

# **Quad 2-Input AND Gate**

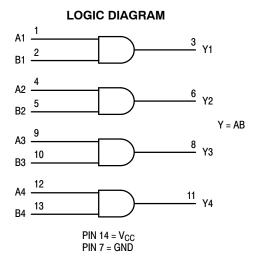
High-Performance Silicon-Gate CMOS

# MC74HC08A, MC74HCT08A

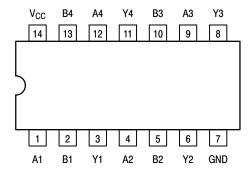
The MC74HC08A/MC74HCT08A is identical in pinout to the LS08. The MC74HC08A device inputs are compatible with Standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs. The MC74HCT08A inputs are compatible with Standard CMOS or TTL outputs.

#### **Features**

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS and TTL
- Operating Voltage Range: 2.0 to 6.0 V (HC), 4.5 to 5.5 V (HCT)
- Low Input Current: 1 μA
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance With the JEDEC Standard No. 7A Requirements
- Chip Complexity: 24 FETs or 6 Equivalent Gates
- –Q Suffix 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 and are RoHS Compliant



## Pinout: 14-Lead Packages (Top View)

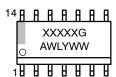


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### MARKING DIAGRAMS



SOIC-14 D SUFFIX CASE 751A





TSSOP-14 DT SUFFIX CASE 948G



XXXX = Specific Device Code
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
А В		Υ
L	L	L
L	Н	L
Н	L	L
Н	Н	Н

#### **ORDERING INFORMATION**

See detailed ordering and shipping information on page 6 of this data sheet.

#### **MAXIMUM RATINGS**

Symbol	Parameter		Value	Unit
V <sub>CC</sub>	DC Supply Voltage		-0.5 to +6.5	V
V <sub>IN</sub>	DC Input Voltage		-0.5 to V <sub>CC</sub> + 0.5	V
V <sub>OUT</sub>	DC Output Voltage		-0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IN</sub>	DC Input Current, per Pin		±20	mA
I <sub>OUT</sub>	DC Output Current, per Pin		±25	mA
I <sub>CC</sub>	DC Supply Current, V <sub>CC</sub> and GND Pins		±50	mA
I <sub>IK</sub>	Input Clamp Current (V <sub>IN</sub> < 0 or V <sub>IN</sub> > V <sub>CC</sub> )		±20	mA
I <sub>OK</sub>	Output Clamp Current (V <sub>OUT</sub> < 0 or V <sub>OUT</sub> > V <sub>CC</sub> )		±20	mA
T <sub>STG</sub>	Storage Temperature		-65 to +150	°C
TL	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
TJ	Junction Temperature Under Bias		±150	°C
$\theta_{\sf JA}$	Thermal Resistance (Note 1)	SOIC-14 TSSOP-14	116 150	°C/W
P <sub>D</sub>	Power Dissipation in Still Air at 25°C	SOIC-14 TSSOP-14	1077 833	mW
MSL	Moisture Sensitivity		Level 1	_
F <sub>R</sub>	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	-
V <sub>ESD</sub>	ESD Withstand Voltage (Note 2)	Human Body Model Charged Device Model	>2000 N/A	V

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.

- Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
   HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

# **RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter		Min	Max	Unit
MC74HC					
V <sub>CC</sub>	DC Supply Voltage (Referenced to GND)		2.0	6.0	V
V <sub>IN</sub> , V <sub>OUT</sub>	DC Input Voltage, Output Voltage (Referenced to GND) (Note 3)		0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Free-Air Temperature		<del>-</del> 55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Vcc	= 2.0 V = 4.5 V = 6.0 V	0 0 0	1000 500 400	ns
MC74HCT					
V <sub>CC</sub>	DC Supply Voltage (Referenced to GND)		4.5	5.5	V
$V_{IN}, V_{OUT}$	DC Input Voltage, DC Output Voltage (Referenced to GND) (Note 3)		0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Free-Air Temperature		<del>-</del> 55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise or Fall Time		0	500	ns

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.

3. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

# DC CHARACTERISTICS (MC74HC08A)

			V <sub>CC</sub>	Guara	nteed Lim	nit	
Symbol	Parameter	Condition	V	-55 to 25°C	≤85°C	≤125°C	Unit
V <sub>IH</sub>	Minimum High-Level Input Voltage	$V_{out} = 0.1V \text{ or } V_{CC} - 0.1V$ $ 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 <sub>IL</sub>	Maximum Low-Level Input Voltage	$V_{out} = 0.1V \text{ or } V_{CC} - 0.1V$ $ 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 <sub>OH</sub>	Minimum High-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out}  \le 20 \mu A$	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		$ \begin{aligned} V_{\text{in}} = & V_{\text{IH}} \text{ or } V_{\text{IL}} & & \left  I_{\text{out}} \right  \leq 2.4 \text{mA} \\ & \left  I_{\text{out}} \right  \leq 4.0 \text{mA} \\ & \left  I_{\text{out}} \right  \leq 5.2 \text{mA} \end{aligned} $	3.0 4.5 6.0	2.48 3.98 5.48	2.34 3.84 5.34	2.20 3.70 5.20	
V <sub>OL</sub>	Maximum Low-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ 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
		$\begin{aligned} V_{in} = V_{IH} \text{ or } V_{IL} & &  I_{out}  \leq 2.4 \text{mA} \\ & &  I_{out}  \leq 4.0 \text{mA} \\ & &  I_{out}  \leq 5.2 \text{mA} \end{aligned}$	3.0 4.5 6.0	0.26 0.26 0.26	0.33 0.33 0.33	0.40 0.40 0.40	
l <sub>in</sub>	Maximum Input Leakage Current	V <sub>in</sub> = V <sub>CC</sub> or GND	6.0	±0.1	±1.0	±1.0	μΑ
I <sub>CC</sub>	Maximum Quiescent Supply Current (per Package)	$V_{in} = V_{CC}$ or GND $I_{out} = 0\mu A$	6.0	1.0	10	40	μΑ

# AC CHARACTERISTICS (MC74HC08A)

		V <sub>CC</sub>	Guaranteed Limit			
Symbol	Parameter	V	-55 to 25°C	≤ <b>85</b> °C	≤125°C	Unit
t <sub>PLH</sub> ,	Maximum Propagation Delay, (A or B) to Y	2.0	75	95	110	ns
t <sub>PHL</sub>	(Figures 1 and 2)	3.0	30	40	55	
		4.5	15	19	22	
		6.0	13	16	19	
t <sub>TLH</sub> ,	Maximum Output Transition Time, Any Output	2.0	75	95	110	ns
t <sub>THL</sub>	(Figures 1 and 2)	3.0	27	32	36	
		4.5	15	19	22	
		6.0	13	16	19	
C <sub>in</sub>	Maximum Input Capacitance		10	10	10	pF

		Typical @ 25°C, V <sub>CC</sub> = 5.0 V, V <sub>EE</sub> = 0 V	
$C_{PD}$	Power Dissipation Capacitance (Per Buffer)*	20	pF

<sup>\*</sup>Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ .

# DC CHARACTERISTICS (MC74HCT08A)

			V <sub>CC</sub>	Guara	nteed Lim	nit	
Symbol	Parameter	Condition	v	-55 to 25°C	≤ <b>85</b> °C	≤125°C	Unit
V <sub>IH</sub>	Minimum High-Level Input Voltage	$V_{out}$ = 0.1 V or $V_{CC}$ -0.1 V $ I_{out}  \le 20 \mu A$	4.5 to 5.5	2.0	2.0	2.0	V
V <sub>IL</sub>	Maximum Low-Level Input Voltage	$V_{out}$ = 0.1 V or $V_{CC}$ - 0.1 V $ I_{out}  \le 20 \mu A$	4.5 to 5.5	0.8	0.8	0.8	V
V <sub>OH</sub>	Minimum High-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out}  \le 20 \mu A$	4.5 5.5	4.4 5.4	4.4 5.4	4.4 5.4	V
		$V_{in} = V_{IH} \text{ or } V_{IL} \qquad  I_{out}  \le 4.0 \text{ mA}$	4.5	3.98	3.84	3.70	
V <sub>OL</sub>	Maximum Low-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out}  \le 20 \mu A$	4.5 5.5	0.1 0.1	0.1 0.1	0.1 0.1	V
		$V_{in} = V_{IH} \text{ or } V_{IL} \qquad  I_{out}  \le 4.0 \text{ mA}$	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	μΑ
Icc	Maximum Quiescent Supply Current (per Package)	$V_{in} = V_{CC}$ or GND $I_{out} = 0 \mu A$	5.5	1.0	10	40	μА

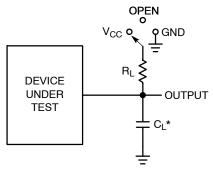
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# AC CHARACTERISTICS (MC74HCT08A)

		V <sub>C</sub>		Guaranteed Limit			
Symbol	Parameter		V	-55 to 25°C	≤ <b>85</b> °C	≤125°C	Unit
t <sub>PLH</sub> , t <sub>PHL</sub>	( -	PLH PHL	5.0	15 17	19 21	22 26	ns
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output (Figures 1 and 2)		5.0	15	19	22	ns
C <sub>in</sub>	Maximum Input Capacitance			10	10	10	pF

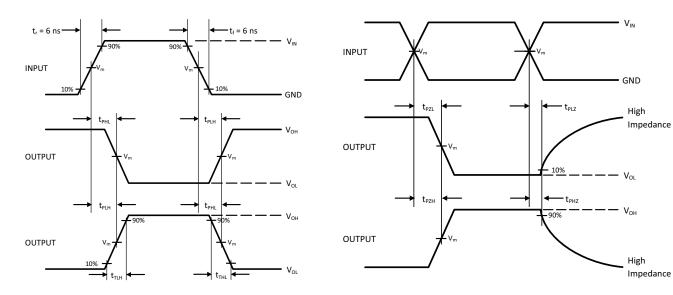
		Typical @ 25°C, V <sub>CC</sub> = 5.0 V, V <sub>EE</sub> = 0 V	
$C_{PD}$	Power Dissipation Capacitance (Per Buffer)*	20	pF

<sup>\*</sup>Used to determine the no–load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ .



Test	Switch Position	C <sub>L</sub>	R <sub>L</sub>
t <sub>PLH</sub> / t <sub>PHL</sub>	Open	50 pF	1 kΩ
t <sub>PLZ</sub> / t <sub>PZL</sub>	V <sub>CC</sub>		
t <sub>PHZ</sub> / t <sub>PZH</sub>	GND		

Figure 1. Test Circuit



Device	V <sub>IN</sub> , V	V <sub>m</sub> , V
MC74HC08A	$V_{CC}$	50% x V <sub>CC</sub>
MC74HCT08A	3 V	1.3 V

Figure 2. Switching Waveforms



Figure 3. Expanded Logic Diagram (1/4 of the Device)

<sup>\*</sup>C<sub>L</sub> Includes probe and jig capacitance

## **ORDERING INFORMATION**

Device	Marking	Package	Shipping <sup>†</sup>
MC74HC08ADG	HC08AG	SOIC-14	55 Units / Rail
MC74HC08ADR2G	HC08AG	SOIC-14	2500 / Tape & Reel
MC74HC08ADG-Q*	HC08AG	SOIC-14	2500 / Tape & Reel
MC74HC08ADR2G-Q*	HC08AG	SOIC-14	2500 / Tape & Reel
MC74HC08ADTR2G	HC 08A	TSSOP-14	2500 / Tape & Reel
MC74HC08ADTR2G-Q*	HC 08A	TSSOP-14	2500 / Tape & Reel
MC74HCT08ADG	HCT08AG	SOIC-14	55 Units / Rail
MC74HCT08ADR2G	HCT08AG	SOIC-14	2500 / Tape & Reel
MC74HCT08ADTR2G	HCT 08	TSSOP-14	2500 / Tape & Reel
MC74HCT08ADTR2G-Q*	HCT 08	TSSOP-14	2500 / Tape & Reel

<sup>†</sup>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.

<sup>\*-</sup>Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

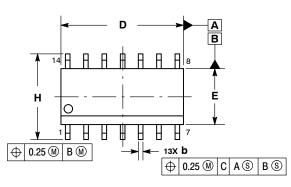




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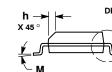
SOIC-14 NB CASE 751A-03 ISSUE L

**DATE 03 FEB 2016** 





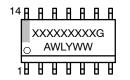




- NOTES:
  1. DIMENSIONING AND TOLERANCING PER
  - ASME Y14.5M, 1994.
    CONTROLLING DIMENSION: MILLIMETERS.
- DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT
- MAXIMUM MATERIAL CONDITION.
  DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.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

	MILLIMETERS		INCHES	
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
е	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 = 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.

#### **SOLDERING FOOTPRINT\***

C SEATING PLANE



DIMENSIONS: MILLIMETERS

#### **STYLES ON PAGE 2**

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

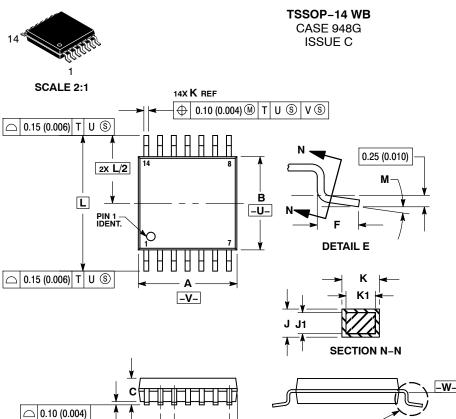
## SOIC-14 CASE 751A-03 ISSUE L

# 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:

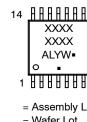
  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

  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. 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 DEEEDERING 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	o°	8 °	0 °	8 °

#### **GENERIC MARKING DIAGRAM\***



= Assembly Location

= Wafer Lot Υ = Year

= Work Week W

= 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.

DETAIL E  0.15 (0.006) T U S  A  O.10 (0.004)  O.10 (0.004)	4. [ 4. [ 1 5. [ 6. ] 7. [ 7. [
SOLDERING FOOTPRINT  7.06  1	A L Y V
0.65 PITCH	(Note:

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