14
D SUFFIX
CASE 751A



TSSOP-14
DT SUFFIX
CASE 948G



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

ORDERING INFORMATION

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

MC74VHC00

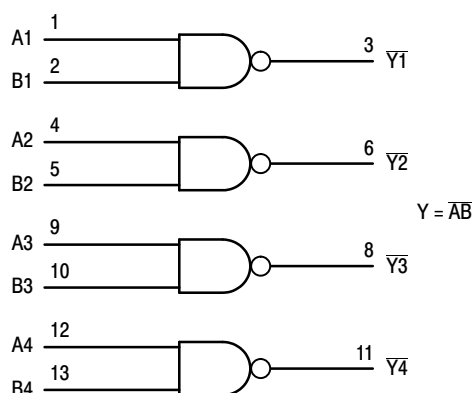


Figure 2. Logic Diagram

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Positive DC Supply Voltage	-0.5 to +7.0	V
V_{IN}	Digital Input Voltage	-0.5 to +7.0	V
V_{OUT}	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
I_{IK}	Input Diode Current	-20	mA
I_{OK}	Output Diode Current	± 20	mA
I_{OUT}	DC Output Current, per Pin	± 25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	± 75	mA
P_D	Power Dissipation in Still Air	SOIC Package 200 TSSOP 180	mW
T_{STG}	Storage Temperature Range	-65 to +150	°C
V_{ESD}	ESD Withstand Voltage	Human Body Model (Note 1) Machine Model (Note 2) Charged Device Model (Note 3)	V
$I_{LATCH-UP}$	Latch-Up Performance	Above V_{CC} and Below GND at 125°C (Note 4)	mA
θ_{JA}	Thermal Resistance, Junction to Ambient	SOIC Package 143 TSSOP 164	°C/W

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. Tested to EIA/JESD22-A114-A
2. Tested to EIA/JESD22-A115-A
3. Tested to JESD22-C101-A
4. Tested to EIA/JESD78

RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics	Min	Max	Unit
V_{CC}	DC Supply Voltage	2.0	5.5	V
V_{IN}	DC Input Voltage	0	5.5	V
V_{OUT}	DC Output Voltage	0	V_{CC}	V
T_A	Operating Temperature Range, All Package Types	-55	125	°C
t_r, t_f	Input Rise or Fall Time	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	0 100 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.

MC74VHC00

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} V	T _A = 25°C			T _A = -40 to 85°C		T _A = -55 to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V _{IH}	High-Level Input Voltage		2.0 3.0 to 5.5	1.50 V _{CC} × 0.7			1.50 V _{CC} × 0.7		1.50 V _{CC} × 0.7		V
V _{IL}	Low-Level Input Voltage		2.0 3.0 to 5.5			0.50 V _{CC} × 0.3		0.50 V _{CC} × 0.3		0.50 V _{CC} × 0.3	V
V _{OH}	High-Level Output Voltage	V _{in} = V _{IH} or V _{IL} I _{OH} = - 50 µA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5		1.9 2.9 4.4		1.9 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		2.40 3.70		
V _{OL}	Low-Level Output Voltage	V _{in} = V _{IH} or V _{IL} I _{OL} = 50 µA	2.0 3.0 4.5		0.0 0.0 0.0	0.1 0.1 0.1		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		0.55 0.55	
I _{in}	Input Leakage Current	V _{in} = 5.5 V or GND	0 to 5.5			± 0.1		± 1.0		± 2.0	µA
I _{CC}	Quiescent Supply Current	V _{in} = V _{CC} or GND	5.5			2.0		20		40	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 = 3.0 ns)

Symbol	Parameter	Test Conditions	T _A = 25°C			T _A = -40 to 85°C		T _A = -55 to +125°C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay, A or B to $\bar{Y}$	V _{CC} = 3.3 ± 0.3 V C _L = 15 pF C _L = 50 pF		5.5 8.0	7.9 11.4	1.0 1.0	9.5 13.0	1.0 1.0	10 14.5	ns
		V _{CC} = 5.0 ± 0.5 V C _L = 15 pF C _L = 50 pF		3.7 5.2	5.5 7.5	1.0 1.0	6.5 8.5	1.0 1.0	7.0 9.5	
C _{in}	Input Capacitance			4.0	10		10		10	pF

C _{PD}	Power Dissipation Capacitance (Note 5)	Typical @ 25°C, V _{CC} = 5.0 V	pF
		19	

5. 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}.

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

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

MC74VHC00

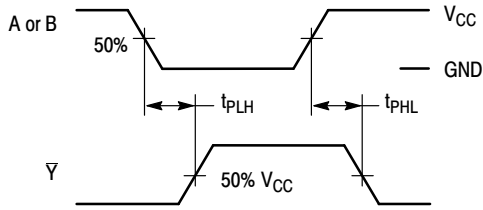
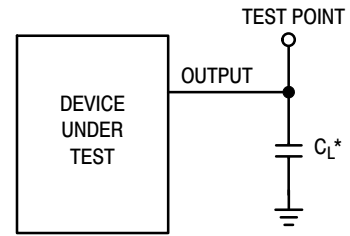


Figure 3. Switching Waveforms



*Includes all probe and jig capacitance

Figure 4. Test Circuit

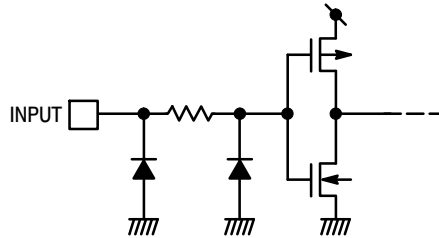


Figure 5. Input Equivalent Circuit

ORDERING INFORMATION

Device	Package	Shipping [†]
MC74VHC00DR2G	SOIC-14 (Pb-Free)	2500 / Tape & Reel
MC74VHC00DTG	TSSOP-14 (Pb-Free)	96 Units / Rail
MC74VHC00DTR2G	TSSOP-14 (Pb-Free)	2500 / Tape & Reel
NLV74VHC00DTR2G*	TSSOP-14 (Pb-Free)	2500 / 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:

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°	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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