

September 1983 Revised January 2005

# MM74HC08 Quad 2-Input AND Gate

#### **General Description**

The MM74HC08 AND gates utilize advanced silicon-gate CMOS technology to achieve operating speeds similar to LS-TTL gates with the low power consumption of standard CMOS integrated circuits. The HC08 has buffered outputs, providing high noise immunity and the ability to drive 10 LS-TTL loads. The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to  $V_{\rm CC}$  and ground.

#### **Features**

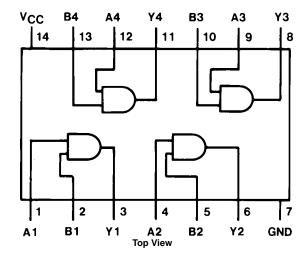
- $\blacksquare$  Typical propagation delay: 7 ns (t<sub>PHL</sub>), 12 ns (t<sub>PLH</sub>)
- Fanout of 10 LS-TTL loads
- Quiescent power consumption: 2 µA maximum at room temperature
- Low input current: 1 µA maximum

#### **Ordering Code:**

Order Number	Package Number	Package Description		
MM74HC08M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow		
MM74HC08MX_NL	M14A	Pb-Free 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow		
MM74HC08SJ	M14D	Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide		
MM74HC08MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide		
MM74HC08MTCX-NL	MTC14	Pb-Free 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide		
MM74HC08N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide		

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code. (Tape and Reel not available in N14A) Pb-Free package per JEDEC J-STD-020B.

### **Connection Diagram**



# Absolute Maximum Ratings(Note 1)

(Note 2)

(Note 2)	
Supply Voltage (V <sub>CC</sub> )	-0.5 to +7.0V
DC Input Voltage (V <sub>IN</sub> )	$-1.5$ to $V_{CC}$ +1.5V
DC Output Voltage (V <sub>OUT</sub> )	$-0.5$ to $V_{CC}$ $+0.5V$
Clamp Diode Current (I <sub>IK</sub> , I <sub>OK</sub> )	±20 mA
DC Output Current, per pin (I <sub>OUT</sub> )	±25 mA
DC V <sub>CC</sub> or GND Current, per pin	
(I <sub>CC</sub> )	±50 mA
Storage Temperature Range (T <sub>STG</sub> )	$-65^{\circ}\text{C}$ to $+150^{\circ}\text{C}$
Power Dissipation (P <sub>D</sub> )	
(Note 3)	600 mW
S.O. Package only	500 mW
Lead Temperature (T <sub>L</sub> )	
(Soldering 10 seconds)	260°C

# Recommended Operating Conditions

	Min	Max	Units
Supply Voltage (V <sub>CC</sub> )	2	6	V
DC Input or Output Voltage	0	$V_{CC}$	V
$(V_{IN}, V_{OUT})$			
Operating Temperature Range (T <sub>A</sub> )	-40	+85	°C
Input Rise or Fall Times			
$(t_r, t_f) V_{CC} = 2.0V$		1000	ns
$V_{CC} = 4.5V$		500	ns
$V_{CC} = 6.0V$		400	ns

Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic "N" package: –12 mW/°C from 65°C to 85°C.

#### DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	v <sub>cc</sub>	$T_A = 25^{\circ}C$		T <sub>A</sub> = -40 to 85°C	T <sub>A</sub> = -40 to 125°C	Units
Symbol		Conditions		Тур	Guaranteed Limits			Units
V <sub>IH</sub>	Minimum HIGH Level		2.0V		1.5	1.5	1.5	V
	Input Voltage		4.5V		3.15	3.15	3.15	V
			6.0V		4.2	4.2	4.2	V
V <sub>IL</sub>	Maximum LOW Level		2.0V		0.5	0.5	0.5	V
	Input Voltage		4.5V		1.35	1.35	1.35	V
			6.0V		1.8	1.8	1.8	V
V <sub>OH</sub>	Minimum HIGH Level	$V_{IN} = V_{IH}$						
	Output Voltage	$ I_{OUT}  \le 20 \ \mu A$	2.0V	2.0	1.9	1.9	1.9	V
			4.5V	4.5	4.4	4.4	4.4	V
			6.0V	6.0	5.9	5.9	5.9	V
		$V_{IN} = V_{IH}$						
		$ I_{OUT}  \le 4.0 \text{ mA}$	4.5V	4.2	3.98	3.84	3.7	V
		$ I_{OUT}  \le 5.2 \text{ mA}$	6.0V	5.7	5.48	5.34	5.2	V
V <sub>OL</sub>	Maximum LOW Level	$V_{IN} = V_{IH}$ or $V_{IL}$						
	Output Voltage	$ I_{OUT}  \le 20 \ \mu A$	2.0V	0	0.1	0.1	0.1	V
			4.5V	0	0.1	0.1	0.1	V
			6.0V	0	0.1	0.1	0.1	V
		$V_{IN} = V_{IH}$ or $V_{IL}$						
		$ I_{OUT}  \le 4.0 \text{ mA}$	4.5V	0.2	0.26	0.33	0.4	V
		$ I_{OUT}  \le 5.2 \text{ mA}$	6.0V	0.2	0.26	0.33	0.4	V
I <sub>IN</sub>	Maximum Input Current	$V_{IN} = V_{CC}$ or GND	6.0V		±0.1	±1.0	±1.0	μΑ
I <sub>CC</sub>	Maximum Quiescent	$V_{IN} = V_{CC}$ or GND	6.0V		2.0	20	40	μΑ
	Supply Current	$I_{OUT} = 0 \mu A$						

Note 4: For a power supply of 5V  $\pm$ 10% the worst case output voltages ( $V_{OH}$ , and  $V_{OL}$ ) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case  $V_{IH}$  and  $V_{IL}$  occur at  $V_{CC} = 5.5V$  and 4.5V respectively. (The  $V_{IH}$  value at 5.5V is 3.85V.) The worst case leakage current ( $I_{IN}$ ,  $I_{CC}$ , and  $I_{OZ}$ ) occur for CMOS at the higher voltage and so the 6.0V values should be used.

#### **AC Electrical Characteristics**

 $V_{CC} = 5V$ ,  $T_A = 25^{\circ}C$ ,  $C_L = 15$  pF,  $t_r = t_f = 6$  ns

Symbol	Parameter	Conditions	Тур	Guaranteed Limit	Units
t <sub>PHL</sub>	Maximum Propagation		12	20	ns
	Delay, Output HIGH-to-LOW				
t <sub>PLH</sub>	Maximum Propagation		7	15	ns
	Delay, Output LOW-to-HIGH				

### **AC Electrical Characteristics**

 $V_{CC} = 2.0 \text{V to } 6.0 \text{V}, C_L = 50 \text{ pF}, t_r = t_f = 6 \text{ ns (unless otherwise specified)}$ 

Symbol	Parameter	Conditions	v <sub>cc</sub>	T <sub>A</sub> = 25°C		T <sub>A</sub> = -40 to 125°C	Units
	Farameter		*CC	Тур	Guai	ranteed Limits	Ullits
t <sub>PHL</sub>	Maximum Propagation Delay,		2.0V	77	121	175	ns
	Output HIGH-to-LOW		4.5V	15	24	35	ns
			6.0V	13	20	30	ns
t <sub>PLH</sub>	Maximum Propagation Delay,		2.0V	30	90	134	ns
	Output LOW-to-HIGH		4.5V	10	18	27	ns
			6.0V	8	15	23	ns
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output		2.0V	30	75	110	ns
	Rise and Fall Time		4.5V	8	15	22	ns
			6.0V	7	13	19	ns
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	(per gate)		38			pF
C <sub>IN</sub>	Maximum Input Capacitance			4	10	10	pF

Note 5:  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} \ V_{CC}^2 \ f + I_{CC} \ V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} \ V_{CC} \ f + I_{CC}$ .

0.008 - 0.010 (0.203 - 0.254) TYP ALL LEADS

0.004 (0.102) ALL LEAD TIPS

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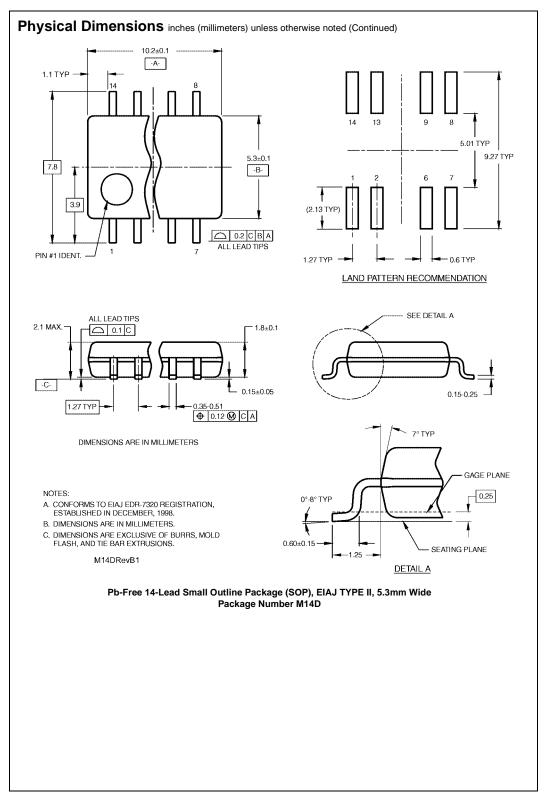
14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Package Number M14A

0.016 - 0.050 (0.406 - 1.270) TYP ALL LEADS 0.014

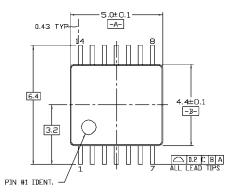
0.050 (1.270) TYP  $\frac{0.014 - 0.020}{(0.356 - 0.508)} \text{ TYP}$ 

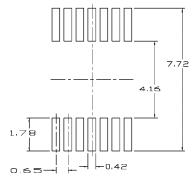
M14A (REV h)

0.008 (0.203) TYP

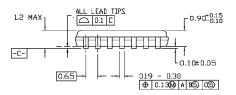


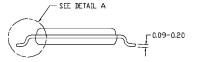
## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)





LAND PATTERN RECOMMENDATION

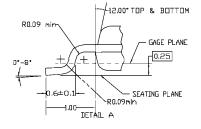




#### NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB\_ REF NOTE 6, DATED 7/93
- B. DIMENSIONS ARE IN MILLIMETERS
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982

MTC14revD



14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC14

#### Physical Dimensions inches (millimeters) unless otherwise noted (Continued) 0.740 - 0.770(18.80 - 19.56)0.090 (2.286) 14 13 12 11 10 9 8 14 13 12 0.250 ± 0.010 PIN NO. 1 IDENT PIN NO. 1 IDENT 1 2 3 4 5 6 7 1 2 3 $\frac{0.092}{(2.337)}$ DIA 0.030 MAX (0.762) DEPTH OPTION 1 OPTION 02 $\frac{0.135 \pm 0.005}{(3.429 \pm 0.127)}$ 0.300 - 0.320 $\overline{(7.620 - 8.128)}$ 0.065 $\frac{0.145 - 0.200}{(3.683 - 5.080)}$ 0.060 4° TYP Optional (1.524) (1.651) $\frac{0.008 - 0.016}{(0.203 - 0.406)}$ TYP 0.020 (0.508) 0.125 - 0.150 $0.075 \pm 0.015$ (3.175 - 3.810)0.280 (1.905 ± 0.381) 0.014-0.023 TYP (7.112) MIN 0.100 ± 0.010 (2.540 ± 0.254) (0.356 - 0.584)

14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide Package Number N14A

 $\frac{0.050 \pm 0.010}{(1.270 - 0.254)} \text{ TYP}$ 

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- A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

 $0.325 + 0.040 \\ -0.015 \\ \hline (8.255 + 1.016) \\ -0.381)$ 

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N144 (REV.E)