FAIRCHILD SEMICONDUCTOR™

January 1998

74VHC08 • 74VHCT08
Quad 2-Input AND Gate

General Description

The VHC/VHCT08 is an advanced high speed CMOS 2 Input AND Gate fabricated with silicon gate CMOS technology. It achieves the high-speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The internal circuit is composed of 4 stages including buffer output, which provide high noise immunity and stable output. An input protection circuit insures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery backup. This circuit prevents device destruction due to mismatched supply and input voltages.

Features

- Low power dissipation:
  I_{CC} = 2 µA (Max) @ T_A = 25˚C
- High Speed:
  t_{pd} = 4.3 ns (typ) at T_A = 25˚C
- High noise immunity:
  VHC $V_{NIH} = V_{NIL}$ = 28% V_{CC} (min)
  VHCT V_{IH} = 2.0V, V_{IL} = 0.8V
- Power down protection:
  VHC inputs only
  VHCT inputs and outputs
- Low noise:
  V_{OLP} = 0.8V (max)
- Pin and function compatible with 74HC/HCT08

Note: Add external pull up resistor to VHCT outputs to drive CMOS inputs.

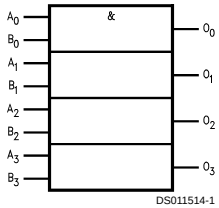
Ordering Code:

Commercial	Package Number	Package Description
74VHC08M	M14A	14-Lead Molded JEDEC SOIC
74VHC08SJ	M14D	14-Lead Molded EIAJ SOIC
74VHC08MTC	MTC14	14-Lead Molded JEDEC Type 1 TSSOP
74VHC08N	N14A	14-Lead Molded DIP
74VHCT08M	M14A	14-Lead Molded JEDEC SOIC
74VHCT08SJ	M14D	14-Lead Molded EIAJ SOIC
74VHCT08MTC	MTC14	14-Lead Molded JEDEC Type 1 TSSOP
74VHCT08N	N14A	14-Lead Molded DIP

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Logic Symbol

IEEE/IEC



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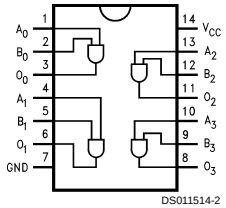
Connection Diagram

Pin Assignment for DIP, TSSOP, and SOIC



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Pin Descriptions

Pin Names	Description
A_n, B_n	Inputs
O_n	Outputs

Truth Table

A	B	O
L	L	L
L	H	L
H	L	L
H	H	H

Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Voltage (V_{IN})	−0.5V to +7.0V
DC Output Voltage (V_{OUT})	
VHC	−0.5V to V_{CC} + 0.5V
VHCT (Note 2)	−0.5V to 7.0V
Input Diode Current (I_{IK})	−20 mA
Output Diode Current (I_{OK})	
VHC	±20 mA
VHCT	−20 mA
DC Output Current (I_{OUT})	±25 mA
DC V_{CC}/GND Current (I_{CC})	±50 mA
Storage Temperature (T_{STG})	−65°C to +150°C
Lead Temperature (T_L)	
(Soldering, 10 seconds)	260°C

Recommended Operating Conditions (Note 3)

Supply Voltage (V_{CC})	
VHC	2.0V to +5.5V
VHCT	4.5V to 5.5V
Input Voltage (V_{IN})	0V to +5.5V
Output Voltage (V_{OUT})	0V to V_{CC}
Operating Temperature (T_{OPR})	−40°C to +85°C
Input Rise and Fall Time (t_r, t_f)	
V_{CC} = 3.3V ±0.3V (VHC only)	0 ns/V ~ 100 ns/V
V_{CC} = 5.0V ±0.5V	0 ns/V ~ 20 ns/V

Note 1: Absolute Maximum Ratings are values beyond which the device may be damaged or have its useful life impaired. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside databook specifications.

Note 2: $V_{OUT} > V_{CC}$ only if output is in H state.

Note 3: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics for VHC

Symbol	Parameter	V_{CC} (V)	T_A = 25°C			T_A = −40°C to +85°C		Units	Conditions	
			Min	Typ	Max	Min	Max			
V_{IH}	High Level Input Voltage	2.0	1.50			1.50		V		
		3.0–5.5	0.7 V_{CC}			0.7 V_{CC}				
V_{IL}	Low Level Input Voltage	2.0			0.50		0.50	V		
		3.0–5.5			0.3 V_{CC}		0.3 V_{CC}			
V_{OH}	High Level Output Voltage	2.0	1.9	2.0		1.9			V_{IN} = V_{IH}	I_{OH} = −50 µA
		3.0	2.9	3.0		2.9		V	or V_{IL}	
		4.5	4.4	4.5		4.4				
		3.0	2.58			2.48		V		I_{OH} = −4 mA
		4.5	3.94			3.80				I_{OH} = −8 mA
V_{OL}	Low Level Output Voltage	2.0		0.0	0.1		0.1		V_{IN} = V_{IH}	I_{OL} = 50 µA
		3.0		0.0	0.1		0.1	V	or V_{IL}	
		4.5		0.0	0.1		0.1			
		3.0			0.36		0.44	V		I_{OL} = 4 mA
		4.5			0.36		0.44			I_{OL} = 8 mA
I_{IN}	Input Leakage Current	0–5.5			±0.1		±1.0	µA	V_{IN} = 5.5V or GND	
I_{CC}	Quiescent Supply Current	5.5			2.0		20.0	µA	V_{IN} = V_{CC} or GND	

Noise Characteristics for VHC

Symbol	Parameter	V_{CC} (V)	T_A = 25°C		Units	Conditions
			Typ	Limits		
V_{OLP} (Note 4)	Quiet Output Maximum Dynamic V_{OL}	5.0	0.3	0.8	V	C_L = 50 pF
V_{OLV} (Note 4)	Quiet Output Minimum Dynamic V_{OL}	5.0	−0.3	−0.8	V	C_L = 50 pF
V_{IHD} (Note 4)	Minimum High Level Dynamic Input Voltage	5.0		3.5	V	C_L = 50 pF
V_{ILD} (Note 4)	Maximum Low Level Dynamic Input Voltage	5.0		1.5	V	C_L = 50 pF

Note 4: Parameter guaranteed by design.

DC Electrical Characteristics for VHCT

Symbol	Parameter	V_{CC} (V)	T_A = 25°C			T_A = −40°C to +85°C		Units	Conditions	
			Min	Typ	Max	Min	Max			
V_{IH}	High Level Input Voltage	4.5	2.0			2.0		V		
		5.5	2.0			2.0				
V_{IL}	Low Level Input Voltage	4.5			0.8		0.8	V		
		5.5			0.8		0.8			
V_{OH}	High Level Output Voltage	4.5	3.15	3.65		3.15		V	V_{IN} = V_{IH}	I_{OH} = −50 μA
		4.5	2.5			2.4		V	or V_{IL}	I_{OH} = −8 mA
V_{OL}	Low Level Output Voltage	4.5		0.0	0.1		0.1	V	V_{IN} = V_{IH}	I_{OL} = 50 μA
		4.5			0.36		0.44	V	or V_{IL}	I_{OL} = 8 mA
I_{IN}	Input Leakage Current	0–5.5			±0.1		±1.0	μA	V_{IN} = 5.5V or GND	
I_{CC}	Quiescent Supply Current	5.5			2.0		20.0	μA	V_{IN} = V_{CC} or GND	
I_{CCT}	Maximum I_{CC}/ Input	5.5			1.35		1.50	mA	V_{IN} = 3.4V Other Inputs = V_{CC} or GND	
I_{OFF}	Output Leakage Current (Power Down State)	0.0			0.5		5.0	μA	V_{OUT} = 5.5V	

Noise Characteristics for VHCT

Symbol	Parameter	V_{CC} (V)	T_A = 25°C		Units	Conditions
			Typ	Limit		
V_{OLP} (Note 5)	Quiet Output Maximum Dynamic V_{OL}		0.4	0.8	V	C_L = 50 pF
V_{OLV} (Note 5)	Quiet Output Minimum Dynamic V_{OL}		−0.4	−0.8	V	C_L = 50 pF
V_{IHD} (Note 5)	Minimum High Level Dynamic Input Voltage			2.0	V	C_L = 50 pF
V_{ILD} (Note 5)	Maximum Low Level Dynamic Input Voltage			0.8	V	C_L = 50 pF

Note 5: Parameter guaranteed by design.

AC Electrical Characteristics for VHCT

Symbol	Parameter	V_{CC} (V)	T_A = 25°C			T_A = −40°C to +85°C		Units	Conditions
			Min	Typ	Max	Min	Max		
t_{PHL}, t_{PLH}	Propagation Delay	3.3±0.3		6.2	8.8	1.0	10.5	ns	C_L = 15 pF
				8.7	12.3	1.0	14.0		C_L = 50 pF
		5.0±0.5		4.3	5.9	1.0	7.0	ns	C_L = 15 pF
				5.8	7.9	1.0	9.0		C_L = 50 pF
C_{IN}	Input Capacitance			4	10		10	pF	V_{CC} = Open
C_{PD}	Power Dissipation Capacitance			18				pF	(Note 6)

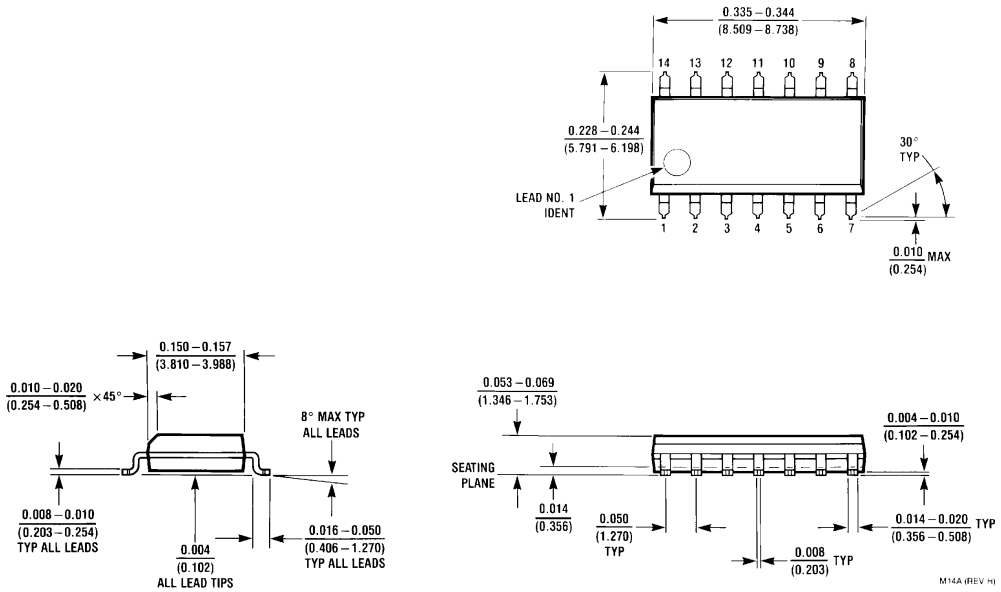
Note 6: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC} (opr.) = C_{PD} * V_{CC} * f_{IN} + I_{CC}/4 (per gate).

AC Electrical Characteristics for VHCT

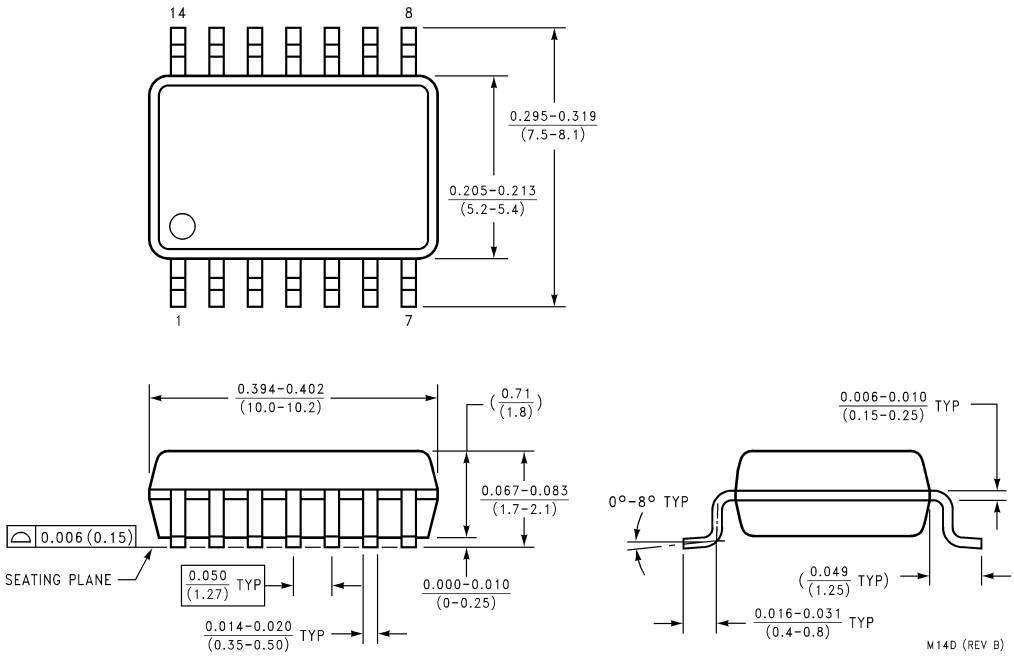
Symbol	Parameter	V_{CC} (V)	T_A = 25°C			T_A = −40°C to +85°C		Units	Conditions
			Min	Typ	Max	Min	Max		
t_{PLH},	Propagation Delay	5.0		5.0	6.9	1.0	8.0	ns	C_L = 15 pF
t_{PHL}		±0.5		5.5	7.9	1.0	9.0		C_L = 50 pF
C_{IN}	Input Capacitance			4	10		10	pF	V_{CC} = Open
C_{PD}	Power Dissipation Capacitance			18				pF	(Note 7)

Note 7: 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 from the equation: I_{CC} (opr.) = C_{PD} * V_{CC} * f_{IN} + I_{CC}/4 (per gate)

Physical Dimensions inches (millimeters) unless otherwise noted

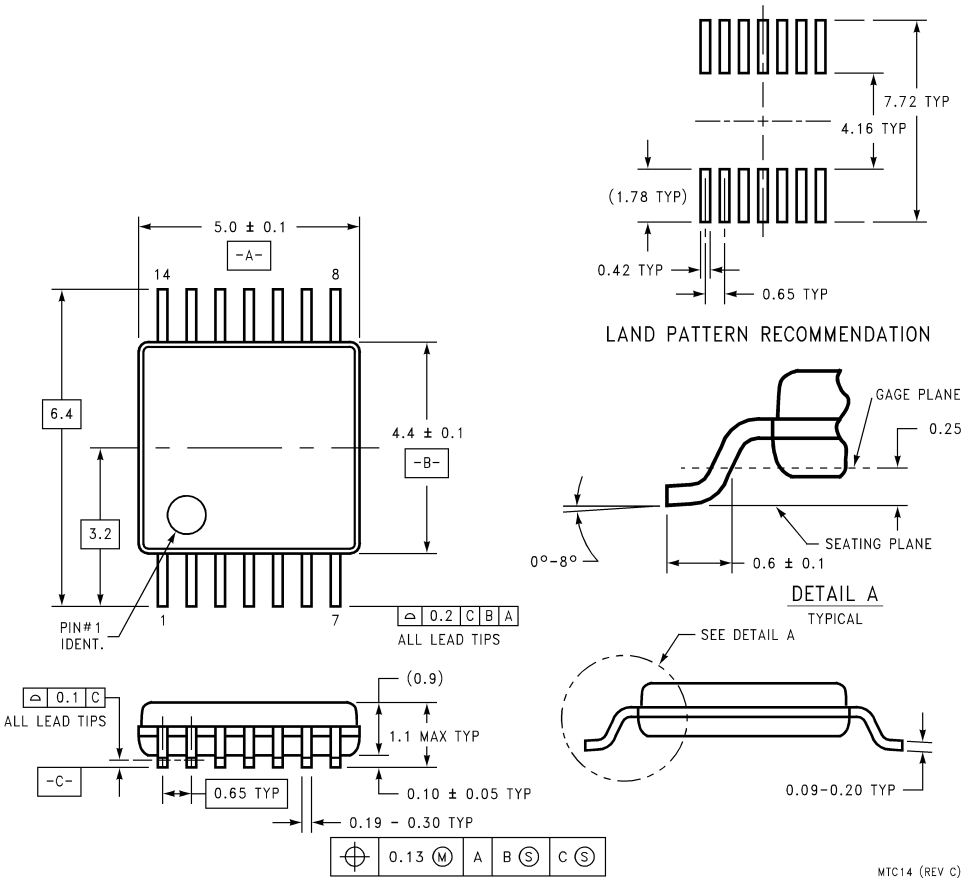


14-Lead Small Outline Integrated Circuit—JEDEC SOIC (M)
Package Number M14A



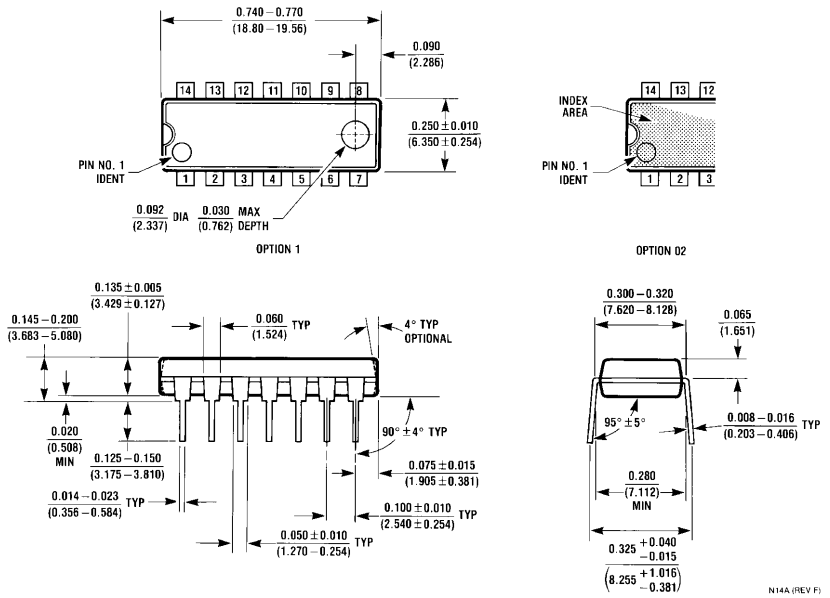
14-Lead Plastic EIAJ SOIC (SJ)
Package Number M14D

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



14-Lead Plastic JEDEC TSSOP Type I (MTC)
Package Number MTC14

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



14-Lead Molded Dual-In-Line Package (MDIP)
Package Number N14A

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