MC74HC03A

Quad 2-Input NAND Gate with Open-Drain Outputs

High−Performance Silicon−Gate CMOS

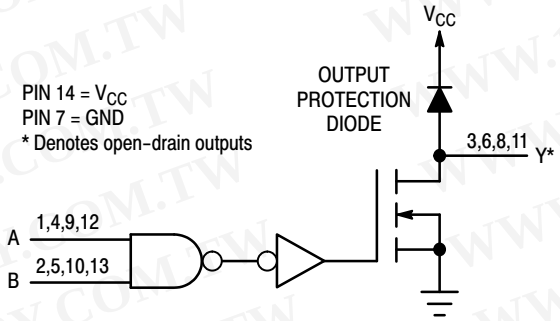
The MC74HC03A is identical in pinout to the LS03. The device inputs are compatible with Standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

The HC03A NAND gate has, as its outputs, a high−performance MOS N−Channel transistor. This NAND gate can, therefore, with a suitable pullup resistor, be used in wired−AND applications. Having the output characteristic curves given in this data sheet, this device can be used as an LED driver or in any other application that only requires a sinking current.

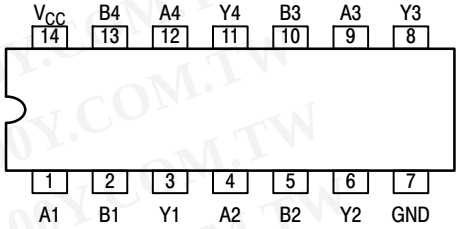
Features

- Output Drive Capability: 10 LSTTL Loads With Suitable Pullup Resistor
- Outputs Directly Interface to CMOS, NMOS and TTL
- High Noise Immunity Characteristic of CMOS Devices
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1 μA
- In Compliance With the JEDEC Standard No. 7 A Requirements
- Chip Complexity: 28 FETs or 7 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, Halogen Free/BFR Free and are RoHS Compliant

LOGIC DIAGRAM



Pinout: 14−Lead Packages (Top View)



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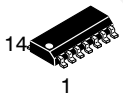
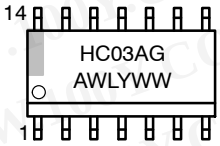
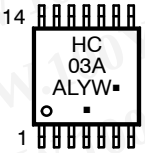
MARKING DIAGRAMS



SOIC−14
D SUFFIX
CASE 751A



TSSOP−14
DT SUFFIX
CASE 948G



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

(Note: Microdot may be in either location)

FUNCTION TABLE

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

Z = High Impedance

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

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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	± 20	mA
I_{out}	DC Output Current, per Pin	± 25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	± 50	mA
P_D	Power Dissipation in Still Air SOIC Package†	500	mW
	TSSOP Package†	450	
T_{stg}	Storage Temperature	–65 to + 150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds SOIC or TSSOP Package	260	°C

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.

†Derating – SOIC Package: – 7 mW/°C from 65° to 125°C
TSSOP Package: – 6.1 mW/°C from 65° to 125°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 ≤ (V_{in} or V_{out}) ≤ 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.

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RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)		2.0	6.0	V
V_{in}, V_{out}	DC Input Voltage, Output Voltage (Referenced to GND)		0	V_{CC}	V
T_A	Operating Temperature, All Package Types		–55	+125	°C
t_r, t_f	Input Rise and Fall Time (Figure 1)	V_{CC} = 2.0 V	0	1000	ns
		V_{CC} = 4.5 V	0	500	
		V_{CC} = 6.0 V	0	400	

DESIGN GUIDE

Criteria	Value	Unit
Internal Gate Count*	7.0	ea
Internal Gate Propagation Delay	1.5	ns
Internal Gate Power Dissipation	5.0	μW
Speed Power Product	0.0075	pJ

*Equivalent to a two–input NAND gate

DC CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Condition	V_{CC} V	Guaranteed Limit			Unit
				−55 to 25°C	≤85°C	≤125°C	
V_{IH}	Minimum High−Level Input Voltage	V_{out} = 0.1V or V_{CC} −0.1V $\|I_{out}\| \le 20\mu A$	2.0 3.0 4.5 6.0	1.50 2.10 3.15 4.20	1.50 2.10 3.15 4.20	1.50 2.10 3.15 4.20	V
V_{IL}	Maximum Low−Level Input Voltage	V_{out} = 0.1V or V_{CC} − 0.1V $\|I_{out}\| \le 20\mu A$	2.0 3.0 4.5 6.0	0.50 0.90 1.35 1.80	0.50 0.90 1.35 1.80	0.50 0.90 1.35 1.80	V
V_{OL}	Maximum Low−Level Output Voltage	V_{out} = 0.1V or V_{CC} − 0.1V $\|I_{out}\| \le 20\mu A$	2.0 4.5 6.0	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} $\|I_{out}\| \le 2.4mA$ $\|I_{out}\| \le 4.0mA$ $\|I_{out}\| \le 5.2mA$	3.0 4.5 6.0	0.26 0.26 0.26	0.33 0.33 0.33	0.40 0.40 0.40	
I_{in}	Maximum Input Leakage Current	V_{in} = V_{CC} or GND	6.0	±0.1	±1.0	±1.0	μA
I_{CC}	Maximum Quiescent Supply Current (per Package)	V_{in} = V_{CC} or GND I_{out} = 0μA	6.0	1.0	10	40	μA
I_{OZ}	Maximum Three−State Leakage Current	Output in High−Impedance State V_{in} = V_{IL} or V_{IH} V_{out} = V_{CC} or GND	6.0	±0.5	±5.0	±10	μA

AC CHARACTERISTICS (C_L = 50 pF, Input t_r = t_f = 6 ns)

Symbol	Parameter	V_{CC} V	Guaranteed Limit			Unit
			−55 to 25°C	≤85°C	≤125°C	
t_{PLZ}, t_{PZL}	Maximum Propagation Delay, Input A or B to Output Y (Figures 1 and 2)	2.0 3.0 4.5 6.0	120 45 24 20	150 60 30 26	180 75 36 31	ns
t_{TLH}, t_{THL}	Maximum Output Transition Time, Any Output (Figures 1 and 2)	2.0 3.0 4.5 6.0	75 27 15 13	95 32 19 16	110 36 22 19	ns
C_{in}	Maximum Input Capacitance		10	10	10	pF
C_{out}	Maximum Three−State Output Capacitance (Output in High−Impedance State)		10	10	10	pF

		Typical @ 25°C, V_{CC} = 5.0 V, V_{EE} = 0 V	
C_{PD}	Power Dissipation Capacitance (Per Buffer)*	8.0	pF

* Used to determine the no−load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

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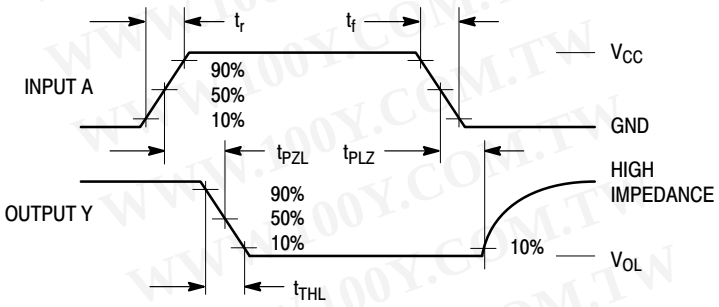
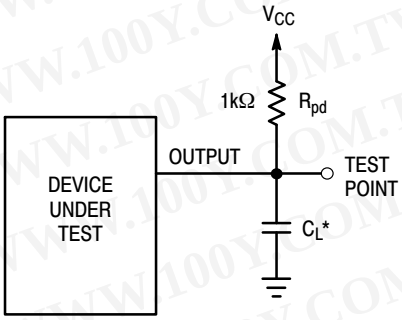
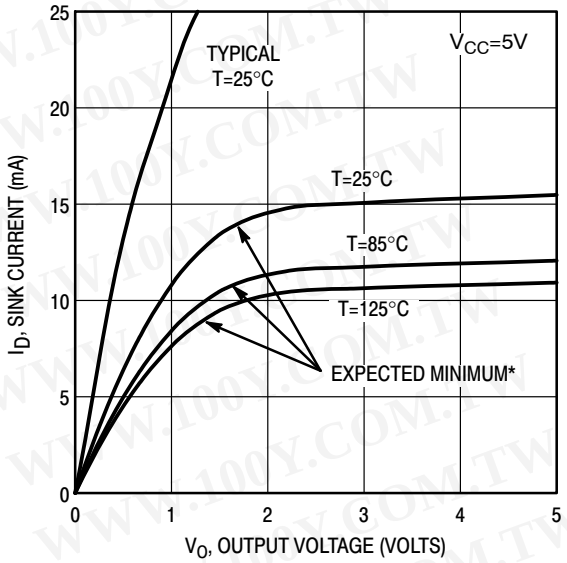


Figure 1. Switching Waveforms



*Includes all probe and jig capacitance

Figure 2. Test Circuit



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*The expected minimum curves are not guarantees, but are design aids.

Figure 3. Open−Drain Output Characteristics

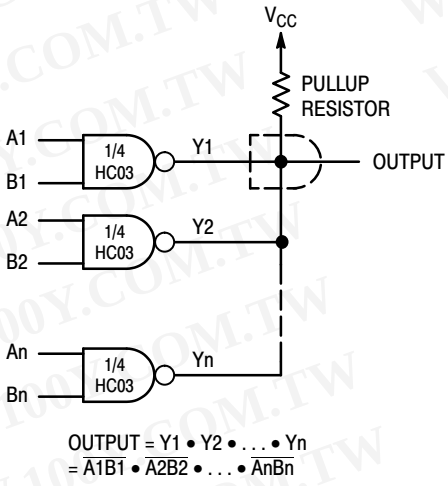

Figure 4. Wired AND

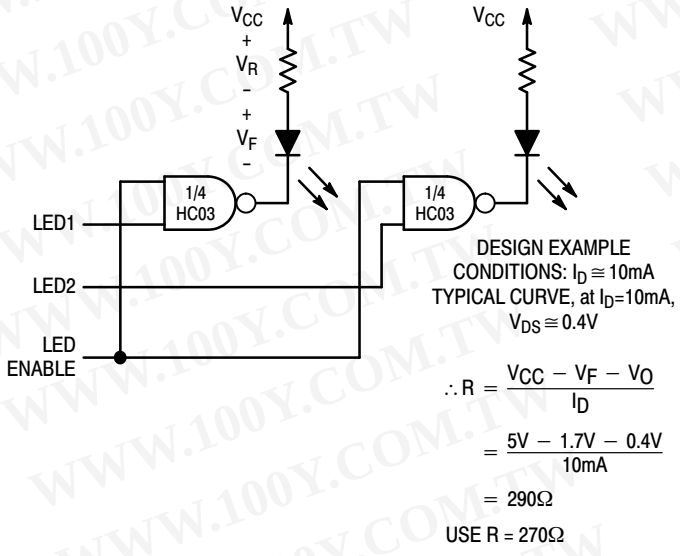

Figure 5. LED Driver With Blanking

ORDERING INFORMATION

Device	Package	Shipping†
MC74HC03ADG	SOIC−14 (Pb−Free)	55 Units / Rail
MC74HC03ADR2G	SOIC−14 (Pb−Free)	2500 / Tape & Reel
MC74HC03ADTR2G	TSSOP−14 (Pb−Free)	2500 / Tape & Reel
NLV74HC03ADG*	SOIC−14 (Pb−Free)	55 Units / Rail
NLV74HC03ADR2G*	SOIC−14 (Pb−Free)	2500 / Tape & Reel
NLV74HC03ADTR2G*	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

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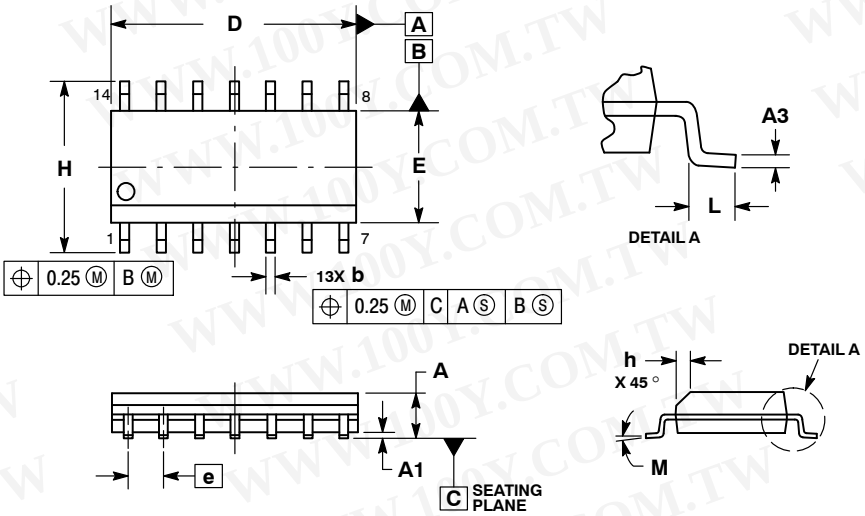
PACKAGE DIMENSIONS

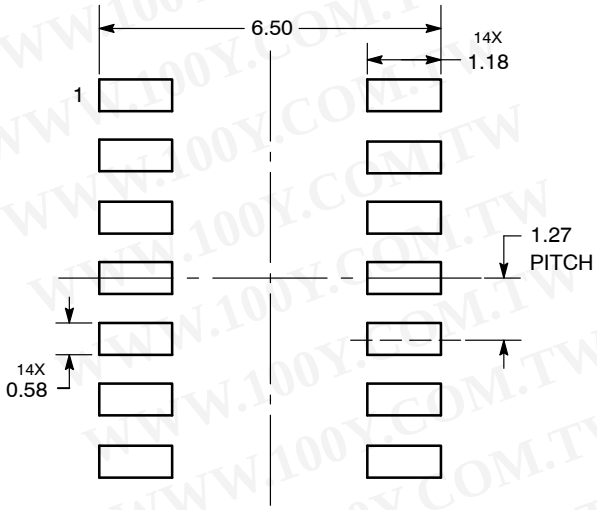
SOIC–14 NB
CASE 751A–03
ISSUE K



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.

	MILLIMETERS		INCHES	
DIM	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.

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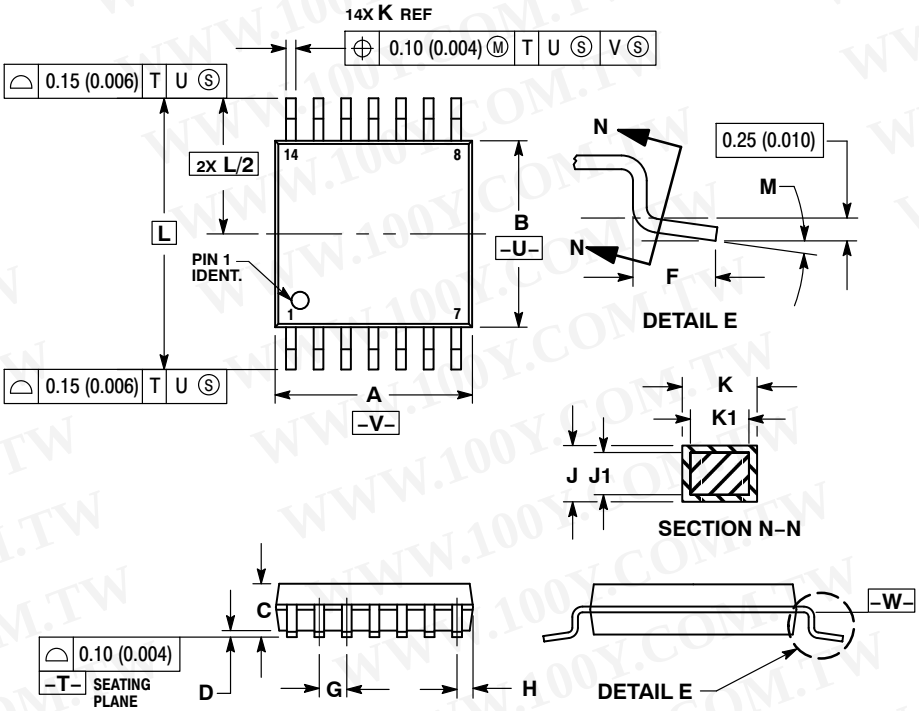
PACKAGE DIMENSIONS

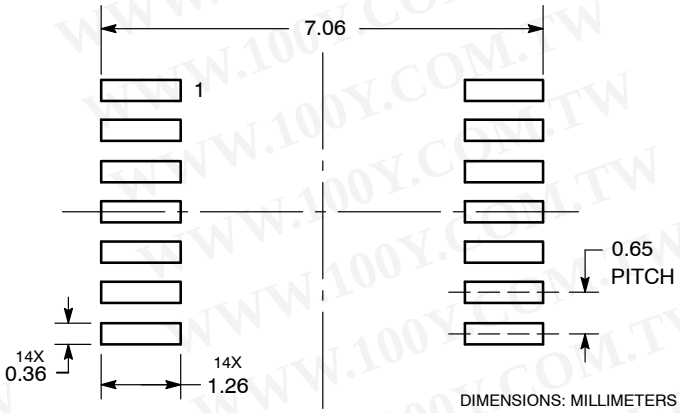
TSSOP-14
DT SUFFIX
CASE 948G-01
ISSUE B



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-.

	MILLIMETERS		INCHES	
DIM	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 °

SOLDERING FOOTPRINT*



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