MC74HCT14A

Hex Schmitt-Trigger Inverter with LSTTL Compatible Inputs

High−Performance Silicon−Gate CMOS

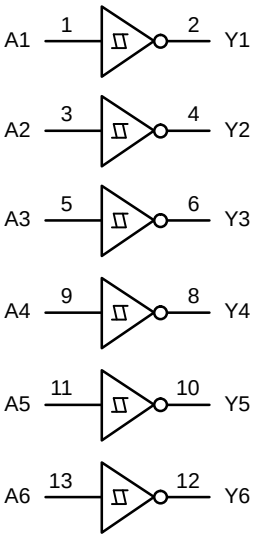
The MC74HCT14A may be used as a level converter for interfacing TTL or NMOS outputs to high−speed CMOS inputs.

The HCT14A is useful to “square up” slow input rise and fall times. Due to the hysteresis voltage of the Schmitt trigger, the HCT14A finds applications in noisy environments.

Features

- Output Drive Capability: 10 LSTTL Loads
- TTL/NMOS−Compatible Input Levels
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 4.5 to 5.5 V
- Low Input Current: 1.0 μA
- In Compliance With the JEDEC Standard No. 7.0 A Requirements
- Chip Complexity: 72 FETs or 18 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 and are RoHS Compliant

LOGIC DIAGRAM



$Y = \overline{A}$ PIN 14 = V_{CC}
PIN 7 = GND

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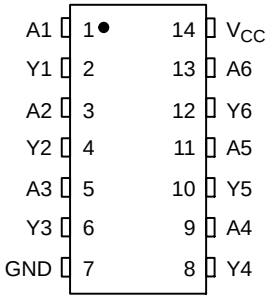
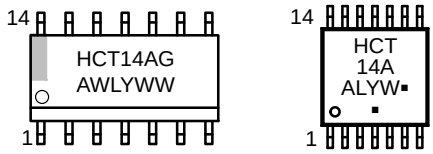
SOIC−14 NB
D SUFFIX
CASE 751A

TSSOP−14
DT SUFFIX
CASE 948G

PIN ASSIGNMENT



MARKING DIAGRAMS



SOIC−14 NB TSSOP−14

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

Input A	Output Y
L	H
H	L

ORDERING INFORMATION

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

MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage	(Referenced to GND)	−0.5 to +7.0	V
V_I	DC Input Voltage	(Referenced to GND)	−0.5 to V_{CC} + 0.5	V
V_O	DC Output Voltage	(Referenced to GND)	−0.5 to V_{CC} + 0.5	V
I_{IK}	DC Input Diode Current		±20	mA
I_{OK}	DC Output Diode Current		±25	mA
I_O	DC Output Sink Current		±25	mA
I_{CC}	DC Supply Current per Supply Pin		±50	mA
I_{GND}	DC Ground Current per Ground Pin		±50	mA
T_{STG}	Storage Temperature Range		−65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
T_J	Junction Temperature under Bias		+150	°C
θ_{JA}	Thermal Resistance	SOIC TSSOP	125 170	°C/W
P_D	Power Dissipation in Still Air at 85°C	SOIC TSSOP	500 450	mW
MSL	Moisture Sensitivity		Level 1	
F_R	Flammability Rating	Oxygen Index: 30% − 35%	UL 94 V−0 @ 0.125 in	
V_{ESD}	ESD Withstand Voltage	Human Body Model (Note 1) Machine Model (Note 2) Charged Device Model (Note 3)	> 4000 > 300 > 1000	V
$I_{Latchup}$	Latchup Performance	Above V_{CC} and Below GND at 85°C (Note 4)	±300	mA

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	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage	(Referenced to GND)	4.5	5.5	V
V_I, V_O	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)		−	(Note 5)	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.

5. No Limit when $V_I \approx 50\%$ V_{CC}, $I_{CC} > 1$ mA.
6. Unused inputs may not be left open. All inputs must be tied to a high−logic voltage level or a low−logic input voltage level.

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC} Volts	Temperature Limit: −55°C to 25°C Min	−55°C to 25°C Max	≤85°C Min	≤85°C Max	≤125°C Min	≤125°C Max	Unit
V_{T+} max	Maximum Positive−Going Input Threshold Voltage	V_O = 0.1 V or V_{CC} – 0.1 V $\|I_{out}\| \le 20$ μA	4.5 5.5		1.9 2.1		1.9 2.1		1.9 2.1	V
V_{T+} min	Minimum Positive−Going Input Threshold Voltage	V_O = 0.1 V or V_{CC} – 0.1 V $\|I_{out}\| \le 20$ μA	4.5 5.5	1.2 1.4		1.2 1.4		1.2 1.4		V
V_{T-} max	Maximum Negative−Going Input Threshold Voltage	V_O = 0.1 V or V_{CC} – 0.1 V $\|I_{out}\| \le 20$ μA	4.5 5.5		1.2 1.4		1.2 1.4		1.2 1.4	
V_{T-} min	Minimum Negative−Going Input Threshold Voltage	V_O = 0.1 V or V_{CC} – 0.1 V $\|I_{out}\| \le 20$ μA	4.5 5.5	0.5 0.6		0.5 0.6		0.5 0.6		
V_H max	Maximum Hysteresis Voltage	V_O = 0.1 V or V_{CC} – 0.1 V $\|I_{out}\| \le 20$ μA	4.5 5.5		1.4 1.5		1.4 1.5		1.4 1.5	
V_H min	Minimum Hysteresis Voltage	V_O = 0.1 V or V_{CC} – 0.1 V $\|I_{out}\| \le 20$ μA	4.5 5.5	0.4 0.4		0.4 0.4		0.4 0 4		
V_{OH}	Minimum High−Level Output Voltage	$V_I < V_{T-}$ min $\|I_{out}\| \le 20$ μA	4.5 5.5	4.4 5.4		4.4 5.4		4.4 5.4		V
		$V_I < V_{T-}$ min $\|I_{out}\| \le 4.0$ mA	4.5	3.98		3.84		3.7		
V_{OL}	Maximum Low−Level Output Voltage	$V_I \ge V_{T+}$ max $\|I_{out}\| \le 20$ μA	4.5 5.5		0.1 0.1		0.1 0.1		0.1 0.1	V
		$V_I \ge V_{T+}$ max $\|I_{out}\| \le 4.0$ mA	4.5		0.26		0.33		0.4	
I_{IK}	Maximum Input Leakage Current	V_I = V_{CC} or GND	5.5		±0.1		±1.0		±1.0	μA
I_{CC}	Maximum Quiescent Supply Current (per package)	V_I = V_{CC} or GND I_{out} = 0 μA	5.5		1.0		10		40	μA
				≥ −55°C		25°C to 125°C				
ΔI_{CC}	Additional Quiescent Supply Current	V_I = 2.4 V, Any One Input V_I = V_{CC} or GND, Other Inputs I_{out} = 0 μA	5.5	2.9		2.4				mA

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 (C_L = 50 pF; Input t_r = t_f = 6.0 ns)

Symbol	Parameter	Test Conditions	Figures	Guaranteed Limit: −55°C to 25°C Min	−55°C to 25°C Max	≤85°C Min	≤85°C Max	≤125°C Min	≤125°C Max	Unit
t_{PLH}, t_{PHL}	Maximum Propagation Delay, Input A to Output Y (L to H)	V_{CC} = 5.0 V ±10% C_L = 50 pF, Input t_r = t_f = 6.0 ns	1 & 2		32		40		48	ns
t_{TLH}, t_{THL}	Maximum Output Transition Time, Any Output	V_{CC} = 5.0 V ±10% C_L = 50 pF, Input t_r = t_f = 6.0 ns	1 & 2		15		19		22	ns

		Typical @ 25°C, V_{CC} = 5.0 V	
C_{PD}	Power Dissipation Capacitance, per Inverter (Note 7)	32	pF

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

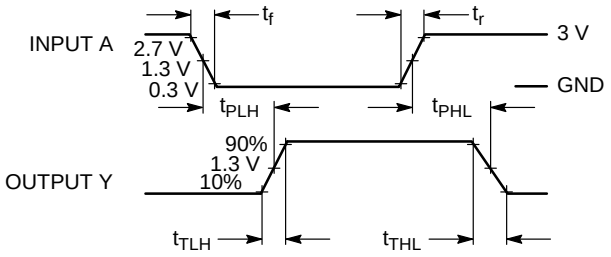
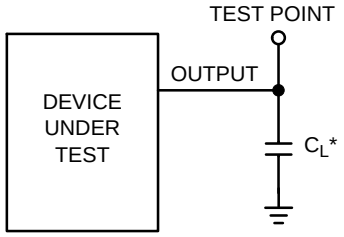


Figure 1. Switching Waveforms



*Includes all probe and jig capacitance.

Figure 2. Test Circuit

ORDERING INFORMATION

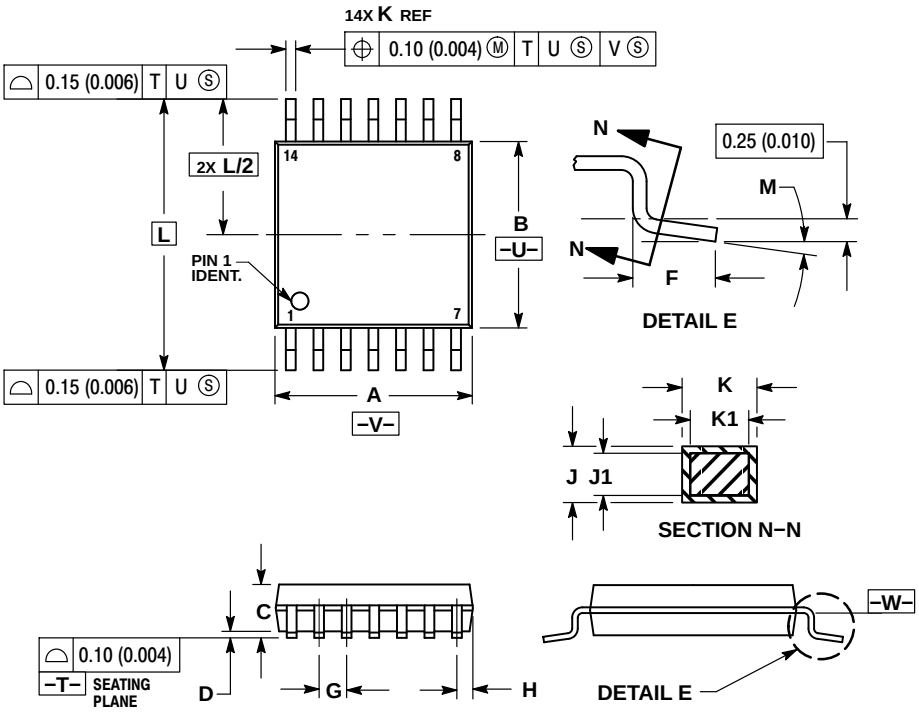
Device	Package	Shipping†
MC74HCT14ADG	SOIC−14 NB (Pb−Free)	55 Units / Rail
NLV74HCT14ADG*		
MC74HCT14ADR2G	SOIC−14 NB (Pb−Free)	2500 / Tape & Reel
NLV74HCT14ADR2G*		
MC74HCT14ADTR2G	TSSOP−14 (Pb−Free)	2500 / Tape & Reel
NLV74HCT14ADTR2G*		

†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.

PACKAGE DIMENSIONS

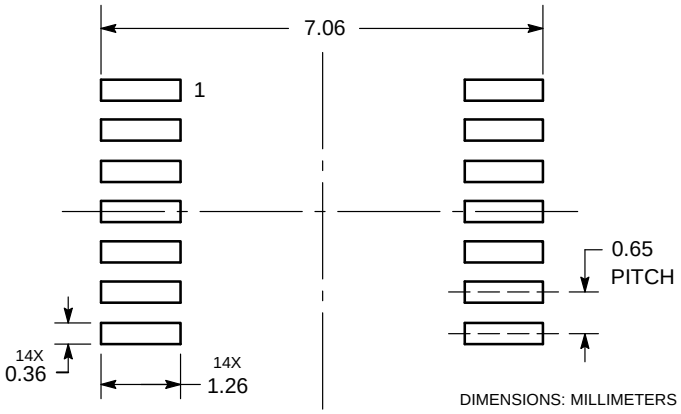
TSSOP−14
CASE 948G
ISSUE B



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 °

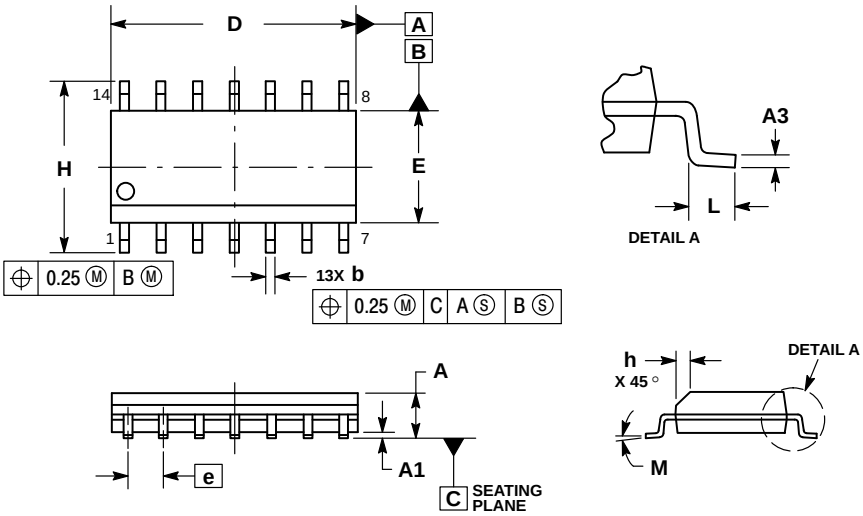
SOLDERING FOOTPRINT*



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

PACKAGE DIMENSIONS

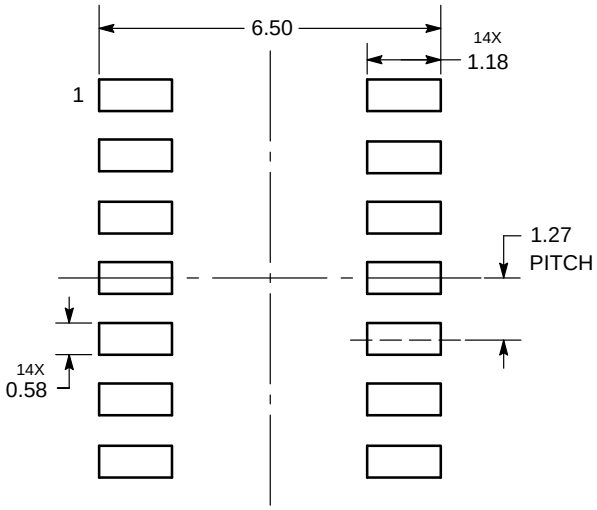
SOIC−14 NB
CASE 751A−03
ISSUE K



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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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